5.3.20 Steelhead (South-Central California Coast DPS) (*Oncorynchus mykiss irideus*)

Steelhead
Photo Credit: National Marine Fisheries Service

Status

- Federally Threatened

Ecological Requirements

- RCIS Regions: Big Sur Coastline, Monterey Bay Coastline, Salinas River and Associated Corridor, Carmel River, Nacimiento River, Pajaro River (NMFS 2013)
- RCIS Natural Communities: River, Riparian (CDFW 2020; NMFS 2013)
- Highly migratory, adults spawn in coastal watersheds and juveniles rear in freshwater or estuarine habitats prior to migrating to the sea (NMFS 2013, 2016). Eelgrass is an important contributer to healthy estuaries (Sherman and DeBruyckere 2018).
- Prefers cool, clear streams with abundant cover and well-vegetated banks, with relatively stable flows. Spawning habitat includes pool and riffle complexes and cold, gravelly streambeds (NMFS 2013).
- Genetic exchange between wild and hatchery fish may impact species (NMFS 2016).
- Full species account available: NMFS 5-Year Review: Summary and Evaluation of South-Central California Coast Steelhead Distinct Population Segment (NMFS 2016)

- RCIS Conservation Target: High (Federally listed, near-endemic to RCIS area, representative of sensitive riparian corridors and aquatic connectivity)

Associated Non-Focal Species

- Least Bell's vireo (*Vireo bellii pusillus*)
- Little willow flycatcher (*Empidonax traillii brewsteri*)
- Clare's pogogyne (*Pogogyne clareana*)
- Eelgrass (*Zostera marina, Z. pacifica*)

Climate Change Vulnerability Assessment

Steelhead (South-Central California Coast Distinct Population Segment DPS) (SCCCS) are vulnerable to climate threats, including summer water deficit, flooding, sea-level rise, sea surface temperatures, and ocean acidification. Steelhead are likely to experience direct effects from increasing water temperatures, such as mortality from heat stress, changes in growth and development rates, and disease resistance (NMFS 2016). Changes in flow regime, especially from flooding and low flow events, are also likely to affect behavior and survival (NMFS 2016). SCCCS may behaviorally respond to these changes by shifting the seasonal timing of adult migration, spawning, fry emergence, and juvenile migration (NMFS 2016). Multiple climate change vulnerability assessments have been conducted for SCCCS and results vary from a "Highly Vulnerable" ranking by Moyle et al. (2012), as shown in Table 5-31., to a ranking of "Moderate" by Crozier et al. (2019). Crozier et al. (2019) also conducted climate vulnerability assessments of exposure and sensitivity factors:

Exposure Factors

- Ocean Acidification Exposure– High
- Flooding– Moderate-high
- Sea-Level Rise– Moderate-high
- Sea Surface Temperature–Moderate-high
- Upwelling– Moderate
- Ocean Currents– Moderate
- Stream Temperature– Moderate
- Summer Water Deficit–Moderate

- Hydrologic Regime–Low

Sensitivity Factors

- Other Stressors-Moderate-high
- Juvenile Freshwater Stage– Moderate
- Estuary Stage– Moderate
- Cumulative Life-Cycle Effects– Moderate
- Population Viability– Moderate
- Ocean Acidification Sensitivity– Moderate
- Early Life History-Low
- Marine Stage-Low
- Adult Freshwater Stage– Low
- Hatchery Influence– Low

Overall Vulnerability

- Overall Sensitivity–Moderate
- Overall Exposure-Moderate-high
- Adaptive Capacity-Moderate
- Overall Vulnerability– Moderate

Table 5-31. Steelhead Summary of Climate Change Vulnerability Ranking

Present day Vulnerability	Climate Change Vulnerability	Combined Vulnerability Score
Approaching Extinction	Highly Vulnerable	On Path to Extinction

Source: Moyle et al. 2012

The goals, objectives, and actions shown in Table 5-32. aim to protect, enhance, and restore present day suitable habitats for steelhead, as well as habitats that may become suitable in the future because of projected climate changes. Actions also address population stability, such as population monitoring, which may allow individuals to move to newly suitable habitats in the future. A summary of natural communities where this species occurs is presented in Chapter 4. Figure 5-16 shows the range and modeled habitat of steelhead.

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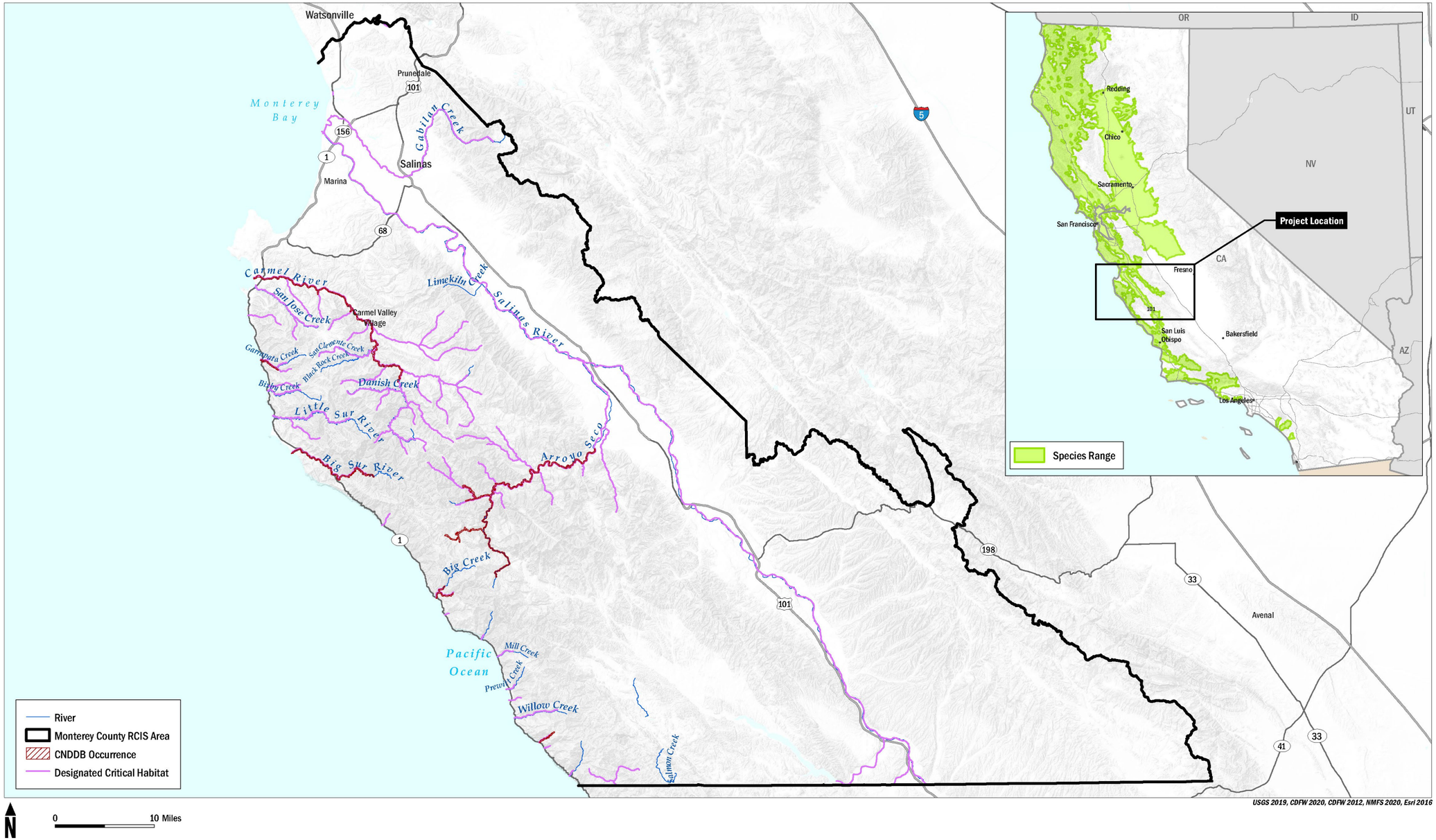

Transportation Agency for Monterey County
Monterey County Regional Conservation Investment Strategy

FIGURE 5-16
Steelhead (South-Central California Coast DPS)

Figure 5-16. Steelhead (South-Central California Coast DPS) Range and Modeled Habitat

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Steelhead Conservation Priorities, Goals, Objectives, and Actions

RC Goal 1 and all Water goals, objectives, and actions apply to steelhead. Table 3-33 summarizes specific goals, objectives, and actions for the species.

Conservation Priorities

- Acquire and protect habitat in NMFS-designated Core Population 1 (i.e., Pajaro River watershed, Salinas River watershed, Carmel River, San Jose Creek, Little Sur River, Big Sur River), and Core Population 2 (i.e., Garrapata Creek, Bixby Creek), and Core Population 3 (i.e., Rocky Creek, Big Creek, Limekiln Creek, Prewitt Creek, Willow Creek, and Salmon Creek) (NMFS 2013) (RC Objective 1.1).
- Modify or remove fish passage barriers on NMFS-designated Core Population 1, 2, and 3 watersheds, including Salinas Dam, San Antonio Dam, Nacimiento Dam, Los Padres Dam, Old Carmel River Dam (NMFS 2013), and throughout the RCIS area (NMFS 2013, 2016), using NMFS and CDFW priority rankings (SCCCS 1.3.1).
- Re-establish access to upper watersheds in both small coastal streams (i.e., San Jose, Pismo, and Arroyo Grande creeks), Big Sur River, and larger interior river systems (i.e., Salinas, Pajaro, and Carmel rivers) (NMFS 2016) (SCCCS 1.3.2).
- Remove barriers and restore fish access to historical spawning and rearing habitats throughout the DPS boundary (NMFS 2013, 2016), including historical watersheds that are anthropogenically blocked (i.e., riparian habitats above Hernandez Dam, San Antonio Dam, Nacimiento Dam, Salinas Dam, Lopez Dam, and North Fork Pacheco Creek Dam; NMFS 2016) (SCCCS 1.3.6).

Table 5-32. Steelhead Goals, Objectives, and Actions

Goal	Objective	Threats	Co-Benefits	Action
SCCCS Goal 1: Promote persistence of steelhead (South-Central California Coast DPS) populations in the RCIS area through protection, restoration, and enhancement of habitat.	SCCCS Objective 1.1: Protect known occurrences and allow expansion by protecting 6,400 acres of suitable habitat. Focus on protecting parcels in NMFS-designated Core Population 1 (Pajaro River watershed, Salinas River watershed, Carmel River, San Jose Creek, Little Sur River, Big Sur River), in Core Population 2 (Garrapata Creek, Bixby Creek), and Core Population 3 (Rocky Creek, Big Creek, Limekiln Creek, Prewitt Creek, Willow Creek, and Salmon Creek). Measure progress by the number of acres of NMFS-designated Core Population and RCIS area riparian, riverine, and estuarine habitat protected and associated/equivalent acres.	• Habitat loss, degradation, fragmentation • Climate change	• Other focal/ non-focal species • Biodiversity • Climate change resilience	RC Objective 1.1 (Protection) actions

Goal	Objective	Threats	Co-Benefits	Action
SCCCS Goal 1:	SCCCS Objective 1.2: Enhance occupied and suitable steelhead (South-Central California Coast DPS) habitat, focusing on NMFS-designated Core Populations 1, 2 and 3 and throughout the RCIS area. Measure progress toward achieving this objective by the number of acres of Core Population and RCIS area riparian, riverine, and estuary habitat enhanced and occupied by steelhead.	• Modifications to natural flow regimes (e.g., water storage, withdrawal, conveyance, and diversions for agriculture, flood control, domestic use, and hydropower) • Climate change	• Water quality • Climate change resilience • Other focal/ non-focal species • Biodiversity	SCCCS 1.2.1: Develop and implement operating criteria to ensure that the pattern and magnitude of groundwater extractions and water releases, including bypass flows around diversions, from Uvas Dam, Pacheco Dam, Salinas Dam, San Antonio Dam, Nacimiento Dam, San Clemente Dam, Los Padres Dam, Arroyo Seco, Lower Salinas River, San Jose Creek, Little Sur River, Big Sur River, to provide essential habitat functions (NMFS 2013).
SCCCS Goal 1:	SCCCS Objective 1.2:	• Habitat loss, degradation, fragmentation • Climate change	• Water quality • Climate change resilience • Other focal/ non-focal species	SCCCS 1.2.2: Enhance estuarine rearing habitat, including the management of artificial sandbar breaching at river mouths and enhancement of supplemental water in NMFS-designated Core

Goal	Objective	Threats	Co-Benefits	Action
			• Biodiversity	Population 1, 2, and 3 watersheds and throughout the RCIS area (NMFS 2013).
SCCCS Goal 1:	SCCCS Objective 1.2:	• Modifications to natural flow regimes (e.g., water storage, withdrawal, conveyance, and diversions for agriculture, flood control, domestic use, and hydropower)	• Water recharge • Water quality • Other focal/ non-focal species • Biodiversity • Connectivity	SCCCS 1.2.3: On the Carmel River, develop and implement an alternative off-channel water supply project, to eliminate or decrease water extraction from the channel, including subsurface extractions (NMFS 2013). Ensure provisional fish passage of adults and juveniles around dams and ensure that seasonal releases from dams support all life history phases (NMFS 2013).

Goal	Objective	Threats	Co-Benefits	Action
SCCCS Goal 1:	SCCCS Objective 1.2:	• Erosion and runoff (e.g., sedimentation, contaminants); Degraded water quality	• Water quality	SCCCS 1.2.4: On the Little Sur River, manage nearby roads to minimize sedimentation (NMFS 2013).
SCCCS Goal 1:	SCCCS Objective 1.2:	• Modifications to natural flow regimes (e.g., water storage, withdrawal, conveyance, and diversions for agriculture, flood control, domestic use, and hydropower) • Climate change	• Water quality • Climate change resilience • Other focal/ non-focal species • Biodiversity	SCCCS 1.2.5: Collaborate with riverine habitat landowners and the State Water Resources Control Board to minimize and manage withdrawals from riparian wells and develop rain and runoff collection facilities to address adequate bypass flows (NMFS 2013).
SCCCS Goal 1:	SCCCS Objective 1.2:	• Potential genetic introgression with hatchery-raised fish	N/A	SCCCS 1.2.6: Investigate the impacts of breeding between hatchery-reared fish and steelhead (South-Central California DPS) and mitigate potential negative impacts by eliminating

Goal	Objective	Threats	Co-Benefits	Action
				the stocking of hatchery-raised fish in non-anadromous waters (NMFS 2016).
SCCCS Goal 1:	SCCCS Objective 1.2:	• Habitat loss, degradation, fragmentation	• N/A	SCCCS 1.2.7: Implement population monitoring in Core Population watersheds where limited or no monitoring is occurring (NMFS 2016).
SCCCS Goal 1:	SCCCS Objective 1.2:	• Recreational activities (e.g., off-road vehicles, illegal take)	• N/A	SCCCS 1.2.8: Provide community education on the impacts of illegal take (NMFS 2013).
SCCCS Goal 1:	SCCCS Objective 1.3: Restore occupied and suitable steelhead habitat throughout the RCIS area, focusing on NMFS-designated Core Populations 1, 2, and 3. Measure progress toward achieving this objective by acres of Core Population and RCIS area habitat and adjacent/equivalent acres	• Fish passage barriers • Increased number of impermeable surfaces (e.g., roads) • Climate change	• Water quality • Climate change resilience • Habitat connectivity	SCCCS 1.3.1: Physically modify or remove fish passage barriers on NMFS-designated Core Population 1, 2, and 3 watersheds, including Salinas Dam, San Antonio Dam, Nacimiento Dam, Los Padres Dam, Old Carmel River Dam (NMFS 2013) and throughout the RCIS area (NMFS 2013,

Goal	Objective	Threats	Co-Benefits	Action
	restored and occupied by steelhead (NMFS 2013).			2016), using NMFS and CDFW priority rankings.
SCCCS Goal 1:	SCCCS Objective 1.3:	• Fish passage barriers • Climate change	• Habitat connectivity • Climate change resilience	SCCCS 1.3.2: Re-establish access to upper watersheds in both small coastal streams (San Jose, Pismo, and Arroyo Grande creeks), Big Sur River, and larger interior river systems (Salinas, Pajaro, and Carmel rivers) (NMFS 2016).
SCCCS Goal 1:	SCCCS Objective 1.3:	• Fish passage barriers; Increased number of impermeable surfaces (e.g., roads)	• Habitat connectivity	SCCCS 1.3.3: Collaborate with the California Department of Transportation (Caltrans) and county transportation departments with oversight on road practices, to reduce or remove transportation related barriers to upstream and downstream passage (including railroad

Goal	Objective	Threats	Co-Benefits	Action
				bridges, abutments, and similar structures) (NMFS 2013).
SCCCS Goal 1:	SCCCS Objective 1.3:	• Modifications to riparian substrates, vegetation, and channel morphology	• Water quality • Other focal/ non-focal species	SCCCS 1.3.4: On the Carmel River, restore spawning gravel and large woody debris recruitment to the lower mainstem (NMFS 2013).
SCCCS Goal 1:	SCCCS Objective 1.3:	• Modifications to natural flow regimes (e.g., water storage, withdrawal, conveyance, and diversions for agriculture, flood control, domestic use, and hydropower) • Climate change	• Climate change resilience • Flood control • Water quality • Protection of working lands	SCCCS 1.3.5: Implement local flood control and management programs (Pajaro River Bench Excavation Program and USACE Lower Pajaro River Flood Control Program) and incorporate habitat protection and restoration provisions (NMFS 2013).
SCCCS Goal 1:	SCCCS Objective 1.3:	• Fish passage barriers • Climate change	• Water quality	SCCCS 1.3.6: Implement restoration projects to provide fish access to historical spawning and

Goal	Objective	Threats	Co-Benefits	Action
			• Climate change resilience • Public access • Habitat connectivity	rearing habitats throughout the DPS boundary (NMFS 2013, 2016), such as to historical watersheds that are blocked anthropogenically (e.g., riparian habitats above Hernandez Dam, San Antonio Dam, Nacimiento Dam, Salinas Dam, Lopez Dam, and North Fork Pacheco Creek Dam; NMFS 2016).
SCCCS Goal 1:	SCCCS Objective 1.3:	• Modifications to natural flow regimes (e.g., water storage, withdrawal, conveyance, and diversions for agriculture, flood control, domestic use, and hydropower) • Climate change	• Water quality • Climate change resilience • Focal/non-focal species	SCCCS 1.3.7: Assess the condition of and restore estuarine habitat through the control of fill, waste discharges, and instream flows, and through the establishment of functioning riparian buffers on intermittent and perennial streams (NMFS 2013).

Goal	Objective	Threats	Co-Benefits	Action
SCCCS Goal 2: Promote persistence of eelgrass populations in the RCIS area through protection, enhancement, and restoration of habitat.	SCCCS Objective 2.1: Create, restore, and enhance eelgrass habitat as an associated non-focal species occurring in estuarine steelhead rearing habitat. The NMFS California Eelgrass Mitigation Policy (CEMP) guidelines and standards include creating or restoring 20% more eelgrass habitat than was previous eliminated as part of mitigation efforts (NMFS 2014).	• Habitat loss, degradation, fragmentation	• Other focal/ non-focal species • Biodiversity	SCCCS 2.1.1: Map eelgrass in the following estuaries where its occurrence has not been evaluated, identify anthropogenic factors inhibiting eelgrass, and develop measures to promote eelgrass where appropriate: Pajaro River, Salinas River, Carmel River, Garrapata Creek, Little Sur Lagoon, and the Big Sur River (Sherman and DeBruyckere 2018).
SCCCS Goal 2:	SCCCS Objective 2.1:	• Erosion and runoff (e.g., sedimentation, contaminants)	• Water quality • Public access • Other focal/ non-focal species • Biodiversity	SCCCS 2.1.2: Decrease sources of sedimentation running into estuaries and the nearshore environment (Sherman and DeBruyckere 2018).

Sources: CDFW 2015; CNPS 2019b; NMFS 2013, 2016; Sherman and DeBruyckere 2018