APPENDIX D

SOUTH-CENTRAL CALIFORNIA COAST STEELHEAD RECOVERY PLANNING AREA THREATS ASSESSMENT (CAP WORKBOOK) METHOD

Introduction

NMFS assessed current and emerging threats to the persistence and recovery of steelhead populations of the SCCCS Recovery Planning Area. This assessment focused on a set of watersheds identified by the TRT and NMFS staff and used the Nature Conservancy's Conservation Action Planning (CAP) method (The Nature Conservancy 2005). The CAP Workbook allows the user to input quantitative as well as qualitative (including best professional judgment) information in order to determine what existing conditions are and what healthy targets should look like. The CAP threats assessment is iterative and can be updated as new information becomes available or during periodic status reviews of the species (Kier Associates and National Marine Fisheries Service 2008a, 2008b, Hunt & Associates 2008a, 2008b). CAP workbooks have been developed previously for salmonid threat assessment and recovery planning for southern Oregon and northern California coast coho.

The Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service (NMFS) contracted with Kier Associates and Hunt & Associates Biological Consulting Services to provide technical support in developing Recovery Plans for *Oncorhynchus mykiss* populations in the South-Central/Southern California Coast Steelhead Recovery Planning Area. Kier Associates was tasked with developing GIS-based data on watershed conditions, and a set of reference values drawn from the existing scientific literature; however, because of lack of available local regional studies several of these reference values were based on studies of more northern populations of steelhead that may have different habitat requirements or tolerances, and so may not in all cases represent the environmental conditions in which more southern populations have evolved (*e.g.,* water temperature, estuarine conditions, seasonal drying of freshwater mainstem or tributary habitats). Hunt & Associates was tasked with reviewing existing information on *O. mykiss* habitat conditions, assessing the magnitude and extent of threats to *O. mykiss* and their habitats on a watershed/landscape scale, and identifying a comprehensive suite of recovery actions across the South-Central California Recovery Planning Area (Hunt & Associates 2008a, 2008b). These documents summarize the method used to assess *O. mykiss* threats and sources of threats to southern steelhead populations, including those in South-Central California coastal watersheds from the Pajaro River at the border between Santa Cruz and Monterey Counties south to, but not including the Santa Maria River, at the border between San Luis Obispo and Santa Barbara Counties. The CAP workbook threat source rankings presented in this recovery plan also incorporate additional information derived from a wide variety of investigations, studies, and watershed plans developed since the initial preparation of the CAP Workbooks in 2008.

Method

The CAP method results in a series of workbooks for individual watersheds, or sub-watersheds. The Workbooks are an Excel database tool developed by The Nature Conservancy as a strategy for evaluating and prioritizing conservation, restoration, and land management planning efforts. NMFS adapted the CAP Workbook for use in the threat assessment portion of the steelhead recovery planning process (using the reference values developed by Kier Associates 2008a). The Workbook provided a tiered analytical framework for documenting existing conditions and identifying prioritizing the types of recovery actions to address systemic threats in individual watersheds; they are not, however, intended to

be a substitute for the design of site-specific recovery actions. A Workbook was developed for each of the 27 selected watersheds (or sub-watersheds) in the SCCCS Recovery Domain identified has having high intrinsic potential, that is, the potential to support an independent viable population in an unimpaired condition (Boughton *et al.* 2006). Several small watersheds were added to the initial suite of watersheds considered in the recovery planning, based on input from NMFS staff. Conservation targets, in this case life history stages such as egg, fry juvenile, smolt, and adult, provided the first tier of analysis. Key ecological attributes of each life history stage, such as water quality, spawning habitat quality, migratory corridor status, *etc*. were identified at the second tier of analysis. These attributes are aspects of steelhead ecology or the environment that, if lost or significantly degraded, could lead to loss of that life history stage. The third tier was ecological indicators (parameters) that measure the status of each key ecological attribute for a particular life history stage, *e.g.,* average percentage of fine particles in substrate for adult spawning and egg development stages. Provisional boundary conditions for each indicator delineated suitable versus unsuitable habitat conditions for the various life history stages.

Information on existing *O. mykiss* habitat conditions in each watershed was gathered from a broad range of published and un-published materials, including, peer-reviewed scientific publications, technical reports, federal, state, and local planning documents, EIS/EIRs, management plans, passage barrier assessments, habitat evaluations, and field surveys, as well as information provided by NMFS and CDFW staffs, as well as stakeholders and other interested parties at a series of public workshops held in 2007. Additionally, since the completion of the formal CAP Workbook assessment in 2008, NMFS reviewed and evaluated a wide variety of investigations, studies, and watershed plans developed or located subsequently.

The CAP Workbooks can be used to organize and evaluate large amounts of information on current *O. mykiss* habitat conditions and threats in selected watersheds. The CAP Workbook method provides a number of useful features in assessing the magnitude and extent of threats to *O. mykiss* and their habitats in that it:

- Incorporates both quantitative and qualitative (*e.g.*, professional judgment) measures of existing habitat conditions;
- Is an objective, consistent tool for tracking changes in the status of each conservation target (i.e., *O. mykiss* life history stage) over time and between watersheds;
- Provides an overall assessment of a watershed's "health" or viability and objective comparisons to other watersheds;
- Focuses recovery actions by identifying past, current, and potential threats to *O. mykiss* and their habitats;
- Becomes a central repository for documenting and updating knowledge and assumptions about existing conditions; and
- Creates a foundation upon which recovery actions can be further developed, tracked, and up-dated, based on changing current conditions.

Conservation Targets: Specific "conservation targets" for analysis within a CAP workbook must be identified by the user. The conservation targets in this case were *O. mykiss* life history stages: egg, fry, smolt, and adult. A more general conservation target, "Multiple Life Stages," was also established to allow landscape-scale land use and habitat assessment, based on information derived from GIS-based analysis of entire watersheds; this conservation target has been the most useful for the SCCCS Recovery

Planning Area because of the lack of established reference values and site (reach) specific information on individual watersheds.

Key Ecological Attributes (KEAs): Assessing the "viability" or "health" of a particular conservation target (i.e., life-history stage) required identifying "Key Ecological Attributes" (KEA) for each target. Specific KEAs are aspects of the conservation target's biology or ecology such that if missing or severely degraded, would result in loss of that target over time. KEAs, such as substrate quality, non-native species, food availability, water quality, *etc.*, were identified for each target and measurable indicators, such as turbidity, water temperature, aquatic invertebrate species richness, presence or absence of non-native predators, miles of road/square mile of watershed, *etc.*, were identified in order to characterize existing conditions in the component watersheds. All KEAs were grouped into three categories:

- *Size*: target abundance *(e.g.*, number of adult *O. mykiss*);
- *Condition*: a measure of the biological composition, structure, and biotic interactions that characterize the target's occurrence (*i.e.*, generally a local measure of habitat quality or composition), and;
- *Landscape Context*: an assessment of the target's environment (*i.e.*, landscape-scale processes, such as connectivity, accessibility of spawning habitat; hydrology). See comment above regarding "Multiple Life Stages".

Current Indicators: The range of variation found for each indicator was then subdivided into four somewhat subjective, but discrete, categories: "Poor," "Fair," "Good," or "Very Good." The current condition of a specific indicator, taken from a field measurement, literature source, or professional judgment, is assigned to one of these four discrete rating categories. A description of indicators used in the CAP steelhead analyses and the rationale for these indicators is available in Kier Associates and National Marine Fisheries Service (2008a). Functionally; however, we assumed that there are essentially two states for an indicator as it relates to the target: 1) "poor-fair," in which the indicator exceeds or minimally meets the requirements for species survival and the population is in danger of extirpation, and 2) "good-very good," where habitat conditions are favorable for species persistence.

Given the large areal extent and complexity of conditions within the SCCCS Recovery Planning Area, the method uses indicators of habitat at local, regional, and landscape-scales. For example, land use indicators such as density of roads per square mile of watershed have been widely employed as a landscape-scale metric of watershed "health" for salmonids throughout the western United States (see Kier Associates and NMFS, 2008b). Landscape-scale indicators were used in this threat assessment to overcome logistical and analytical problems inherent in local-scale indicators of *O. mykiss* habitat quality (*e.g.*, water temperature), that exhibit extreme spatial and temporal variation, which can lead to misinterpretations. While local-scale indicators tend to exhibit extreme spatial and temporal variation they may be critical in planning and designing site-specific recovery actions.

The goal of establishing measurable indicators in a number of instances was not possible with the current knowledge of existing habitat conditions in the component watersheds. For example, turbidity is known to be an important habitat indicator for *O. mykiss*. For the *O. mykiss* fry life stage, turbidity was defined as the "number of days turbidity exceeded 25 NTUs." Currently, there is little or no systematic and widespread collection of turbidity data in most of the watersheds to permit a quantative assessment of this indicator. In these instances, subjective information, such as observations of mass wasting of slopes, descriptions of point and non-point sediment input, *etc.*, were used to qualitatively assess a current

condition and rating for this indicator. Because the CAP Workbook analysis is iterative, results can be improved as better quantitative information becomes available, though this type of information may be more useful in designing site specific recovery actions than for recovery planning at a landscape-scale.

Stresses and Sources of Stress (Threats): An important step in the CAP Workbook assessment, and the purpose of these analyses, is identification of a series of stresses to each *O. mykiss* life history stage. These stresses are basically altered KEAs and directly affect the life stage, *e.g.*, degraded hydrologic function, increased turbidity, presence of non-native predators, increased substrate embeddedness. Because of the lack of field derived information on specific habitat requirements (*i.e.,* tolerances) and specific habitat conditions, the GIS-based surrogate variables used for the "Multiple Life Stages" conservation target actually are sources of stress, not direct stressors on *O. mykiss* life stages, *e.g.*, increased road density (a source of stress) contributes indirectly to increased turbidity (a direct stressor). The severity (very high, high, medium, or low) and geographic scope (very high, high, medium, and low) of each stress was determined through a review of existing information. The CAP Workbook then assigns an overall stress rank (very high, high, medium, or low) to that stress.

The CAP Workbook automatically inputs the overall rank of each stress into a table that relates the stress to a series of anthropogenic sources of stress (also called Threats) that have been identified by the user as relevant to that watershed (*e.g.*, roads, grazing practices, logging, recreational facilities, agricultural conversion of watershed lands, dams, groundwater extraction, in-channel mining, *etc.*). Each threat is ranked on the basis of its relative "contribution" (very high, high, medium, or low) and "irreversibility" (very high, high, medium, or low) to each stress (*e.g.*, increased turbidity, delayed migration, *etc.*). Within the CAP Workbook threats (source of stress) are ranked as "Very High," "High," "Medium," or "Low" and inputs the rank into the next step of the assessment. In theory, this process is repeated for each conservation target (egg, fry, juvenile, smolt, and adult), where such data exists, as well as for the "Multiple Life Stages" conservation target.

Summary of Threats: The CAP Workbook ranks the threat sources for each conservation target (*i.e.,* life-history stage) from the previous analysis into a "Summary of Threats" table that lists all the threat sources for all life history stages and assigns a composite "Overall Threat Rank" to each threat source (*e.g.*, dams and surface water diversions, etc.), as well as an overall threat rank to that watershed for all threat sources combined. The Workbook *derives* a second table ("Stress Matrix") that shows the rank of each stress on each life-history stage. The third step in the steelhead CAP assessment is the derivation of a third table entitled, "Overall Viability Summary," that ranks the viability of each life history stage and KEA category (size, condition, and landscape context) by calculating a composite rank of the current habitat indicators from the "Viability" table of the workbook, as well as an overall "Project Biodiversity Health Rank," which is a measure of watershed "health" based on current habitat conditions. The first and third summary tables proved the most useful in analyzing stresses and sources of stress to *O. mykiss* in the SCCCS Recovery Planning Area.

Data Gaps. The tables in the CAP Workbooks for the present study have numerous blank cells. Blank cells indicate a lack of available information. Watersheds that have been intensively studied have fewer blank cells than watersheds with few studies. However, an important feature of the CAP Workbook method is the ability to update the assessment as information becomes available. In the interim, professional judgment – supplemented by more recent investigations - must be used to address such gaps until such time as field derived, quantitative data are available.

The set of watersheds assessed with the CAP Workbook method in the SCCCS DPS are identified in Table D-1, and arranged geographically (north to south) within each of the 4 BPG

Table D-1. South-Central California Steelhead Recovery Planning Area Component Biogeographic Population Groups, Watersheds, and Corresponding CAP Workbooks.

Biogeographic Population Group	Watershed (North to South)	CAP Workbook
Interior Coast Range	Pajaro River	Main stem Pajaro River
		Uvas Creek
	Lower Salinas Basin	Main stem Salinas River
		Gabilan Creek
		Arroyo Seco
	Upper Salinas Basin	San Antonio River
		Nacimiento River
Carmel River Basin	Carmel River	Carmel River
Big Sur Coast	San Jose Creek	San Jose Creek
	Garrapata Creek	Garrapata Creek
	Bixby Creek	Bixby Creek
	Little Sur River	Little Sur River
	Big Sur River	Big Sur River
	Willow Creek	Willow Creek
	Salmon Creek	Salmon Creek
San Luis Obispo Terrace	San Carpoforo Creek	San Carpoforo Creek
	Arroyo de la Cruz	Arroyo de la Cruz
	Little Pico Creek	Little Pico Creek
	Pico Creek	Pico Creek
	San Simeon Creek	San Simeon Creek
	Santa Rosa Creek	Santa Rosa Creek
	Morro Creek	Morro Creek
	Morro Bay Estuary	Chorro Creek
		Los Osos Creek
	San Luis Obispo Creek	San Luis Obispo Creek
	Pismo Creek	Pismo Creek
	Arroyo Grande Creek	Arroyo Grande Creek

NMFS used two sets of CAP Workbooks prepared independently by two consultants (Kier Associates and Hunt & Associates), but using a common set of reference values, for its threat assessments and related recovery actions. As noted above, Kier Associates developed the reference values and analyzed a set of watersheds using a set of available GIS-based landscape indicators (*e.g.*, number of miles of roads per square mile of watershed, extent of agricultural conversion of watershed, riparian canopy cover, *etc.*) and a small number of point-data measurements of key ecological attributes (*e.g.*, dissolved oxygen, water temperature, *etc.*) believed to be important for assessing habitat conditions for steelhead (Kier Associates and NMFS 2008a, 2008b). The CAP Workbooks prepared by Hunt & Associates used the

reference values developed by Kier Associates, but added ground-based information on existing *O. mykiss* conditions in each selected watershed from a broad range of published and unpublished materials, including: peer-reviewed scientific publications; technical reports, federal, state, and local planning documents; EIR/EISs, management plants; passage barrier assessments; project-driven habitat evaluations; field surveys; information provided by NMFS and CDFWS staffs; and stakeholder input gathered at a series of public workshops held in 2007 (Hunt & Associates Biological Consulting Services 2008a).

The CAP Workbooks analyses prepared by Kier Associates are intended to complement, not duplicate, those prepared by Hunt & Associates. During the initial stages of CAP Workbook analyses by Hunt & Associates, it was determined that, in some cases, surrogate indicators covering regional spatial scales and derived from GIS-based watershed analysis, might be useful in overcoming the spatial and temporal problems associated with habitat indicators that rely on point-data measurements (such as water temperature, turbidity, riparian corridor width and composition, *etc.*). A separate conservation target category "Multiple Life Stages" was developed for the CAP Workbook analyses that used GIS-based surrogate indicators. Surrogate indicators, such as density of roads per square mile of watershed, density of roads within 300 feet of streams per square mile of watershed, human population density, percent of watershed converted to agriculture; percent of watershed converted to impervious surfaces, percent of watershed burned in past 25 years, and others provided a general measure of existing watershed conditions as they affect multiple steelhead life history stages. For example, road density, especially riparian road density, and percent of watershed covered by impervious surfaces, has strong predictive power of general habitat conditions for steelhead because paved surfaces have manifold adverse effects on habitat quality, water quality, and the hydrology of streams.

Hunt & Associates developed CAP Workbooks for 27 drainages across the South-Central California Steelhead DPS (Hunt & Associates 2008a). Kier Associates CAP Workbooks for 23 drainages across the South-Central California Steelhead DPS (Kier Associates and National Marine Fisheries Service 2008b).

Table D-2 compares the results of the two independent threats assessments for watersheds in the SCCCS Recovery Planning Area. It should be noted that the difference between a "Poor" and "Fair" habitat rating or a "Good" and "Very Good" rating is often a matter of professional judgment and may not always represent important differences in overall habitat quality. Table D-2 explains discrepancies between "Poor-Fair" and "Good-Very Good" categories between the Hunt & Associates and Kier Associates CAP Workbook assessments.

Discrepancies typically could be explained by the type (point-data measurements) and the number of indicators used in the analysis by Kier Associates versus Hunt &Associates. As the number of indicators decreases, the relative weight given to each indicator in the analysis correspondingly increases, and if these indicators are based on point-data measurements, such as water temperature or dissolved oxygen, that exhibit extreme spatial and temporal variation, then different results can be obtained. Aside from these relatively few specific differences, the results of the two threats assessments closely agree.

Further refinement of individual threat severity and threat sources in specific watersheds was conducted for these threat assessments by using information from NOAA and CDFWS staff familiar with the selected watersheds to override certain assessments generated through the formal CAP Workbook process, and additional information developed or located in subsequent development phases of the SCCCS Recovery Plan. Finally, in addition to the CAP threats assessment, NMFS considered how

predicted changes in climate and the marine environment may affect the species ability to recover and persist.

Table D-2. Variation in Assessments of Overall Habitat Conditions for Steelhead in Component Watersheds in the South-Central California Steelhead Recovery Planning Area Between Two CAP Workbook Analyses*

Watershed*	Steelhead Habitat Rating		Reasons for** Discrepancy
	Hunt & Associates	Kier Associates	
Pajaro River			**Minor difference in cutoff points between indicator categories; difference in number of indicators used to determine steelhead life history stage viability**
Lower Salinas River			
Upper Salinas River			
Carmel River			
San Jose Creek			**Minor difference in cutoff points between indicator categories; difference in number of indicators used to determine steelhead life history stage viability**
Garrapata Creek			**Minor difference in cutoff points between indicator categories; difference in number of indicators used to determine steelhead life history stage viability**
Bixby Creek			
Little Sur River			
Big Sur River			**Difference in rating floodplain connectivity and number of available indicators used in analysis**
Willow Creek			
Salmon Creek			**Natural barrier (waterfall) in lower reach is limit of anadromy. Kier rates entire watershed as poor on this basis; Hunt & Associates rates only accessible reach.**
San Carpoforo Creek			
Arroyo de la Cruz			
Little Pico Creek			
Pico Creek			**Kier includes point measurements for dissolved oxygen for fry, juvenile, and smolt life stages (rated as "poor"); difference in number of available indicators**
San Simeon Creek			

Santa Rosa Creek			**Minor difference in cutoff points between indicator categories; difference in number of indicators used to determine steelhead life history stage viability**
Morro Creek			
Chorro Creek			Minor difference in cutoff points between indicator categories; difference in number of indicators used to determine steelhead life history stage viability
Los Osos Creek			Minor difference in cutoff points between indicator categories; difference in number of indicators used to determine steelhead life history stage viability
San Luis Obispo Creek			
Pismo Creek			
Arroyo Grande Creek			Minor difference in cutoff points between indicator categories; difference in number of indicators used to determine steelhead life history stage viability

Key: dark green = very good conditions; light green = good conditions; yellow = fair conditions; red = poor conditions.

** Watersheds analyzed only by Hunt & Associates are not shown. Overall habitat condition rating taken from "Project Biodiversity Health Rank" rating in "Overall Viability Summary" table in Summary section of individual CAP Workbooks (composite rating of habitat conditions for all steelhead life history stages combined)..*

*** Pervasive discrepancies between Hunt Associates vs. Kier Associates "poor" and "fair" categories here are due to fewer indicators used in the latter analyses.*

The full CAP Workbooks, with references, are available on CDs upon request to NOAA's Long Beach, CA.