8.0 RESULTS

Whenever a large sample of chaotic elements are taken in hand … an unsuspected and most beautiful form of regularity proves to have been latent all along.

Francis Galton, 19th century

This chapter summarizes the results outlining the final list of populations that will represent the recovery scenario, status of listing factors and protective efforts, CAP assessments and the total cost of implementing recovery actions over a 100 year period for the 28 focus populations. Viability and Threat result tables are provided at the end of the chapter. The individual CAP workbooks and the aggregated data that informed the analyses can be made available upon request; however, it is anticipated that the information will be uploaded online.

8.1 POPULATIONS, LISTING FACTORS & PROTECTIVE EFFORTS

A total of 28 focus populations and 11 supplemental populations were selected to fulfill recovery criteria for the CCC coho salmon ESU. The total area associated with these 28 populations represent 1736 km of potential habitat, or 33%, of the total 5,194 km of habitat identified by the historical structure analysis (Chapter 6). The status of the Section 4(a)(1) FRN listing factors and protective efforts were evaluated (See Chapters 4 and 5). While many protective efforts are in place, the threats are not sufficiently ameliorated or abated to prevent the continued decline of CCC coho salmon populations.

8.2 CAP VIABILITY RESULTS

A summary of attributes and indicator ratings for all life stages and watershed processes across diversity strata are presented in Table 18 and Table 19. These tables display the CAP results by target life stages as well as by attributes and indicators. These tables informed an analysis for each diversity stratum.

Table 18: Viability Summary Table by Target Life Stage

CCC Coho Population Conditions By Target Life Stage			Lost Coast									Navarro Pt.-Gualala Pt.			Coastal						Santa Cruz Mountains								
Target	Attribute	Indicator	Usal	Cottaneva	Wages	Ten Mile	Pudding	Noyo	Caspar	Big	Albion	Big Salmon	Navarro	Garcia	Gualala	Russian	Salmon	Pine Gulch	Walker	Lagunitas	Redwood	San Gregori	Pescadero	Gazos	Waddell	Scott	San Vicente	San Lorenz	Soquel	Aptos
Adults	Habitat Complexity	Large Wood Frequency (BFW 0-10 meters)	P	P	P	F	P	P	V	P	P	G	F	G	G	P	P	F	P	P	V	P	P	F	F	F	P	P	P	F
Adults	Habitat Complexity	Large Wood Frequency (BFW 10-100 meters)	P	V	F	P	F	P	G	P	F	F	P	P	G	P	P	ND	P	F	ND	P	P	V	V	F	P	P	P	G
Adults	Habitat Complexity	Pool/Riffle/Flatwater Ratio	F	F	F	V	G	F	V	P	F	F	F	G	P	P	F	F	P	P	F	F	G	F	P	P	F	F	P	P
Adults	Habitat Complexity	Shelter Rating	P	P	F	P	P	P	P	P	P	F	P	P	P	P	P	P	P	F	P	P	P	F	P	P	P	P	P	P
Adults	Hydrology	Passage Flows	V	V	G	G	G	G	V	G	G	V	F	G	F	F	F	G	G	V	G	P	F	F	V	G	G	G	V	V
Adults	Passage/Migration	Passage at Mouth or Confluence	F	V	V	V	G	V	V	V	G	V	G	F	G	F	G	V	F	G	V	F	G	F	V	G	G	G	G	G
Adults	Passage/Migration	Physical Barriers	V	V	V	V	V	V	V	V	V	V	G	V	V	V	V	V	F	V	V	G	G	V	V	G	V	G	G	G
Adults	Riparian Vegetation	Tree Diameter (North of SF Bay)	F	G	P	P	P	F	G	F	F	P	P	F	F	P	P	P	P	P	P	NA	NA	NA	NA	NA	NA	NA	NA	NA
Adults	Riparian Vegetation	Tree Diameter (South of SF Bay)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	G	G	F	F	F	F	G	G	F
Adults	Sediment	Quantity & Distribution of Spawning Gravels	V	G	G	G	G	G	V	G	F	F	G	F	V	F	G	F	P	G	G	G	F	F	V	V	G	V	F	P
Adults	Velocity Refuge	Floodplain Connectivity	G	G	G	F	G	F	F	F	F	F	G	G	F	P	F	F	P	P	P	F	G	G	G	G	F	F	F	P
Adults	Water Quality	Toxicity	V	G	G	G	G	G	G	G	G	G	F	G	F	F	G	F	F	G	F	F	G	G	F	G	G	F	F	F
Adults	Water Quality	Turbidity	F	F	G	P	P	G	F	F	F	P	G	G	G	F	P	F	F	G	F	P	P	F	F	F	G	P	F	P
Adults	Viability	Density	P	F	P	P	F	F	F	P	F	F	P	P	P	P	P	P	P	F	P	P	P	P	P	P	P	P	P	P
Eggs	Hydrology	Flow Conditions (Instantaneous Condition)	V	G	G	G	G	G	V	G	F	V	F	G	F	F	G	G	F	G	G	F	G	V	V	V	G	F	F	G
Eggs	Hydrology	Redd Scour	F	V	G	G	G	F	V	F	F	G	F	F	F	P	F	V	F	F	G	P	F	F	F	P	F	P	P	F
Eggs	Sediment	Gravel Quality (Bulk)	P	F	P	F	P	F	F	F	ND	P	F	F	G	G	ND	ND	P	G	G	P	P	F	F	F	F	P	P	P
Eggs	Sediment	Gravel Quality (Embeddedness)	F	V	P	P	F	F	V	P	P	F	F	V	F	F	G	P	P	F	P	P	V	V	F	F	F	P	P	P
Summer Rearing Juveniles	Estuary/Lagoon	Quality & Extent	P	G	F	G	F	F	F	F	F	V	F	F	F	P	P	P	F	F	P	F	P	F	F	F	P	P	F	P
Summer Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	P	P	P	F	P	P	V	F	P	G	P	G	G	P	P	F	P	P	V	P	P	F	F	F	P	P	P	F
Summer Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	P	P	F	P	F	P	G	P	F	F	P	P	G	P	P	ND	P	F	ND	P	P	V	V	F	P	P	P	G
Summer Rearing Juveniles	Habitat Complexity	Percent Primary Pools	P	P	P	P	P	P	P	P	P	P	P	G	P	P	G	P	P	F	F	P	P	F	P	G	V	F	P	P
Summer Rearing Juveniles	Habitat Complexity	Pool/Riffle/Flatwater Ratio	F	F	F	V	G	F	G	P	P	F	P	G	P	P	F	F	P	P	F	F	G	F	P	P	F	F	P	P
Summer Rearing Juveniles	Habitat Complexity	Shelter Rating	P	P	F	P	P	P	P	P	P	F	P	P	P	P	P	P	P	P	P	P	P	F	P	P	P	P	P	P
Summer Rearing Juveniles	Hydrology	Flow Conditions (Baseflow)	G	G	G	G	F	F	G	F	F	G	F	F	P	P	F	F	P	F	F	P	F	G	G	F	F	P	P	G
Summer Rearing Juveniles	Hydrology	Flow Conditions (Instantaneous Condition)	G	V	G	G	V	G	V	G	F	G	F	G	F	P	G	G	F	G	G	F	G	G	G	V	V	F	P	V
Summer Rearing Juveniles	Hydrology	Number, Condition and/or Magnitude of Diversions	V	V	F	G	G	G	V	G	F	G	F	G	G	F	F	F	G	F	P	P	P	P	F	F	G	P	F	G
Summer Rearing Juveniles	Passage/Migration	Passage at Mouth or Confluence	G	V	V	V	G	G	V	G	G	G	F	F	F	F	G	V	F	G	V	F	G	F	V	G	V	G	G	G
Summer Rearing Juveniles	Passage/Migration	Physical Barriers	V	V	V	V	V	V	V	V	G	V	F	V	V	V	G	V	F	V	V	G	G	V	V	G	V	G	V	F
Summer Rearing Juveniles	Riparian Vegetation	Canopy Cover	V	V	V	V	G	G	V	P	G	P	F	G	F	F	F	P	F	F	V	F	F	V	G	V	G	V	V	G
Summer Rearing Juveniles	Riparian Vegetation	Tree Diameter (North of SF Bay)	F	G	P	P	P	F	G	F	F	P	P	F	F	P	P	P	P	P	P	NA	NA	NA	NA	NA	NA	NA	NA	NA
Summer Rearing Juveniles	Riparian Vegetation	Tree Diameter (South of SF Bay)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	G	G	F	F	F	F	G	G	F
Summer Rearing Juveniles	Sediment (Food Productivity)	Gravel Quality (Embeddedness)	F	V	P	P	F	F	V	P	F	F	F	V	F	F	G	F	P	F	F	P	V	V	F	F	F	P	P	P
Summer Rearing Juveniles	Water Quality	Temperature (MWMT)	G	G	V	F	G	P	F	P	F	G	P	F	F	P	F	G	P	F	G	F	F	G	F	F	G	P	F	F
Summer Rearing Juveniles	Water Quality	Toxicity	V	G	G	G	G	G	G	G	G	G	F	G	F	F	G	F	F	G	F	F	F	G	P	G	G	F	F	F
Summer Rearing Juveniles	Water Quality	Turbidity	G	F	G	G	P	G	G	V	V	F	F	G	G	F	G	V	F	V	G	G	G	G	G	G	G	V	F	F
Summer Rearing Juveniles	Viability	Density	P	F	P	P	F	F	F	F	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
Summer Rearing Juveniles	Viability	Spatial Structure	P	G	G	F	G	V	G	G	G	V	P	G	G	F	G	P	F	G	F	P	V	P	P	P	G	P	P	P
Winter Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	P	P	P	F	P	P	V	F	P	G	P	G	G	P	P	F	P	P	V	P	P	F	F	F	P	P	P	F
Winter Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	P	P	F	P	F	P	G	P	F	F	P	P	G	P	P	ND	P	F	ND	P	P	V	V	F	P	P	P	G
Winter Rearing Juveniles	Habitat Complexity	Pool/Riffle/Flatwater Ratio	G	F	F	V	G	F	G	P	P	F	P	G	P	P	F	F	P	P	F	F	G	F	P	P	F	F	P	P
Winter Rearing Juveniles	Habitat Complexity	Shelter Rating	P	P	F	P	P	P	P	P	P	F	P	P	P	P	P	P	P	P	P	P	P	F	P	P	P	P	P	P
Winter Rearing Juveniles	Passage/Migration	Physical Barriers	V	V	V	V	G	G	V	V	G	V	F	V	V	V	V	V	F	V	V	G	G	V	V	G	V	G	V	F
Winter Rearing Juveniles	Riparian Vegetation	Tree Diameter (North of SF Bay)	F	G	P	P	P	G	G	F	F	P	P	F	F	P	P	P	P	P	P	NA	NA	NA	NA	NA	NA	NA	NA	NA
Winter Rearing Juveniles	Riparian Vegetation	Tree Diameter (South of SF Bay)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	G	G	F	F	F	F	G	G	F
Winter Rearing Juveniles	Sediment (Food Productivity)	Gravel Quality (Embeddedness)	F	V	P	P	F	F	V	P	F	F	F	V	F	F	G	F	F	F	F	P	V	V	F	F	F	P	P	P
Winter Rearing Juveniles	Velocity Refuge	Floodplain Connectivity	G	G	G	F	F	F	P	P	F	F	F	G	F	P	F	F	P	P	P	F	F	G	G	G	F	F	P	P
Winter Rearing Juveniles	Water Quality	Toxicity	V	G	G	G	G	G	G	G	G	G	F	G	F	F	G	F	F	G	F	F	G	G	P	G	G	F	F	F
Winter Rearing Juveniles	Water Quality	Turbidity	F	F	G	P	P	F	P	F	G	P	G	G	F	F	P	F	P	G	P	P	P	F	F	F	F	P	F	P
Smolts	Estuary/Lagoon	Quality & Extent	F	G	F	G	F	F	F	F	F	V	F	F	F	F	F	P	F	F	F	G	F	F	F	F	P	P	F	F
Smolts	Habitat Complexity	Shelter Rating	P	P	F	P	P	P	P	P	P	F	F	P	P	P	P	P	P	F	P	P	P	F	P	P	P	P	P	P
Smolts	Hydrology	Number, Condition and/or Magnitude of Diversions	V	V	F	G	G	G	V	G	F	G	F	F	G	F	F	F	G	F	F	P	P	P	F	F	G	P	F	G
Smolts	Hydrology	Passage Flows	V	V	G	G	G	G	V	G	G	V	F	G	F	P	G	G	F	V	G	P	F	F	G	F	G	P	G	G
Smolts	Passage/Migration	Passage at Mouth or Confluence	P	V	V	V	G	V	V	G	G	V	G	F	F	F	F	V	F	G	V	F	G	G	V	V	V	G	V	G
Smolts	Smoltification	Temperature	V	G	V	V	V	G	V	G	G	G	F	G	F	F	F	G	F	G	G	V	G	V	G	G	V	G	G	G
Smolts	Water Quality	Toxicity	V	G	G	G	G	G	G	G	G	G	F	G	F	F	G	F	F	G	F	F	G	G	P	G	G	F	F	F
Smolts	Water Quality	Turbidity	F	F	G	P	P	F	P	F	G	F	F	G	F	F	F	G	P	G	P	P	P	F	F	F	G	P	F	P
Smolts	Viability	Abundance	P	P	P	P	F	P	P	P	F	F	P	P	F	P	P	P	P	F	P	P	P	P	P	P	P	P	P	P
Watershed Processes	Hydrology	Impervious Surfaces	V	V	V	V	V	V	V	V	V	V	V	V	V	G	V	V	V	V	V	V	V	V	V	V	V	G	V	V
Watershed Processes	Landscape Patterns	Agriculture	V	V	V	V	V	V	V	V	V	V	V	V	V	G	V	F	P	V	V	V	V	V	V	V	V	V	V	V
Watershed Processes	Landscape Patterns	Timber Harvest	G	F	F	P	F	F	V	F	P	G	G	G	F	V	G	V	V	V	G	V	V	V	V	G	G	V	V	V
Watershed Processes	Landscape Patterns	Urbanization	V	V	V	V	P	V	V	V	G	P	G	V	V	F	P	V	V	G	G	V	V	V	V	V	P	P	P	P
Watershed Processes	Riparian Vegetation	Species Composition	V	V	V	G	V	G	G	F	V	V	P	V	G	F	F	F	P	F	G	G	G	V	V	G	F	G	G	G
Watershed Processes	Sediment Transport	Road Density	P	P	P	P	P	P	P	P	P	P	P	P	P	P	F	V	V	G	P	P	F	G	G	F	G	P	P	P
Watershed Processes	Sediment Transport	Streamside Road Density (100 m)	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	F	P	P	P	P	P	P	P	P	P	P	P	P

NA = Not Applicable
ND = No Data

Table 19: Viability Summary Table by Attribute and Indicator Rating

CCC Coho Population Conditions By Habitat Attribute			Lost Coast										Navarro Pt.-Gualala Pt.			Coastal						Santa Cruz Mountains								
Target	Attribute	Indicator	Usal	Cottaneva	Wages	Ten Mile	Pudding	Noyo	Caspar	Big	Albion	Big Salmon	Navarro	Garcia	Gualala	Russian	Salmon	Pine Gulch	Walker	Lagunitas	Redwood	San Gregorio	Pescadero	Gazos	Waddell	Scott	San Vicente	San Lorenzo	Soquel	Aptos
Smolts	Estuary/Lagoon	Quality & Extent	F	G	F	G	F	F	F	F	F	V	F	F	F	F	F	P	F	F	F	G	F	F	F	F	P	P	F	F
Summer Rearing Juveniles	Estuary/Lagoon	Quality & Extent	P	G	F	G	F	F	F	F	F	V	F	F	F	P	P	P	F	F	P	F	P	F	F	F	P	P	F	P
Adults	Habitat Complexity	Large Wood Frequency (BFW 0-10 meters)	P	P	P	F	P	P	V	P	P	G	F	G	G	P	P	F	P	P	V	P	P	F	F	F	P	P	P	F
Summer Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	P	P	P	F	P	P	V	F	P	G	P	G	G	P	P	F	P	P	V	P	P	F	F	F	P	P	P	F
Winter Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 0-10 meters)	P	P	P	F	P	P	V	F	P	G	P	G	G	P	P	F	P	P	V	P	P	F	F	F	P	P	P	F
Summer Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	P	P	F	P	F	P	G	P	F	F	P	P	G	P	P	ND	P	F	ND	P	P	V	V	F	P	P	P	G
Winter Rearing Juveniles	Habitat Complexity	Large Wood Frequency (Bankfull Width 10-100 meters)	P	P	F	P	F	P	G	P	F	F	P	P	G	P	P	ND	P	F	ND	P	P	V	V	F	P	P	P	G
Adults	Habitat Complexity	Large Wood Frequency (BFW 10-100 meters)	P	V	F	P	F	P	G	P	F	F	P	P	G	P	P	ND	P	F	ND	P	P	V	V	F	P	P	P	G
Summer Rearing Juveniles	Habitat Complexity	Percent Primary Pools	P	P	P	P	P	P	P	P	P	P	P	G	P	P	G	P	P	F	P	P	P	F	P	G	V	F	P	P
Adults	Habitat Complexity	Pool/Riffle/Flatwater Ratio	F	F	F	V	G	F	V	P	F	F	F	G	P	P	F	F	P	P	F	F	G	F	P	P	F	F	P	P
Summer Rearing Juveniles	Habitat Complexity	Pool/Riffle/Flatwater Ratio	F	F	F	V	G	F	G	P	P	F	P	G	P	P	F	F	P	P	F	F	G	F	P	P	F	F	P	P
Winter Rearing Juveniles	Habitat Complexity	Pool/Riffle/Flatwater Ratio	G	F	F	V	G	F	G	P	P	F	P	G	P	P	F	F	P	P	F	F	G	F	P	P	F	F	P	P
Adults	Habitat Complexity	Shelter Rating	P	P	F	P	P	P	P	P	P	F	P	P	P	P	P	P	P	F	P	P	P	F	P	P	P	P	P	P
Smolts	Habitat Complexity	Shelter Rating	P	P	F	P	P	P	P	P	P	F	F	P	P	P	P	P	P	F	P	P	P	F	P	P	P	P	P	P
Summer Rearing Juveniles	Habitat Complexity	Shelter Rating	P	P	F	P	P	P	P	P	P	F	P	P	P	P	P	P	P	P	P	P	P	F	P	P	P	P	P	P
Winter Rearing Juveniles	Habitat Complexity	Shelter Rating	P	P	F	P	P	P	P	P	P	F	P	P	P	P	P	P	P	P	P	P	P	F	P	P	P	P	P	P
Summer Rearing Juveniles	Hydrology	Flow Conditions (Baseflow)	G	G	G	G	F	F	G	F	F	G	F	F	P	P	F	F	P	F	F	P	F	G	G	F	F	P	P	G
Eggs	Hydrology	Flow Conditions (Instantaneous Condition)	V	G	G	G	G	G	V	G	F	V	F	G	F	F	G	G	F	G	G	F	G	V	V	V	G	F	F	G
Summer Rearing Juveniles	Hydrology	Flow Conditions (Instantaneous Condition)	G	V	G	G	V	G	V	G	F	G	F	G	F	P	G	G	F	G	G	F	G	G	G	V	V	F	P	V
Watershed Processes	Hydrology	Impervious Surfaces	V	V	V	V	V	V	V	V	V	V	V	V	V	G	V	V	V	V	V	V	V	V	V	V	V	G	V	V
Smolts	Hydrology	Number, Condition and/or Magnitude of Diversions	V	V	F	G	G	G	V	G	F	G	F	F	G	F	F	F	G	F	F	P	P	P	F	F	G	P	F	G
Summer Rearing Juveniles	Hydrology	Number, Condition and/or Magnitude of Diversions	V	V	F	G	G	G	V	G	F	G	F	G	G	F	F	F	G	F	P	P	P	P	F	F	G	P	F	G
Adults	Hydrology	Passage Flows	V	V	G	G	G	G	V	G	G	V	F	G	F	F	F	G	G	V	G	P	F	F	V	G	G	G	V	V
Smolts	Hydrology	Passage Flows	V	V	G	G	G	G	V	G	G	V	F	G	F	P	G	G	F	V	G	P	F	F	G	F	G	P	G	G
Eggs	Hydrology	Redd Scour	F	V	G	G	G	F	V	F	F	G	F	F	F	P	F	V	F	F	G	P	F	F	F	P	F	P	P	F
Watershed Processes	Landscape Patterns	Agriculture	V	V	V	V	V	V	V	V	V	V	V	V	V	G	V	F	P	V	V	V	V	V	V	V	V	V	V	V
Watershed Processes	Landscape Patterns	Timber Harvest	G	F	F	P	F	F	V	F	P	G	G	G	F	V	G	V	V	V	G	V	V	V	V	G	G	V	V	V
Watershed Processes	Landscape Patterns	Urbanization	V	V	V	V	P	V	V	V	G	P	G	V	V	F	P	V	V	G	G	V	V	V	V	V	P	P	P	P
Adults	Passage/Migration	Passage at Mouth or Confluence	F	V	V	V	G	V	V	V	G	V	G	F	G	F	G	V	F	G	V	F	G	F	V	G	G	G	G	G
Smolts	Passage/Migration	Passage at Mouth or Confluence	P	V	V	V	G	V	V	G	G	V	G	F	F	F	F	V	F	G	V	F	G	G	V	V	V	G	V	G
Summer Rearing Juveniles	Passage/Migration	Passage at Mouth or Confluence	G	V	V	V	G	G	V	G	G	G	F	F	F	F	G	V	F	G	V	F	G	F	V	G	V	G	G	G
Adults	Passage/Migration	Physical Barriers	V	V	V	V	V	V	V	V	V	V	G	V	V	V	V	V	F	V	V	G	G	V	V	G	V	G	G	G
Summer Rearing Juveniles	Passage/Migration	Physical Barriers	V	V	V	V	V	V	V	V	G	V	F	V	V	V	G	V	F	V	V	G	G	V	V	G	V	G	V	F
Winter Rearing Juveniles	Passage/Migration	Physical Barriers	V	V	V	V	G	G	V	V	G	V	F	V	V	V	V	V	F	V	V	G	G	V	V	G	V	G	V	F
Summer Rearing Juveniles	Riparian Vegetation	Canopy Cover	V	V	V	V	G	G	V	P	G	P	F	G	F	F	F	P	F	F	V	F	F	V	G	V	G	V	V	G
Watershed Processes	Riparian Vegetation	Species Composition	V	V	V	G	V	G	G	F	V	V	P	V	G	F	F	F	P	F	G	G	G	V	V	G	F	G	G	G
Adults	Riparian Vegetation	Tree Diameter (North of SF Bay)	F	G	P	P	P	F	G	F	F	P	P	F	F	P	P	P	P	P	P	NA	NA	NA	NA	NA	NA	NA	NA	NA
Summer Rearing Juveniles	Riparian Vegetation	Tree Diameter (North of SF Bay)	F	G	P	P	P	F	G	F	F	P	P	F	F	P	P	P	P	P	P	NA	NA	NA	NA	NA	NA	NA	NA	NA
Winter Rearing Juveniles	Riparian Vegetation	Tree Diameter (North of SF Bay)	F	G	P	P	P	G	G	F	F	P	P	F	F	P	P	P	P	P	P	NA	NA	NA	NA	NA	NA	NA	NA	NA
Adults	Riparian Vegetation	Tree Diameter (South of SF Bay)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	G	G	F	F	F	F	G	G	F
Summer Rearing Juveniles	Riparian Vegetation	Tree Diameter (South of SF Bay)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	G	G	F	F	F	F	G	G	F
Winter Rearing Juveniles	Riparian Vegetation	Tree Diameter (South of SF Bay)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	G	G	F	F	F	F	G	G	F
Eggs	Sediment	Gravel Quality (Bulk)	P	F	P	F	P	F	F	F	ND	P	F	F	G	G	ND	ND	P	G	G	P	P	F	F	F	F	P	P	P
Eggs	Sediment	Gravel Quality (Embeddedness)	F	V	P	P	F	F	V	P	P	F	F	V	F	F	G	P	P	F	P	P	V	V	F	F	F	P	P	P
Adults	Sediment	Quantity & Distribution of Spawning Gravels	V	G	G	G	G	G	V	G	F	F	G	F	V	F	G	F	P	G	G	G	F	F	V	V	G	V	F	P
Summer Rearing Juveniles	Sediment (Food Productivity)	Gravel Quality (Embeddedness)	F	V	P	P	F	F	V	P	F	F	F	V	F	F	G	F	P	F	F	P	V	V	F	F	F	P	P	P
Winter Rearing Juveniles	Sediment (Food Productivity)	Gravel Quality (Embeddedness)	F	V	P	P	F	F	V	P	F	F	F	V	F	F	G	F	F	F	F	P	V	V	F	F	F	P	P	P
Watershed Processes	Sediment Transport	Road Density	P	P	P	P	P	P	P	P	P	P	P	P	P	P	F	V	V	G	P	P	F	G	G	F	G	P	P	P
Watershed Processes	Sediment Transport	Streamside Road Density (100 m)	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	F	P	P	P	P	P	P	P	P	P	P	P	P
Smolts	Smoltification	Temperature	V	G	V	V	V	G	V	G	G	G	F	G	F	F	F	G	F	G	G	V	G	V	G	G	V	G	G	G
Adults	Velocity Refuge	Floodplain Connectivity	G	G	G	F	G	F	F	F	F	F	G	G	F	P	F	F	P	P	P	F	G	G	G	G	F	F	F	P
Winter Rearing Juveniles	Velocity Refuge	Floodplain Connectivity	G	G	G	F	F	F	P	P	F	F	F	G	F	P	F	F	P	P	P	F	F	G	G	G	F	F	P	P
Smolts	Viability	Abundance	P	P	P	P	F	P	P	P	F	F	P	P	F	P	P	P	P	F	P	P	P	P	P	P	P	P	P	P
Adults	Viability	Density	P	F	P	P	F	F	F	P	F	F	P	P	P	P	P	P	P	F	P	P	P	P	P	P	P	P	P	P
Summer Rearing Juveniles	Viability	Density	P	F	P	P	F	F	F	F	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
Summer Rearing Juveniles	Viability	Spatial Structure	P	G	G	F	G	V	G	G	G	V	P	G	G	F	G	P	F	G	F	P	V	P	P	P	G	P	P	P
Summer Rearing Juveniles	Water Quality	Temperature (MWMT)	G	G	V	F	G	P	F	P	F	G	P	F	F	P	F	G	P	F	G	F	F	G	F	F	G	P	F	F
Adults	Water Quality	Toxicity	V	G	G	G	G	G	G	G	G	G	F	G	F	F	G	F	F	G	F	F	G	G	F	G	G	F	F	F
Smolts	Water Quality	Toxicity	V	G	G	G	G	G	G	G	G	G	F	G	F	F	G	F	F	G	F	F	G	G	P	G	G	F	F	F
Summer Rearing Juveniles	Water Quality	Toxicity	V	G	G	G	G	G	G	G	G	G	F	G	F	F	G	F	F	G	F	F	F	G	P	G	G	F	F	F
Winter Rearing Juveniles	Water Quality	Toxicity	V	G	G	G	G	G	G	G	G	G	F	G	F	F	G	F	F	G	F	F	G	G	P	G	G	F	F	F
Adults	Water Quality	Turbidity	F	F	G	P	P	G	F	F	F	P	G	G	G	F	P	F	F	G	F	P	P	F	F	F	G	P	F	P
Smolts	Water Quality	Turbidity	F	F	G	P	P	F	P	F	G	F	F	G	F	F	F	G	P	G	P	P	P	F	F	F	G	P	F	P
Summer Rearing Juveniles	Water Quality	Turbidity	G	F	G	G	P	G	G	V	V	F	F	G	G	F	G	V	F	V	G	G	G	G	G	G	V	F	F	P
Winter Rearing Juveniles	Water Quality	Turbidity	F	F	G	P	P	F	P	F	G	P	G	G	F	F	P	F	P	G	P	P	P	F	F	F	F	P	F	P

NA = Not Applicable
ND = No Data

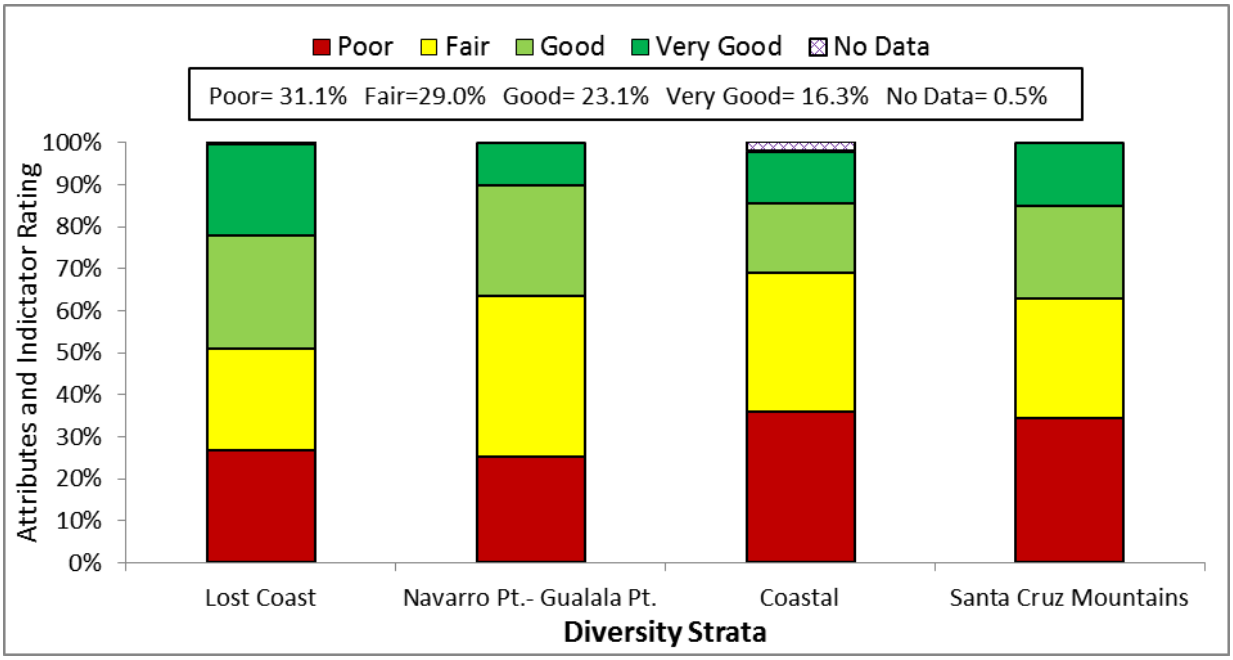

Figure 24: Attribute Indicator Ratings for CCC coho salmon across Diversity Strata

8.3 ATTRIBUTE & LIFE STAGE RESULTS: ESU LEVEL

Across strata, the Coastal stratum had a slightly larger percentage of poor and fair viability attribute ratings followed by Navarro Point- Gualala Point and Santa Cruz Mountains (Figure 24). The Lost Coast diversity stratum had the fewest attributes rated as poor or fair.

Winter rearing juveniles are the most threatened life stage across the ESU with 77% of the indicator ratings reported as poor or fair. The adult, egg, summer rearing juvenile and smolt life stages are also threatened with approximately 60% of the indicator ratings reported as poor or fair (Figure 25). Watershed processes, on an ESU level, have 37% of the attributes reported as poor or fair.

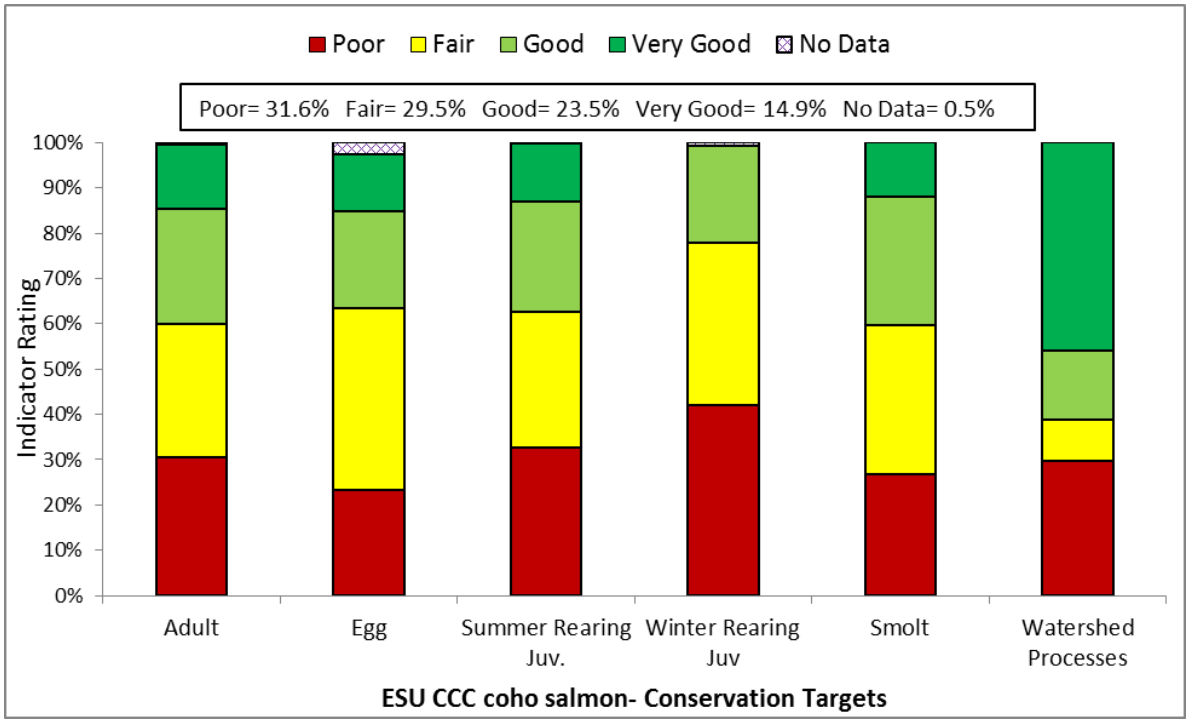

Figure 25: Attribute Indicator Ratings for CCC coho salmon- ESU by Lifestage

8.4 VIABILITY RESULTS: DIVERSITY STRATA & LIFE STAGES

The following results came from the viability tables which lists the indicator rankings for habitat attributes for each population.

Lost Coast: This stratum had the lowest percentage of poor and fair ratings of the ESU. The winter rearing life stage appears most limiting for this stratum.

Navarro Point-Gualala Point: The egg, summer rearing juvenile and smolt all had higher percent poor and fair ratings than winter rearing juveniles.

Coastal: This stratum has the greatest percent of poor and fair ratings for each life stage, except for the egg life stage, across the ESU.

Santa Cruz Mountains: This stratum had the second highest percentage of poor and fair ratings of the ESU.

Adult Viability Results

- ESU Level Results: The indicators of greatest concern were habitat complexity (LWD), pool/riffle/flatwater ratio, shelter rating, riparian, floodplain connectivity, water quality and viability (Figure 26).
- Diversity Strata Results: Adult conditions were similar across strata with little differences between stratum.

Egg Viability Results

- ESU Level Results: The indicators of most concern were redd scour and gravel quality (Figure 27).
- Diversity Strata Results:
    - Lost Coast: Sediment was the indicator of greatest concern.
    - Navarro Point – Gualala Point: Flow, redd scour and gravel quality all ranked fair.
    - Coastal: Instantaneous flow and redd scour are of greatest concern.
    - Santa Cruz Mountains: Hydrology and sediment indicators are of greatest concern.

Summer Rearing Viability Results

- ESU Level Results: Indicators of greatest concern (> 68% poor or fair) are estuary/lagoon quality and extent, habitat complexity (LWD), percent primary pools, pool/riffle/flatwater ratio, shelter rating, baseflow, riparian vegetation, sediment, water quality and viability (Figure 28).
- Diversity Strata Results:
    - Lost Coast: Hydrology had better than average summer rearing ratings than other strata.

- Navarro Point – Gualala Point: Passage/migration are more a concern in this stratum than the other diversity stratum.
- Coastal: Number of diversions, canopy cover and viability had a greater percentage of poor and fair ratings than other strata.
- Santa Cruz Mountains: Number of diversions, toxicity and viability had a greater percentage of poor and fair ratings than other strata.

Winter Rearing Viability Results

- ESU Level Results: This life stage had the largest percentage of poor and fair ratings across the ESU. The indicators of greatest concern were LWD, pool/riffle/flatwater ratio, shelter rating, riparian, sediment, floodplain connectivity and water quality (Figure 29).
- Diversity Strata Results:
    - Lost Coast: Fair to poor winter rearing conditions.
    - Navarro Point – Gualala Point: Ratings higher than other strata for LWD, sediment, floodplain connectivity and water quality.
    - Coastal: Fair to poor winter rearing conditions.
    - Santa Cruz Mountains: Fair to poor winter rearing conditions.

Smolt Viability Results

- ESU Level Results: Attributes of concern are quality and extent of estuary/lagoon, shelter rating, turbidity, and abundance (Figure 30).
- Diversity Stratum Results:
    - Lost Coast: Strata results mimic ESU level results.
    - Navarro Point – Gualala Point: Habitat complexity (shelter rating) and viability (abundance) had a 75% poor rating and a 25% fair rating. Estuary/lagoon

(quality and extent) has a 100% fair rating and all other attributes are rated 75% fair and 25% good for smolts.

- Coastal: All attributes that are of concern on the ESU level were of similar concern for smolts.
- Santa Cruz Mountains: In addition to all of the above listed ESU attributes of concern, hydrology (number, condition, and/or magnitude of diversions) had a greater poor/fair indicator rating than the ESU average for smolts.

Watershed Processes Viability Results

- ESU Level Results: Road density and streamside road density are the greatest overall source of impairment to watershed processes (Figure 31).
- Diversity Strata Results:
  - Lost Coast: Timber harvest is the most significant concern to this stratum.
  - Navarro Point-Gualala Point: Road density is the greatest concern in this stratum.
  - Coastal: Riparian vegetation and species composition are the greatest concern in this stratum.
  - Santa Cruz Mountains: Urbanization is the greatest concern in this stratum.

8.5 CAP ESU THREAT RESULTS

ESU Level Results

- Table 20 is the ESU output of threats across populations. Of the 15 identified threats, the four of greatest concern across the ESU were roads and railroads, water diversions and impoundment, residential and commercial development and severe weather (Figure 32).

Diversity Threat Results: Lost Coast

- The greatest threats were roads and severe weather the in this stratum. No very high threats were identified (Figure 33).

Diversity Threat Results: Navarro Point – Gualala Point

- Logging and wood harvesting, severe weather, roads, and water diversion and impoundment were the greatest threat in the stratum. No very high threats were identified (Figure 34).

Diversity Threat Results: Coastal

- Residential and commercial development, water diversions and impoundments, severe weather, roads and railroads, channel modification, and livestock farming and ranching are the greatest threats in this stratum (Figure 35).

Diversity Threat Results: Santa Cruz Mountains

- Roads and railroads, severe weather patterns, water diversions and impoundments, residential and commercial development, and fire and fuel management are the greatest threats in this stratum (Figure 36).

8.6 EMERGING THREATS

For the plan to be successful, it is important that actions are rapidly implemented to address, minimize, or prevent current and future threats resulting from water toxins (*e.g.*, nutrients, pesticides, and pharmaceuticals), climate change, water diversions, urbanization, and the adverse effects associated with the actual size of a population (*e.g.*, small population dynamics). We anticipate strategies and actions addressing these emerging threats are not fundamentally different than actions already recommended in this plan which address existing threats. However, some limiting factors may extend to more life stages or to larger spatial areas than anticipated, which will require implementation of recovery actions over large spatial and temporal scales. Additionally, some areas may become increasingly more important for protection and restoration than other areas. NMFS recognizes the need to develop a research, monitoring, and evaluation plan (RME) to assess the status of listed species and their habitat.

The RME should track progress toward achieving recovery goals and provide information to refine recovery strategies and actions through the process of adaptive management. For example, a formal risk analyses at the population level, specific to climate change projections, may be needed. This assessment will help prioritize existing actions and identify new strategies and actions.

8.6.1 CLIMATE CHANGE

NMFS recognizes climate change is a serious risk to coho salmon in California. The best available scientific information indicates the Earth's climate is warming, driven by the accumulation of greenhouse gasses (GHGs) in the atmosphere (IPCC 2007). The Intergovernmental Panel on Climate Change (IPCC) concluded in 2007 that warming of the climate system is unequivocal based on observations of increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising global average sea level. Changes in seasonal temperature regimes affect fish and wildlife (Quinn and Adams 1996; Schneider and Root 2002; Walther *et al.* 2002).

Climate shifts can affect fisheries, with profound socio-economic and ecological consequences (Osgood 2008). In a recent 2011 report on the Global Climate Change Impacts in the U. S. it was noted that, "salmon in the Northwest are under threat from a variety of human activities, but global warming is a growing source of stress." Salmon and steelhead from northern California to the Pacific Northwest are now challenged by global warming induced alteration of habitat conditions throughout their complex life cycles (Mantua and Francis 2004; Glick 2005; ISAB 2007; Martin and Glick 2008; Glick *et al.* 2009). Salmon productivity in the Pacific Northwest is sensitive to climate-related changes in stream, estuary, and ocean conditions. Specific characteristics of a population or its habitat vulnerable to climate change include temperature requirements, suitability of available habitat, and the genetic diversity of the ESU. Climate change could alter freshwater habitat conditions and affect the future survival of Pacific salmon stocks. Nearly 75 percent of California's anadromous salmonid populations are vulnerable to

climate change, and future climate change will affect the ability to influence their recovery in most or all of their watersheds (Moyle *et al.* 2008). Because coho salmon depend on freshwater streams and the ocean during different stages of their life history cycle, populations throughout the ESU, but particularly at the southern end of the range, are likely to be significantly impacted by climate change in the future. Climate change as it relates to salmonids is discussed in further detail in Appendix A.

8.6.2 SMALL POPULATION DYNAMICS

As populations decline random events have a larger impact on population dynamics and the ability of a population to persist. The perils small populations face may be either deterministic, the result of systematic forces that cause population decline (*e.g.*, overexploitation, development, deforestation, inability to find mates, inability to defend against predators), or stochastic (the result of random fluctuations that have no systematic direction). Stochastic pressure can express itself in three ways: genetic, demographic and environmental. Descriptions of these pressures are described below:

- Genetic stochasticity refers to changes in the genetic composition of a population unrelated to systematic forces (selection, inbreeding, or migration), (*i.e.*, genetic drift). It can have a large impact on the genetic structure of populations, by reducing the amount of diversity retained within populations and by increasing the chance that deleterious recessive alleles may be ultimately expressed throughout a population. Loss of diversity could limit a population's ability to adaptively respond to future environmental changes. Additionally, an increase in the frequency of expressed deleterious recessive alleles (from increased homozygosity) could reduce individual viability and reproductive capacity;

- Demographic stochasticity refers to the variability in population growth rates arising from random seasonal differences between individuals in survival and reproduction.

This variability will occur even if all individuals have the same expected ability to survive and reproduce and if expected rates of survival and reproduction do not change from one generation to the next. Small populations are particularly vulnerable to the adverse consequences of demographic stochasticity; and

- Environmental stochasticity refers to variation in birth and death rates from one season to the next in response to weather, disease, competition, predation, or other factors external to the population.

Many populations of CCC coho salmon have declined in abundance to levels well below low-risk abundance targets, and several are, if not extirpated, far below the high-risk depensation thresholds specified by Spence *et al.* (2008). These populations are at risk from natural stochastic processes, in addition to deterministic threats, that may make recovery more difficult. As wild populations get smaller, stochastic processes may cause alterations in genetics, breeding structure, and population dynamics that may interfere with the success of recovery efforts. These impacts need to be considered when evaluating population response to recovery actions. The effects of stochastic processes associated with small population size have placed CCC coho salmon at a high risk of extinction.

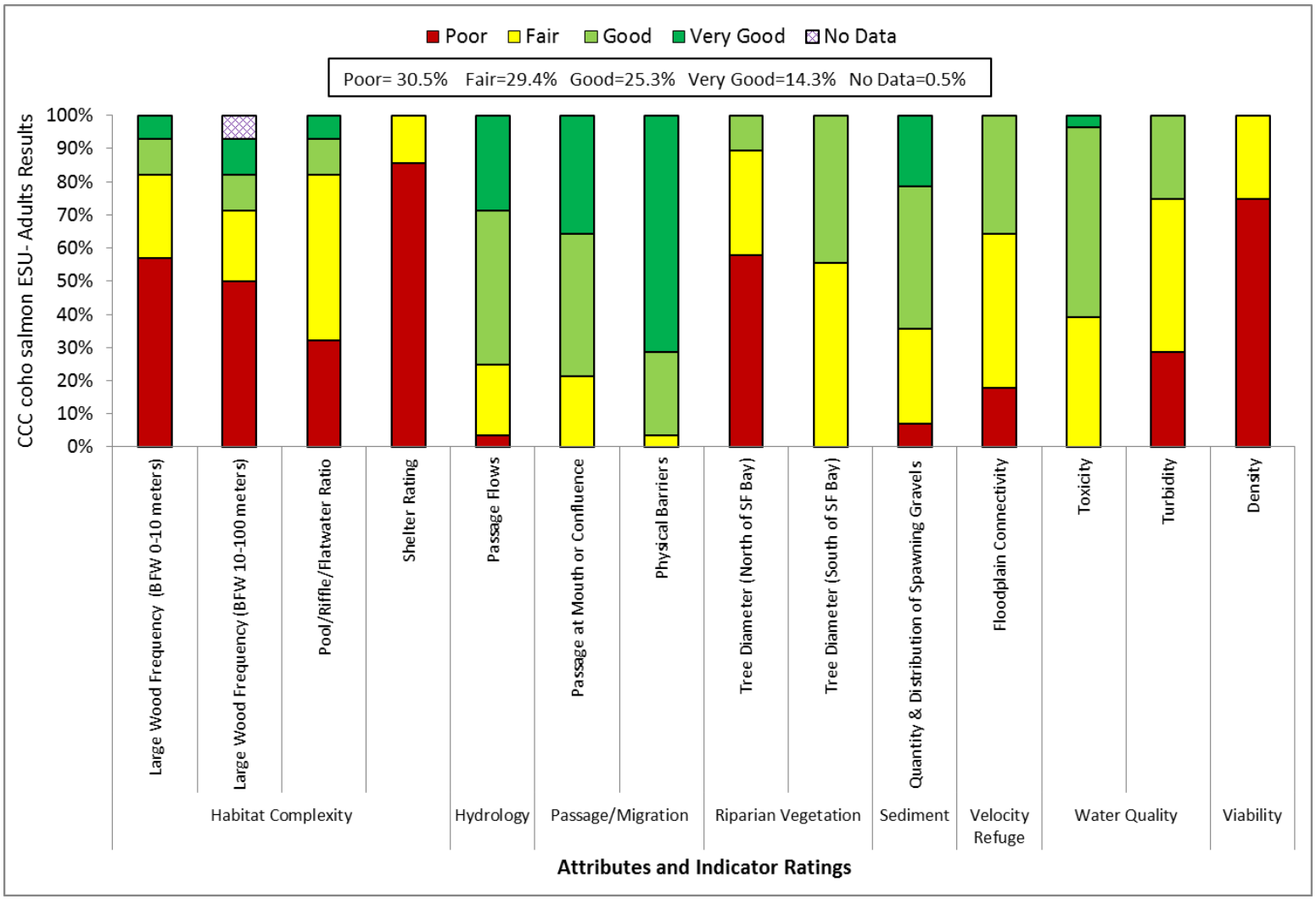

Figure 26: ESU Viability Results for Adults

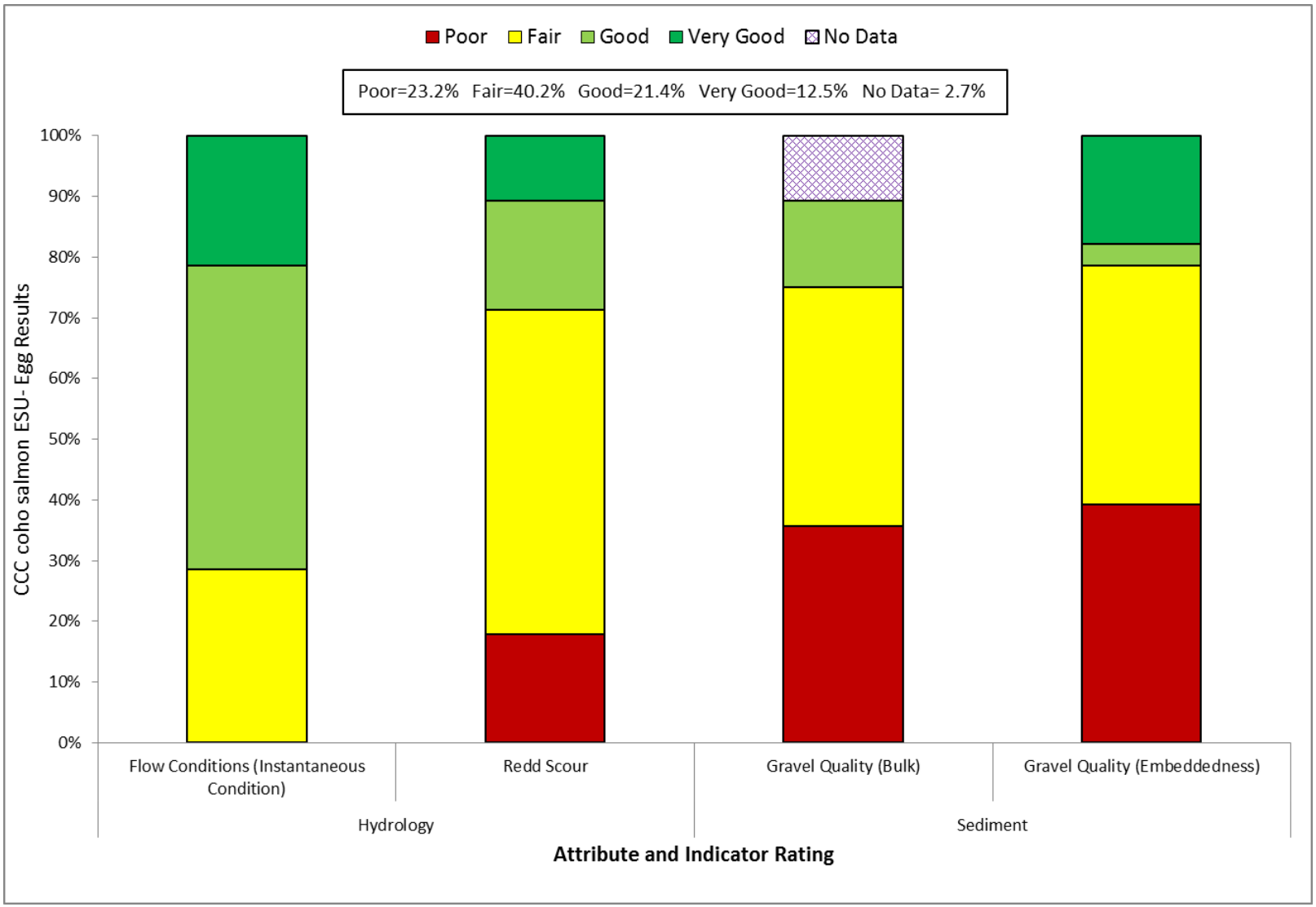

Figure 27: ESU Viability Results for Eggs

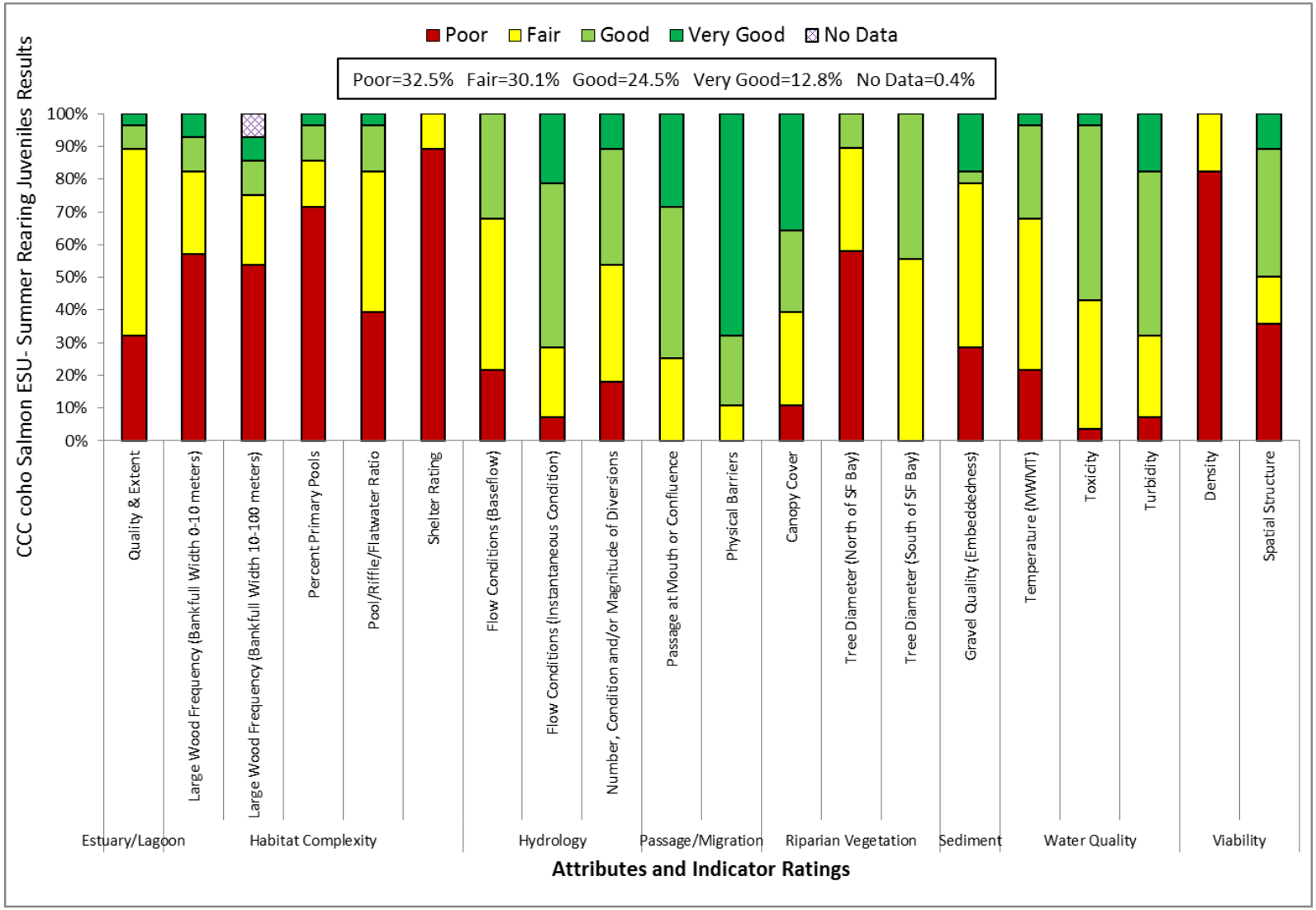

Figure 28: ESU Viability Results for Summer Rearing Juveniles

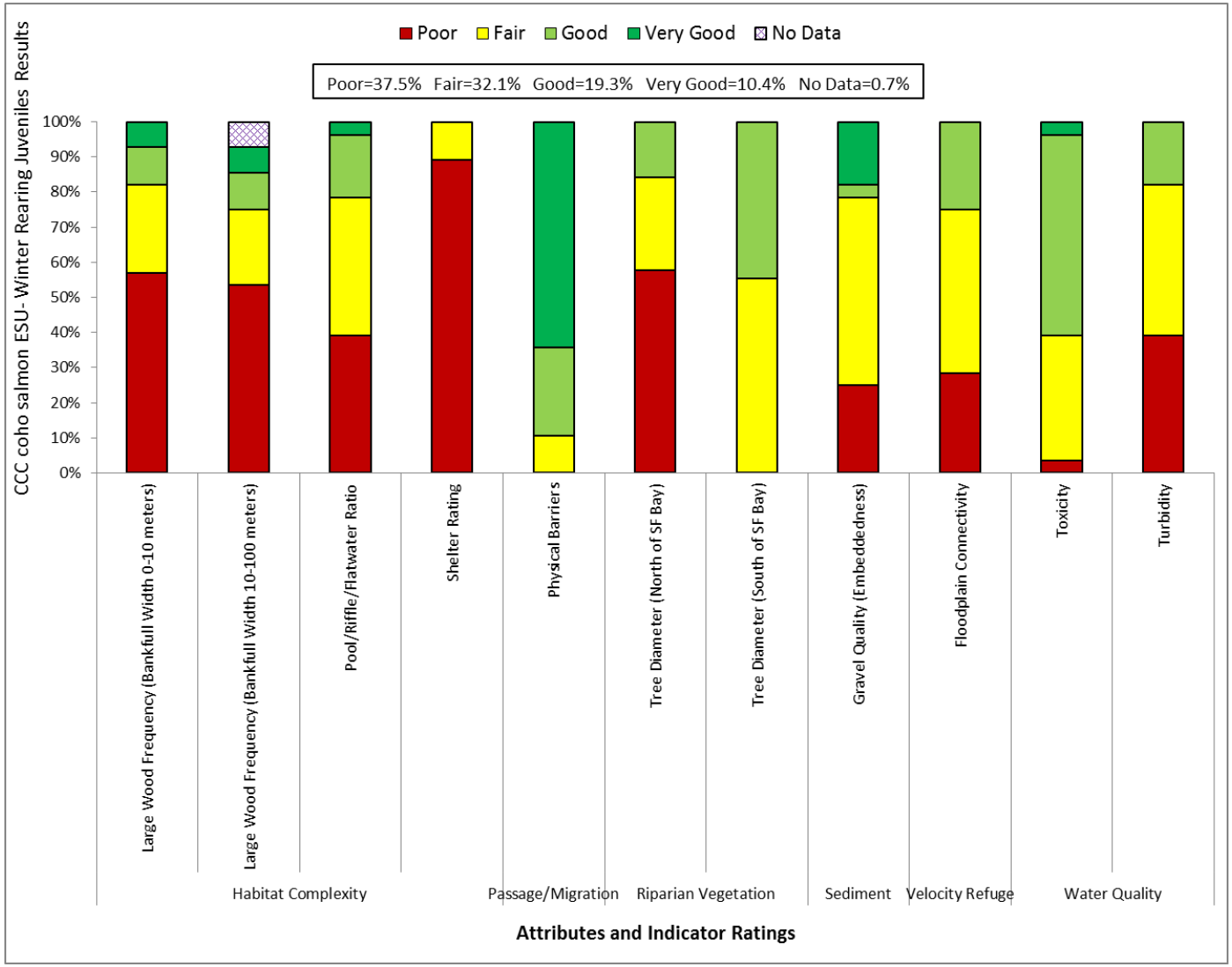

Figure 29: ESU Viability Results for Winter Rearing Juveniles

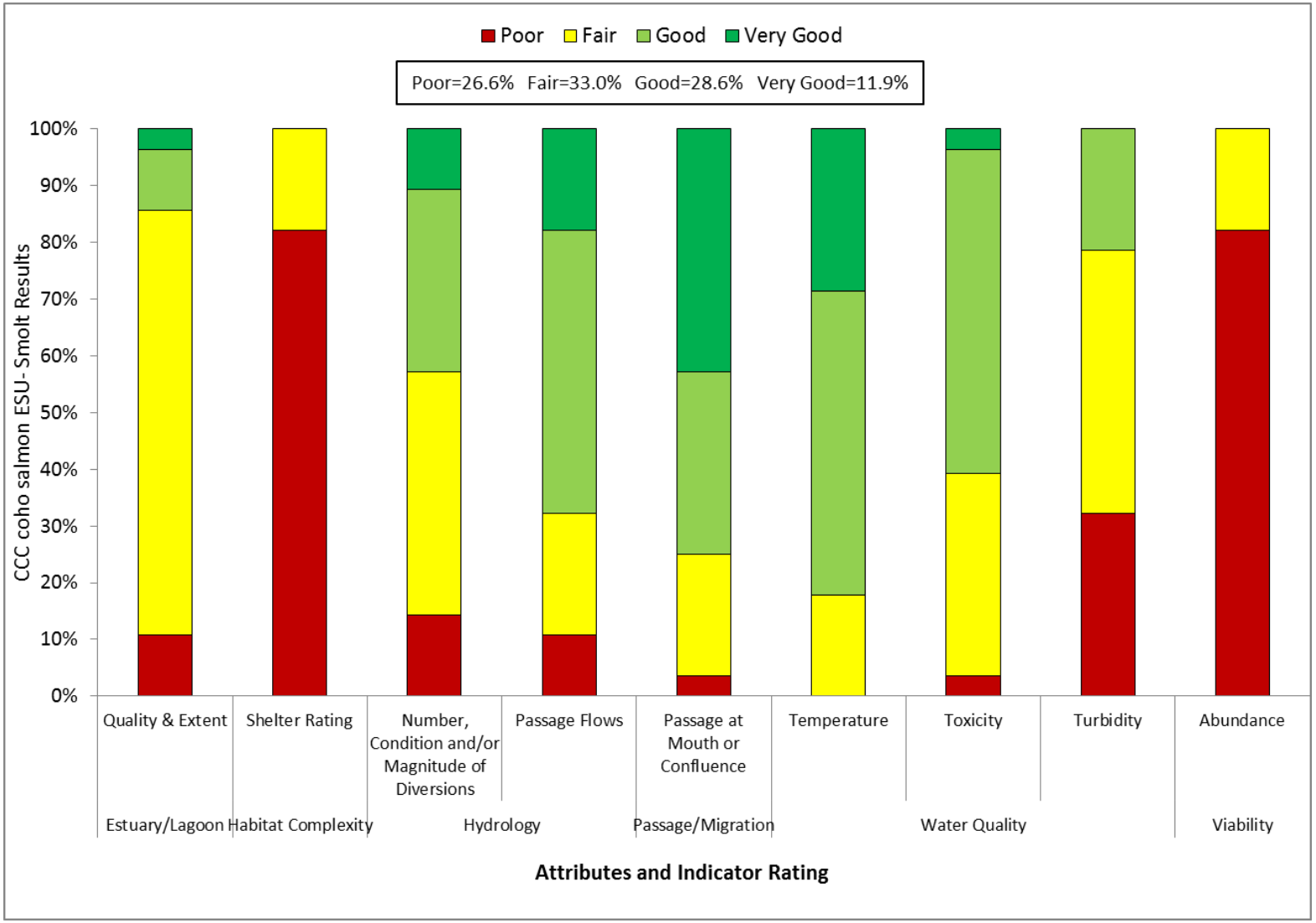

Figure 30: ESU Viability Results for Smolts

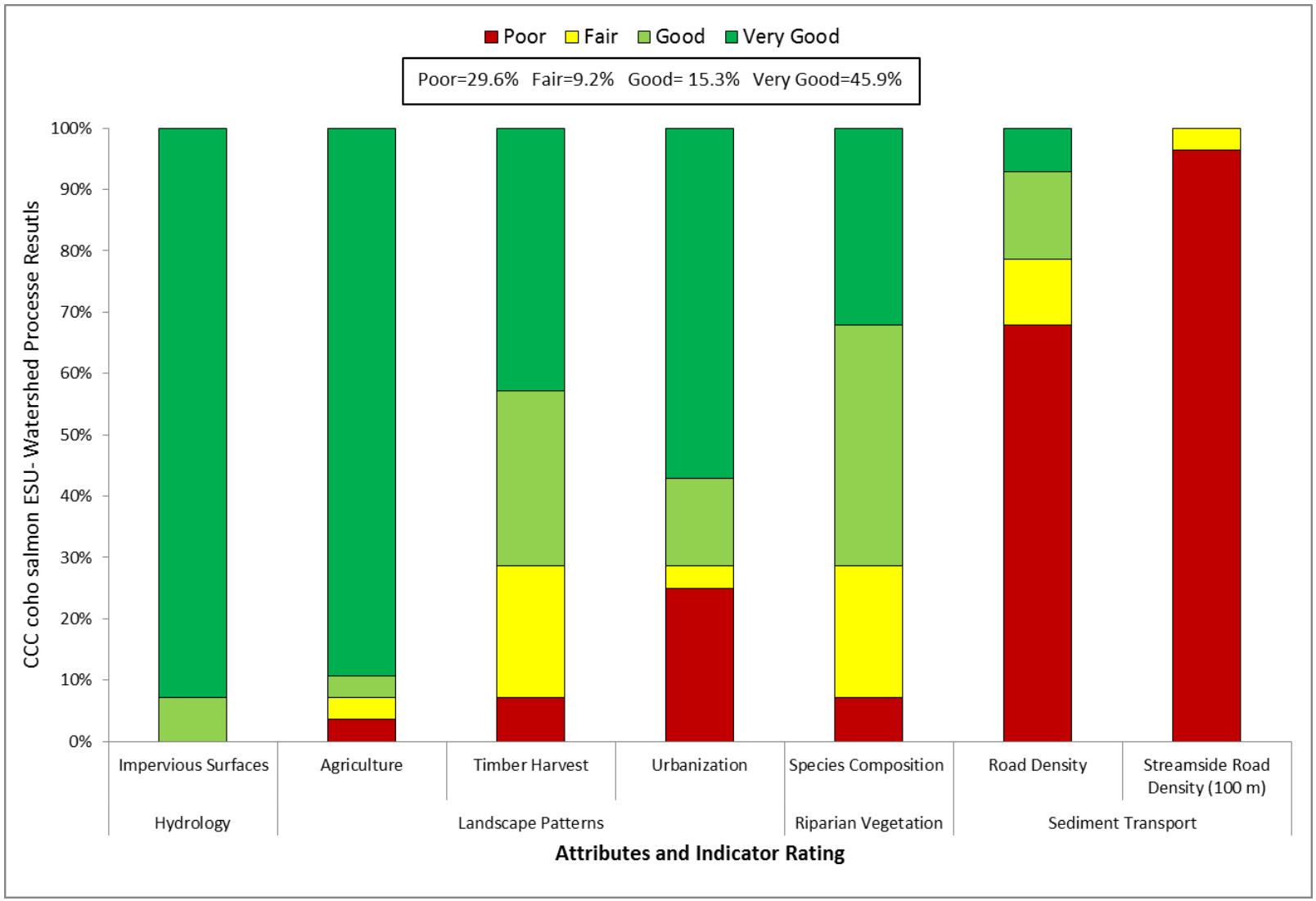

Figure 31: ESU Viability Results for Watershed Processes

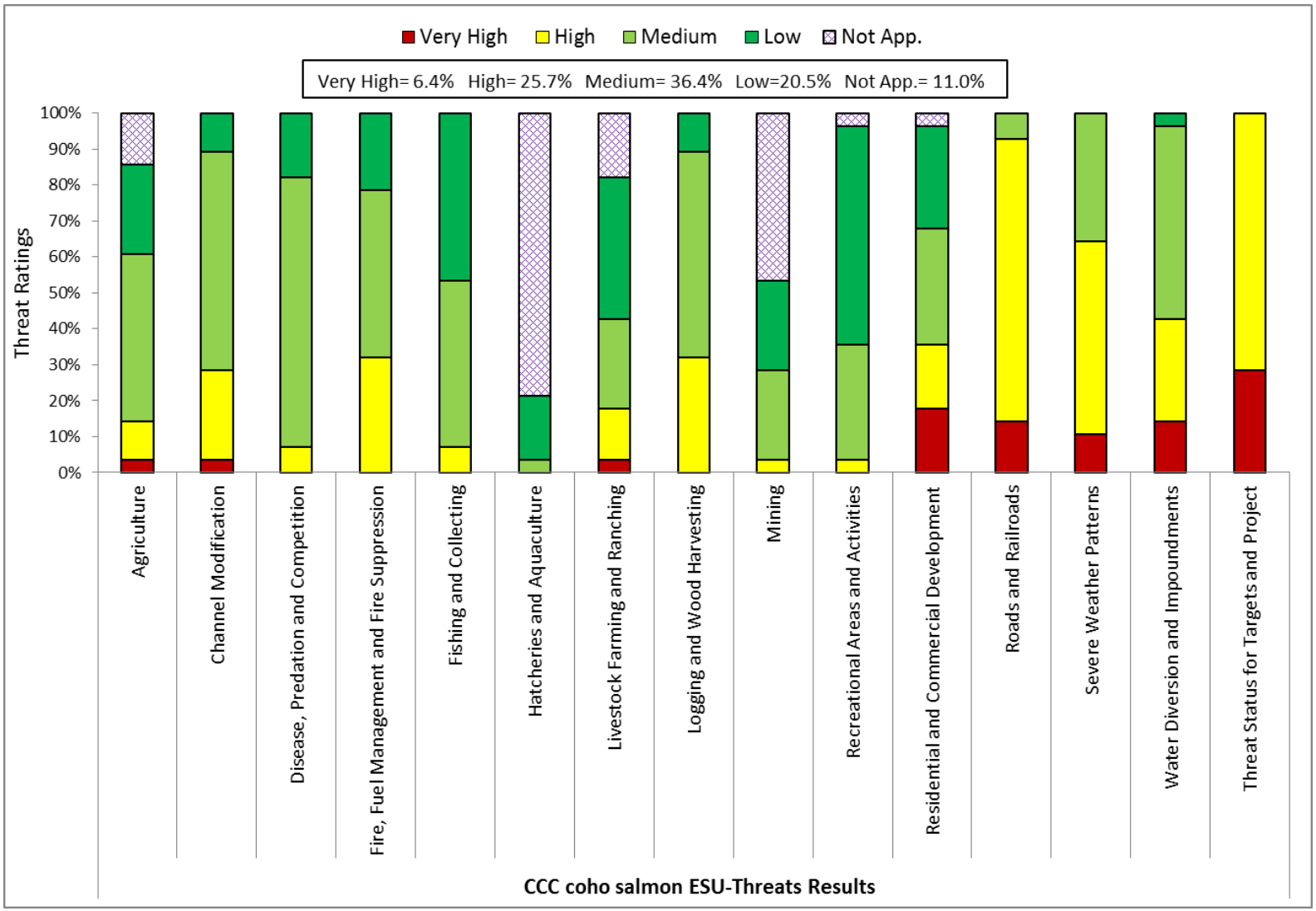

Figure 32: ESU Threat Results

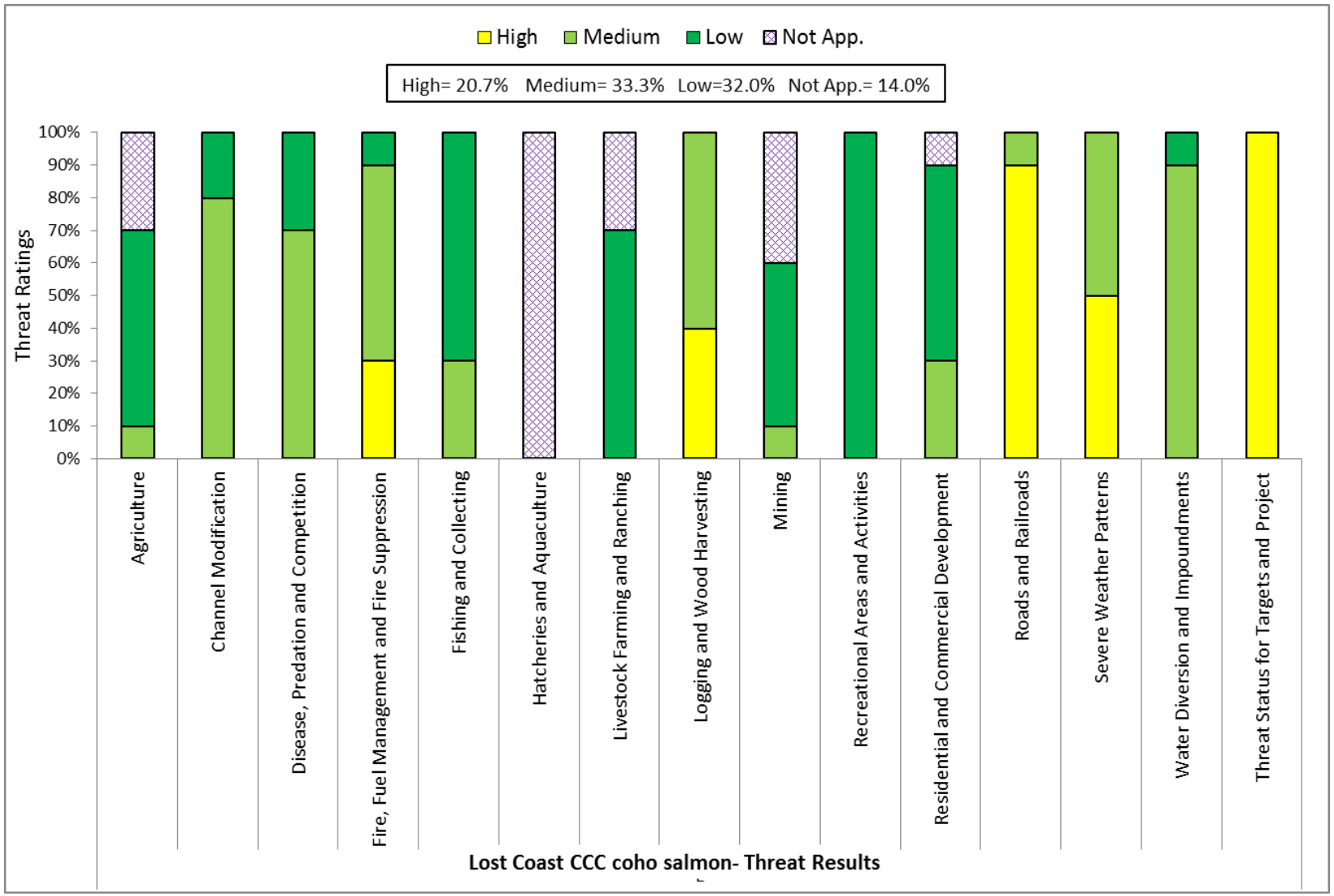

Figure 33: Lost Coast Diversity Strata Threat Results

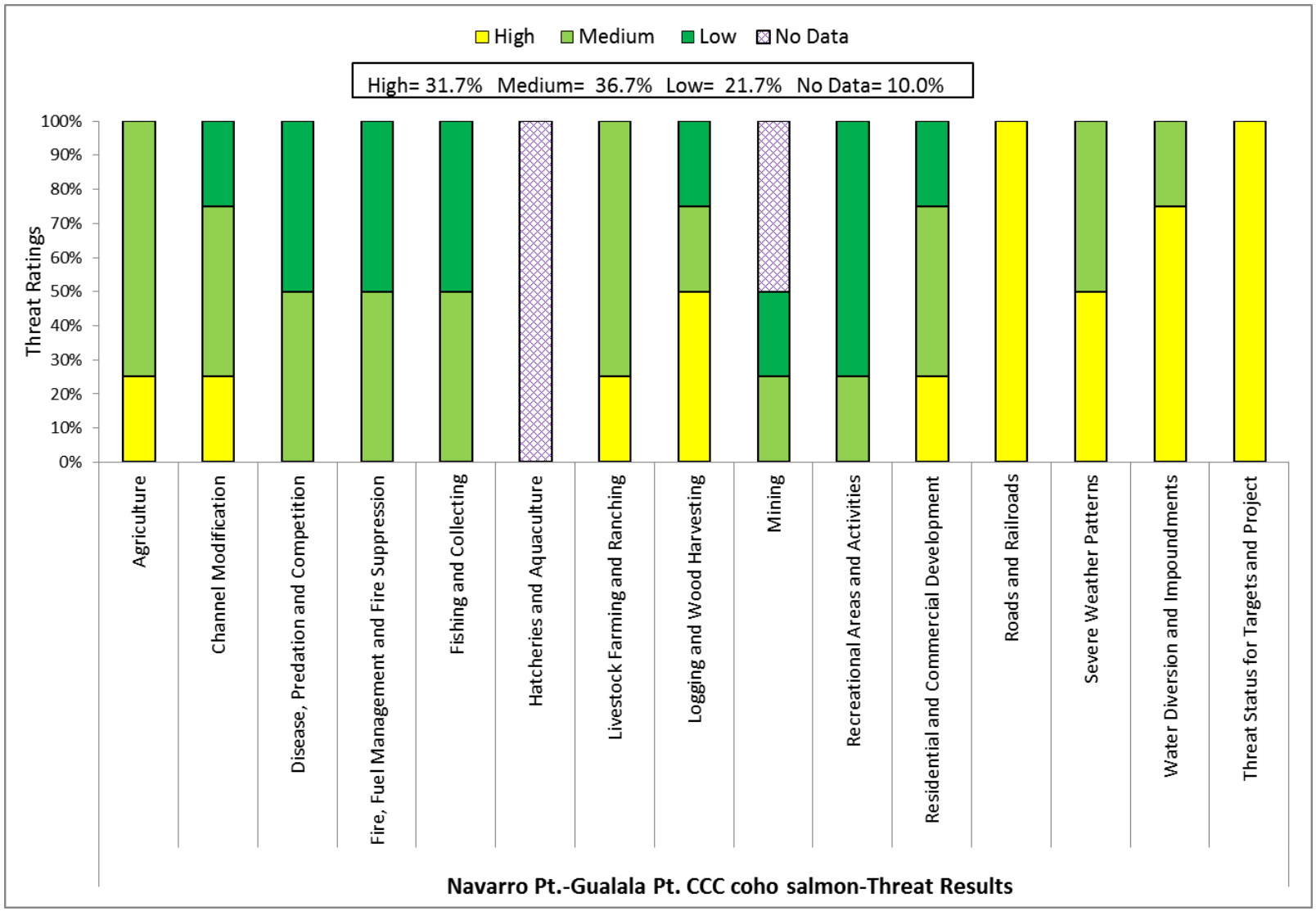

Figure 34: Navarro Pt. – Gualala Pt. Diversity Strata Threat Results

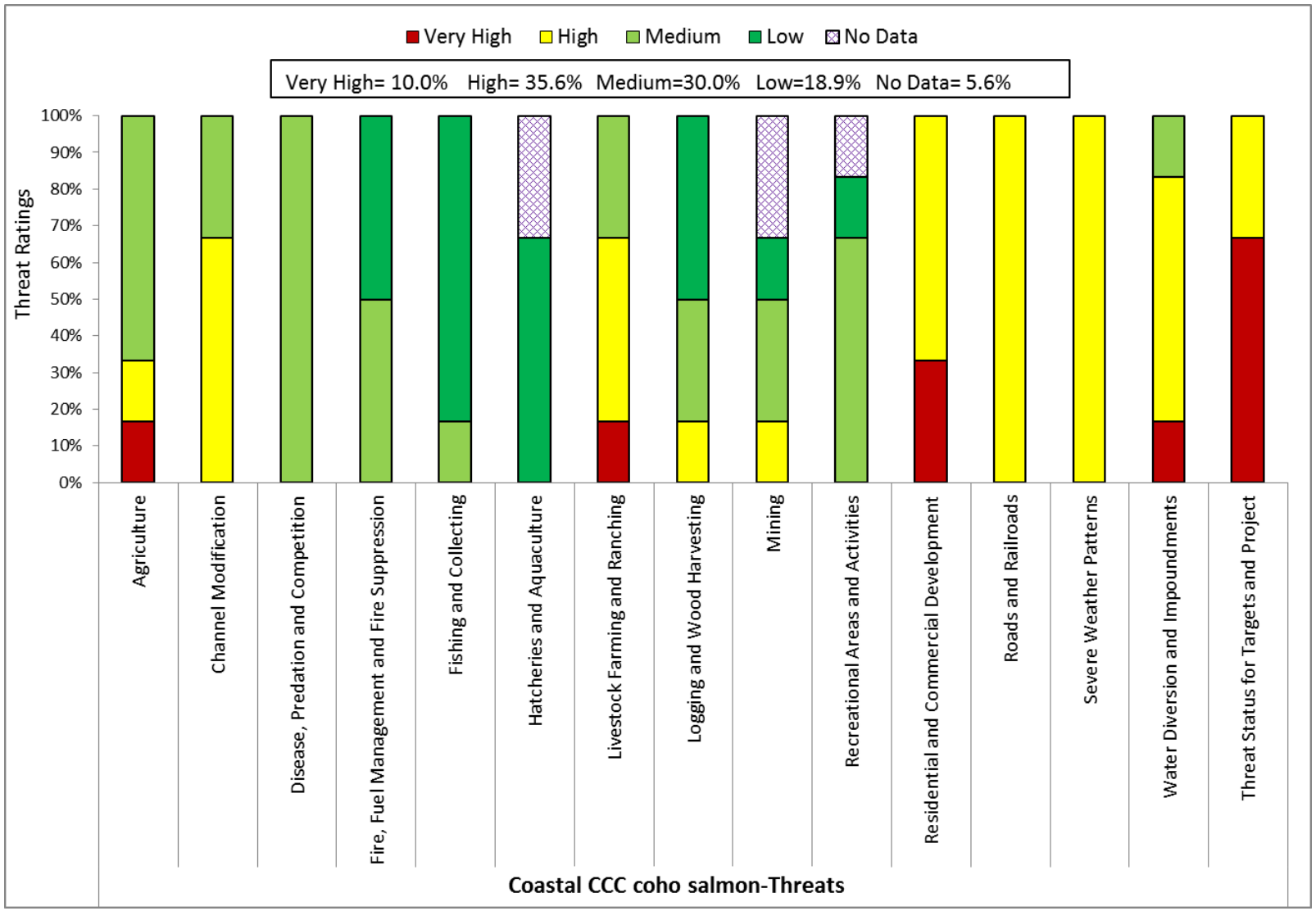

Figure 35: Coastal Diversity Strata Threat Results

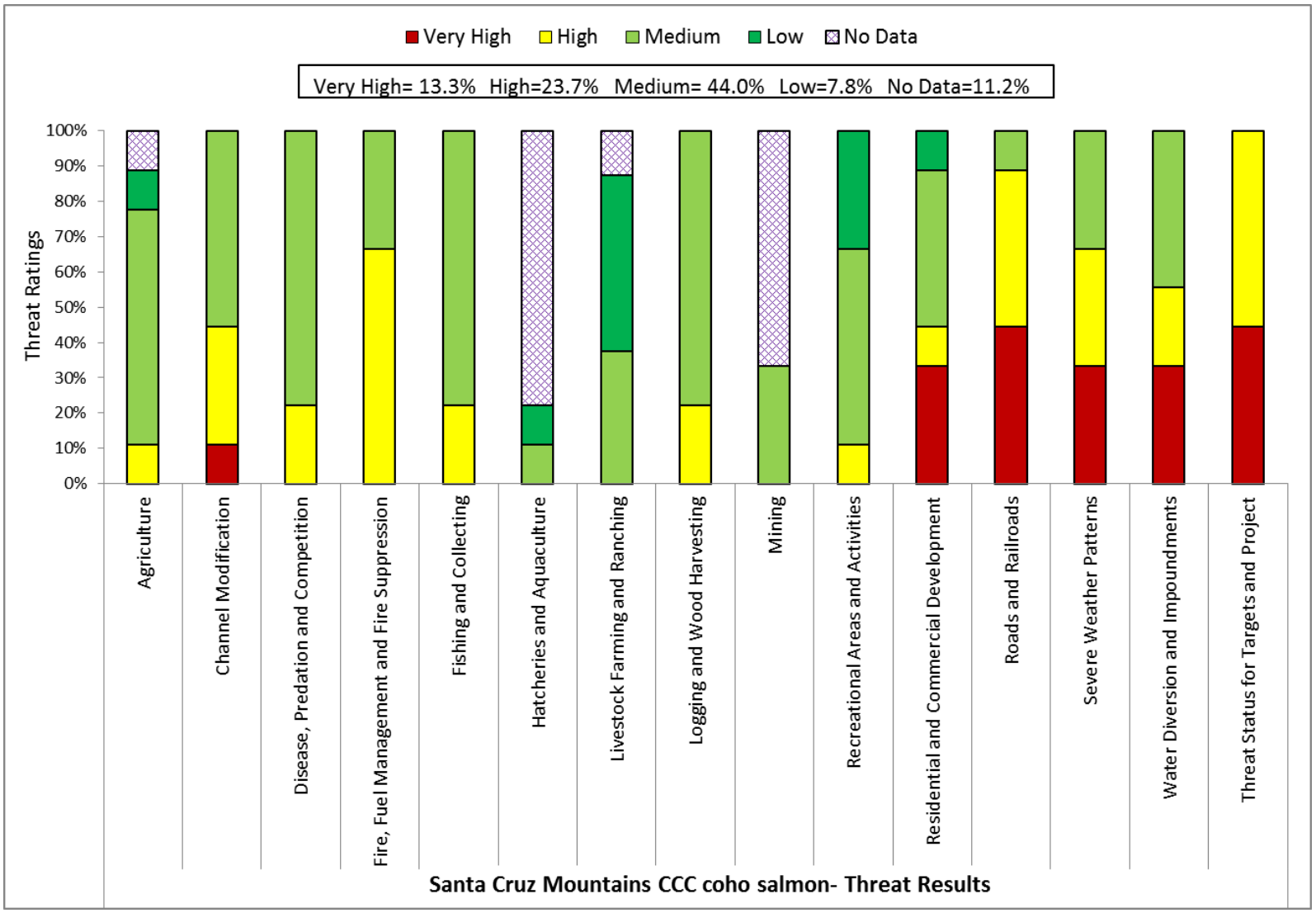

Figure 36: Santa Cruz Mountains Diversity Strata Threat Results

Table 20: Threat Summary Table

Diversity Strata	Lost Coast										Navarro Pt.-Gualala Pt.			Coastal						Santa Cruz Mountains								
CCC Coho Threat/Population	Usal	Cottaneva	Wages	Ten Mile	Pudding	Noyo	Caspar	Big	Albion	Big Salmon	Navarro	Garcia	Gualala	Russian	Salmon	Pine Gulch	Walker	Lagunitas	Redwood	San Gregorio	Pescadero	Gazos	Waddell	Scott	San Vicente	San Lorenzo	Soquel	Aptos
Agriculture	-	-	L	M	L	L	L	L	L	-	M	M	H	H	M	M	VH	M	M	H	M	L	M	M	-	M	M	M
Channel Modification	M	M	M	M	M	L	M	M	L	M	L	M	M	H	M	H	M	H	H	H	M	M	M	M	M	VH	H	H
Disease, Predation and Competition	M	M	L	M	M	M	M	L	L	M	M	L	L	M	M	M	M	M	M	M	M	M	M	M	H	H	M	M
Fire, Fuel Management and Fire Suppression	M	M	H	H	M	L	M	M	M	H	L	M	L	L	L	M	L	M	M	H	H	M	H	M	M	H	H	H
Fishing and Collecting	M	L	M	L	L	L	M	L	L	L	L	M	M	M	L	L	L	L	L	M	H	M	M	M	M	M	H	M
Hatcheries and Aquaculture	-	-	-	-	-	-	-	-	-	-	-	-	-	L	L	-	L	L	-	-	-	-	-	L	-	M	-	-
Livestock Farming and Ranching	-	-	L	L	L	L	L	L	L	-	M	H	M	H	H	M	VH	H	M	M	L	-	L	L	-	M	M	L
Logging and Wood Harvesting	M	H	M	H	H	H	M	M	M	M	M	H	H	M	H	L	L	M	L	M	M	M	M	M	M	H	H	M
Mining	L	L	L	M	L	-	-	-	-	L	-	L	M	H	-	-	M	M	L	-	-	-	-	-	M	M	M	-
Recreational Areas and Activities	L	L	L	L	L	L	L	L	L	L	L	L	L	L	-	M	M	M	M	M	M	L	M	L	L	H	M	M
Residential and Commercial Development	-	L	M	L	L	L	M	L	M	L	M	M	L	VH	H	H	H	VH	H	VH	M	M	L	M	M	VH	VH	H
Roads and Railroads	H	H	H	H	H	M	H	H	H	H	H	H	H	H	H	H	H	H	H	VH	H	H	H	H	M	VH	VH	VH
Severe Weather Patterns	H	M	M	M	H	M	H	H	M	H	H	M	M	H	H	H	H	H	H	VH	H	M	H	M	M	VH	VH	H
Water Diversion and Impoundments	M	M	M	M	M	L	M	M	M	M	M	H	H	VH	H	H	H	H	M	VH	H	M	M	M	M	VH	VH	H
Threat Status for Targets and Project	H	H	H	H	H	H *	H	H	H	H	H	H	H	VH	VH	H	VH	VH	H	VH	H	H	H	H	H	VH	VH	VH