6. Steelhead Recovery Goals, Objectives & Criteria

"Recovery is the process by which listed species and their ecosystems are restored and their future safeguarded to the point that protections under the ESA are no longer needed. A variety of actions may be necessary to achieve the goal of recovery, such as the ecological restoration of habitat or implementation of conservation measures with stakeholders."

Endangered and Threatened Species Recovery Planning Guidance, National Marine Fisheries Service, 2010

6.1 DPS RECOVERY GOAL

The goal of this Recovery Plan is *to prevent the extinction of South-Central California Coast steelhead in the wild and ensure the long-term persistence of viable, self-sustaining, wild populations of steelhead distributed across the South-Central California Coast Steelhead (SCCCS) Distinct Population Segment (DPS). It is also the goal of this Recovery Plan to ensure a sustainable South-Central California Coast steelhead sport fishery through the restoration of viable steelhead populations across the SCCCS DPS.*

Recovery of the SCCCS DPS will require the protection, restoration, and maintenance of habitats of sufficient quantity, quality, and natural complexity throughout the SCCCS Recovery Planning Area. These efforts will target conservation of the full range of life history forms of *O. mykiss* (*e.g.*, switching between resident and anadromous forms, timing and frequency of anadromous runs, and dispersal rates between watersheds). Targeting the full range of life history forms will allow these fish to successfully use a wide variety of habitats which will help them overcome the natural challenges of a highly variable physical and biological environment into the future.

A **viable population** is defined as a population having a negligible risk (< 5%) of extinction due to threats from demographic variation, non-catastrophic environmental variation, and genetic diversity changes over a 100-year time frame. A **viable DPS** is comprised of a sufficient number of viable populations broadly distributed throughout the DPS but sufficiently well-connected through ocean and freshwater dispersal to maintain long-term (1,000-year) persistence and evolutionary potential (McElhany *et al*. 2000).

6.2 DPS RECOVERY OBJECTIVES

To ensure recovery of the SCCCS DPS, specific objectives are necessary to guide recovery efforts and to measure the species' progress towards recovery. Similarly, specific, measurable and objective criteria are also necessary to describe the steelhead recovery.

Steelhead in South-Central California occupy highly variable watersheds, some portions of which are severely degraded with highly modified natural watershed processes and streamflows. Under these degraded habitat conditions, steelhead populations in some watersheds have declined to very low numbers. Existing threats constrain the species' current distribution to small, disjunct portions of its historical range and preclude steelhead from expressing their full range of life history strategies in response to naturally varying habitat conditions. To recover, the SCCCS DPS requires substantially higher numbers of returning adults, successful spawning, successful juvenile rearing in freshwater and estuarine environments, and emigration of juveniles and adults to the ocean. To achieve these goals, it is essential to preserve and restore the species' existing freshwater habitat, as well as restore its access to historically important spawning and rearing habitats throughout the SCCCS Recovery Planning Area. Individual watersheds, and in some cases groups of watersheds, must have the capacity to support self-sustaining populations of steelhead in the face of natural variation in environmental conditions such as droughts, floods, wildfires, variable ocean-rearing conditions, and long-term climate changes.

To recover steelhead, the following objectives were identified:

- ❑ Prevent steelhead extinction by protecting existing populations and their habitats
- ❑ Maintain current distribution of steelhead and restore distribution to some previously occupied areas
- ❑ Increase steelhead abundance to viable population levels, including the expression of all life history forms and strategies
- ❑ Conserve existing genetic diversity and provide opportunities for interchange of genetic material between and within viable populations
- ❑ Maintain and restore suitable habitat conditions and characteristics to support all life history stages of viable populations
- ❑ Conduct research and monitoring necessary to refine and demonstrate attainment of recovery criteria

6.3 RECOVERY CRITERIA

Prior to determining a species has "recovered" and can be removed from the List of Threatened and Endangered Species (*i.e.,* delisting) or have its protective status lowered from "endangered" to "threatened" (*i.e.,* down listing), certain criteria for recovery, must be met. These criteria are related to the condition of the species and the status of identified threats at the time of listing. In the case of delisting the threatened SCCCS DPS, biological recovery criteria regarding the abundance, productivity, spatial structure, and diversity of the populations within the DPS and the DPS as a whole, are the principal measures of recovery. Threats abatement criteria are indicators that key threats to the populations and DPS have been abated or controlled. Both types of recovery criteria are used by NMFS to assess whether the species is recovering (moving towards meeting the criteria, and down listing may be appropriate) or has recovered (meets the criteria and delisting may be appropriate). Several of these criteria have not been established quantitatively because additional research is needed to define or refine them. Due to the lack of quantifiable information, one of the six recovery objectives for the SCCCS DPS focuses on research and monitoring. Research and monitoring is needed to refine delisting criteria and provide a means to evaluate whether steelhead populations are responding to recovery actions. Given the species' condition and the severity of the threats in the SCCC DPS, it is clear significant increases in population and reductions in critical threat sources are needed.

The Technical Recovery Team (TRT) identified two different approaches to articulating viability criteria: 1) prescriptive criteria, which identify specific targets, generally expressed in quantitative terms, and 2) performance criteria, which identify standards for final performance, expressed in theoretical terms. In light of uncertainties regarding aspects of the biology of South-Central California Coast steelhead (*e.g.*, the role of the resident form of *O. mykiss* in supporting the anadromous form, dispersal rates between watersheds, *etc.*), quantitative prescriptive criteria must be precautionary, while performance criteria require development of direct estimates of risk, and a quantitative account of uncertainty (Boughton *et al*. 2007b, 2006). Because of the uncertainty of the efficacy of the provisional prescriptive criteria (which are based on limited quantitative population data from South-Central California Coast steelhead), the Recovery Plan uses performance based criteria until more specific prescriptive criteria are available.

6.3.1 Biological Recovery Criteria

The TRT developed general viability criteria for both individual steelhead populations and for the SCCCS DPS as a whole. These criteria describe characteristics of both individual populations and the DPS, that if achieved, would indicate the DPS is viable and at a low risk of extinction over a specific period of time. [1] The population and DPS criteria are independent of anthropogenic effects in the sense that they must be met regardless of habitat conditions and human-caused threats. The time frame and related recommended criteria address the preservation of the evolutionary potential of the species (*i.e.*, genetic, phenotypic, and behavioral diversity). Appropriate time scales will ensure the DPS will persist long enough to exhibit future evolutionary changes, such as adaptation or diversification in response to environmental changes. Preserving the evolutionary potential of the species is an important component in ensuring long-term viability.

The TRT viability criteria provide guidance for evaluating recovery of steelhead populations and the SCCCS DPS given the current level of knowledge and understanding of the biology and ecology of SCCCC steelhead. The recommended criteria carry varying levels of uncertainty depending on quantity and quality of available information on steelhead in the SCCCS Recovery Planning Area. Given the current level of uncertainty, NMFS has adopted many of the viability criteria as recovery criteria until sufficient scientific information is available to refine population DPS viability criteria. Additionally, these criteria will be reviewed when NMFS conducts 5-year status reviews.

[1] For a detailed discussion of the methods used by the TRT to develop the recommended viability criteria, see Boughton *et al.* 2007b.

Table 6-1. Biological Recovery Criteria for the South-Central California Coast Steelhead DPS.

POPULATION-LEVEL CRITERIA – Apply to Populations selected to meet DPS-level criterion D.1.1		
Criterion Type[1]	**Recovery Threshold**	**Notes**
P.1 Mean Annual Run Size	Run size is sufficient to result in an extinction risk of <5% within 100 yrs.	Monitoring run size will provide information on year-to-year fluctuations in the population necessary to determine the appropriate recovery threshold for individual populations. Research on the role of non-anadromous spawning fraction in stabilizing anadromous faction will also enable refinement of the minimum recovery threshold (see Boughton *et al.* [2007b] for discussion of steps in determination of threshold value for each viable population).
P.2 Ocean Conditions	Run Size criterion met during poor ocean conditions	"Poor ocean conditions" determined empirically, or size criterion met for at least six decades
P.3 Spawner Density	*Unknown at present*	Research needed
P.4 Anadromous Fraction[2]	N = 100% of Mean Annual Run Size	Requires further research (see note above)

DPS-LEVEL CRITERIA	
Criterion Type	**Recovery Threshold**
D.1 Biogeographic Diversity	1. Biogeographic Population Group contains minimum number of viable populations: Interior Coast Range (4 populations); Carmel River Basin (1 population); Big Sur Coast (3 populations); San Luis Obispo Terrace (5 populations) (see Boughton *et al*. 2007b for detailed discussion) 2. Viable populations inhabit and successful persist in watersheds during drought conditions 3. Viable populations separated from one another by at least 68 km or as widely dispersed as possible[3]
D.2 Life-History Diversity	All three life-history types (fluvial-anadromous, lagoon-anadromous, freshwater resident) are exhibited and distributed across each Biogeographic Population Group.

[1] It is assumed that all spawner criteria represent escapement (*i.e.*, unharvested spawning adults) rather than migrating adults that may be captured before having an opportunity spawn.

[2] The anadromous fraction is the percentage of the run size that must exhibit an anadromous life history to be counted toward meeting the mean annual run size criteria. However, the recovery strategy recognizes the potential role of the non-anadromous form of *O. mykiss* and includes recovery actions which would restore habitat occupied by the non-anadromous form, as well as reconnect such habitat with anadromous waters, and thus allow the anadromous and non-anadromous forms to interbreed, and the non- anadromous forms to potentially express an anadromous life history.

[3] This geographic separation is based on the maximum width of recorded historic wildfires; see additional discussion below under Section 6.3.1. 2.

The population level criteria apply to certain populations in all of the BPGs.[2] Further research is needed to refine the population criteria in the BPGs; for example, data on the magnitude of natural population fluctuations could reveal smaller mean run sizes are sufficient to attain viability in some basins (Williams *et al.* 2011). Additionally, further research could refine the role of each of the BPGs in the recovery of the SCCCS DPS. At a minimum, all BPGs will need to achieve sufficient spatial structure and diversity (*i.e.*, two of the four criteria that define a viable DPS in the wild). Dispersal of steelhead between BPGs may be an important mechanism for maintaining viability of steelhead populations. In addition, preservation of the resident form of the species and habitats supporting residency may be critical to conserving the genetic diversity of steelhead. Preserving the resident life from may provide stock to re-establish and support the fluvial-anadromous and lagoon-anadromous life history strategies.

6.3.1.1 Discussion of Population-Level Recovery Criteria

Criterion P.1 – Mean Annual Run Size. The mean annual run size necessary for viable anadromous *O. mykiss* populations is currently uncertain for the SCCCS Recovery Area and probably differs for different populations (and watersheds). The TRT estimated a prescriptive mean annual run size to accommodate this uncertainty by using a "random-walk-with-drift" model (Lindley 2003; see also Foley 1994, Lande 1993). This model used quantitative field data for one anadromous *O. mykiss* population and 19 Chinook salmon populations in California's Central Valley (Lindley 2007, 2003). Modeling results determined 4,150 spawners per year provided a 95 percent chance of persistence of a population over 100 years and applied to generalized situations where no quantitative field data on specific local populations is available (Boughton *et al*. 2007b). The estimation of the spawner abundance target incorporated a number of variables including irregular inter-annual patterns of precipitation, anecdotal accounts of highly variable spawning runs and the expectation that larger abundances buffer populations against the increased extinction risks that come with variations in freshwater and marine survival. It can be expected that an average of 4,150 spawners per year, persisting through a cycle of poor ocean conditions would be adequate to safeguard a population (see also discussion below, P.2 – Ocean Conditions).

This target may be higher than necessary, especially in relatively small watersheds such as those along the Big Sur and San Luis Obispo BPGs which exhibit different characteristics such as shorter distances between individual watersheds and between the ocean and upstream spawning and rearing areas, a strong marine climatic influence, and generally steeper stream gradients. These BPGs may support viable populations at average runs sizes well below 4,150 (Boughton *et al*. 2007b). Factors that may be evaluated to refine the spawner viability target for these BPGs will likely include information such as reliability of access to spawning and rearing areas, escapement to the ocean, stability of freshwater environments, the supporting role of non-anadromous forms of *O. mykiss*, inter-watershed exchanges (by dispersal) of anadromous forms of *O. mykiss*. These factors may play an important role in stabilizing the life-history, and allow for refinement of the population-level recovery criteria, including a smaller mean run size that is sufficient for viability (Williams *et al.* 2011). Until research is undertaken and revisions are made to the prescriptive viability criteria, the population–level viability criterion for a demographically discrete or independent population of *O. mykiss* is 4,150. This target will be reviewed during NMFS' 5-year review of the Recovery Plan, and

[2] See Chapter 2 and Table 2-2, Steelhead Biology and Ecology and Chapter 7, Recovery Strategy, for a discussion of these populations.

potentially during the general 5-year status review updates for Pacific salmon and steelhead listed under the ESA.

The separate watersheds comprising each BPG are treated as individual steelhead populations for the purposes of meeting the run-size criterion (except the Salinas River basin, which supports three different populations). Because of uncertainty regarding the applicability of 4,150 spawners per year to many of the watersheds within the SCCCS Recovery Planning Area and the lack of current data to develop more refined criteria, this Recovery Plan proposes that performance-based run-size criteria be developed for different core populations throughout the DPS. Development of this criterion for each population would use a precautionary approach towards determining run sizes for the individual populations. A precautionary approach will be framed to provide for a 95 percent chance of persistence of the population over 100 years. In general, the 4,150 number can be thought of as an approximate upper bound on what the ultimate viability targets will turn out to be, although there is a chance that development of a performance-based criterion would result in values higher than 4,150 spawners in some watersheds (Boughton *et al*. 2007b).

Performance-based criteria require better estimates of some key risk factors before settling on final viability targets, including: 1) the magnitude of year-to-year fluctuations in spawner abundance; 2) the survival and growth rate during poor ocean conditions; and 3) the ability or inability of the resident form of *O. mykiss* (rainbow trout) to contribute progeny to steelhead populations and thereby bolster steelhead populations during periods of otherwise poor ocean survival.

Methods exist for estimating extinction risk through the use of time-series of spawner counts (Dennis *et al*. 2006, Lindley 2007, 2003, Holmes 2001; see also Beissinger and Westphal 1998). In general, about 20 years' worth of these data are necessary to obtain reasonable confidence for such estimates (Lindley 2007, 2003) to be used for the purposes of delisting the SCCCS DPS.

There is a critical need for immediate implementation of population abundance monitoring in key watersheds. However, some populations may currently have run sizes so low that obtaining accurate counts would be difficult because of the small sample size, or surveying may be detrimental because of the associated mortality associated with sampling techniques. Collecting useful data may not be practical until such populations have been recovered to some level, depending on the field methods used for monitoring, further underscoring the importance of initiating recovery actions. Boughton *et al.* 2007b) describe a decision tree for use in refining and establishing a viability criterion for mean population size. See also, Adams *et al*. (2011) for a proposed coast-wide strategy for monitoring California coastal salmonid populations.

Criterion P.2 – Ocean Conditions. Year-to-year variation in a population's survival and/or reproduction can cause large fluctuations in population growth rate irrespective of population size. This larger variance causes the number of fish to fluctuate, increasing the chance of the population fluctuating to zero. A large mean population growth rate lowers this risk by shortening the recovery time from downward fluctuations, and a large mean population size keeps the population further away from zero to begin with (McElhany *et al*. 2000, Lande 1993, Foley 1997, 1994).

Variation in ocean conditions can have dramatic impacts on marine survival of Pacific salmonids (Mantua and Hare 2002, Mueter *et al.* 2002, Mantua, *et al.* 1997). A conservative working assumption is that salmonid ocean survival fluctuates widely due to variations in ocean conditions. Periods of poor ocean conditions (as reflected in a significant increase in mean ocean mortality of *O. mykiss*) can last for multiple decades and may result in as much as a five-fold decrease in ocean survival of salmonids (Mantua *et al.* 1997). A population meeting the run-size criterion (P.1) during a period of good ocean survival is likely to decline to risky levels when ocean survival deteriorates for long periods. Therefore, a simple but effective criterion for ocean condition is that the run size criterion must be met during a period of poor ocean survival. This criterion could be met via two distinct strategies:

1. Monitor population size for at least the duration of the longest-period climate "cycle" (about 60 years according to Mantua and Hare [2002], though others question the notion of predictable cycles), or
2. Concurrently monitor population size and ocean survival, so that periods of low ocean survival can be empirically determined.

Data on ocean survival (derived from smolt counts combined with adult counts) should be useful for separating the effects of ocean cycles and watershed conditions on population growth. Investment in both smolt counts and adult counts allows an estimation of ocean survival as distinct from freshwater production and survival (with only adult counts, the vital rates in the two habitats are confounded and cannot be estimated separately). In addition, short-term improvements in run size due to watershed restoration could be distinguished from short-term improvement due to ocean cycles. The Coastal Monitoring Plan being prepared by NMFS and CDFW (Adams *et al.* 2011) recommends a series of "Life Cycle Monitoring Stations" to monitor smolts and spawners to evaluate ocean survival for individual populations (see Chapter 13, South-Central California Coast Steelhead Research, Monitoring, and Adaptive Management, Table 13-1). As performance-based run-size criteria are developed for the SCCCS DPS, the ocean conditions criterion may change, or even preclude the need for such a specific criterion, though not the consideration of marine conditions. As discussed above, the magnitude and duration of poor ocean survival on the extinction risk of the population is a key factor to consider when developing the run-size criterion.

Criterion P.3 – Spawner Density. The distribution of adult or juvenile fish across a watershed can influence the viability of a population. If widely distributed and at low abundance, populations can decline as a result of the difficulty in locating mates. However, a marginal benefit of a wide distribution is reduced vulnerability to localized catastrophes or environmental variations when occupying a broader range of habitats. If too densely packed within a limited spatial distribution, populations may be more vulnerable to unpredictable environmental events because all members of the population experience the same conditions. The TRT concluded that a viability criterion related to population spawner density (at some scale) was warranted, particularly for historically larger populations. A potentially suitable threshold for these purposes is the density at which intra-specific competition for redd sites becomes observable. For coho salmon this appears to be on average about 40 spawners per kilometer (one spawning pair per 50 meters of stream length), although individual streams vary considerably around this mean (Bradford *et al*. 2000). However, the TRT could not find data for deriving a corresponding steelhead criterion. The Coastal Monitoring Plan proposes to implement redd-counting for monitoring salmon and steelhead in the northern coastal area of California (Aptos Creek, Santa Cruz County, to the Oregon border). This should provide sufficient data for deriving specific spawner density criterion. If these data are not sufficient to derive density criteria, redd-counts specific to the SCCCS Recovery Planning Area **may be necessary.**

Criterion P.4 – Anadromous Fraction. "Anadromous fraction" is the mean fraction of reproductive adults that are anadromous (steelhead) versus resident. Steelhead in the SCCCS Recovery Planning Area co-occur with rainbow trout. Elsewhere, steelhead have been observed to have resident forms among their progeny, and vice versa (Zimmerman and Reeves 2000). It is not known how often these transitions occur in South-Central California Coast *O. mykiss*, or what factors bring them about, though clearly individual populations can have more than one life history type (Sogard *et al*. 2012, Hendry *et al*. 2004, Hendry and Stearns 2004). Depending on the rate of transition, a group of resident and anadromous fish may function as a single population; two completely distinct populations; or something in between.

Interchange between resident and anadromous fish groups would almost certainly lower the extinction risk of both groups, for the same two reasons that dispersal between separate steelhead populations reduces risk: 1) the existence of a "rescue effect" and 2) the possibility of recolonization (Hanski and Gilpin 1997, Foley 1997). The rescue effect would occur at low steelhead abundance, when input from the resident *O. mykiss* population prevents their complete disappearance. Recolonization can occur after steelhead disappear completely and are regenerated by the resident population via "recolonization" of the steelhead niche (Hendry *et al.* 2004). This phenomenon may have maintained steelhead in the Carmel River system, and possibly Salmon Creek and other South-Central California Coast watersheds, in recent times, since most contemporary steelhead runs in these watersheds appear far too small to be self-sustaining (Boughton *et al*. 2005). Unfortunately, lack of data on life history polymorphism prevents a reasonable estimate for the magnitude of the rescue effect, or for a viability threshold for anadromous fraction. Lacking such data, the precautionary criterion for anadromous fraction must assume the rescue effect is negligible, and the anadromous fraction must be 100. Future research[3] on this topic could be used to estimate a viability threshold that is more efficient than the precautionary "100% rule."

6.3.1.2 DPS-Level Recovery Criteria

Criterion D.1 (.1, .2, and .3) – Biogeographic Diversity. This criterion contains three elements to address issues of redundancy and separation between populations and within-watershed conditions to provide for resilience against natural environmental events such as droughts and wildfires. The BPGs are important components in the recovery of the SCCCS DPS and all BPGs must be restored to viability before the DPS as a whole can be recovered and eventually delisted. The delineation of BPGs was based on suites of basic environmental conditions (*e.g.,* large inland and short coastal stream networks in a range of climatic, terrestrial, and aquatic regimes). The recovery of multiple watersheds and populations in each BPG ensures sufficient populations are present within the BPG and across the DPS. This will provide resiliency in the face of environmental fluctuations (including projected long-term climate changes) and ensure a variety of habitat types and conditions are represented (*e.g.,* different stream gradients and estuary size,

[3] One of the most useful scientific tools for addressing the interchange question involves otolith microchemistry but, as this technique requires lethal sampling of fish, a scientific collecting permit under section 10(1)(A) of the ESA would be required to authorize mortality using this methodology. Newer, non-lethal genetic techniques are also being explored (D. Pearse, personal communication). However, in populations where anadromous fish are currently quite rare, it will probably be necessary to recover run sizes somewhat before numbers are sufficient for useful ecological research.

complexity and function). Recovery of the SCCCS DPS will require recovery of a sufficient number of viable populations (or sets of interacting trans-watershed populations) within each of the four BPGs to conserve the natural diversity (genetic, phenotypic, and behavioral), spatial distribution, and resiliency of the DPS as a whole.

Criterion D.2 – Life History Diversity. Essential to the recovery and long-term conservation of the SCCCS DPS is the preservation and restoration of all the life history forms and strategies the species has evolved which has allowed them to exploit the wide diversity and range of habitat conditions characteristic of South-Central California. These life history forms include the fluvial-anadromous, lagoon-anadromous, and freshwater life history patterns. Achieving this goal will require a number of closely coordinated activities, such as:

- further research into the diverse life history patterns and adaptations of steelhead in a semi-arid and highly dynamic environment including the ecological relationship between non-anadromous and anadromous populations;

- monitoring of existing populations; and

- implementation of the habitat protection and restoration actions to produce the suite of conditions necessary to promote all life history forms.

Criteria D.2 – Redundancy and Geographic Separation. Wildfires, droughts, and debris flows (triggered by wildfires followed by heavy precipitation) pose the greatest natural threats to entire populations (see for example, California Office of Emergency Services 2008, Gabet and Mudd 2006, Ellen and Wieczorek 1988, Wieczorek 1987). Preservation of the various life history forms of *O. mykiss* in a dynamic landscape requires redundancy and an effective separation of populations.

To ensure the survival of at least one viable population per BPG during a catastrophic wildfire season, two criteria must be met: 1) the number of viable populations in each BPG should outnumber the number of wildfires expected in a catastrophic wildfire season, and 2) if possible, populations should be spatially separated by a distance sufficient to prevent an individual wildfire from extirpating more than one viable population.

To determine the level of redundancy and spatial differentiation between populations necessary to withstand catastrophic wildfires, the expected geographic extent of a thousand-year wildfire was estimated based on wildfire data from 1910 through 2003. Fire interval and number were estimated for each BPG using standard methods. An analysis of the 1000-year fire scenario was used to determine the number of viable populations necessary for each BPG. Results indicate at least one viable population plus the maximum number of wildfires expected for the BPG, (or the number of historical viable populations in the BPG), whichever was less were need to ensure long-term resiliency. The recommended minimum geographic distance between individual viable populations should be 68km (42 miles). This distance was predicted as the minimum necessary to reduce the likelihood that the minimum number of viable populations would be extirpated a thousand-year wildfire event. The preservation of a necessary minimum number of viable populations within a BPG against debris flows is also achieved through the redundancy and geographic separation prescribed to protect against wildfire risk.

Droughts however, tend to occur over spatial scales broader than the Recovery Planning Area, and thus require a different strategy. Such a strategy involves maximizing the ability of fish to move in response to drying conditions by removing or modifying fish passage barriers; identifying and protecting drought resilient watersheds, that is those with over-summering refugia habitat; control of water extractions (both surface or groundwater); or in some cases the use of managed flows from reservoirs. (Boughton 2010a, Boughton *et al.* 2007b).

6.4 THREATS ABATEMENT CRITERIA

Current and future threats impeding recovery of the SCCCS DPS must be addressed and must meet the population and DPS-level recovery criteria described above. Basic threats abatement criteria identified below are used to track recovery efforts. The identified existing and future threats fall within the categories of listing factors identified during the species listing process (see Chapters 9-12, sub-sections 9.4-12.4 for each BPG). Each listing factor must be addressed prior to making a determination that a species has recovered and no longer requires the protections of the ESA.

This Recovery Plan prioritizes recovery actions for the watersheds within the BPGs according to the role of the watershed in recovery, the severity of the threat, and the listing factors addressed by the action. Each recovery action has been given a priority of 1 or 2 as defined in the NMFS Interim Recovery Planning Guidance (see box, below, for definitions) for purposes of providing general guidance in the implementation of individual recovery actions. Further, a priority 3 ranking has been assigned for all other recovery actions which do not meet the criteria used for priority 1 or 2 recovery actions. Each recovery action has been qualified with an additional descriptor: A) if the action addresses the first listing factor regarding the destruction or curtailment of the species' habitat; or B) if the action addresses one of the other four listing factors (for definition of listing factors see Chapter 3, Factors Contributing to Decline and Federal Listing). Where the recovery action addresses both types of listing factors, the descriptor is based on the principal listing factor addressed. Priority 1 recovery actions are necessary to prevent the extinction of the SCCCS DPS or an irreversible decline. Priority 2 actions are intended to ensure individual populations essential to the recovery scenario are not further degraded. Priority 3 actions are the remainder of the full suite of actions necessary to address all the viability criteria identified for the full recovery of the DPS (including recovery of individual populations identified in Table 7-1).

Priority 1: Actions that must be taken to prevent extinction or to prevent the species from declining irreversibly.

Priority 2: Actions that must be taken to prevent a significant decline in species population/habitat quality or in some other significant negative impact short of extinction.

NMFS proposes ***all*** watershed threats having a priority 1A or 1B recovery actions in core 1 and 2 populations be abated to a "low" level using the same threats assessment process used to establish threat levels for this plan.

In addition, for watershed threats with recovery actions ranked as either priority 2 or 3, the threat must be abated one level below its current threat ranking based on the ranking system used in the threats assessment (*e.g.*, abate from "high" to "medium," or "medium" to "low").

The application of these threats abatement criteria is illustrated in the example in Table 5-2. High-level (red) threats associated with high-priority (1A and 1B) recovery actions are abated to low (green) levels. However, high-level threats associated with secondary (2A and 2B) priority recovery actions need only be abated one threat level to medium (yellow).

Table 6-2. Example application of threats abatement criteria.[4]

Threat	Current Threat Level	Recovery Action Rank	Target Abatement Level for Recovery
Dams and Surface Water Diversions		1A	
Groundwater Extractions		1B	
Culverts and Road Crossings (Passage Barriers)		1B	
Wildfires		2B	
Urban Development		2B	

[4] Note: This table is only intended to illustrate the application of the threats abatement criteria, to the various Recovery Action Priority categories (1A, 1A, 1B, 2B) and not the priority of threats or ranking of individual recovery actions across the SCCCS DPS, or any specific watershed. For threat rankings in individual watersheds see the Biogeographic Chapters 9-12.

The threats abatement criteria are linked to one or more of the listing factors identified for the SCCCS DPS. Only Listing Factor 2, Over-utilization, does not have specific threats abatement criteria identified, as changes in fishing regulations have already ameliorated, though not eliminated, the threat posed to the species from angling through the prohibition of angling in most anadromous waters within the SCCCS DPS. These threats abatement criteria are intended to ensure that:

- ❑ Freshwater migration corridors supporting viable populations meet the steelhead life history and habitat requirements (Listing Factors 1, 3, 4, and 5).
- ❑ Viable populations have unimpeded access to previously occupied habitats (Listing Factors 1, 4, and 5).
- ❑ Watersheds supporting viable populations have habitat conditions and characteristics that support all life history stages (Listing Factors 1, 3, 4, and 5).
- ❑ Standardized monitoring of populations and their habitats in each BPG across the SCCCS DPS evaluates the effectiveness of recovery actions and measures progress towards recovery (Listing Factors 4 and 5).
- ❑ Adequate funding, staffing, and training are provided to city, county, state, and federal regulatory agencies to ensure the ecosystem and species protections of state and federal requirements are properly implemented and remain in place (Listing Factor 4).

The threat source ranking for each component watershed is presented in BPG Chapters 9-12; a description of the CAP workbook method can be found in Appendix D.