SOUTHERN CALIFORNIA COAST STEELHEAD RECOVERY PLANNING AREA

CONSERVATION ACTION PLANNING (CAP) WORKBOOKS THREATS ASSESSMENT SUMMARY

Matilija Creek, Ventura River watershed, Ventura County

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Southern California Coast ESU
Steelhead Threats Assessment Methodology

Introduction. The Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service (NMFS) contracted with Lawrence E. Hunt of Hunt & Associates Biological Consulting Services to provide technical support in developing Recovery Plans for steelhead (*Oncorhynchus mykiss*) populations in the South-Central California Coast Steelhead Evolutionarily Significant Unit (ESU) and the Southern California Coast Steelhead ESU. Specifically, Hunt & Associates was tasked with reviewing existing information on steelhead habitat conditions and assessing the magnitude and extent of threats to steelhead and their habitats and developing recovery planning actions across these two ESUs. This document summarizes the results of an assessment of threats and sources of threats to steelhead in the Southern California Coast Steelhead ESU, which includes coastal steelhead populations in the Santa Maria River system in Santa Barbara County southward to the Tijuana River watershed (U.S. portion only) along the United States-Mexico border. Recovery action matrices for each watershed in both ESUs are provided in a separate document.

Methods. Thirty-two coastal basins, representing 46 drainages, were selected for threats assessment analysis and recovery planning actions in this ESU (see Table 1 in Threats Assessment Summary section). Boughton et al. (2006) identified these watersheds as supporting historical and extant steelhead populations. Information on existing steelhead habitat conditions in the project area was gathered from a broad range of books, peer-reviewed scientific publications, technical reports, federal, state, and local environmental documents, EIR/EISs, management plans, passage barrier assessments, habitat evaluations, and field surveys, as well as specific information given by stakeholders and other interested parties at a series of public workshops held throughout both ESUs in 2007. These sources are listed in the bibliography in this document.

A separate CAP Workbook was established for each of the 46 component watersheds analyzed in this ESU. The reader is directed to any of these workbooks for the following discussion:

The Conservation Action Planning (CAP) Workbook, a relational database developed by The Nature Conservancy to identify conservation targets, assess existing habitat conditions, and identify management issues was used to organize and evaluate the large amount of information on current steelhead habitat conditions and threats to steelhead in these watersheds, as gleaned from widely disparate sources. The CAP Workbook methodology provides a number of benefits in assessing the magnitude and extent of threats to steelhead and their habitats:

- It can use quantitative and qualitative (i.e., professional judgment) measures of existing habitat conditions;
- It provides an objective, consistent means for determining changes in the status of each conservation target (steelhead life history stage) over time;

- It provides an objective, consistent way to compare the status of a specific target between watersheds;
- It provides an overall assessment of a watershed's "health" or viability and allows objective comparisons to other watersheds;
- It focuses recovery actions by identifying past, current, and potential threats to steelhead and their habitats;
- It provides a central repository for documenting current knowledge and assumptions about existing conditions;
- It can be continually updated as information on the target's biology and/or existing conditions within watersheds change, and;
- It creates the foundation upon which recovery actions can be monitored and updated, based on changing current conditions.

The CAP Workbook process uses available information on the target's biology in an explicit, objective, consistent, credible, and transparent assessment of current habitat conditions. Assessing threats to particular or multiple life stages does not require "perfect" information. Rather, the CAP Workbook allows the user to input quantitative as well as qualitative (professional judgment) information in order to determine what existing conditions are and what healthy targets should look like. The Workbook is flexible, iterative, and adaptable—it uses the best available knowledge at the time, and can be updated as additional information becomes available.

CAP Methodology—Conservation Targets. The user identifies specific "conservation targets" for analysis. The conservation targets in this case are steelhead life history stages: egg, fry, smolt, and adult. In an effort to balance the specificity inherent in a life history stage approach, a more general conservation target, "Multiple Life Stages", also was established to allow landscape-scale land use and habitat assessment, based on information derived from GIS=based analysis of entire watersheds (see section below describing relationship between Kier Associates' and Hunt & Associates' CAP Workbook analyses).

CAP Methodology—KEAs. Assessing the "viability" or "health" of a particular conservation target (life history stage) begins with identifying "Key Ecological Attributes" (KEA) for each target. 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, road density, 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. KEAs were grouped into three categories, based roughly on spatial scale:

- *Size*: target abundance (i.e., number of adult steelhead);

- *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).

CAP Methodology—Current Indicators. The range of variation found in each indicator is subdivided into four more or less 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 (see the description of indicators used in the CAP steelhead analyses and the justification for these discrete indicator categories in Kier Associates and National Marine Fisheries Service (2008)). Functionally however, there are essentially two states for the indicator as it relates to the species: "poor-fair", in which the indicator exceeds or barely meets the requirements for species survival and the population is in danger of extirpation, and "good-very good", where habitat conditions are favorable for species persistence.

The CAP Workbook can use local-, regional-, and landscape-scale indicators. For example, land use indicators, such as density of roads per square mile of watershed, has been widely employed as a landscape-scale metric of watershed "health" for salmonids throughout the western United States (see discussion in Kier Associates and NMFS, 2008). These types of landscape-scale metrics were used in the present document to overcome logistical and analytical problems inherent in local-scale metrics of steelhead habitat quality, e.g, water temperature, that exhibit extreme spatial and temporal variation.

The conceptual goal of establishing measurable and objective indicators sometimes exceeded current knowledge of existing habitat conditions in the component watersheds. For example, turbidity is an important steelhead habitat indicator. For the steelhead fry life stage, turbidity was defined as the "number of days turbidity exceeded 25 NTUs" and the "poor" category was defined as "> 30 days during fry development period", while "very good" was defined as "< 10 days during fry development period", with "fair" and "good" conditions intermediate between these boundaries. Currently, there is little or no systematic and widespread collection of turbidity data in most of the subject watersheds drainages to permit a useful analysis. In these instances, subjective information, such as observations of mass wasting of slopes, descriptions of point and non-point sediment inputs, etc., were used to qualitatively assess a current condition and rating for this indicator. A key feature of the CAP Workbook process is its ability to use quantitative information as well as professional judgment to assess current habitat conditions. Because the CAP Workbook analysis is iterative, results can be improved as better quantitative information becomes available.

CAP Methodology—Stresses and Sources of Stress (Threats). The next step in the CAP Workbook analysis is identifying a series of stresses to each steelhead life history stage. These stresses are basically altered KEAs and, ideally, should directly affect the life stage, e.g., degraded hydrologic function, increased turbidity, presence of non-native predators, increased substrate embeddedness). In this CAP Workbook analysis however, the GIS-based surrogate variables used for the "Multiple Life Stages" conservation target actually are sources of stress, not direct stressors on steelhead life stages (e.g., increased road density (a source of stress) contributes indirectly to increased turbidity (a direct stressor). This resulted in some level of redundancy in the analyses. The user assesses the severity (very high, high, medium, or low) and geographic scope (very high, high, medium, and low) of each stress, then the CAP Workbook 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.). The user ranks each threat 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). The CAP Workbook then ranks the threat (source of stress) as "Very High', "High", "Medium", or "Low" and inputs that rank into the next step of the analysis. This process was repeated for each conservation target (steelhead life history stage--egg, fry, juvenile, smolt, and adult), as well as the "Multiple Life Stages" conservation target.

CAP Methodology—Summary of Threats. The CAP Workbook ranks the threat sources for the various conservation targets (life history stages) 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), 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 final step in the steelhead CAP analysis was 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" page 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 most useful in analyzing stresses and sources of stress to steelhead in the South-Central California Coast and Southern California Coast steelhead ESUs.

Data Gaps. The pages in the CAP Workbooks for the present study have many 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. In general, the level of available information on current watersheds conditions, with a few notable exceptions, increased dramatically south of the Santa Monica Mountains (e.g., the Mojave Rim Biogeographic Population Group watersheds and most of the Orange and San Diego county watersheds). As previously stated, a feature of the CAP Workbook methodology is the ability to update the analyses as information becomes available.

Relationship between CAP Workbook analyses developed by Hunt & Associates and Kier Associates. The CAP Workbooks analyses prepared by Kier Associates are meant 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 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 as input. 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 as impervious surface, has strong predictive power of general habitat conditions for steelhead because paved surfaces have manifold effects on habitat quality, water quality, and hydrology of streams.

Kier Associates was subsequently contracted by NOAA-NMFS to provide GIS-based metrics and values for individual watersheds as support for the CAP Workbook analyses in-progress by Hunt & Associates. Kier Associates analyzed 54 watersheds across both steelhead ESUs (23 in the South-Central California Coast Steelhead ESU and 31 in the Southern California Coast Steelhead ESU), using the GIS-based regional indicators. Their workbooks also include information on a small number of point-based measurements, such as dissolved oxygen, water temperature, etc.

The Kier Associates' workbooks supplement those prepared by Hunt & Associates. Hunt & Associates' workbooks are based on review of a large number and broad range of ground-based steelhead surveys, habitat and barrier assessments, and other fieldwork, as well as the GIS-based indicators for the "Multiple Life History" target category developed by Kier Associates. Hunt & Associates developed CAP Workbooks for 73 watersheds across both steelhead ESUs (27 in the South-Central California Coast Steelhead ESU and 46 in the Southern California Coast Steelhead ESU).

Kier Associates' workbooks are provided as a separate document (Kier Associates and NMFS, 2008). In order to avoid confusion and explain discrepancies in the overall assessment of steelhead habitat conditions in watersheds found in the present document and Kier Associates' document, Table 1 compares the results of the two documents for watersheds in the Southern California Coast Steelhead ESU. 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 does not represent important differences in habitat quality. Of real concern, are habitat differences between the "poor-fair" and "good-very good" indicator categories. Table 1 explains discrepancies between "poor-fair" and "good-very good" categories between the Hunt & Associates and Kier Associates CAP Workbook analyses.

Table 1. Assessment of Overall Habitat Conditions for Steelhead in Component Watersheds in the Southern California Coast Steelhead ESU Between Two CAP Workbook Analyses*

Watershed	Steelhead Habitat Rating		Reasons for Discrepancy**
	Hunt & Associates	Kier Associates	
Santa Maria River			
Santa Ynez River			
Ventura River			
Santa Clara River			
Gaviota Creek			
Arroyo Hondo			**Hunt & Associates rates passage barrier at Highway 101 as severe, but being re-designed for fish passage. Override function used to rate this relatively undisturbed watershed as "good"**
Tecolote Creek			
Goleta Slough			
Mission Creek			
Montecito Creek			
Carpinteria Creek			
Rincon Creek			
Big Sycamore Creek			
Arroyo Sequit			

Malibu Creek			
Las Flores Canyon Creek			
Topanga Canyon Creek			
Los Angeles River			
San Gabriel River			
Santa Ana River			
San Juan/Trabuco Creek			
San Mateo Creek			
San Onofre Creek			
Santa Margarita River			
San Luis Rey River			
San Dieguito River			
San Diego River			
Sweetwater River			
Otay River			
Tijuana River			

*** 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). Watersheds analyzed only by Hunt & Associates are not shown.**

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

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

The results of the two analyses closely agree. There are four discrepancies (bolded table entries) that can be explained by the type (point measurements) and lower number of indicators used in each analysis by Kier Associates. This is a consistent difference between Kier Associates' and Hunt & Associates' workbooks. 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 measurements, such as water temperature or dissolved oxygen, that exhibit extreme spatial and temporal variation, then different results can be obtained. Despite these differences, again, the results closely agree.

Southern California Coast Steelhead Recovery Planning Area
Threats Assessment Summary

Location and Component Watersheds. The Southern California Coast Steelhead Environmentally Significant Unit (ESU) encompasses five Biogeographic Population Groups (BPGs) that extend from the southern end of the Santa Lucia Mountains southward through the Transverse and Peninsular ranges to the Mexican border, and includes portions of San Luis Obispo, Santa Barbara, Kern, Ventura, Los Angeles, Riverside, San Bernardino, Orange, and San Diego counties. These BPGs vary greatly in size, from the Santa Monica Mountains BPG at about 107,500 acres to the Monte Arido Highlands BPG, which encompasses over 2.95 million acres. The component watersheds of the five BPGs analyzed in this document are listed in Table 1 and the results of the Conservation Action Planning (CAP) Workbook analyses are presented in individual summaries for each BPG.

Table 1. Southern California Coast Steelhead ESU Component Biogeographic Population Groups, Watersheds, and Corresponding CAP Workbooks.

Biogeographic Population Group	Watershed	CAP Workbook
Monte Arido Highlands	Santa Maria River	Main stem Santa Maria River
		Cuyama River
		Sisquoc River
	Santa Ynez River	Main stem Santa Ynez River (lower, middle, and upper reaches)
	Ventura River	Main stem Ventura River
		Coyote Creek
		Main stem Matilija Creek
		North Fork Matilija Creek
		San Antonio Creek
	Santa Clara River	Main stem Santa Clara River
		Santa Paula Creek
		Sespe Creek
		Piru Creek
Conception Coast	Jalama Creek	Jalama Creek
	Canada de Santa Anita	Canada de Santa Anita
	Gaviota Creek	Gaviota Creek
	Arroyo Hondo Creek	Arroyo Hondo Creek
	Tecolote Creek	Tecolote Creek
	Goleta Slough	San Jose, Atascadero, San Pedro, and Maria Ygnacio creeks
	Mission Creek	Mission Creek
	Montecito Creek	Montecito Creek
	Carpinteria Creek	Carpinteria Creek
	Rincon Creek	Rincon Creek
Santa Monica Mountains	Big Sycamore Canyon Creek	Big Sycamore Canyon Creek
	Arroyo Sequit	Arroyo Sequit
	Malibu Creek	Malibu Creek
	Las Flores Canyon Creek	Las Flores Canyon Creek
	Topanga Canyon Creek	Topanga Canyon Creek
Mojave Rim	Los Angeles River	Main stem Los Angeles River
		Arroyo Seco
	San Gabriel River	Main stem San Gabriel River
		East Fork San Gabriel River
		West Fork San Gabriel River

	Santa Ana River	Main stem Santa Ana River
		Lytle Creek
		Mill Creek
Santa Catalina Gulf Coast	San Juan River	San Juan River/Trabuco Creek
	San Mateo Creek	San Mateo Creek
	San Onofre Creek	San Onofre Creek
	Santa Margarita River	Santa Margarita River
	San Luis Rey River	San Luis Rey River
	San Dieguito River	San Dieguito River
	San Diego River	San Diego River
	Sweetwater River	Sweetwater River
	Otay River	Otay River
	Tijuana River	Tijuana River

Land Use. Public ownership of lands in the Southern California Coast Steelhead ESU varies widely between watersheds but generally decreases southward. Although public ownership of these watersheds (National Forest and BLM lands, military reservations, etc.) can be extensive, public lands are concentrated in the upper watersheds leaving the middle and lower watersheds subject to private development. Population centers in this BPG are concentrated on the coastal terraces, plains, and basins. Population density varies widely between watersheds (Fig. 1; Table 2). Average population density is very high in the Mojave Rim BPG because it includes the very large metropolitan areas of the Los Angeles Basin. Although the Santa Catalina Gulf Coast BPG includes the San Diego metropolitan area, the Conception Coast BPG has the second highest population density because the watersheds in the latter are very small relative to those in the former. Regardless, population density is a relative measure of intensity of land use and impacts to individual watersheds.

Urban and suburban conversion of watershed lands in some parts of this ESU is very high, but again, varies greatly between BPGs, depending on human population density (Table 2). For example, 50% to 60% of the area of the San Gabriel River and Los Angeles River watersheds, respectively, in the Mojave Rim BPG is classified as urban, compared to less than 1% of the Big Sycamore Canyon Creek watershed in the Santa Monica Mountains BPG. Population densities in this ESU are generally highest in the Santa Barbara/Goleta region of the Conception Coast BPG, the Malibu Creek region of the Santa Monica Mountains BPG, the Los Angels Basin portion of the Mojave Rim BPG watersheds, and the northern and southern portions of the Santa Catalina Gulf Coast BPG (Table 2).

Table 2. Human population density of component watersheds in the Southern California Coast Steelhead ESU (data from CDFFP Census 2000 block data (migrated), 2003).

Watershed (north to south)	**Human Population Density (# / square mile)**
Monte Arido Highlands BPG	
Santa Maria River *	66
Santa Ynez River	83
Ventura River	196
Santa Clara River	216

Conception Coast BPG	
Jalama Creek	2
Canada de Santa Anita	5
Gaviota Creek	2
Arroyo Hondo	< 1
Tecolote Creek	57
Goleta Slough **	1,201
Mission Creek	3,491
Montecito Creek	409
Carpinteria Creek	205
Rincon Creek	22
Santa Monica Mountains BPG	
Big Sycamore Canyon Creek	1
Arroyo Sequit	31
Malibu Creek	678
Las Flores Canyon Creek	229
Topanga Canyon Creek	278
Mojave Rim BPG	
Los Angeles River	5,237
San Gabriel River	3,343
Santa Ana River	1,744
Santa Catalina Gulf Coast BPG	
San Juan River/Trabuco Creek	1,079
San Mateo Creek	30
San Onofre Creek	84
Santa Margarita River	246
San Luis Rey River	257
San Dieguito River	371
San Diego River	1,140
Sweetwater River	1,119
Otay River	838
Tijuana River ***	159

* includes the Santa Maria River, Cuyama River, and Sisquoc River watersheds
** includes the San Pedro, Atascadero, San Jose, and Maria Ygnacio watersheds
*** includes only the U.S. portion of the watershed

Some of these watersheds have been extensively developed for agriculture, which typically utilizes floodplain land first. The upland slopes in several of the watersheds in the Conception Coast BPG and Santa Catalina Gulf Coast BPG are extensively planted in orchard crops. The spatial configuration and intensity of land use within these watersheds generally determines the type and magnitude of impacts to steelhead and their habitats. A relatively small amount of urban or agricultural development can have disproportionately large impacts on instream and riparian conditions for steelhead. The typical pattern of urban and agricultural development focuses on the flatter portions of a watershed, typically within the floodplain and usually along the main stem of the drainage and one or more tributaries, thereby magnifying potential impacts to steelhead even if most of the watershed remains undeveloped.

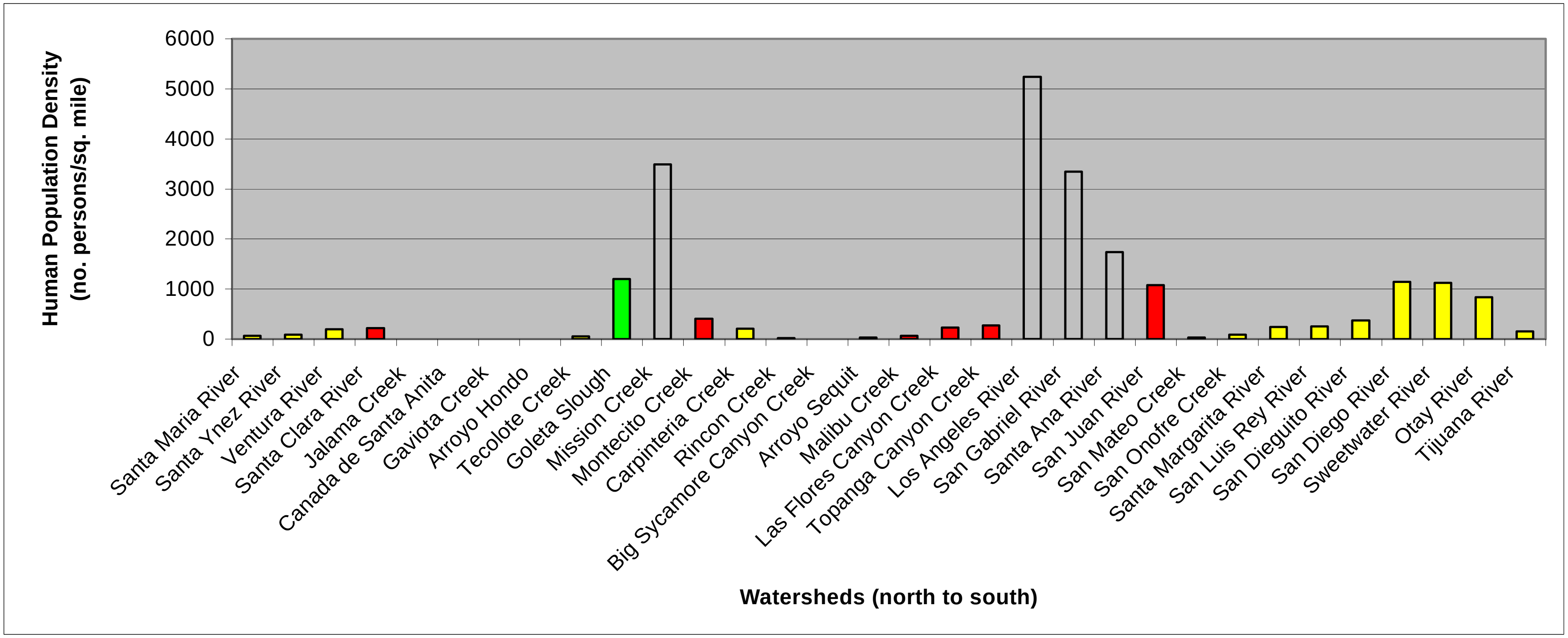

Figure 1. Habitat conditions for steelhead versus human population density in component watersheds of the Southern California Coast Steelhead ESU (densities are listed in Table 2; histogram color code is same as for indicator ratings in individual BPG summaries). Note scale of Y-axis relative to Fig. 1 in the South-Central California Coast Steelhead ESU threats summary.

Threats. Each of the watersheds in the Southern California Coast Steelhead ESU is impacted by a variety of anthropogenic factors, but the most frequent source of threats arises from agricultural and urban development, specifically water management activities. Dams, surface water diversions, groundwater extraction are common across this ESU, especially on the larger rivers, such as the Santa Maria, Santa Ynez, Ventura, Santa Clara (tributaries), San Gabriel, and Santa Ana rivers, some of which contain three major dams on the main stem alone. Fourteen of the 47 watersheds listed in Table 1 are sub-watersheds that depend on the main stem of the river to maintain connectivity to the estuary and ocean. Loss of surface flows or other passage impediments along the main stem of the river indirectly degrades these tributaries as spawning and rearing habitat even if the tributaries themselves remain undisturbed. Re-establishing or maintaining connections between the ocean and upper watersheds expands access to historically important spawning and rearing habitats, and significantly improve habitat conditions in these watersheds for steelhead, as well as the existing populations of native rainbow trout that currently are isolated above dams and reservoirs.

Urban and agricultural conversion of floodplain lands flanking the main stem of these rivers and creeks typically requires levees or other structures to protect these lands from flooding. The urban and agricultural reaches of all of the watersheds in this ESU have been subjected to some degree of channelization and/or levee construction with the resulting loss or degradation of the riparian corridor and/or streambed. Habitat impairments for steelhead may range from increased water temperature, incision of the streambed and loss of structural complexity and instream refugia (meanders, pools, undercut banks, etc.), complete loss of bed and bank habitat, increased sedimentation, turbidity, and substrate embeddedness, and nutrient loading.

Estuaries are used by steelhead as rearing areas for juveniles and smolt as well as staging areas for smolt acclimating to saline conditions in preparation for entering the ocean and adults acclimating to freshwater in preparation for spawning. Approximately 75% of estuarine habitats across this ESU have been lost (Table 3), and the remaining 25% are constrained by agricultural and urban development, levees, and transportation corridors (highways and railroads). Estuarine habitat loss varies widely across BPGs, with the Santa Maria River and Santa Ynez River estuaries being the most physically intact, though they are impaired by reduced freshwater inflows and point and non-point waste discharges from both municipal and agricultural sources.

Table 3. Estuarine habitat loss in component watersheds in the Southern California Coast Steelhead ESU.

Watershed (north to south)	Remaining Estuarine Habitat as Percentage of Historic Habitat
Monte Arido Highlands BPG	
Santa Maria River	81
Santa Ynez River	94
Ventura River	32
Santa Clara River	15
	Average = 56% remaining

Conception Coast BPG	
Gaviota Creek	25
Arroyo Hondo	5
Tecolote Creek	25
Goleta Slough	31
Mission Creek	10
Montecito Creek	5
Carpinteria Creek	20
Rincon Creek	5
	Average = 16% remaining
Santa Monica Mountains BPG	
Big Sycamore Canyon Creek	10
Arroyo Sequit	10
Malibu Creek	34
Las Flores Canyon Creek	3
Topanga Canyon Creek	30
	Average = 17% remaining
Mojave Rim BPG	
Los Angeles River	0
San Gabriel River	2
Santa Ana River	3
	Average = 2% remaining
Santa Catalina Gulf Coast BPG	
San Juan River	10
San Mateo Creek	76
San Onofre Creek	20
Santa Margarita River	41
San Luis Rey River	10
San Dieguito River	43
San Diego River	9
Sweetwater River	5
Otay River	14
Tijuana River	52
	Average = 28% remaining

Summary. The overall condition of component major watersheds within this ESU was rated as “Fair” to “Poor” (Fig. 1; see CAP Workbook summaries for more detailed information). Only four of the 45 watersheds analyzed in this ESU were rated overall as “Good” or “Very Good” in the CAP Workbook analyses: San Antonio Creek and Santa Paula Creek in the Monte Arido Highlands BPG, Arroyo Hondo in the Conception Coast BPG, and Topanga Canyon Creek in the Santa Monica Mountains BPG (see attached Overall Viability Summary in attachments for details). However, many of the watersheds in this BPG support high-quality steelhead spawning and rearing habitat but are compromised by one or more anthropogenic factors (e.g., Matilija Creek (dam), North Fork Matilija Creek (other passage barriers), and Sespe Creek (excessive groundwater extraction in the lower reaches) in the Monte Arido Highlands BPG). The overall low rating of watersheds in this ESU, specifically, the middle and lower reaches, reflects generally high to very high population density across portions of this ESU (Table 2; Fig. 1). Whereas in the South-Central Steelhead ESU where watershed health was directly related to population density, population density and development pressures are generally so high in most of the watersheds in the Southern California ESU as to preclude this relationship. Even watersheds that have relatively low population densities, such as the Santa Maria River, Santa Ynez River and Tijuana River watersheds, support one or more major dams that severely degrade overall habitat conditions for steelhead by reducing and completely limiting flows necessary for fish passage, and blocking access to a majority of the prime spawning and rearing habitats in the upper reaches of these watersheds.

Table 4. Severe or Very Severe Threat Sources in the Southern California Coast Steelhead ESU*.

Threat Source	Biogeographic Population Group				
	Monte Arido Highlands	Conception Coast	Santa Monica Mountains	Mojave Rim	Santa Catalina Gulf Coast
Urban Development	X	X	X	X	X
Flood Control	X	X	X	X	X
Other Passage Barriers	X	X	X	X	X
Non-Native Wildlife	X	X	X	X	X
Roads	X	X	X	X	X
Dams and Surface Water Diversions	X		X	X	X
Groundwater Extraction	X	X		X	X
Agricultural Development	X	X		X	X
Levees and Channelization	X	X		X	X
Wildfires	X	X	X		
Non-Point Pollution			X	X	X
Mining and Quarrying	X	X			
Agricultural Effluents	X				X
Urban Effluents	X				
Non-Native Species	X				

*** These are the "severe" (yellow) and "very severe" (red) threat sources taken from the top five threat sources identified by the CAP Workbook analyses. See individual BPG Threat Summaries for more information.**

Because different threat sources can produce similar proximal stresses on steelhead and steelhead habitat, the severe and very severe sources of threats listed in Table 4 grouped into the following categories:

- Urban development (road density; culverts and stream/river crossings; non-point pollution; floodplain encroachment; levees and channelization, wastewater effluents; channel maintenance; non-native vegetation);
- Agricultural development (floodplain encroachment; levees and channelization; agricultural effluents; channel maintenance; non-native vegetation);

- Water management (dams, surface water diversions, and groundwater extraction to serve urban and agricultural development; non-native vegetation);
- Mining and quarrying (floodplain encroachment; passage barriers);
- Recreation (fisheries) development (non-native wildlife);
- Wildland fire (sedimentation; altered hydrograph; non-native vegetation).

These sources of threats are not mutually exclusive—they can create a number of primary and secondary sources of threats, which in turn degrade steelhead habitat and/or directly stress one or more steelhead life stages. Urban and agricultural development creates a cascading series of sources of threats to steelhead, e.g., dam construction creates passage barriers to spawning and rearing habitat and negatively affects the hydrology, sediment transport processes, and geomorphology of the affected drainages, but frequently includes recreational development of reservoirs for fishing and camping, which can introduce non-native predators and/or competitors to steelhead (e.g., largemouth bass, crayfish, western mosquitofish) as well as promote trampling of the active channel, which can lead to direct loss of redds.

A widespread trend observed in this ESU is severe to very severe degradation of habitat conditions along the main stem of impaired watersheds, while the upper main stem and tributaries retain relatively high habitat values for steelhead. Because the main stem of these drainages is the conduit that connects steelhead spawning and rearing habitat with the ocean, recovery actions in watersheds impaired in this manner should focus on reducing the severity of anthropogenic impacts along the main stem resulting from encroachment into riparian areas and related flood control activities in order to promote connectivity between the ocean and estuarine habitats. Additionally, degraded estuarine conditions stemming from filling, artificial sandbar manipulation, and both point and non-point waste discharges should be further evaluated and addressed as part of any recovery strategy for this ESU (see threats summaries and recovery action matrices for individual BPGs for more specific threats and recovery actions).

Threats Assessment for the Monte Arido Highlands Biogeographic Population Group

Location and Physical Characteristics. The Monte Arido Highlands BPG region encompasses four moderate-sized to large coastal watersheds and eight sub-watersheds that drain the western half of the Transverse Range in southern San Luis Obispo, Santa Barbara, Ventura, and eastern Los Angeles counties. The Santa Maria River watershed proper is a small, coastal drainage formed by the confluence of two large interior watersheds: the Cuyama River and the Sisquoc River, which together drain most of the Sierra San Rafael, Sierra Madre, and Caliente ranges. The Santa Ynez River drains the south-facing slopes of the Sierra San Rafael and north-facing slopes of the Santa Ynez Mountains. Together the Santa Maria and Santa Ynez rivers also drain the Santa Maria Basin, a coastal subsidence basin formed by crustal elongation and clockwise rotation of the Santa Ynez Mountains. The Ventura River drains the coastal slopes of the eastern end of the Santa Ynez Mountains and the western end of the Transverse Range. The Santa Clara River drains much of the western Transverse Range, including the northern slopes of the San Gabriel Mountains. The main stems of the Santa Maria River and Santa Ynez rivers are oriented to the west and discharge to the Pacific Ocean in western Santa Barbara County. The Ventura and Santa Clara watersheds abut the upper watersheds of the former two, but their main stems flow south and southwesterly into the Pacific Ocean in southern Ventura County (Fig. 2).

These watersheds are highly disparate in slope, aspect, and size, but share one common feature: the interior portions are mountainous and include high peak elevations, ranging between 5,700 and 8,600 feet above sea level. Each of these watersheds flows across a coastal terrace, but the Santa Maria, Santa Ynez, and Santa Clara rivers traverse broad coastal plains before entering the Pacific Ocean. Overall, stream lengths tend to be very long, owing to high topographic relief in the interior watersheds. The Santa Maria River watershed (Cuyama River sub-watershed) extends the furthest inland—almost 90 miles between the mouth and the limits of the upper watershed.

Average annual precipitation in the Santa Maria River and Santa Clara River watersheds is much lower than the other two because the former include extensive arid interior regions. Although rainfall amounts increase dramatically with increasing elevation, the orographic effect is enhanced in the coastal mountainous portions of these watersheds because much of their interiors lie in “rain shadows” formed by more coastal portions of the same watersheds. For example, Old Man Mountain at 5,500 feet above sea level in the Ventura River watershed not only receives five to ten times the amount of precipitation that falls on coastal locations only a few miles away in the same watershed, but also receives much more rainfall than interior peaks of comparable elevation in this region. The drainages in these watersheds exhibit “flashy” flow patterns during and after storm events and peak winter and summer base flows can vary by several orders of magnitude. Extensive portions of the main stems of all four major watersheds exhibit intermittent flows (with isolated pools) in summer because of a combination of strong seasonal variation in rainfall and anthropogenic factors.

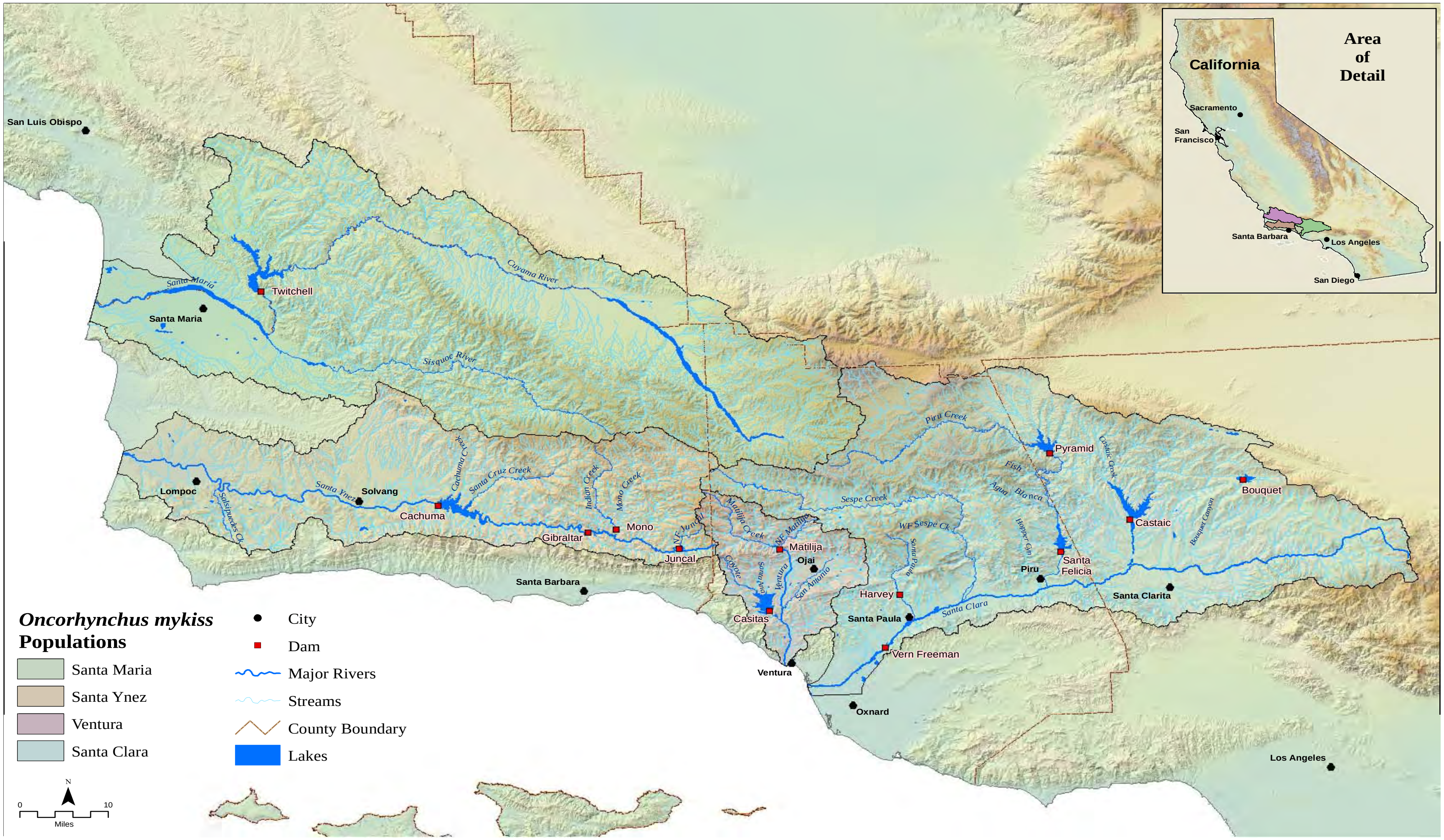

Figure 2. The Monte Arido Highlands Biogeographic Population Group region. Thirteen steelhead populations/watersheds were analyzed in this region: three in the Santa Maria River watershed; one in the Santa Ynez River watershed, five in the Ventura River watershed, and four in the Santa Clara River watershed.

Table 5. Physical and Land Use Characteristics of Watersheds in the Monte Arido Highlands BPG.

Physical Characteristics				Land Use				
Watershed (north to south)	Area (acres/miles²)[1]	Stream Length[2] (miles)	Average Annual Rainfall[3] (in.)	Total Human Population[4]	Public Ownership*	Urban Area[5]	Agriculture/ Barren[5]	Open Space[5]
Santa Maria River**	1,187,491/1,855	2,941	17.2	123,043	49%	10%	3%	87%
Santa Ynez River	576,717/901	1,543	18.3	74,900	39%	7%	3%	90%
Ventura River	144,967/227	409	18.8	44,550	48%	6%	9%	85%
Santa Clara River	1,040,223/1,625	2,485	16.7	350,363	54%	6%	7%	87%
Total/Average	**2,949,398/4,608**	**7,378**	**17.7**	**592,856**	**48%**	**7%**	**6%**	**87%**

Sources: 1. CDFFP CalWater 2.2 Watershed delineation, 1999 (www.ca.nrcs.usda.gov/features/calwater/)
2. CDFG 1:1,000,000 Routed stream network, 2003 (www.calfish.org/)
3. USGS Hydrologic landscape regions of the U.S., 2003 (1 km grid cells)
4. CDFFP Census 2000 block data (migrated), 2003
5. CDFFP Multi-source land cover data (v02_2), 2002 (100 m grid cells) (http://frap.cdf.ca.gov/data/frapgisdata/select.asp)

* National Forest Lands only; does not include State or County Parks or Military Reservations (http://old.casil.ucdavis.edu/casil/gis.ca.gov/teale/govtowna/)
** The Santa Maria River watershed includes the Cuyama River and Sisquoc River sub-watersheds.

Land Use. Table 5 summarizes land use and population density in this region. The coastal terrace and floodplains of these watersheds receive the most intensive land use. The interiors are largely uninhabited and include several federally-designated wilderness areas within the Los Padres National Forest: San Rafael, Dick Smith, Matilija, Chumash, and Sespe. Additionally, there are two federally-designated Wild and Scenic rivers within the Los Padres National Forest: Sisquoc River (Wild) in the Santa Maria River watershed, and Sespe Creek (Wild and Scenic), in the Santa Clara River watershed. Human population density increases steadily to the south, and averages about 129 persons/square mile over the BPG. The Santa Maria River watershed has the lowest population density (66 persons/square mile), while the Santa Clara River watershed, which extends into northeastern Los Angeles County, has the highest (216 persons/square mile). Population densities in individual watersheds vary widely across this region.

In most of these watersheds, the first land use change was livestock ranching and dry farming, followed by irrigated row crop agriculture. Urbanization followed this trend on the coastal plain, with current coastal population centers at Santa Maria, Lompoc, Buellton, Ventura, and Oxnard. More recently, interior portions of the floodplain of the Santa Clara River that were converted to agriculture (primarily orchards) decades ago, have experience strong urban growth and now include population centers at Santa Paula, Fillmore, and, most recently, the Santa Clarita-Castaic-Newhall area in Los Angeles County. The upper watersheds throughout this region are in the Los Padres and Angeles national forests; the coastal and middle watersheds are mostly privately owned. Semi-developed rural land, used for livestock ranching and orchard production covers extensive portions of the coastal and middle portions of these watersheds.

Agriculture (orchard production, row crops, and livestock ranching), are important land uses that directly or indirectly impact watershed processes throughout these watersheds, especially the lower Santa Maria, Santa Ynez, and Santa Clara River watersheds, which traverse broad coastal basins or plains that have mostly converted to agriculture. The Santa Ynez River and the Ventura River watersheds have been transformed by a series of dams constructed to serve municipal water needs for the cities of Goleta, Santa Barbara, Montecito, Summerland, Carpinteria, and Ventura. A major diversion on the lower main stem and three large dams in the upper watershed on Piru and Castaic creeks has similarly affected steelhead and their habitats in the Santa Clara River drainage. Municipal and agricultural water sources also include a number of groundwater wells located throughout the floodplains of these watersheds.

Current Watershed Conditions. Watershed conditions were assessed for the main stems of the four major rivers and for eight sub-watersheds. The relative ratings of current habitat and land use conditions (indicators) used to assess the viability of watersheds to support steelhead in the BPG are presented in Figure 3. The number of indicators used in the evaluations ranged from 17 for the Matilija Creek main stem watershed to 38 for the Santa Maria River watershed. The main stem and major tributaries of most of the drainages in this BPG offer fair to poor habitat conditions for steelhead in otherwise high rated tributaries to the Santa Maria River (Sisquoc River), Ventura River (Matilija Creek), and the Santa Clara River (Sespe Creek). Indicator ratings were typically downgraded because of passage barriers (see Threat Sources section below). Good- to excellent-quality steelhead habitat is generally found in the upper watersheds above these barriers, particularly in the Sisquoc River, Matilija Creek main stem, North Fork Matilija Creek, San Antonio Creek, Santa Paula Creek, and Sespe Creek drainages (Fig. 3). Sespe Creek probably supports the highest-quality and most extensive steelhead spawning and rearing habitat in this BPG, but is frequently isolated from the estuary and ocean by water management activities elsewhere in the watershed that reduce or eliminate surface flows along extensive reaches of the main stem.

Threats and Threat Sources. Varying numbers and intensity of habitat impairments (sources of threats) were identified in the CAP Workbooks analyses, ranging from seven sources in the North Fork Matilija Creek watershed to 21 in the Cuyama River watershed (Fig. 4). “Severe” and “Very Severe” sources of threats involving passage barriers created by dams and lack of surface flows caused by groundwater extraction or surface flow diversions disproportionately affect habitat conditions in all of the watersheds in this BPG. For example, Sespe Creek, although largely uninhabited and supporting some of the best steelhead spawning habitat in the BPG, is severely threatened by urban development occurring along the main stem of the Santa Clara River watershed, such as water management activities, that interrupt the connection between this sub-watershed, the main stem, estuary, and ocean.

Fifteen anthropogenic activities ranked as the top five sources of stress to steelhead in the Monte Arido BPG and are strongly associated with urban and agricultural development and recreation (Table 6).

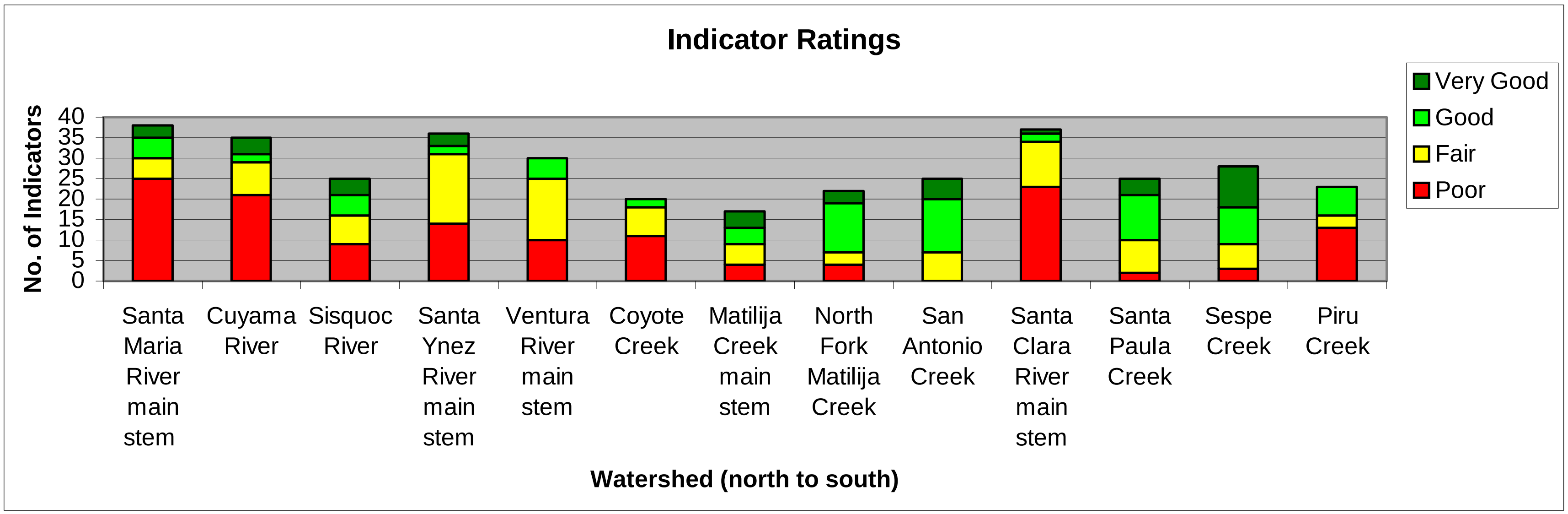

Figure. 3. Relative frequency of indicator ratings for watersheds in the Monte Arido Highlands BPG. Indicators are rated as "Very Good", "Good", etc., on the basis of the current condition of landscape, habitat, or population variables. The relative distribution of rankings provides a general picture of existing conditions for steelhead and their habitats within and between watersheds (see CAP Workbooks for details).

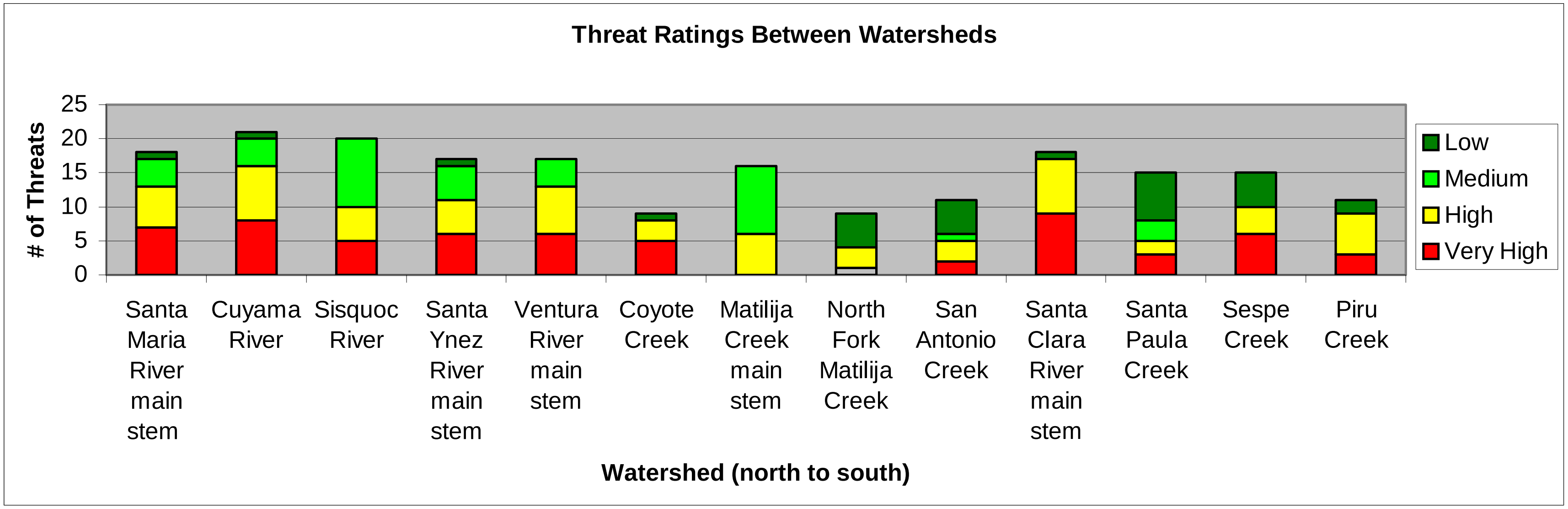

Figure 4. Relative frequency of threat source ratings in watersheds in the Monte Arido Highlands BPG, as identified by the CAP Workbook analyses.

Table 6. The top five sources of stress to steelhead and their habitats in the Monte Arido Highlands BPG (see CAP Workbooks for details).

Threat Sources	**Component Watersheds (north to south)**												
	Santa Maria River	Cuyama River	Sisquoc River	Santa Ynez River	Ventura River	Coyote Creek	Matilija Creek main stem	North Fork Matilija Creek	San Antonio Creek	Santa Clara River	Santa Paula Creek	Sespe Creek	Piru Creek
Dams and Surface Water Diversions	Red	Red	Red	Red	Red	Red	Red			Red	Red	Red	Red
Groundwater Extraction	Red	Red		Red	Red	Red			Yellow	Red	Red	Red	
Agricultural Development	Red	Red		Red	Red				Yellow	Red	Red	Red	
Urban Development		Red	Red		Red	Red			Yellow	Red	Yellow	Red	
Recreational Facilities				Red	Red	Red	Yellow	Yellow	Yellow				Red
Non-Native Species				Red		Red	Yellow			Red	Yellow		Red
Levees and Channelization	Red		Red						Yellow			Red	
Flood Control		Red	Red										Yellow
Wildfires			Red					Yellow					Yellow
Mining and Quarrying								Red					
Roads								Red					

Urban Effluents													
Agricultural Effluents													
Other Passage Barriers													

Key: Threat cell colors represent threat rating from CAP Workbook:
Red = Very High threat
Yellow = High threat
Light green = Medium threat
Dark green = Low threat

Agricultural and urban development has driven water management projects that conflict with steelhead habitat requirements. Dams, surface water diversions, and groundwater extraction have severely reduced or eliminated surface flows along extensive reaches of the main stems of the Santa Maria, Santa Ynez, Ventura, and Santa Clara rivers. Twitchell Dam on the Cuyama River is located close to the Sisquoc River confluence and blocks steelhead passage to the very large Cuyama River watershed, including several tributaries (e.g., Pine Creek). Surface flows in the Cuyama River disappear for most of the year because of excessive groundwater pumping throughout the arid Cuyama Valley to water row crops that have been extensively planted on the floodplain. Steelhead access to the equally large Sisquoc River watershed is severely limited because Twitchell Dam is managed for aquifer recharge in the Santa Maria Valley with the aim of minimizing surface flows to the ocean. Consequently, the Santa Maria River, which is the steelhead access corridor for both the Cuyama and Sisquoc rivers, is dry most of the year in most years. Bradbury, Gibraltar, Juncal, and Mono Debris Basin dams on the middle and upper main stem of the Santa Ynez River block access to at least 50% of their respective watersheds and the most extensive and productive spawning and rearing habitat. Matilija and Casitas dams on the main stem of Matilija Creek and Coyote Creek, respectively, have eliminated access to the most extensive and highest quality spawning habitat in the Ventura River watershed. Piru Dam and Pyramid Lake Dam on Piru Creek effectively eliminate this major tributary of the Santa Clara River as spawning and rearing habitat for steelhead, and access to all of the major tributaries is severely limited by loss of surface flows in the main stem of the Santa Clara River and to the estuary. Watersheds or portions of watersheds isolated by water management activities from the estuary and ocean continue to support high-quality steelhead spawning and rearing habitat. Moreover, all of the drainages in this BPG have native rainbow trout populations in their upper watersheds that would likely be anadromous if connectivity were restored.

Most or all of the reservoirs formed by these dams support sport fishing that have intentionally or accidentally introduced non-native predators or competitors on or with steelhead. These species have moved out of the reservoirs into the main stem and tributaries, including reaches below the dams and established reproducing populations (e.g., crayfish, largemouth bass, sunfish, catfish, carp, western mosquitofish, bullfrogs, etc.). Bullfrogs and carp are common throughout the main stem of the Santa Ynez and Ventura rivers. The African clawed frog (*Xenopus laevis*), a significant predator of native amphibians and fish, infests much of the main stem of the Santa Clara River from the estuary upstream to Fillmore, including large tributaries such as Santa Paula Creek and Hopper Canyon Creek.

The estuaries at the mouth of the Santa Maria and Santa Ynez rivers are relatively physically intact, retaining 81% to 94% of their historic size, respectively, although both are impacted by agricultural and urban effluent discharge. The Ventura River estuary has lost approximately 68% of its former size because of urban and agricultural encroachment (e.g., Ventura County Fairgrounds, Emma Wood State Beach, Union Pacific Railroad bridge, Highway 101 bridge). The Santa Clara River estuary has lost approximately 85% of its former size to agricultural encroachment and levee construction. Because estuaries are the gateway used by both immigrating adults and emigrating juveniles moving between the marine and freshwater environments, estuarine loss affects steelhead throughout in the entire watershed. The remaining estuarine habitats are subject to degradation from urban, agricultural, and/or recreational development and loss of freshwater inflows. Surface flows diverted from the main stem for urban and agricultural use adversely affect both water quality and the seasonal breaching pattern of the sandbar at the mouth of the estuary.

Agricultural and urban development has severely constrained floodplain connectivity on the floodplains of the Santa Maria, lower Sisquoc, Santa Ynez, Ventura, San Antonio Creek, Santa Clara River, and lower Sespe Creek. Levees, channelization, and other flood control structures and activities, including related flood control activities (levee and vegetation management, etc.), constrict the floodplain and affect hydrology, sediment transport processes, and geomorphology, which limit instream habitat diversity and riparian corridor structure.

Fire is an important factor in slope erosion and sediment inputs to watersheds throughout this region. The Sisquoc River, North Fork Matilija Creek, and Piru Creek watersheds were identified as potentially severely threatened by mass wasting of slopes and loss of riparian canopy cover due to fires that occurred in 2006 and 2007 that covered most of their watersheds, but substantial portions of each of these watersheds have burned in the past 50 years.

The remaining anthropogenic factors listed in Table 6 are generally restricted to single watersheds. For example, the North Fork of Matilija Creek supports high-quality spawning and rearing habitat for steelhead but a landslide caused by on-going quarrying operations near the confluence with the main stem of Matilija Creek has blocked passage to and from this watershed. Passage barriers also have been created on this drainage by Highway 33, which closely parallels and crosses it for most of its length. Matilija Dam on the main stem of Matilija Creek creates ideal conditions for giant reed (*Arundo donax*) and this invasive grass has completely replaced native riparian vegetation along extensive portions of the lower reaches. A large-scale project to remove this species, and other invasive, non-native plants, from the Ventura River watershed began in 2007 and is part of an on-going project to improve habitat conditions for steelhead in the Matilija Creek and Ventura River watersheds. Runoff from agricultural fields that drain directly into the lower Santa Maria River is the source for nutrient loading, herbicides, and other agricultural chemicals in the lower river and estuary. The lower reaches of the main stem of Matilija Creek

Despite widespread and varied impacts to the coastal and middle portions of the watersheds in this region, steelhead continue to spawn in each of the watersheds in this BPG and native rainbow trout populations, which would be anadromous if barriers were removed, inhabit the high-quality habitat found in the upper watersheds above dams, reservoirs, and dry stream reaches. When connectivity through the main stem to the estuary and ocean is periodically re-established in years of adequate rainfall, steelhead spawn in many of these drainages.

Improving conditions for steelhead passage, spawning, and/or rearing in these watersheds will require multiple, long-term, measures, while conditions in others can be substantially improved with focused restoration projects that target fish passage barriers. The most effective improvement would be to maintain adequate surface flows to ensure passage between the ocean/estuary and upstream tributaries, as well as maintain suitable upstream spawning and rearing habitat conditions for steelhead within the Santa Maria, Santa Ynez, Ventura, and Santa Clara River systems.

The threat sources discussed in this section should be the focus of a variety of recovery actions to address specific stresses to steelhead viability associated with these threats. Spatial and temporal data acquired on specific indicators associated with sources of threats or stresses, such as water temperature, pH, nutrients, etc., are generally inadequate to be the target of specific recovery actions. This type of data acquisition should be the subject of site-specific investigations in order to refine the primary recovery actions or to target additional recovery actions. Impediments to fish passage stemming from the construction and operation of dams and groundwater extraction, modification of channel morphology and adjacent riparian habitats through flood control, instream activities such as sand and gravel mining, and loss of estuarine functions caused by filling and point and non-point waste discharges from agricultural and other anthropogenic activities should be further evaluated and addressed as part of any recovery strategy for the Monte Arido Highlands BPG (see recovery action matrices for more specific recovery actions).

ATTACHMENT. SUMMARY TABLES FOR STRESSES AND THREATS, STRESS MATRIX, AND OVERALL VIABILITY SUMMARY FOR THE MONTE ARIDO HIGHLANDS BPG

Threats Assessment for the Conception Coast Biogeographic Population Group

Location and Physical Characteristics. The Conception Coast BPG region encompasses eight small, coastal watersheds that drain a 50-mile long stretch of the south-facing slopes of the Santa Ynez Mountains in southern Santa Barbara County and extreme southwestern Ventura County (Fig. 5). The Santa Ynez Mountains are an east-west trending spur of the Transverse Range and create some of the steepest watersheds in any of the five BPG regions in the Southern California Coast Steelhead ESU. Peak elevations reach 4,300 feet just 5.5 air miles from the Pacific Ocean. These watersheds are relatively homogeneous in slope, aspect, and size, with steep upper watersheds with lower watersheds that cut across a relatively narrow coastal terrace. Stream lengths are short. The Gaviota Creek watershed penetrates the furthest inland (about seven air miles). Goleta Slough, the largest estuary in this BPG, is formed by the confluence of several sub-watersheds: Tecolotito Creek, Los Carneros Creek, San Pedro Creek, Las Vegas Creek, Maria Ygnacio Creek, San Jose Creek, and Atascadero Creek. Of these, the latter three watersheds were evaluated using the CAP analyses. The second largest estuary in this BPG, Carpinteria Slough, is formed by a synclinal basin fed by Santa Monica Creek and several minor drainages that are not included in the watersheds covered in the Conception Coast BPG.

Precipitation shows a strong increase in rainfall amounts with increasing elevation. Rainfall amounts in the upper watershed can be five to six times higher than on the coastal terrace portion of the watershed during the same storm event and the steep topography in these watersheds creates extremely "flashy" flows.

Table 7. Physical and Land Use Characteristics of Watersheds in the Conception Coast BPG region.

Physical Characteristics				Land Use				
Watershed (west to east)	**Area (acre/mi²)[1]**	**Stream Length[2] (miles)**	**Average Annual Rainfall[3] (in.)**	**Total Human Population[4]**	**Public Ownership***	**Urban Area[5]**	**Agriculture/ Barren[5]**	**Open Space[5]**
Jalama Creek	15,800/25	45	17.4	59			< 1%	
Canada de Santa Anita	2,067/3	5	17.4	16			< 1%	
Gaviota Creek	12,912/20	39	17.5	40			1%	
Arroyo Hondo	2,796/4	6	17.8	1			< 1%	
Tecolote Creek	3,726/6	11	19.0	339			18%	
Goleta Slough**	30,410/48	92	19.2	57,664			16%	
Mission Creek	7,760/12	16	19.6	41,890			3%	
Montecito Creek	3,970/6	11	19.5	2,453			< 1%	
Carpinteria Creek	10,712/17	25	19.8	3,493			20%	
Rincon Creek	9,422/15	25	19.3	324			23%	
Total/Average	**213,099/333**	**560*** **	**18.6**	**201,459*** **		**16%**	**8%**	**74%**

Sources: 1. CDFFP CalWater 2.2 Watershed delineation, 1999
2. CDFG 1:1,000,000 Routed stream network, 2003
3. USGS Hydrologic landscape regions of the U.S., 2003 (1 km grid cells)
4. CDFFP Census 2000 block data (2003)

5. 5. CDFFP Multi-source land cover data (2002); 100m grid cells

* National Forest Lands only; does not include State or County Parks
** "Goleta Slough" includes analyses only for San Jose, San Pedro, Maria Ygnacio, and Atascadero creeks.
*** Total for entire BPG area, not component watersheds.

Land Use. Table 7 summarizes land use and population density in this region. The coastal terrace and middle portions of these watersheds receive the most intensive land use. Human population density varies widely between the component watersheds, averaging about 605 persons/square mile over the BPG. The western half of this BPG region has very low population density (one to 59 persons/square mile), while the Goleta Slough and Mission Creek watersheds average 1,201 and 3,491 persons/square mile, respectively (see Table 2 in the ESU Summary for details).

In most of these watersheds, the first land use change was livestock ranching and dry farming, followed by irrigated row crop agriculture, especially orchard crops, such as avocados, lemons, and walnuts. Most recently, the steep slopes in the middle reaches of some watersheds have been developed with avocado and other orchard crops. Urbanization followed this trend on the coastal plain in the eastern half of this BPG region then moved up into the montane portions of these watersheds as cities grew in size. The upper watersheds throughout this region are in the Los Padres National Forest; the coastal and middle watersheds are mostly privately owned. Semi-developed rural land and orchards cover extensive portions of the coastal and middle portions of the western watersheds. Most of the Arroyo Hondo watershed has recently been put under a conservation easement and is managed by the Land Trust of Santa Barbara County.

A number of coastal areas in this region have been developed as County and State Parks, including Gaviota State Beach (Gaviota Creek), Refugio State Beach (Refugio Creek), El Capitan State Beach (El Capitan Creek), Goleta Beach County Park (mouth of Goleta Slough), Arroyo Burro Beach County Park (Arroyo Burro Creek), City of Santa Barbara beaches (east and west of mouth of Mission Creek), Carpinteria State Beach (Carpinteria Creek), and Rincon Beach County Park (Rincon Creek). Each of these parks is located around the mouth of these drainages, including the estuary.

Agriculture (orchard cultivation and livestock ranching), are important land uses that directly or indirectly impact watershed processes throughout these watersheds. Most of the municipal water for Goleta, Santa Barbara, Montecito, Summerland, and Carpinteria is supplied by reservoirs on the middle and upper main stem of the Santa Ynez River on the north side of the Santa Ynez Range. This municipal water source is supplemented by groundwater wells located throughout the coastal terrace. The ranches that support irrigated orchard crops in these watersheds also depend heavily on groundwater as their source for agricultural water. Some large ranches have diversions and dams on their property to create reservoirs for agricultural use (e.g., Glen Annie Canyon, unnamed tributary of Dos Pueblos Creek, and Gato Creek).

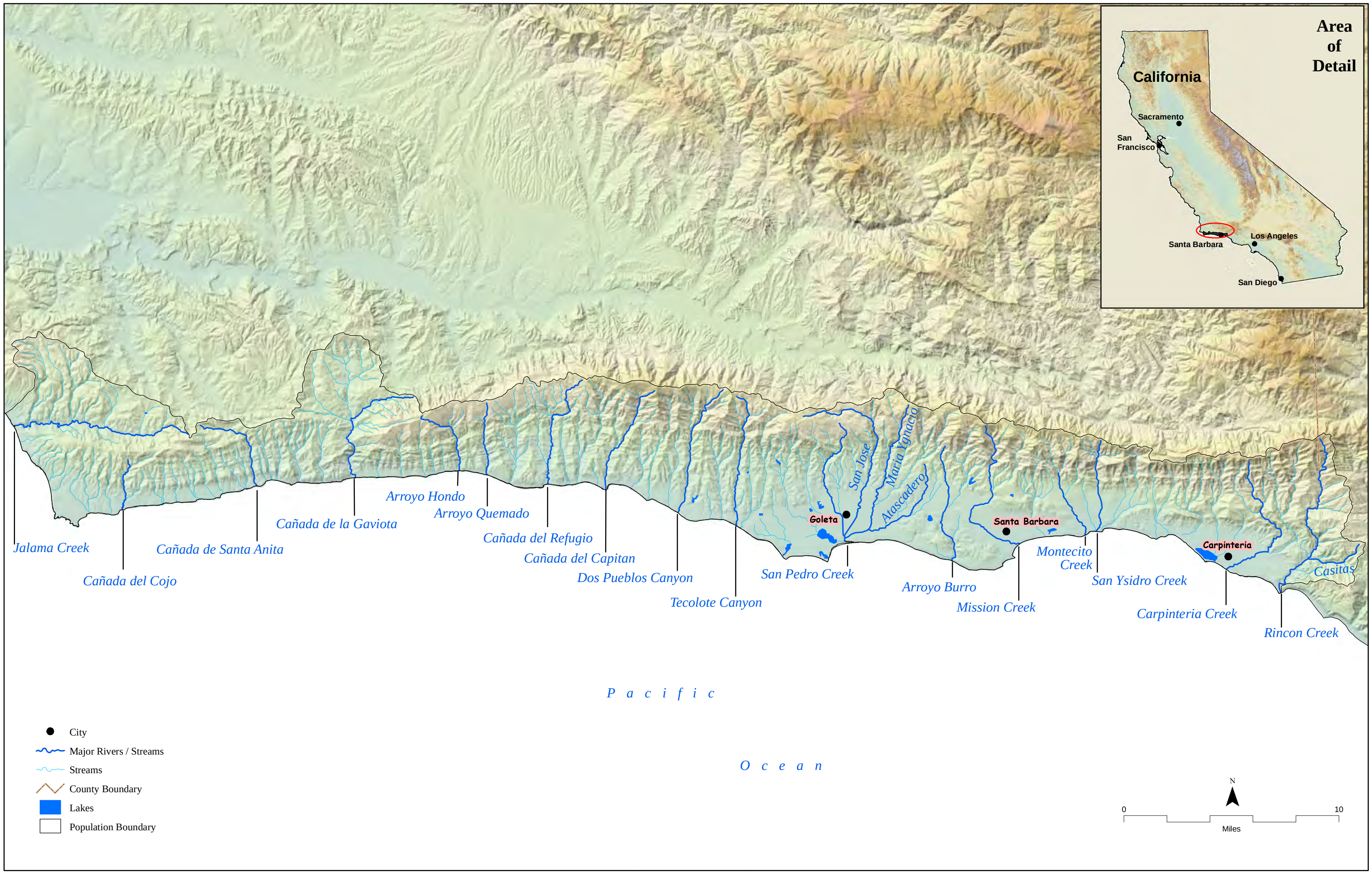

Figure 5. The Conception Coast Biogeographic Population Group region. Ten steelhead populations/watersheds were analyzed in this region.

Some of these reservoirs support small populations of bullfrogs and non-native predatory fish (e.g., Dos Pueblos Creek tributary reservoir), but the majority of the drainages in these watersheds are relatively free from these steelhead predators. Non-native crayfish and western mosquitofish, which may prey on steelhead eggs, occur in many urbanized drainages. Tecolotito Creek in the Goleta Slough watershed supports a reproducing population of African clawed frogs (*Xenopus laevis*), which may be a predator on certain steelhead life stages.

Current Watershed Conditions. The relative ratings of current habitat and land use conditions (indicators) used to assess the viability of watersheds to support steelhead in the BPG are presented in Figure 6. The number of available indicators used in the CAP Workbook analyses ranged from 16 for the Canada de Santa Anita to 33 in the Carpinteria Creek watershed.

In general, instream, riparian, and floodplain conditions for steelhead in watersheds in this BPG are rated “Fair” or “Good”, but conditions vary widely within and between watersheds, depending on land use. The upper watersheds consistently support good to excellent quality steelhead spawning and rearing habitat. Conditions in each of these watersheds deteriorate downstream on the coastal plain. Highway 101 and the Union Pacific Railroad tracks traverse the main stem of each of these watersheds at or in close proximity to their mouths, which has damaged estuarine habitat and created passage impediments for steelhead. Agriculture-related activities, such as groundwater extraction, have reduced surface flows and degraded habitat conditions in the lower and middle portions of these watersheds. Urban development dominates the lower reaches of the Goleta Slough, Mission Creek, Montecito Creek, and Carpinteria Creek watersheds. Most of these watersheds also exhibit high road densities. The Arroyo Hondo watershed provides the least disturbed conditions for steelhead in this BPG because of low-intensity land use and its inclusion in a natural reserve system managed by the Land Trust of Santa Barbara County. The Goleta Slough watershed (San Jose, San Pedro, Maria Ygnacio, and Atascadero creeks) and the Mission Creek and Rincon Creek watersheds exhibit the least favorable conditions for steelhead, however, their upper watersheds sustain reproducing populations of native rainbow trout and, occasionally, steelhead despite urbanization, channelization, channel maintenance, and other urban creek land uses throughout their lower reaches.

Threats and Sources of Threats. Varying numbers and intensity of habitat impairments (sources of threats) were identified in the CAP Workbooks analyses, ranging from 10 in the Gaviota Creek and Arroyo Hondo watersheds to 17 in the Rincon Creek watershed (Figure 7). “Severe” and “Very Severe” sources of threats exist in all of the watersheds in this BPG, but the Arroyo Hondo watershed has the least number and severity of threats for steelhead. Threat sources are concentrated in the middle and lower portions of the watersheds and are associated with urban and agricultural development. The number and severity of threats generally diminishes in the upper, undeveloped portion of these watersheds. Steelhead and resident rainbow trout spawn in the upper reaches of most, and even in the degraded lower reaches of some of these drainages, such as Maria Ygnacio, Mission, and Carpinteria creeks.

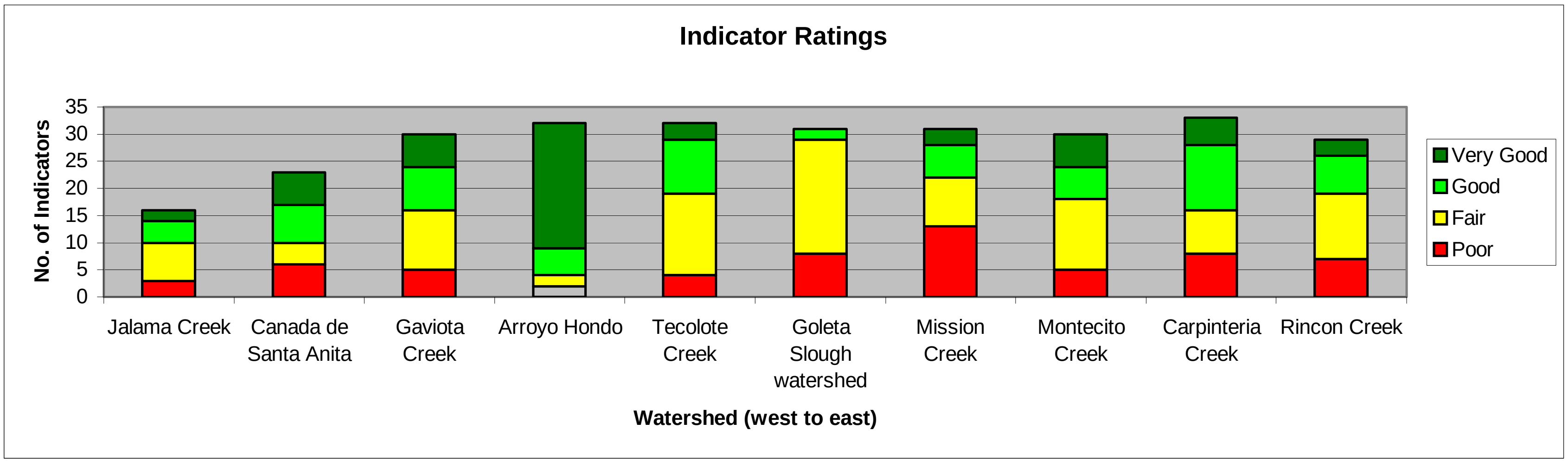

Figure 6. Relative frequency of indicator ratings for watersheds in the Conception Coast BPG. The relative ranking of indicators provides a general picture of existing conditions for steelhead and their habitats within and across watersheds in this BPG (see CAP Workbooks for more information).

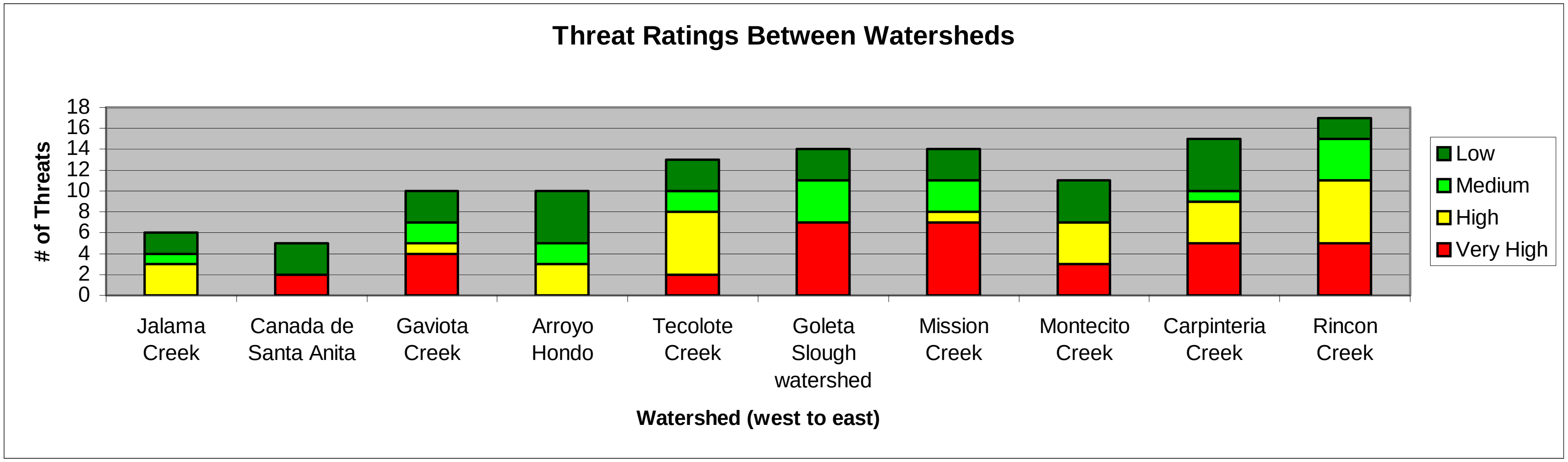

Figure 7. Relative frequency of sources of threats to steelhead and their habitats in watersheds in the Conception Coast BPG, as identified by the CAP Workbook analyses.

Thirteen anthropogenic activities, all strongly associated with urban and agricultural development, ranked as the top five sources of stress to steelhead in the Conception Coast BPG watersheds (Table 8). Road density, including roads in close proximity to stream riparian zones, and passage barriers associated with transportation corridors, consistently ranked as "Severe" to "Very Severe" source of threats to steelhead and their habitats. Proximal stressors associated with increased road density, especially roads near the drainage, include increased non-point pollution, sedimentation, substrate embeddedness, floodplain encroachment and constriction, channel incision, and loss of channel structural complexity.

Increased road density also leads to increased frequency of road crossings, culverts, and other structures that can form passage barriers, preventing steelhead from accessing spawning and rearing habitat. As previously stated, Highway 101 and the Union Pacific Railroad tracks cross the main stem of each of these watersheds near their mouths and, in most cases, the drainage passes through culverts at these points. Highway 101 and the railroad tracks typically crossed these drainages by filling the streambed with an earth berm and forcing the stream to flow through a culvert of varying lengths. In some cases, construction of these transportation corridors reduced the extent of estuarine habitat. The Highway 101 culvert on Rincon Creek and a number of other creeks is an impassable barrier preventing steelhead from reaching spawning and rearing habitat and isolating formerly anadromous populations in the upper watershed.

Groundwater extraction for municipal and agricultural use also is a pervasive threat source among these watersheds. Widespread pumping of groundwater routinely eliminates surface flows and de-waters pools in portions of most of these drainages; the magnitude of loss of surface flows and severity of passage barriers is exacerbated during years of below-average precipitation. These effects negatively impact on particular life-stages (e.g., egg incubation, alevins, fry, and parr development).

Increasing urbanization of the Tecolote Creek, Goleta Slough, Mission Creek, Montecito Creek, and Carpinteria Creek watersheds creates a number of threat sources ranging from increased road density to floodplain encroachment and increased need for flood control structures, such as levees and channelization, and channel maintenance.

Five other threat sources are specific to one or two watersheds and have seriously degraded habitat conditions for steelhead there. For example, past quarrying activities in Rincon Creek have created a rock barrier the completely blocks upstream migration of steelhead and severely impedes downstream migration of resident rainbow trout above this barrier. Fire has recently burned much of the Gaviota Creek watershed and erosion of burned slopes in the watershed is a significant, though diminishing source of sediment input. Gaviota State Beach campground was developed along the shores of the estuary at the mouth of the Gaviota Creek watershed and has affected the size of the estuary, degraded water quality in the estuary, and created a severe passage impediment at a road crossing that provides access to Gaviota State Beach campground and the Hollister Ranch. Jalama Creek and Canada de Santa Anita have dams or other severe passage impediments on their main stems and tributaries.

Table 8. The top sources of threats, ranked in order of frequency of occurrence and severity, in component watersheds in the Conception Coast BPG (see CAP Workbooks for individual watersheds for details).

Threat Sources	Component Watersheds (west to east)									
	Jalama Creek	Canada de Santa Anita	Gaviota Creek	Arroyo Hondo	Tecolote Creek	Goleta Slough*	Mission Creek	Montecito Creek	Carpinteria Creek	Rincon Creek
Roads	[yellow]	[dark green]	[red]	[yellow]	[yellow]	[red]	[red]	[red]	[red]	[red]
Culverts & Crossings (passage barrier)	[yellow]	[red]	[red]	[yellow]	[red]	[red]	[red]	[yellow]	[red]	[red]
Groundwater Extraction					[red]	[red]	[red]	[yellow]	[red]	[red]
Levees and Channelization			[red]	[yellow]	[yellow]		[red]	[red]	[red]	
Urban Development					[yellow]	[red]	[red]	[red]	[red]	
Wildfires			[red]	[green]						
Recreational Facilities	[green]		[yellow]							
Non-Point Pollution				[green]						
Flood Control						[red]				
Mining and Quarrying										[red]
Agricultural Development		[dark green]								[red]

Dams and Surface Water Diversions										
Livestock Ranching										

Key: Threat cell colors represent threat rating from CAP Workbook:
Red = Very High threat
Yellow = High threat
Light green = Medium threat
Dark green = Low threat
* includes San Jose, Maria Ygnacio, and Atascadero creeks only.

Estuarine habitats at the mouths of these watersheds in this BPG have been reduced in size by 70% to 95% of their natural size by the development of transportation corridor (roads and railroad), urbanization, and development of recreational facilities (see Table 3 in ESU summary). In many cases, these estuaries were not large to begin with. The Goleta Slough, formed by the confluence of several watersheds and the estuary associated with Mission Creek and lands immediately to the east, were the largest estuarine habitats in this BPG. They have been reduced by 70% to 90% of their former size, respectively. The remaining estuarine habitats are subject to constriction and isolation from urban, agricultural, and/or recreational development, as well as degradation of the amount and quality of surface flows as a result of surface runoff inputs from roads and groundwater extraction.

Despite widespread and varied impacts to the coastal and middle portions, steelhead continue to spawn in each of the component watersheds in this BPG and native rainbow trout populations still inhabit the high-quality habitat found in the upper watersheds. Improving conditions for steelhead passage, spawning, and/or rearing in these watersheds will require multiple, long-term, measures in the urbanized watersheds, such as Goleta Slough and Mission Creek, while conditions in others (e.g., Maria Ygnacio and Rincon creeks) can be substantially improved with focused restoration projects that target fish passage beneath Highway 101 and other road crossings and the Union Pacific Railroad right-of-way, controlling sediment inputs from unpaved rural roads, and water management.

The threat sources discussed in this section should be the focus of a variety of recovery actions to address specific stresses on steelhead viability associated with these threats. Spatial and temporal data acquired on specific indicators associated with sources of threats or stresses, such as water temperature, pH, nutrients, etc., are generally inadequate to be the target of specific recovery actions. This type of data acquisition should be the subject of site-specific investigations in order to refine the primary recovery actions or to target additional recovery actions. Impediments to fish passage stemming from the construction and maintenance of roads and other transportation corridors, privately-owned dams and other passage barriers on some drainages, groundwater extraction, modification of channel morphology and adjacent riparian habitats through flood control, instream activities such as sand and gravel mining, and loss of estuarine functions caused by filling and point and non-point waste discharges from agricultural and other anthropogenic activities should be further evaluated and addressed as part of any recovery strategy for the Conception Coast BPG (see recovery action matrices for more specific recovery actions).

ATTACHMENT. SUMMARY TABLES FOR STRESSES AND THREATS, STRESS MATRIX, AND OVERALL VIABILITY SUMMARY FOR THE CONCEPTION COAST BPG

**Threats Assessment for the
Santa Monica Mountains Biogeographic Population Group**

Location and Physical Characteristics. The Santa Monica Mountains Biogeographic Population Group (BPG) consists of five coastal watersheds located in southern Ventura and western Los Angeles counties. These watersheds are formed by the east-west coastal Santa Monica Mountains. These mountains are composed of recently uplifted marine and volcanic formations that extend approximately 32 miles between the Oxnard Plain on the west and the Los Angeles Basin on the east. With the exception of Malibu Creek, these watersheds are relatively small and do not extend inland beyond the Santa Monica Mountains. The watersheds, from west to east, are: Big Sycamore Canyon Creek, Arroyo Sequit, Malibu Creek, Las Flores Canyon Creek, and Topanga Canyon Creek (Fig. 8).

The Santa Monica Mountains BPG is similar to the Conception Coast BPG in comprising a series of short, nearly parallel streams that drain steep south-facing slopes, with an average elevation of less than 2,500 feet. The annual seasonal rainfall in the watershed basins of this BPG is approximately 18 inches, although rainfall is lower along the coast and increases with increasing elevation in the upper reaches of the watersheds. Malibu Creek is the largest watershed of the five basins presented here, encompassing approximately 110 square miles and, unlike coastal streams in the Big Sur Coast and Conception Coast BPGs, penetrates through a break in the Santa Monica Mountains to drain a portion of its north-facing slopes and the south-facing slopes of the Simi Hills. Calleguas Creek and the Los Angeles River drain the remainder of the northern slopes of the Santa Monica Mountains.

Land Use. A significant portion of the Santa Monica Mountains is undeveloped, and portions are publicly held as part of the Santa Monica Mountains National Recreation Area, seven state parks and beaches (Point Mugu State Park, Malibu Creek State Park, Leo Carrillo State Beach, Topanga State Park, R.H. Meyer Memorial State Beach, Dan Blocker State Beach, and Will Rogers State Park), and several local parks and beaches, including Zuma County Beach and Solstice Canyon Park. The large amount of public land and recreational facilities, coupled with the proximity of the BPG to a large urban area (the Los Angeles Basin) results in the watersheds here receiving very high recreational use.

Table 9 lists physical and land use characteristics of the component watersheds in the Santa Monica Mountains BPG. Development within the Santa Monica Mountain watersheds is principally residential, with some commercial and recreational development concentrated near the mouths of several of the streams. The Malibu Creek and Topanga Canyon Creek watersheds support the highest human population densities. Watersheds in the western portion of the Santa Monica Mountains generally have less development and significantly more area in public ownership than watersheds in the eastern half of the range. Human population density and private land ownership increases in the Santa Monica Mountains from west to east with increasing proximity to the Los Angeles Basin. Agricultural conversion of watershed lands is generally light throughout this BPG.

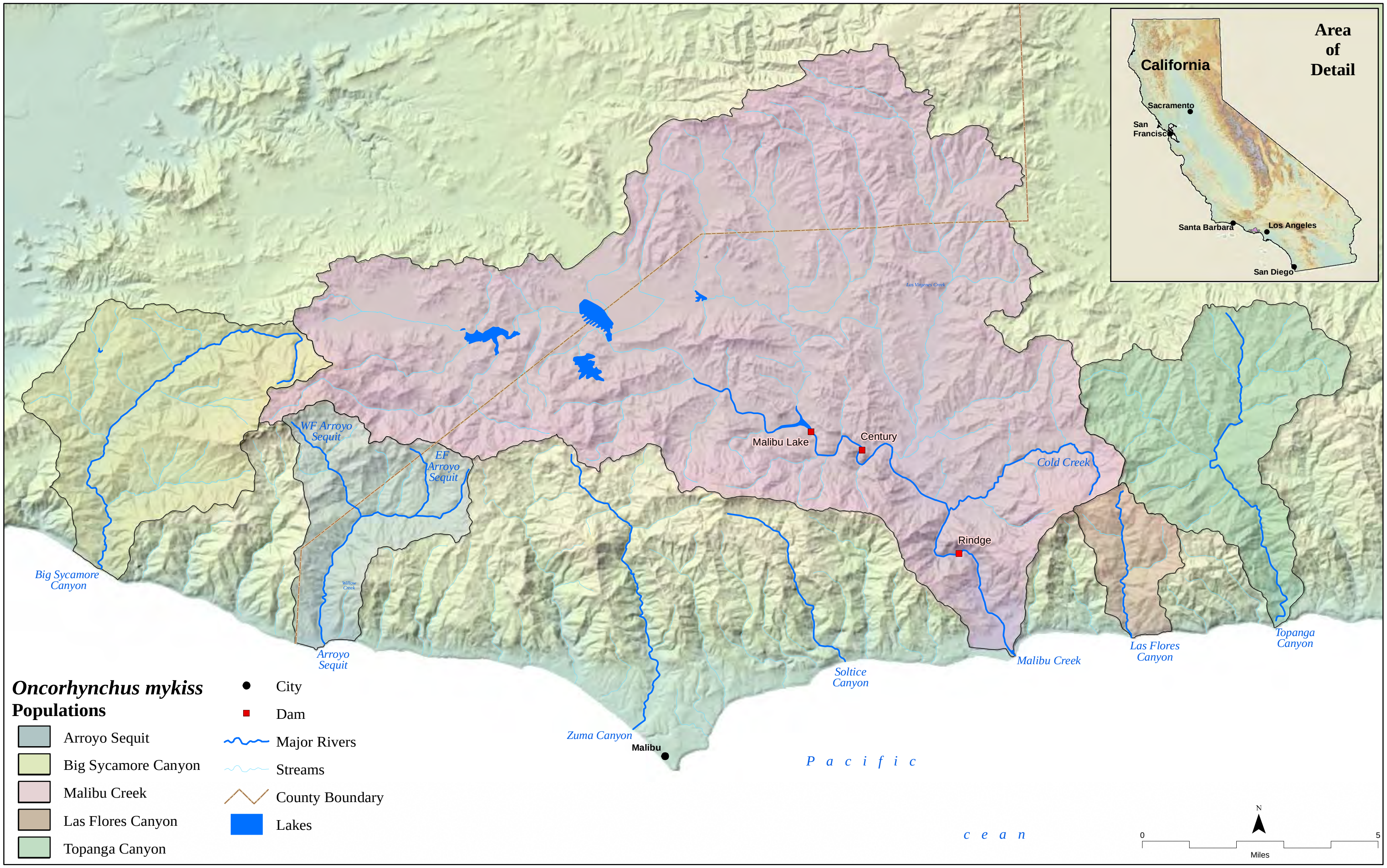

Figure 8. The Santa Monica Mountains Biogeographic Population Group region. Five steelhead populations/watersheds were analyzed in this region.

Table 9. Physical and Land Use Characteristics of Watersheds in the Santa Monica Mountains BPG.

Physical Characteristics				Land Use				
Watershed (north to south)	Area (acres/miles^2)[1]	Stream Length[2] (miles)	Average Annual Rainfall[3] (in.)	Total Human Population[4]	Public Ownership*	Urban Area[5]	Agriculture/ Barren[5]	Open Space[5]
Big Sycamore Canyon Creek	13,649/21	32	17.9	27	76%	< 1%	< 1%	99%
Arroyo Sequit	7,572/12	17	17.9	370	38%	3%	1%	96%
Malibu Creek	70,726/110	161	18.0	74,585	7%	23%	2%	75%
Las Flores Canyon Creek	2,908/5	6	18.5	1,144	5%	15%	< 1%	85%
Topanga Canyon Creek	12,616/20	30	17.9	5,561	2%	15%	< 1%	85%
Total/Average	**107,471/168**	**246**	**18.0**	**81,687**	**---**	**18%**	**1%**	**81%**

Sources: 1. CDFFP CalWater 2.2 Watershed delineation, 1999
6. CDFG 1:1,000,000 Routed stream network, 2003
7. USGS Hydrologic landscape regions of the U.S., 2003 (1 km grid cells)
8. CDFFP Census 2000 block data (migrated), 2003
9. CDFFP Multi-source land cover data (v02_2), 2002 (100 m grid cells)
* National Recreation Areas, State Parks, and County Parks.

Current Watershed Conditions. Indicator ratings for the five watersheds in the Santa Monica Mountains BPG are presented in Figure 9.

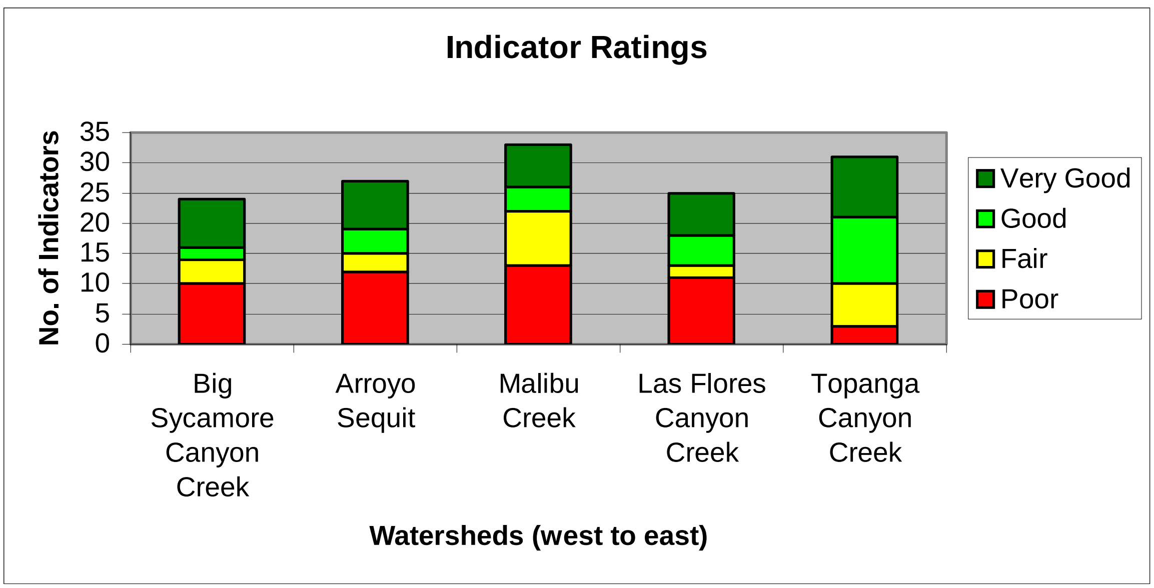

Fig. 9. Relative frequency of current indicator ratings for watersheds in the Santa Monica Mountains BPG. Indicators are the current condition of landscape, habitat, or population variables within a watershed. Although the amount of information available for particular watersheds varies, the relative ranking of indicators as "Very Good", "Good", etc., provides a general picture of watershed conditions across the BPG (see CAP Workbooks for each watershed for details).

The number of indicators used to assess existing conditions for steelhead in these watersheds varied from 24 indicators in the Big Sycamore Canyon watershed to 33 indicators in the Malibu Creek watershed. Information on existing conditions is found in the CAP Workbooks for each watershed.

Existing steelhead habitat quality was rated as "Fair" in the Big Sycamore Canyon, Arroyo Sequit, Malibu Creek, and Las Flores Canyon watersheds, and "Good" in the Topanga Canyon Creek watershed (see attached "Overall Viability Summary" for each watershed). Existing conditions within the Topanga Canyon Creek watershed, despite having the second highest human population density in this BPG (Table 9), are relatively good for steelhead: perennial flows, high-quality instream and riparian conditions, barriers to upstream and downstream movement, if present, are seasonally passable, and non-native predators, which infest other watersheds in this BPG, are absent.

Threats and Sources of Threats. The relatively high population and development pressures along the coastal portions of the Santa Monica Mountains, coupled with the proximity of this BPG to the densely populated Los Angeles Basin, creates a series of recurring, severe to very severe threats to steelhead persistence in each of the component watersheds. The number of threat sources used by the CAP Workbooks in determining threat status for the Santa Monica Mountains BPG watersheds varied from 8 in the Big Sycamore Canyon Creek watershed to 16 in the Malibu Creek watershed (Fig. 10).

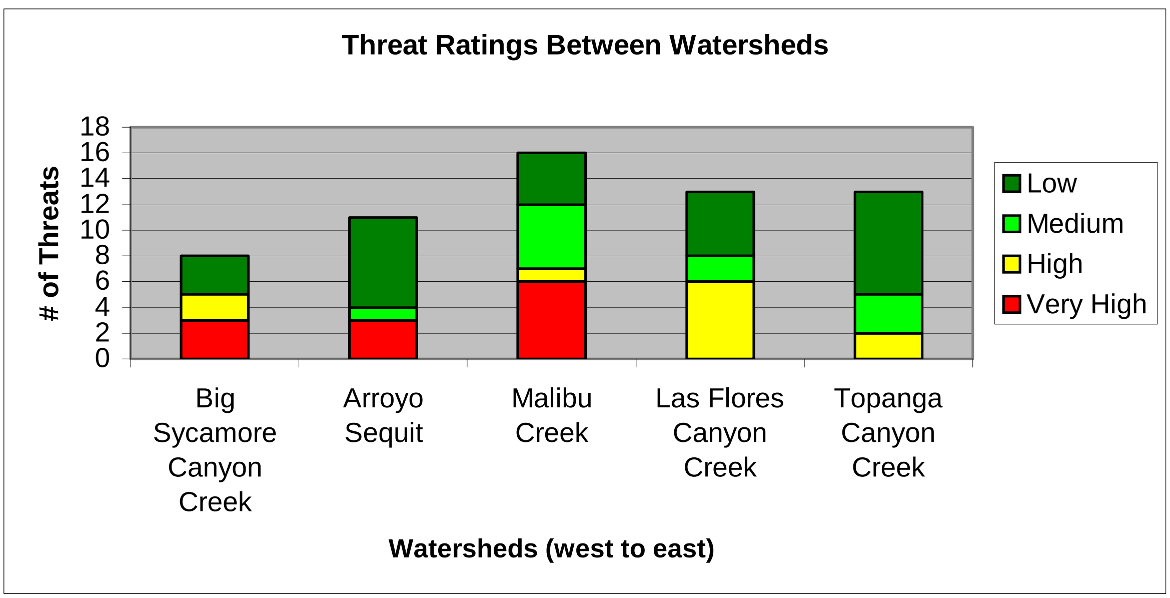

Fig. 10. Relative frequency of threat ratings between watersheds in the Santa Monica Mountains BPG. The sources, number, and severity of threats varies between watersheds, but watersheds in the western and middle portion of the BPG are subject to more severe threats than those in the east.

The relative number of severe threats is generally less in the Las Flores and Topanga Canyon Creek watersheds relative to the Big Sycamore Canyon Creek, Arroyo Sequit, and Malibu Creek watersheds, which are subject to a number of threats related to impediments to movement, disturbance of instream habitats, and the introduction of non-native wildlife that either prey on steelhead life history stages or compete with them for food and space (Fig. 10).

Ten anthropogenic activities ranked as the top five sources of stress to steelhead in the Santa Monica Mountains BPG (Table 10). Each watershed has a unique combination of threats, however, recurring threats among most or all of the watersheds include: high road density, including roads in close proximity to riparian corridors, impacts from recreational facilities, barriers to movement caused by culverts and roadway stream crossings. Other threats are unique to particular watersheds, such as the Rindge and Malibou Lake dams on Malibu Creek.

Table 10. The top five sources of threats, ranked in order of frequency of occurrence and severity, in the component watersheds of the Santa Monica Mountains BPG (see CAP Workbook for details).

Threat Sources	Watershed (west to east)				
	Big Sycamore Canyon Creek	Arroyo Sequit	Malibu Creek	Las Flores Canyon Creek	Topanga Canyon Creek
Roads	Red	Red	Red	Yellow	Yellow
Recreational Facilities	Red	Red	Red	Yellow	Light green
Other Passage Barriers	Red	Red	Red	Yellow	
Wildfires	Yellow	Light green			Light green
Urban Development				Yellow	Yellow
Levees and Channelization				Yellow	Light green
Dams and Surface Water Diversions			Red		
Non-Native Species			Red		
Pipeline Crossing*	Yellow				
Non-Point Pollution		Dark green			

Key: Threat cell colors represent threat rating from CAP Workbook:
Red = Very High threat
Yellow = High threat
Light green = Medium threat
Dark green = Low threat

* The impediment to steelhead movement caused by the pipeline crossing on Big Sycamore Canyon Creek is currently the focus of restoration efforts and is also discussed in the recovery actions matrix under "Other Recovery Actions".

Each of these threat sources generates multiple stresses on steelhead habitat and viability. Road density is high throughout the Santa Monica Mountains BPG, both on private and public lands. Road density, particularly roads that are within 300 feet of riparian corridors are affecting each of these watersheds by: altering surface runoff patterns and the stream hydrograph, encroaching on floodplains and decreasing floodplain connectivity, creating the need for bank stabilization and levee construction to protect development, and providing a conduit for sediment, pollutant, and bacterial input to the watercourse. In other cases, roads create barriers to upstream and downstream movement of steelhead.

Because of the proximity of the Santa Monica Mountains to large urban areas, there is significant pressure to develop and maintain recreational facilities. Each of the watersheds in the Santa Monica Mountains BPG support one or more coastal and inland campgrounds and other high-use recreational facilities. This is particularly the case in the Big Sycamore, Arroyo Sequit, and Malibu watersheds, where large portions of the watersheds are publicly-owned. Recreational activities were recurring sources of direct and indirect threats to steelhead, including roadway stream crossings in and around campgrounds that pose physical barriers to upstream and/or downstream movement of steelhead, introduction of non-native plants and animals, disturbance to stream banks, instream habitats, and even redds by foot traffic and off-road vehicles, loss of or disturbance to riparian corridors around campgrounds, and constriction of the floodplain. The type of threat posed by recreational facilities varies significantly between watersheds, from one location, such a single road crossing on Arroyo Sequit, to multiple sites, such as the location of campgrounds in floodplains or multiple stream crossings in the Malibu Creek watershed.

Increased residential development, including high road densities, has significantly altered natural fire regimes in the Santa Monica Mountains BPG because it has allowed human access to almost all portions of the component watersheds. Fires have consumed 71% to 100% of the Big Sycamore Canyon Creek, Arroyo Sequit, Malibu Creek, and Las Flores Canyon Creek watersheds within the past 25 years, including recent fires in 2007. Approximately 32% of the Topanga Canyon Creek watershed has burned in the last 25 years (see CAP Workbooks for specifics). Increased fire frequency can increase slope erosion and sediment input to streams, resulting in long-term changes to substrate texture and embeddedness, water quality (e.g., turbidity), and water temperature (loss of riparian canopy cover). Steelhead in each of the watersheds in the Santa Monica Mountains BPG have been subjected to these secondary effects of fire.

The terrain of the Santa Monica Mountains results in development on steep slopes, often accompanied by road cuts to provide access, thus affecting watershed processes such as erosion and sedimentation. Development has also occurred along narrow riparian corridors, which physically constrains the ability of streams to meander, decreases floodplain connectivity, removes fringing riparian vegetation, encourages bank stabilization, levee construction, and other flood control activities, may constrict the floodplain, removes fringing riparian vegetation, which can result in increased human activity within stream channels.

The Malibu Creek watershed is highly constrained by two major dams: the Rindge Dam and the Malibou Lake Dam. The former structure is located approximately two stream miles upstream of the lagoon and blocks access to over 90% of the steelhead spawning and rearing habitat within Malibu Creek. It also has isolated native rainbow trout that otherwise would be anadromous and prevents the periodic re-colonization of upstream habitats that may experience periodic temporary extirpations as a result of natural stochastic processes, such as wildfires, droughts, and landslides. Dams have manifold effects on physical, hydrological, and habitat characteristics of the middle and lower reaches of the main stem and create and maintain suitable habitat conditions for several species of non-native fishes and bullfrogs, that may affect one or more life history stages of steelhead directly (predation) or indirectly (competition for food). Non-native crayfish, snails, fishes, and bullfrogs are particular problems in the Malibu and Las Flores Canyon watersheds.

Estuarine habitat loss in the component watersheds of the Santa Monica Mountains BPG ranges from 66% to 97%. Malibu Creek formerly had the largest estuary of any of these watersheds in the BPG and still has the highest amount of remaining estuarine habitat (34%) (see Table 3 in ESU Summary). Topanga Canyon Creek has the second highest amount of remaining estuarine habitat (30%), but the estuary is highly impacted by Highway 1, commercial development, and recreational activities. Road construction, bridges, levees, floodplain encroachment by residential and commercial development (e.g., City of Malibu and Malibu Colony in Malibu Creek) have significantly reduced estuarine habitat in almost all cases in this BPG.

Some of the watersheds in the Santa Monica Mountains BPG, particularly those in the western portion of the range where population impacts are reduced and the watersheds are mostly publicly-owned, could significantly improve steelhead viability by correcting one or more specific threats (e.g., pipeline crossing in Big Sycamore Canyon Creek and roadway culvert/crossing in Arroyo Sequit are impediments to steelhead movement). Improving habitat conditions in other watersheds, such as Malibu Creek, will require multiple, long-term measures (e.g., dam removal, non-native wildlife control).

The ten threat sources listed in Table 10 are not mutually exclusive and can be grouped into the following general threat categories:

- barriers to upstream and downstream movement (roads, dams, etc.);
- water quality impacts caused by roads as conduits for sediment and pollutants;
- recreational facilities;
- fire frequency, and;
- non-native predators and/or competitors.

These threat sources should be the focus of a variety of recovery actions to address specific stresses on steelhead viability associated with these threats. Spatial and temporal data acquired on specific indicators associated with sources of threats or stresses, such as water temperature, pH, nutrients, etc., are generally inadequate to be the target of specific recovery actions. This type of data acquisition should be the subject of site-specific investigations in order to refine the primary recovery actions or to target additional recovery actions. Impediments to fish passage stemming from the construction and maintenance of roads and other transportation corridors, dams and other passage barriers on some drainages, groundwater extraction, modification of channel morphology and adjacent riparian habitats through flood control, instream activities such as sand and gravel mining, and loss of estuarine functions caused by filling and point and non-point waste discharges from agricultural and other anthropogenic activities should be further evaluated and addressed as part of any recovery strategy for the Santa Monica Mountains BPG (see recovery action matrices for more specific recovery actions).

ATTACHMENT. SUMMARY TABLES FOR STRESSES AND THREATS, STRESS MATRIX, AND OVERALL VIABILITY SUMMARY FOR THE SANTA MONICA MOUNTAINS BPG

Threats Summary for the
Mojave Rim Biogeographic Population Group

Location and Physical Characteristics. The Mojave Rim BPG region encompasses three large coastal watersheds that drain the northern slopes of the Santa Monica Mountains and the coastal slopes of the San Gabriel and San Bernardino mountains in southern Los Angeles County, southwestern San Bernardino, and western Riverside and Orange counties: Los Angeles River, San Gabriel River, and the Santa Ana River (Fig. 11). Habitat conditions also were evaluated for five major tributaries of these drainages: Arroyo Seco in the Los Angeles River watershed; East and West forks of the San Gabriel River, and Mill and Lytle creeks in the upper Santa Ana River watershed. The upper portion of each of these watersheds includes steep, montane regions; the lower watersheds cut across the Los Angeles Basin—an extensive coastal plain. The Los Angeles, San Gabriel, and Santa Ana rivers have not always discharged to the Pacific Ocean at their current locations, but sometimes migrated across the Los Angeles Basin and discharged as far west as Ballona Creek and as far east as present-day Huntington Beach. The Los Angeles, San Gabriel, and Santa Ana rivers currently discharge to the Pacific Ocean within 20 miles of each other in southern Los Angeles and northern Orange counties. The component watersheds are large, extending up to 83 miles inland in the case of the Santa Ana River watershed (Fig. 11).

Average annual precipitation in these three watersheds is higher than that of the two adjacent BPGs (Santa Monica Mountains and Santa Catalina Gulf Coast) because the upper watersheds include the San Gabriel and San Bernardino mountain ranges, whose upper elevations receive high annual rainfall and snowfall (Table 11). Rainfall along the coastal terrace portion of each of these watersheds is significantly lower than in the mountainous portions. For example, the average annual total precipitation for the City of Los Angeles is about 14.4 inches; much lower than the average for the Los Angeles River watershed. Much of the main stem and tributaries of the Mojave Rim BPG drainages flow across the relatively level Los Angeles Basin, with relatively few tributaries for their overall watershed size; as a result, the overall stream length is less than that of other BPG watersheds of comparable area.

Table 11. Physical and Land Use Characteristics of Watersheds in the Mojave Rim BPG region.

Physical Characteristics				Land Use				
Watershed (north to south)	**Area (acres/miles²)[1]**	**Stream Length[2] (miles)**	**Average Annual Rainfall[3] (in.)**	**Total Human Population[4]**	**Public Ownership***	**Urban Area[5]**	**Agriculture/ Barren[5]**	**Open Space[5]**
Los Angeles River	535,923/837	766	19.1	4,383,260	25%	61%	1%	38%
San Gabriel River	463,167/723	784	19.8	2,417,034	35%	53%	2%	46%
Santa Ana River	1,141,195/1,783	2,074	17.3	3,109937	29%	37%	8%	55%
Total/Average	**2,140,285/3,343**	**3,624**	**18.7**	**9,910,231**	**30%**	**50%**	**4%**	**46%**

Sources: 1. CDFFP CalWater 2.2 Watershed delineation, 1999
10. CDFG 1:1,000,000 Routed stream network, 2003

11. USGS Hydrologic landscape regions of the U.S., 2003 (1 km grid cells)
12. CDFFP Census 2000 block data (migrated), 2003
13. CDFFP Multi-source land cover data (v02_2), 2002 (100 m grid cells)

* National Forest Lands only; Military Reservations or State and County Parks not included.

Land Use. Table 11 summarizes land use and population density in this region. This BPG region encompasses the second-largest metropolitan area in the United States. Human population density here is the highest of any of the five BPG regions, averaging 2,964 persons per square mile, over six times greater than the next most densely populated BPG, the Santa Catalina Gulf Coast. Population density is much greater in some of the component watersheds: the Los Angeles River watershed supports 5,237 persons/square mile. Population centers are mostly concentrated in the Los Angeles Basin portion of these watersheds, but the interior portions of the Santa Ana River watershed also have extensive metropolitan areas (see Table 2 and Figure 1 in ESU Summary).

There are at least 20 dams on the main stem and/or major tributaries of each of the three drainages in this BPG that are large enough to be regulated by the California Department of Water Resources and/or Department of Defense (also see Fig. 11 for distribution and size of reservoirs). These dams are owned and operated by federal, state, public utility, local government, or private interests for irrigation, flood control and storm water management, recreation, municipal water supply, fire protection, farm ponds, or some combination of these purposes. Most of the reservoirs and lakes in this region receive high recreational use and many are sources of non-native crayfish, fishes, and bullfrogs, and other non-native species that prey on steelhead or compete with steelhead for food and habitat space.

Public land ownership is concentrated in the montane regions of these watersheds, mostly within the Angeles National Forest, San Bernardino National Forest, and the northern portion of Cleveland National Forest. These three National Forests encompass several federally-designated wilderness areas: San Gabriel and Sheep Mountain Wilderness Areas (Angeles National Forest); San Gorgonio, Cucamonga, San Jacinto, Santa Rosa, and Big Horn Mountain Wilderness Areas (San Bernardino National Forest), and Aqua Tibia Wilderness Area (Cleveland National Forest). Additionally, several rivers have been evaluated for inclusion in the federally-designated Wild and Scenic River system: Little Rock Creek, North and South forks of the San Gabriel River (tributaries to the San Gabriel River), Middle Fork Lytle Creek, Bear Creek, and Siberia Creek (tributaries to the Santa Ana River). Agriculture (row crop, orchard cultivation, and livestock ranching), used to be important land uses throughout the flatter portions of these watersheds, but have largely been displaced by urban development.

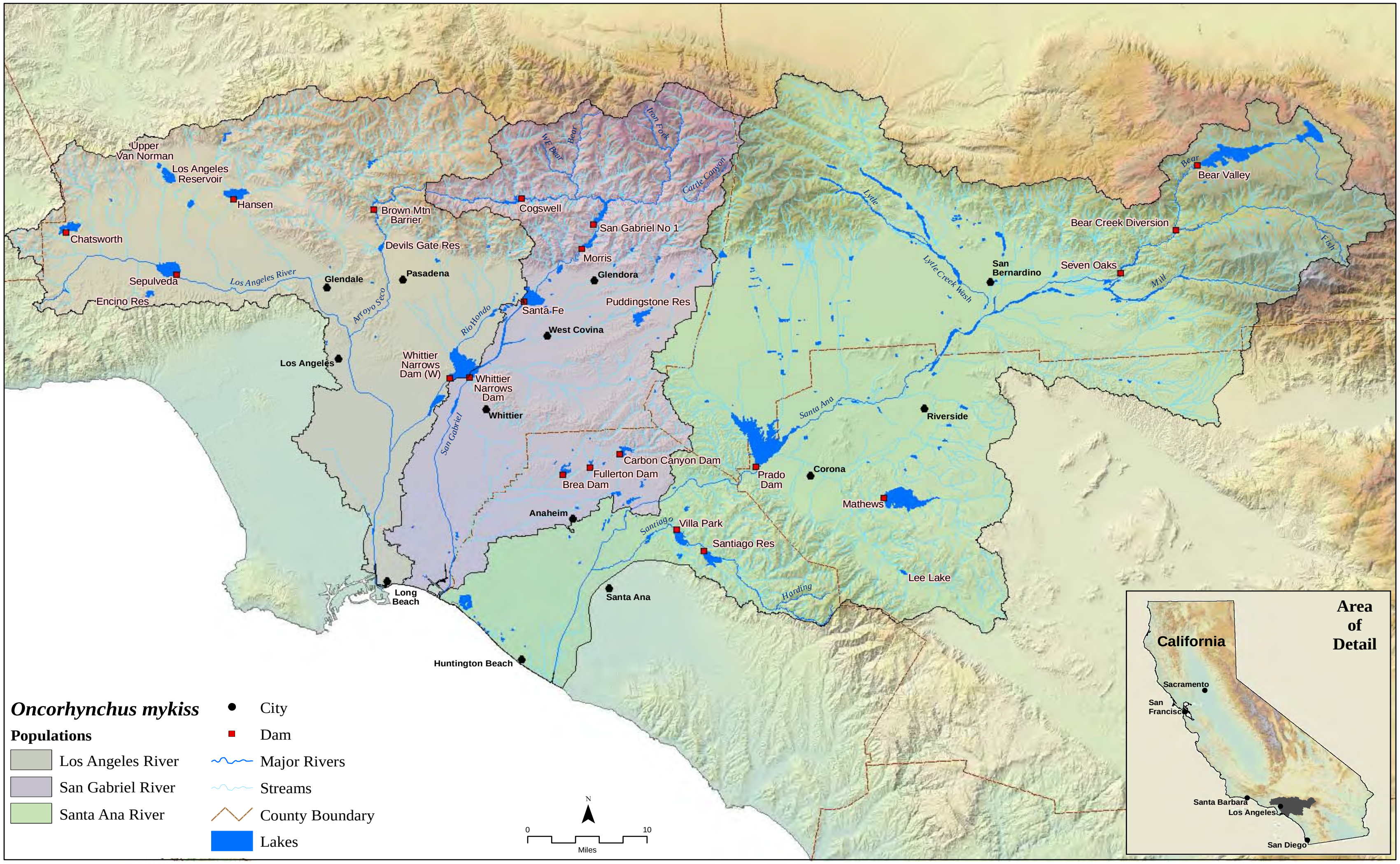

Figure 11. The Mojave Rim Biogeographic Population Group region. Eight steelhead populations/watersheds were analyzed in this region: two in the Los Angeles River watershed; three in the San Gabriel River watershed, and; three in the Santa Ana River watershed.

Current Watershed Conditions. The relative ratings of current habitat and land use conditions (indicators) used to assess the viability of watersheds to support steelhead in the Mojave Rim BPG are presented in Figure 12. The number of indicators varied widely between watersheds, from 12 for the Arroyo Seco and Mill Creek sub-watersheds to 28 indicators for the main stem of the Santa Ana River.

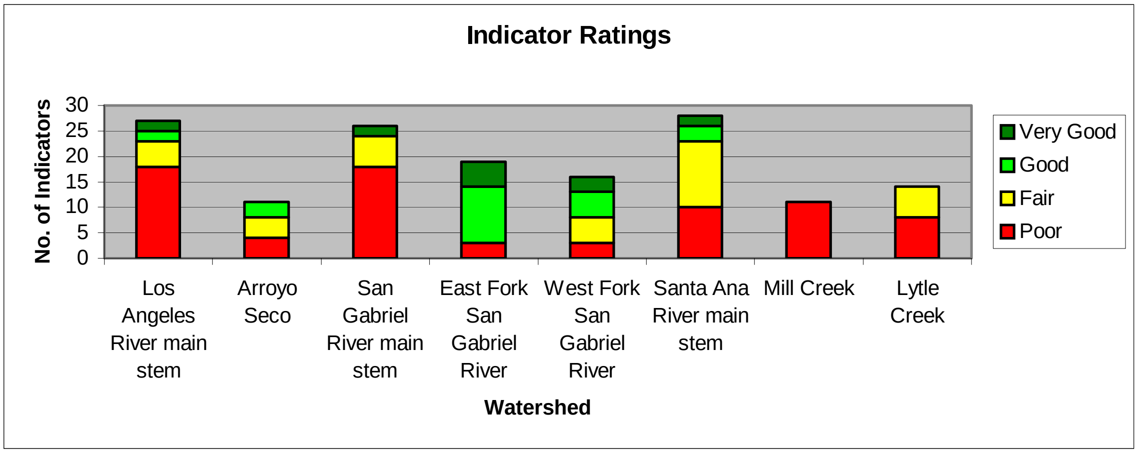

Figure 12. Relative frequency of indicator ratings for watersheds in the Mojave Rim BPG. Indicators are rated as "Very Good", "Good", etc., based on the habitat conditions for steelhead. The relative ranking of indicators provides a general picture of existing habitat and land use conditions across the BPG (see individual CAP workbooks for details).

In general, instream, riparian, and floodplain conditions for steelhead in watersheds in this BPG are in poor shape, reflecting pervasive urban conversion of watershed lands, particularly along the main stem of these drainages, but even in the upper sub-watersheds in the Santa Ana River watershed. The upper watersheds of the San Gabriel River watershed (East and West forks) still provide good to very good habitat conditions for resident rainbow trout, but these reaches are isolated from the anadromous population component found in the main stem.

Threats and Sources of Threats. Habitat impairments were rated as severe to very severe in five of the eight watersheds and sub-watersheds in this region because of the very high population density throughout this BPG (Fig. 13).

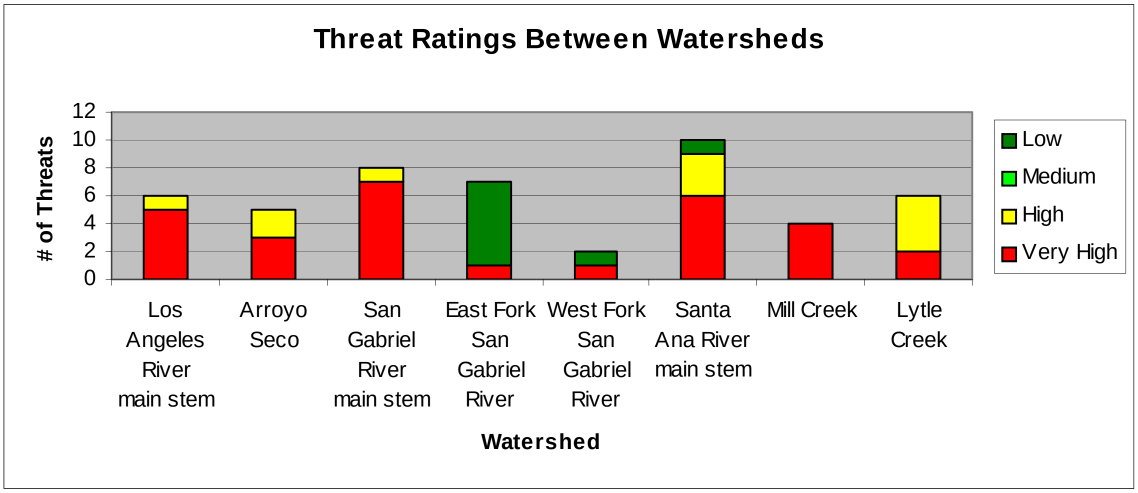

Figure 13. Relative frequency of ratings of the sources of threats to steelhead habitat in watersheds in the Mojave Rim BPG. The sources, number, and severity of threats varies between watersheds.

Ten anthropogenic activities ranked as the top five sources of stresses to steelhead and their habitat in the Mojave Rim BPG (Table 12). These sources of threats focus on water management activities to serve municipal uses (dams, surface water diversions, and groundwater extraction). The main stems of the Los Angeles, San Gabriel, and Santa Ana rivers, including the main tributaries of the latter, provide little suitable spawning or rearing habitat for steelhead because of loss of passage barriers, channelization and flood control activities, loss of surface flows, and impaired water quality. The East and West forks of the San Gabriel River watershed, above Morris and Cogswell dams and their reservoirs, are mostly are in public ownership (Angeles National Forest and Cleveland National Forest) and these reaches provide relatively good habitat conditions for steelhead. Both of these sub-watersheds support reproducing populations of resident rainbow trout that are isolated from their anadromous counterparts downstream of the dams.

Table 12. The top five sources of threats, ranked in order of frequency of occurrence and severity, in the Mojave Rim BPG (see CAP Workbooks for individual watersheds for details).

Threat Sources	Compenent Watersheds							
	Los Angeles River main stem	Arroyo Seco	San Gabriel River main stem	East Fork San Gabriel River	West Fork San Gabriel River	Santa Ana River main stem	Lytle Creek	Mill Creek
Dams and Surface Water Diversions	Red	Yellow	Red	Red	Red	Red		Red
Flood Control	Red	Red	Red	Green		Red	Red	Yellow
Groundwater Extraction	Red	Yellow		Green		Red	Red	Red

Levees and Channelization	Red	Red	Red			Red	Red	Yellow
Urban Development	Red	Red	Red			Red	Red	
Recreational Facilities				Dark green	Dark green			
Other Passage Barriers			Red					
Agricultural Development								Yellow
Non-Point Pollution				Dark green				
Wildfires*			Red	Red	Red	Red	Red	Red

Key: Threat cell colors represent threat rating from CAP Workbook:

Red = Very High threat
Yellow = High threat
Light green = Medium threat
Dark green = Low threat

* Wildfires as a source of threats to steelhead habitat is not reflected in the top five threat sources in the CAP summary for these watersheds (see CAP workbooks), but is included here because of the extent and severity of recent (2005-2007) wildfires in this region.

At least 18 major dams and surface water diversions have been constructed in the watersheds of this region to serve mostly urban purposes. These structures and water management practices have significantly altered natural sediment and hydrological processes in these watersheds. The reservoirs behind these dams create suitable habitat conditions for several species of non-native snails, fishes, bullfrogs, and other introduced species that may affect one or more life history stages of steelhead directly (predation) or indirectly (competition for food). Non-native crayfish, fishes, and/or amphibians occur in the main stems of the Los Angeles, San Gabriel, and Santa Ana rivers, as well as in most or all of the major tributaries. A major indirect impact to the main stem of the San Gabriel River as a result of dam construction and operation is periodic sluicing of sediments accumulated behind the dams, which severely degrade instream and riparian habitat quality for salmonids downstream of these structures.

Widespread pumping of groundwater in aquifers throughout the watershed basins routinely eliminate surface flows in portions of most of these drainages and the magnitude of loss of surface flows and passage barriers is exacerbated during years of below-average precipitation. Very high road density in the urbanized portions of these watersheds also is a common source of passage barriers for steelhead that constricts the main stems of the three watersheds to a narrow channel.

Urban and agricultural conversion of coastal and middle reaches of these watersheds has created a number of severe stressors on steelhead. High road density throughout the floodplains of the main stems has increased sediment and non-point pollutant inputs to these drainages and their estuaries and degraded rearing and spawning habitat. Nutrient and coliform bacteria loading from agricultural and wastewater treatment effluents are important sources of degraded water quality in most of these drainages. Channelization, levee construction, and other flood control activities have completely removed instream and riparian habitat from extensive reaches of the main stems of these drainages as they pass through urban areas.

The formerly extensive estuaries that formed at the mouths of the Los Angeles, San Gabriel, and Santa Ana rivers have been all but eliminated by urban and commercial development (see Table 3 in the ESU Summary).

All three watersheds receive very high recreational activity because of their proximity to large urban areas. Trash, foot traffic, and ORV traffic have significantly affected instream and riparian habitats along extensive reaches of the upper watersheds.

Fires have burned 21% and 26% of the San Gabriel River and Santa Ana River watersheds, respectively, in the past 25 years and may be significant, widespread, and long-term sources of sedimentation, turbidity, substrate embeddedness, and loss of riparian canopy cover.

Despite widespread and varied habitat degradation to the coastal and middle main stems of all three watersheds, including the main tributaries of the latter, steelhead continue to spawn in each of the watersheds in this BPG and resident rainbow trout populations still inhabit the relatively high-quality habitat that survive upstream of the dams in this region. Improving conditions for steelhead passage, spawning, and/or rearing in these watersheds will require multiple, long-term, measures related to water management, recreation, and fish passage past large dams.

The threat sources discussed in this section should be the focus of a variety of recovery actions to address specific stresses on steelhead viability associated with these threats. Spatial and temporal data acquired on specific indicators associated with sources of threats or stresses, such as water temperature, pH, nutrients, etc., are generally inadequate to be the target of specific recovery actions. This type of data acquisition should be the subject of site-specific investigations in order to refine the primary recovery actions or to target additional recovery actions. A fish passage impediment inventory and assessment should be conducted for each of the major watershed in the Mojave Rim BPG. Impediments to fish passage stemming from the construction and operation of dams and groundwater extraction, modification of channel morphology and loss of adjacent riparian habitats through flood control, instream activities such as sand and gravel mining, and loss of estuarine functions due to filling and point and non-point waste discharges should be further evaluated and addressed as part of any recovery strategy for the Mojave Rim BPG (see recovery action matrices for more specific recovery actions).

ATTACHMENT. SUMMARY TABLES FOR STRESSES AND THREATS, STRESS MATRIX, AND OVERALL VIABILITY SUMMARY FOR THE MOJAVE RIM BPG

Threats Assessment for the
Santa Catalina Gulf Coast Biogeographic Population Group

Location and Physical Characteristics. The Santa Catalina Gulf Coast Biogeographical Population Group (BPG) region encompasses ten coastal watersheds of moderate size that drain the western slopes of the Santa Ana Mountains and Peninsular Range in southwestern Orange and Riverside counties southward through San Diego County to the United States-Mexico border (Figure 14). The upper portion of almost all of these watersheds includes steep, montane regions; the lower watersheds cut across coastal terraces. Two watersheds, Sweetwater River and Otay River, drain into San Diego Bay; the other eight watersheds drain directly into the Pacific Ocean. The component watersheds vary greatly in size—the San Luis Rey River watershed is twelve times the size of the San Onofre Creek watershed.

Average annual precipitation in this region is relatively low and is spatially variable (Table 13). The coastal terrace portion of each of these watersheds receives significantly less rainfall that the interior montane portions. For example, the average annual total precipitation for the City of San Diego is about 9.9 inches; much lower than the average for the San Diego River watershed as a whole (i.e., 18 inches). Because of low rainfall, many of the drainages in this BPG are naturally seasonal or have extensive seasonal reaches during years of below-average precipitation. Stream length increases substantially in the interior portions of these watersheds because of the highly dissected terrain and associated tributaries and contributes to the large total stream length found in this region (4,235 miles). Because of low rainfall, many of the drainages are naturally seasonal or have extensive seasonal reaches during years of below-average precipitation.

Table 13. Physical and Land Use Characteristics of Watersheds in the Santa Catalina Gulf Coast BPG region.

Physical Characteristics				Land Use				
Watershed (North to South)	Area (acres/miles^2)[1]	Stream Length[2] (miles)	Average Annual Rainfall[3] (in.)	Total Human Population[4]	Public Ownership*	Urban Area[5]	Agriculture/ Barren[5]	Open Space[5]
San Juan River	113,977/178	280	12.5	191,997	37%	23%	7%	70%
San Mateo Creek	85,964/134	200	13.3	4,011	48%	3%	2%	95%
San Onofre Creek	37,617/59	86	14.0	4,981	---	6%	< 1%	94%
Santa Margarita River	472,633/738	949	15.6	181,376	10%	10%	13%	77%
San Luis Rey River	367,329/574	749	17.8	147,782	11%	8%	19%	73%
San Dieguito River	223,155/349	432	18.3	129,475	11%	18%	10%	72%
San Diego River	281,059/439	537	18.0	500,469	17%	26%	2%	72%
Sweetwater River	142,511/223	271	17.7	249,589	15%	27%	1%	72%
Otay River	93,504/146	256	16.7	122,342	---	16%	9%	75%

Tijuana River	301,649/471	475	17.3	75,117	38%	5%	2%	93%
Total/Average	**2,119,398/3,311**	**4,235**	**16.1**	**1,607,140**	**---**	**14%**	**7%**	**79%**

Sources: CDFFP CalWater 2.2 Watershed delineation, 1999
CDFG 1:1,000,000 Routed stream network, 2003
USGS Hydrologic landscape regions of the U.S., 2003 (1 km grid cells)
CDFFP Census 2000 block data (migrated), 2003
CDFFP Multi-source land cover data (v02_2), 2002 (100 m grid cells)

* National Forest Lands only; does not include Military Reservations or State and County Parks

Land Use. Table 13 summarizes land use and population density in this region. Human population density varies widely between the component watersheds, but collectively, population density here is the second highest among the nine BPGs, averaging 485 persons per square mile. Population centers are concentrated on the coastal terrace portion of these watersheds, especially around San Diego Bay, which comprises one of the largest urban areas in the United States. The San Mateo Creek and portions of the Santa Margarita River and San Onofre Creek watersheds have very low population densities compared to the other watersheds, averaging less than 30 and 84 persons/square mile, respectively. Average population densities in the San Diego River and Sweetwater River watersheds, which contains the very large urban center of greater San Diego, average over 1,100 persons/square mile (see Table 2 and Figure 1 in ESU Summary).

In most of these watersheds, the first land use change was row crop agriculture, primarily orchard crops, followed by increasing urbanization, especially on the coastal terraces. Specialty agriculture to supply nurseries still remains and in some areas has expanded. More recently, the upper watersheds of the Santa Margarita River and the San Luis Rey River have experienced rapid urban growth. Semi-developed rural land and orchards cover extensive portions of the coastal and middle portions of these watersheds. Public ownership of land (mostly in Cleveland National Forest lands) is largely concentrated in the interior, montane watersheds and includes several federally-designated Wilderness Areas: Agua Tibia, San Mateo, Pine Creek, and Hauser Wilderness Areas. Portions of several watersheds have also been evaluated for inclusion in the Federal system of Wild and Scenic Rivers: upper San Luis Rey River; Cottonwood Creek (tributary to the Tijuana River), upper San Mateo Creek, and Devil’s Canyon (tributary to San Mateo Creek). The San Juan River/Trabuco Creek watershed contains large county parks (e.g., Caspers Regional Park) that cover much of the upper watersheds of these drainages. Marine Corps Base Camp Pendleton covers the coastal and middle portions of the San Mateo Creek, San Onofre Creek, and Santa Margarita River watersheds. Overall though, public ownership constitutes a minority of land ownership in the watersheds in this BPG, especially the coastal and middle portions.

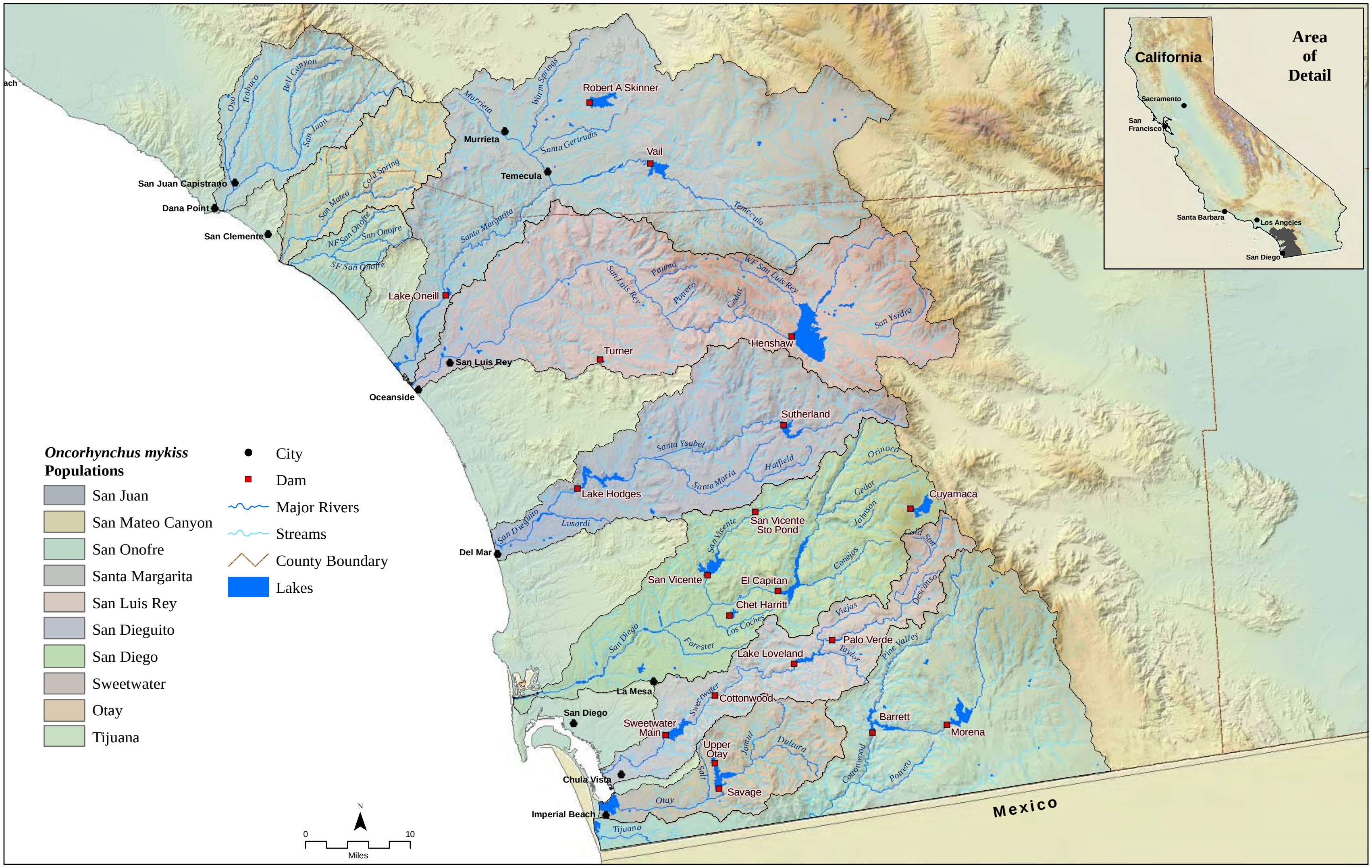

Figure 14. The Santa Catalina Gulf Coast Biogeographic Population Group region. Ten steelhead populations/watersheds were analyzed in this region.

Agriculture (row crop and orchard cultivation and livestock ranching), are important land uses that directly or indirectly impact watershed processes throughout these watersheds. A major consequence of agricultural and urban growth in this region is reservoir development. There are at least 20 major dams on watersheds in this region that are large enough to be regulated by the California Department of Water Resources and/or Department of Defense (Fig. 14 shows 18 of the largest dams). These dams are owned and operated by federal, state, public utility, local government, or private interests for irrigation, flood control and storm water management, recreation, municipal water supply, fire protection, farm ponds, or a combination of these purposes. Two of these dams have enlarged natural lakes: Lake Henshaw in the San Luis Rey River watershed and Vail Lake in the Santa Margarita River watershed. None of these facilities have incorporated fish passage provisions, including downstream flow provisions, into their operation. Most of the reservoirs and lakes in this region receive high recreational use and many are sources of non-native crayfish, fishes, and bullfrogs, and other non-native species that prey on steelhead or compete with steelhead for food and habitat space.

Current Watershed Conditions. The relative ratings of current habitat and land use conditions (indicators) used to assess the viability of watersheds to support steelhead in the Santa Catalina Gulf Coast BPG are presented in Figure 15. The number of indicators varied widely between watersheds, from 20 for the San Diego River, Sweetwater River, and Otay River watersheds to 40 indicators for the San Mateo Creek watershed.

In general, instream, riparian, and floodplain conditions for steelhead in watersheds in this BPG are rated as “Poor” to “Very Poor”, reflecting pervasive agricultural and urban conversion of watershed lands, particularly along the middle and coastal reaches. In contrast, the upper watersheds of many of these drainages are in relatively good condition (exceptions are the upper watersheds of the Santa Margarita River and San Luis Rey River). Relatively few indicators were rated as “Good” or “Very Good”.

Threats and Sources of Threats. Varying numbers and intensity of habitat impairment (threats) were identified in the CAP Workbooks analyses, ranging from 11 in the San Onofre Creek watershed to 17 in the Santa Margarita River and San Luis Rey River watersheds (Figure 16). Most of the habitat impairments were rated as severe to very severe in all but the San Mateo Creek and San Onofre Creek watersheds, and are related to high population density and urban and agricultural conversion of watershed lands. The relatively good steelhead habitat quality in San Mateo and San Onofre creeks, and, to a lesser degree in the Santa Margarita River, is due to the fact that Camp Pendleton Marine Corps Base, which covers substantial portions of the coastal and middle reaches of these watersheds. The upper watersheds, above dams and reservoirs, mostly are in public ownership (Cleveland National Forest). These reaches provide relatively good habitat conditions for steelhead and support reproducing populations of resident rainbow trout.

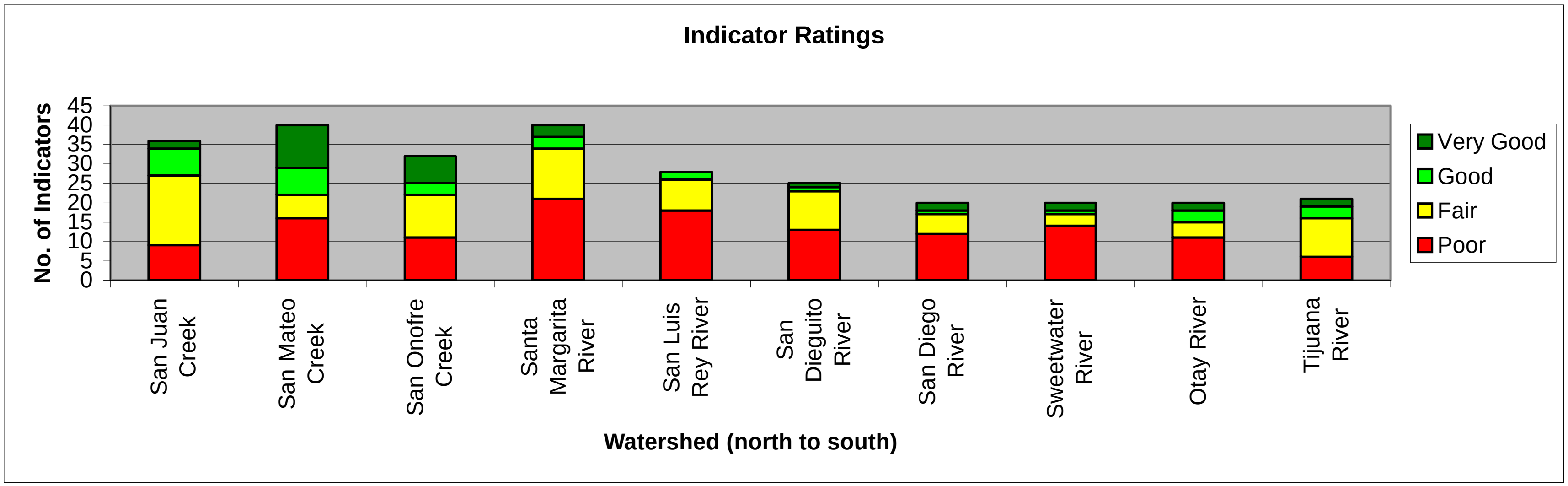

Fig. 15. Indicator ratings for watersheds in the Santa Catalina Gulf Coast Range BPG. Indicators are rated as "Very Good", "Good", etc., based on the current condition of landscape, habitat, or population variables. Although the amount of available information (the number of indicators) varies between watersheds, the relative ranking of indicators provides a general picture of existing habitat and land use conditions across the BPG (see individual CAP Workbooks for details).

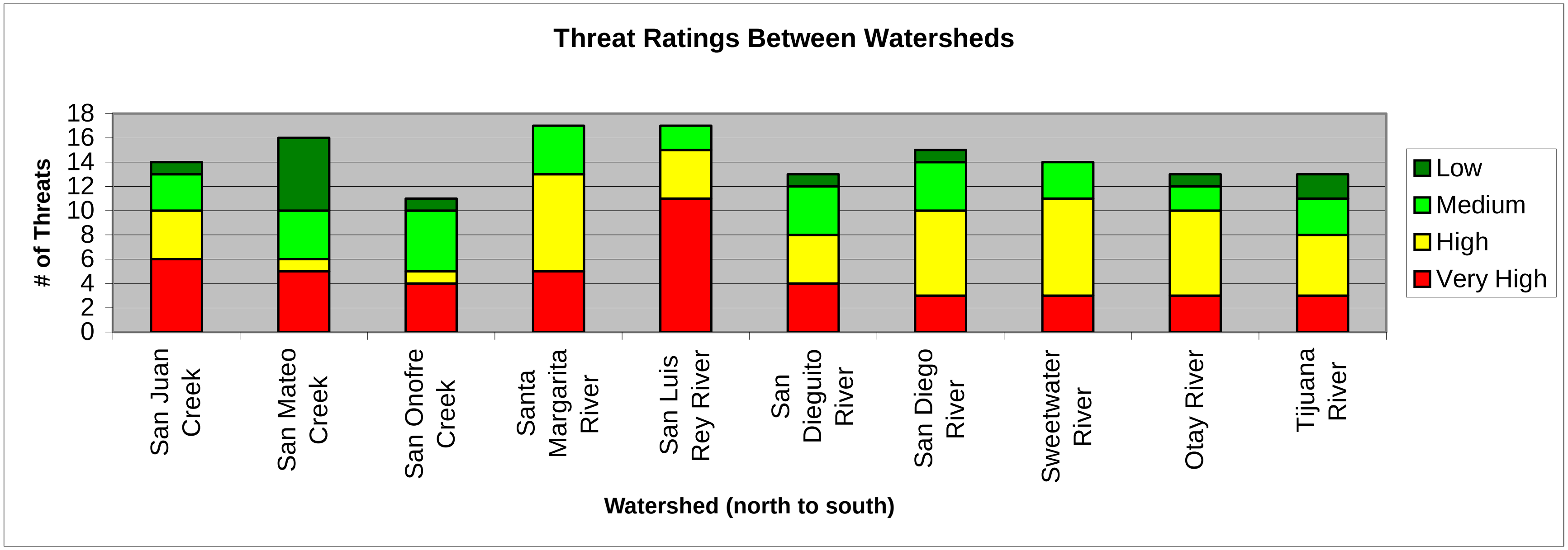

Fig. 16. Relative frequency of threat ratings to steelhead and their habitats in watersheds in the Santa Catalina Gulf Coast BPG. The sources, number, and severity of threats varies between watersheds.

Twelve anthropogenic activities ranked as the top five sources of stress to steelhead in the Santa Catalina Gulf Coast BPG (Table 14). The most significant feature of this ranking is that each of the top five threats are rated as "Severe" or "Very Severe" and that groundwater extraction and/or dams or surface water diversions are pervasive sources of threats to steelhead in each of the watersheds. Although open space is the dominant land use in this BPG region, urban and agricultural conversion of the coastal and middle portions of these watersheds, especially within the floodplains of these drainages, has disproportionately degraded habitat conditions for steelhead here.

Water management activities associated with urban and agricultural conversion of watershed lands are the most pervasive source of threats to steelhead in this region. Climatically, the Santa Catalina Gulf Coast BPG region is classified as semi-arid. Steelhead compete for water with urban and agricultural interests throughout the watersheds in this region. At least 20 major dams and surface water diversions without provisions for fish passage have been constructed on the BPG watersheds south of the San Juan Creek watershed to serve agricultural, urban, and recreational purposes. These structures and water management practices have significantly altered natural sediment and hydrological processes in these watersheds. Dams also have isolated rainbow trout in the upper watersheds of these drainages that otherwise would be anadromous. The reservoirs behind these dams create suitable habitat conditions for several species of non-native snails, fishes, bullfrogs, and other introduced species that may affect one or more life history stages of steelhead directly (predation) or indirectly (competition for food). Non-native crayfish, fishes, and bullfrogs occur in all of the drainages in this BPG, but are particularly abundant in the San Mateo Creek, San Onofre Creek, and Santa Margarita River watersheds.

Widespread pumping of groundwater in aquifers below these dams routinely eliminate surface flows in portions of most of these drainages and the magnitude of loss of surface flows and passage barriers is exacerbated during years of below-average precipitation. High road density and frequency of stream crossings (culverts, bridges, etc.) in most of the urbanized portions of these watersheds also is a common source of passage impediments for steelhead. As a result of widespread construction of dams in the lower and middle reaches of these watersheds, resident rainbow trout populations are isolated in high-quality instream and riparian habitat in the upper watersheds above these reservoirs.

Urban and agricultural conversion of coastal and middle reaches of these watersheds has created a number of severe stressors on steelhead. High road density increases sediment and pollutant inputs to these drainages and their estuaries, degrading rearing and spawning habitat and increasing mortality of one or more life stages. Channelization and levee construction have, in some cases, completely removed instream and riparian habitat from extensive reaches of these drainages as they pass through urban and agricultural areas or has, at best, severely reduced instream refugia and structural complexity. Flood control structures are widespread along the lower portions of drainages that pass through large urban areas, such as San Juan Creek, San Luis Rey River, San Dieguito River, San Diego River, Sweetwater River, and the Otay River.

Table 14. The top five sources of threats to steelhead and their habitats in each watershed of the Santa Catalina Gulf Coast BPG (see CAP Workbooks for details).

Threat Sources	Watershed (north to south)									
	San Juan Creek	San Mateo Creek	San Onofre Creek	Santa Margarita River	San Luis Rey River	San Dieguito River	San Diego River	Sweetwater River	Otay River	Tijuana River
Groundwater Extraction	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red
Dams and Surface Water Diversions		Red	Red	Red	Red	Red	Red	Red	Red	Red
Urban Development	Red					Red	Red	Red	Red	Red
Agricultural Development		Red			Red	Red		Yellow	Yellow	
Levees and Channelization	Red				Red	Yellow	Yellow			
Other Passage Barriers	Red				Red		Yellow	Yellow		
Recreational Facilities		Red	Red	Red						Yellow
Non-Native Species		Red	Red	Red						
Roads			Yellow	Red						
Flood Control	Red									
Non-Point Pollution										Yellow
Agricultural Effluents									Yellow	
Wildfires*	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow				

Key: Threat cell colors represent threat rating from CAP Workbook:

Red = Very High threat Light green = Medium threat
Yellow = High threat Dark green = Low threat

* Wildfires were not recognized during the CAP Workbook analyses as one of the top five threats in these watersheds, but recent fires in coastal watersheds of southern Orange and northern and central San Diego counties in Fall, 2007 could result in significant, long-term impacts to steelhead habitat.

Agricultural use of floodplains, increased density of roads throughout the watershed, and the placement of roads in or near the riparian corridor, increases sedimentation and substrate embeddedness, and creates non-point source pollution. Nutrient and coliform bacteria loading from agricultural and wastewater treatment effluents are important sources of threats to steelhead in most of these drainages.

Severe loss of estuary habitat has occurred throughout these BPG watersheds. Only the San Mateo Creek estuary was rated as "Good" (based on remaining acreage), with 76% of the historic estuary intact. At least 48% to 95% of the estuaries in the other watersheds have been lost. The remaining estuarine habitats are subject to constriction and isolation from urban, agricultural, and/or recreational development, as well as degradation of water quality and inflows as a result of surface runoff from roads, wastewater treatment effluent, and loss of upstream surface flows (see Table 3 in ESU Summary).

Development of recreational facilities within the floodplain and/or mouths of the San Mateo Creek, San Onofre Creek, Santa Margarita River, and Tijuana River watersheds are sources of estuarine, riparian, and instream habitat degradation and loss. Loss of estuarine habitat as a result of recreational development is most pronounced around the mouths of the San Juan, San Dieguito, San Diego, Sweetwater, and Otay Rivers, though significant portions of the Santa Margarita estuarine complex has been isolated from regular freshwater inflow as a result of the construction of the Interstate 5 highway. ORV activity is common in the middle and upper portions of several of these watersheds (e.g., upper Santa Margarita and San Luis Rey watersheds).

Fires have burned from 22% (San Mateo Creek) to 74% (San Diego River) of the component watersheds in this BPG region in the past 25 years, including significant coastal portions of watersheds in southern Orange and northern and central San Diego counties in 2007), and may be significant, widespread, and long-term sources of sedimentation, turbidity, substrate embeddedness, loss of riparian canopy cover, and other threats.

Despite widespread and varied habitat degradation to the coastal and middle portions, steelhead attempt to enter and spawn in each of the watersheds of the Santa Catalina Gulf Coast BPG and native rainbow trout populations still inhabit the relatively high-quality habitat that remains upstream of most of the dams in this region. Improving conditions for steelhead passage, spawning, and/or rearing in these watersheds will require multiple, long-term, measures related to water management, recreation, and fish passage past large dams.

The threat sources discussed in this section should be the focus of a variety of recovery actions to address specific stresses on steelhead viability associated with these threats. Spatial and temporal data acquired on specific indicators associated with sources of threats or stresses, such as water temperature, pH, nutrients, etc., are generally inadequate to be the target of specific recovery actions. This type of data acquisition should be the subject of site-specific investigations in order to refine the primary recovery actions or to target additional recovery actions. A fish passage impediment inventory and assessment should be conducted for each of the major watersheds in the Santa Catalina Gulf Coast BPG. Impediments to fish passage stemming from the construction and operation of dams and groundwater extraction, modification of channel morphology and adjacent riparian habitat due to flood control, instream activities such as sand and gravel mining, and loss of estuarine functions from filling and point and non-point waste discharges should be further evaluated and addressed as part of any recovery strategy for the Santa Catalina Gulf Coast BPG (see recovery action matrices for more specific recovery actions).

ATTACHMENT. SUMMARY TABLES FOR STRESSES AND THREATS, STRESS MATRIX, AND OVERALL VIABILITY SUMMARY FOR THE SANTA CATALINA GULF COAST BPG

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