Using Macroinvertebrates and Other Metrics to Understand Aquatic Health and Suitability for Pacific Salmon

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Outline

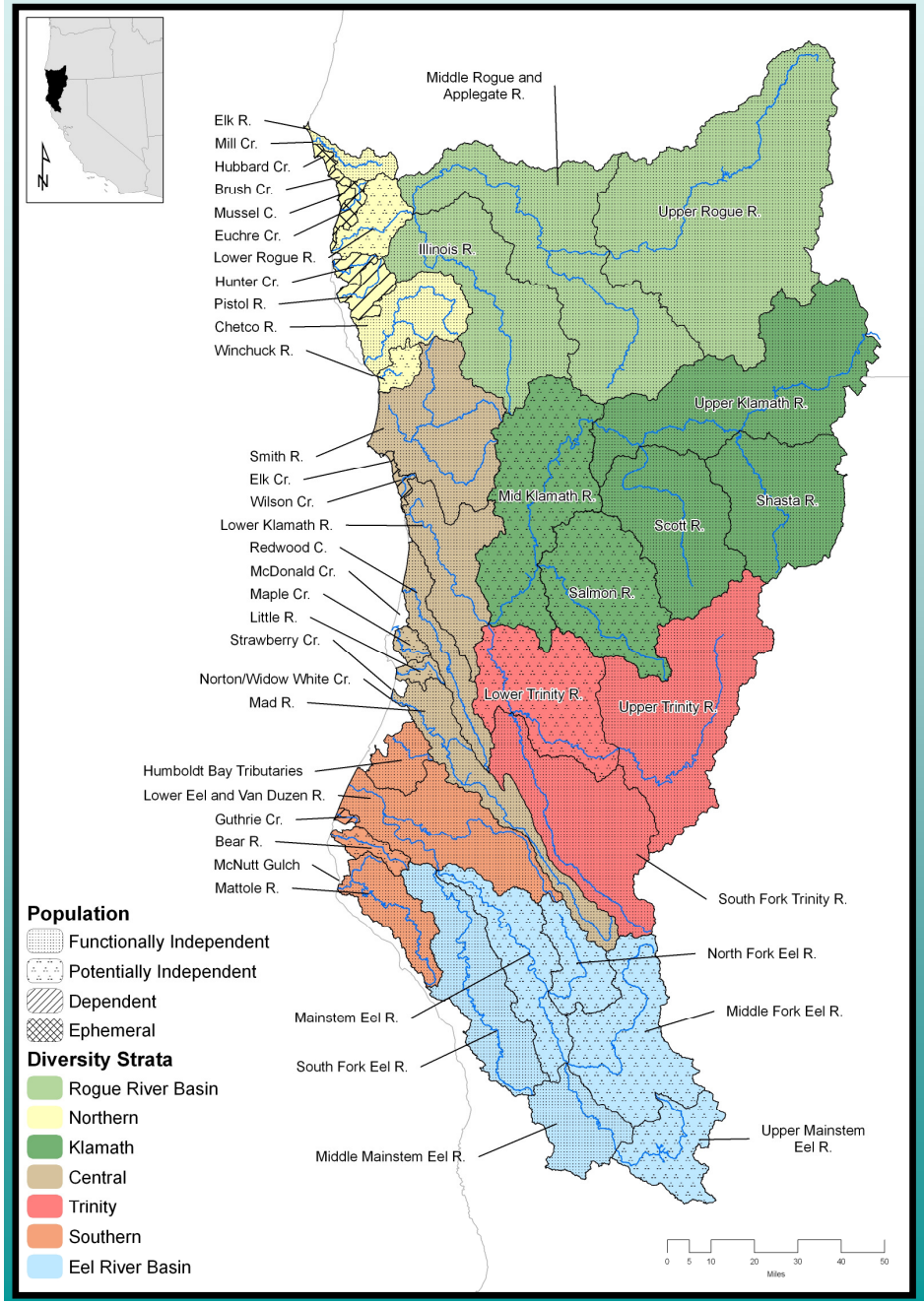
- Objectives
- Geography
- Challenges
- Methods
  - CAP workbook structure
  - Data sources used
  - Data visualization tools
- Macroinvertebrate Use
- Conclusions

Objectives

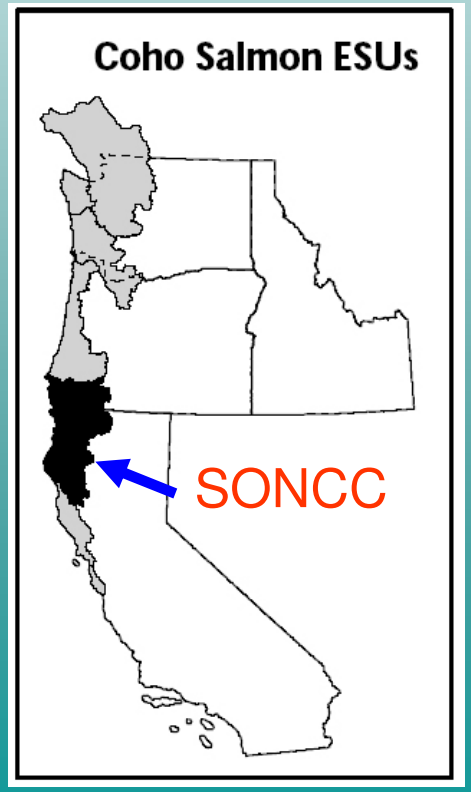
- Characterize the quality of salmonid freshwater habitats and threats to those habitats
- Provide baseline data and tool that can be used for trend monitoring to gauge the effectiveness of Recovery Plan implementation and to enable adaptive management.

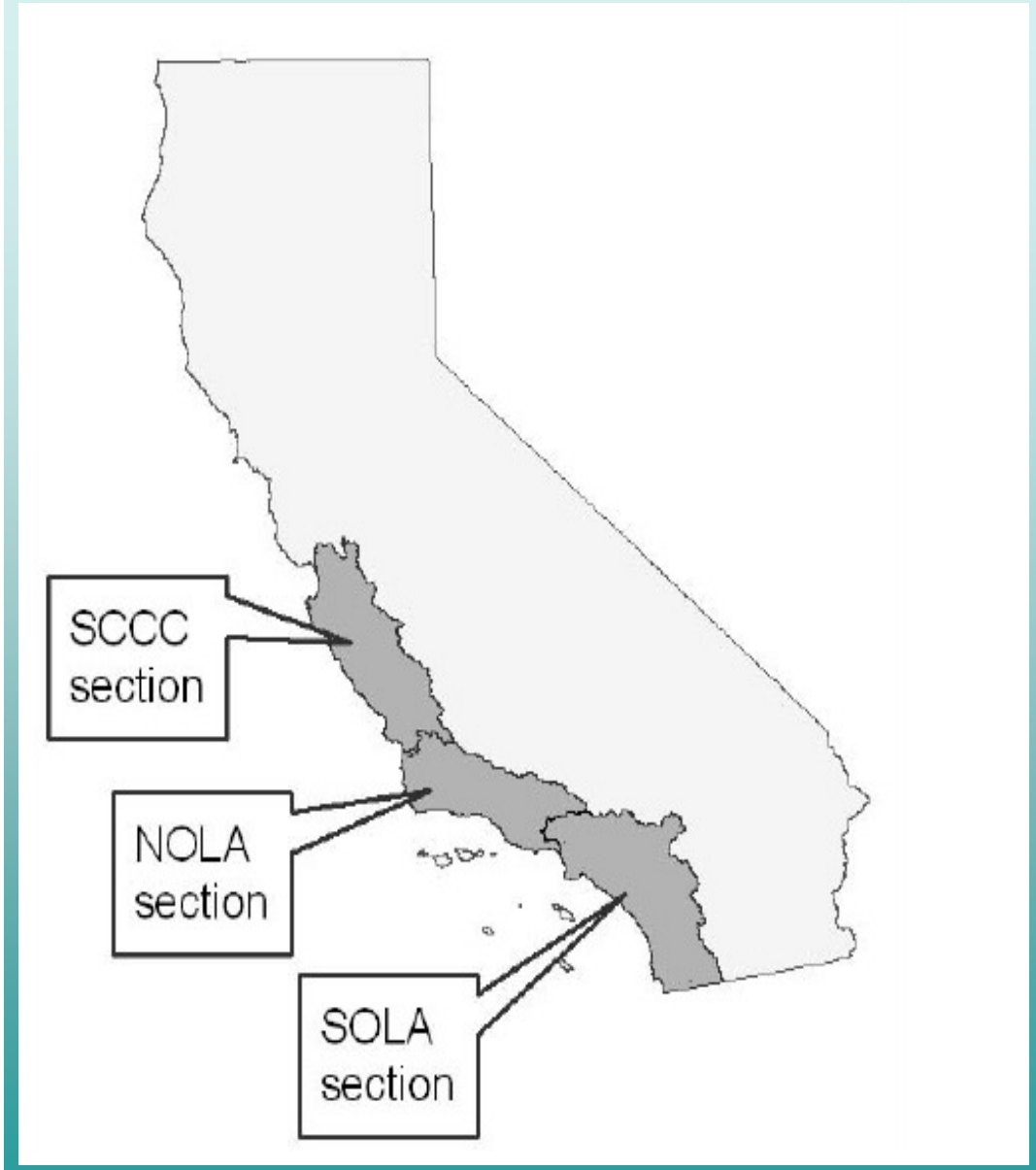
- **Scientific transparency as key guiding principle**

SONCC Coho Populations



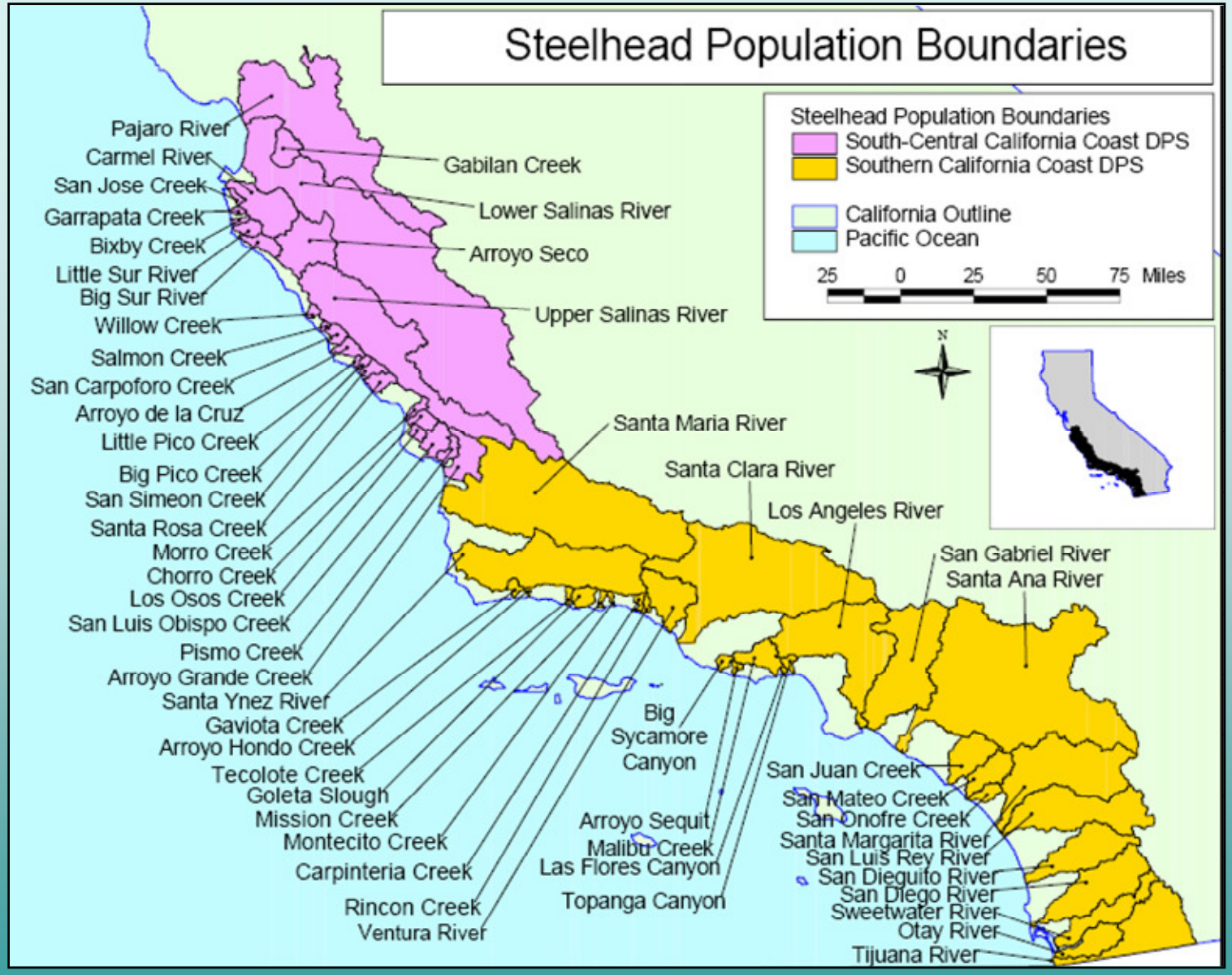
- Southern Oregon / Northern California Coast (SONCC)
- The SONCC coho populations are those defined by Williams et al. (2006):
  - 45 historic populations
  - 7 major population groups





Southern CA Steelhead

South Central and Southern California Coastal Steelhead ESU regions vary significantly in terms of climate, geology, stream conditions and biodiversity. The southern ESU is divided into north of Los Angeles (NOLA) and south of Los Angeles (SOLA)



South-Central California Coast (SCCC) and Southern California Coast (SCC) Distinct Population Segments contain 55 steelhead populations (Boughton et al., 2006)

Challenges

- Large geographic area
  - ~75% of California Coast, ~20% Oregon Coast
- Data:
  - What is available?
  - Who has it?
  - How do we obtain it?
  - How do we organize/assemble it?
  - How do we analyze/summarize it?
  - What are key data gaps and what do we do about it?
- Diverse monitoring protocols and varying levels of coordination

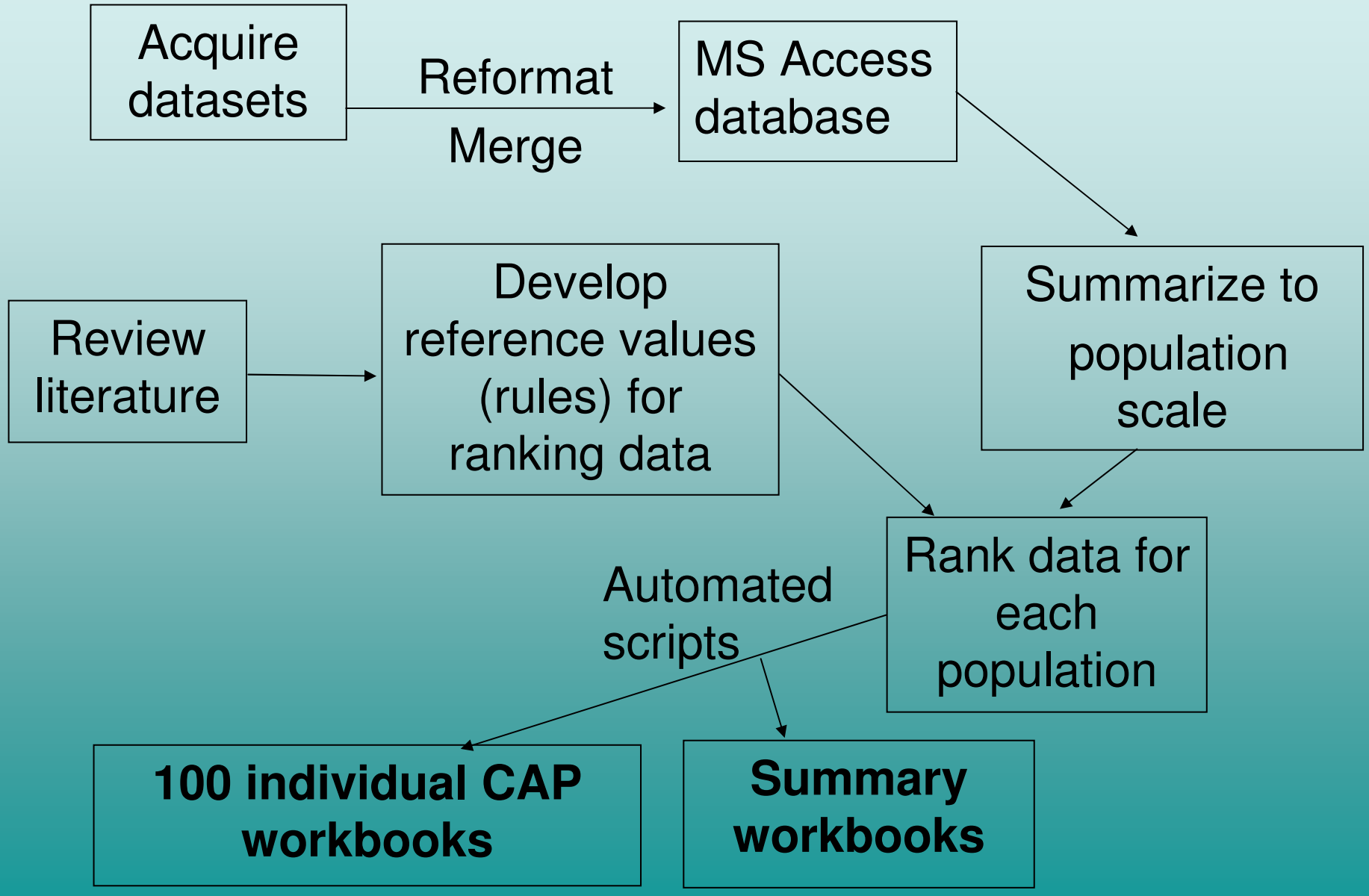
Application of CAP to Salmonid Recovery Planning

- Adapt The Nature Conservancy's widely-used **Conservation Action Planning (CAP)** Excel Workbooks to recovery planning for:
  - Southern Oregon/Northern California Coast coho (SONCC) salmon
  - South-Central California Coast (SCCC) and Southern California Coast (SCC) steelhead
- Develop new tools to facilitate application of CAP over large geographic areas
- Similar (not identical) methods used for the two geographic areas

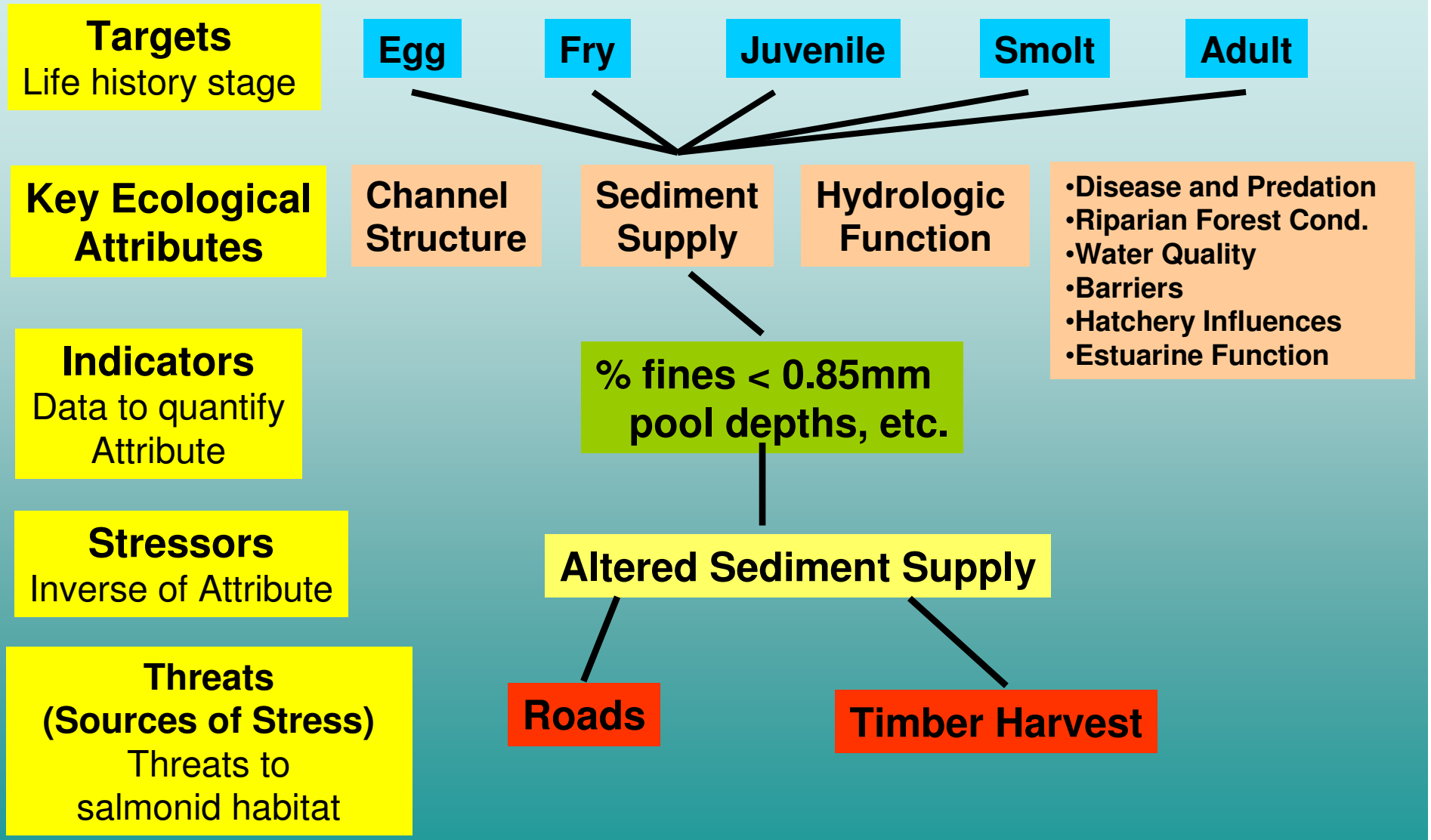
Overview of Methods

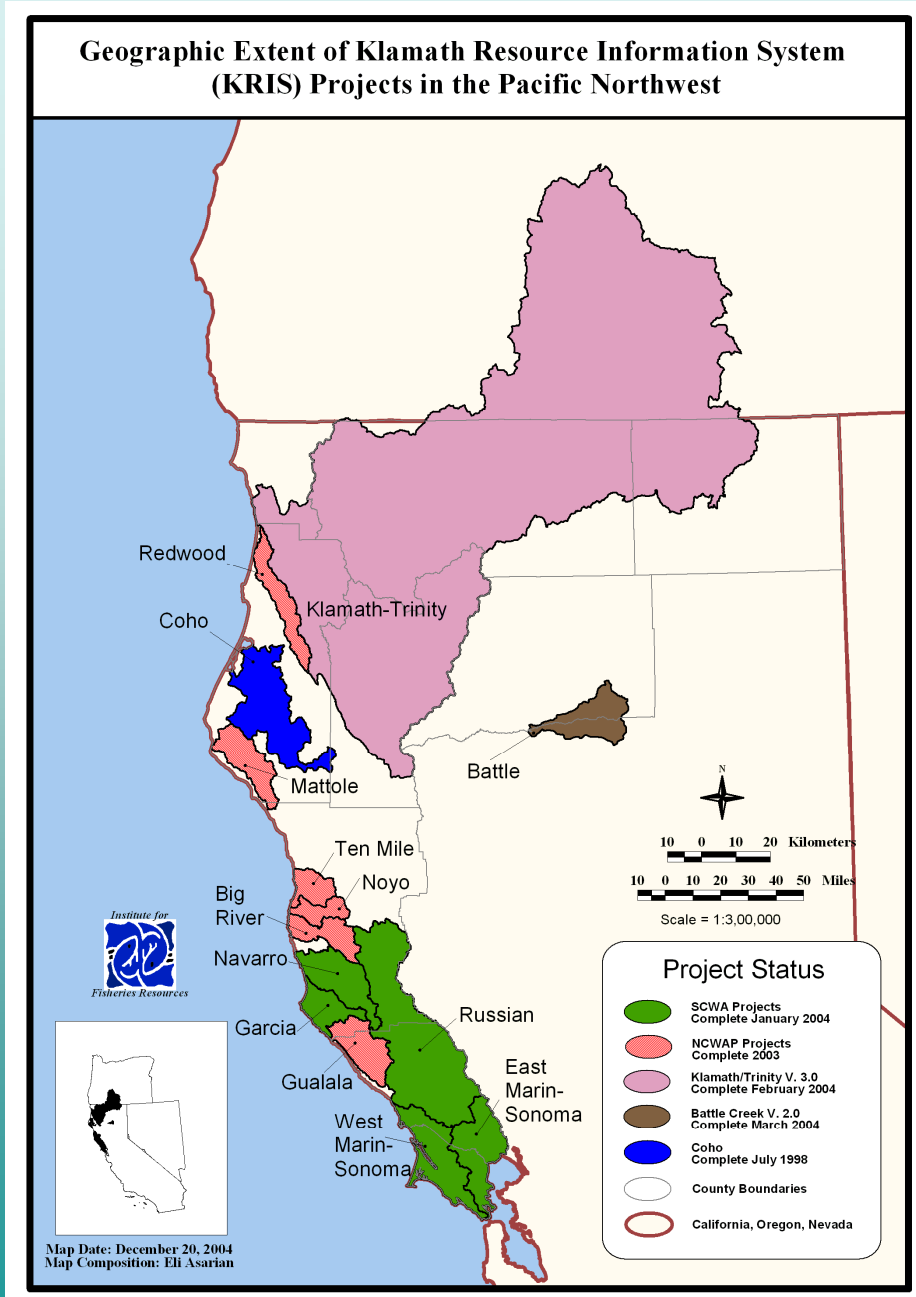
- Use **existing data,** supplemented by **professional judgment,** to characterize salmonid freshwater **habitat quality** and **identify Threats** posed by land/water management
- Establish **Reference Values** for the aquatic habitat **Indicators** and **Threats**
- Link **observed aquatic habitat conditions** to **upslope conditions**
- Create a custom **Microsoft Access database** to house data, develop **automated methods** for populating CAP Excel workbooks and data visualization tools
- **Enable updates** of the databases to support adaptive management processes

CAP / Access System



CAP Structure and Terminology





Data Sources

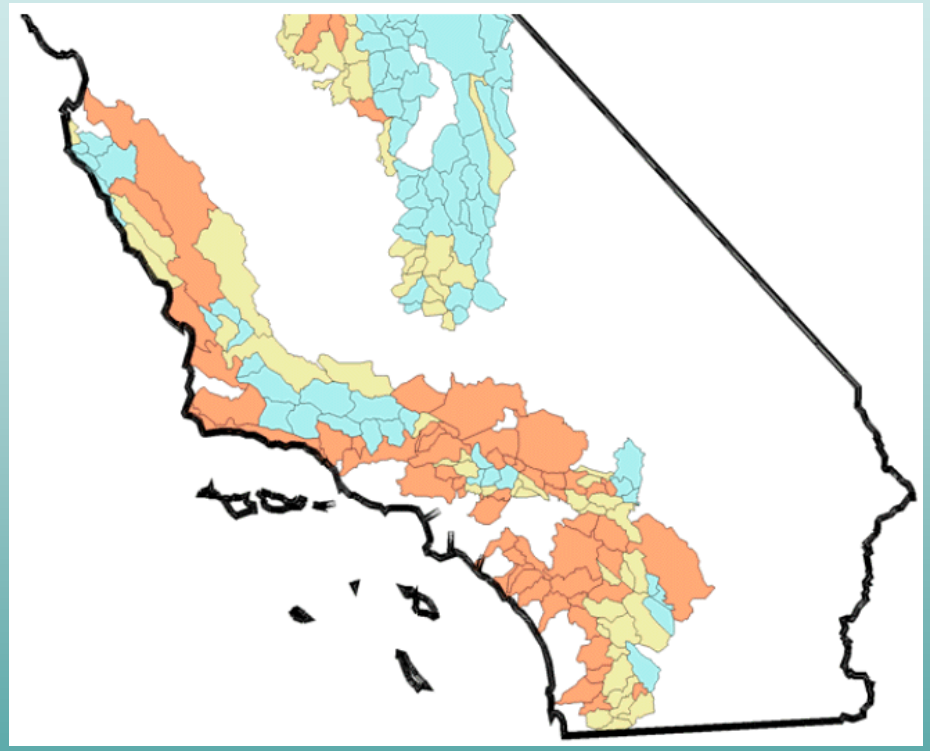
- Existing data were integrated from numerous state and federal agencies, non-profit groups, and tribes.

- For example, 1300 datasets from existing Klamath Resource Information System (KRIS) projects were evaluated and the most relevant were merged into an Access database to supply values for the CAP workbooks.

Data Sources (partial list)

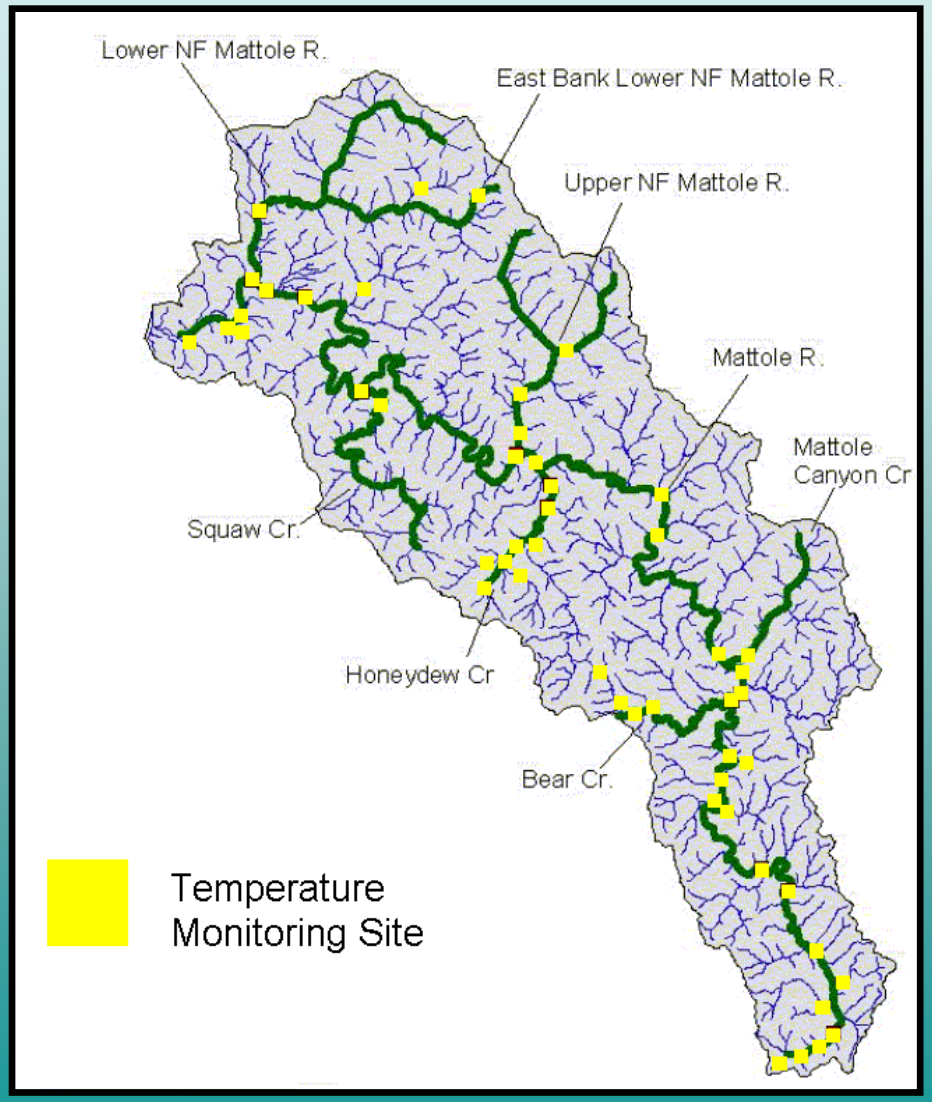
- National Marine Fisheries Service (NMFS)
- California Department of Fish and Game (CDFG)
- State Water Resources Control Board (SWRCB)
- California Department of Forestry and Fire Protection (CDF)
- U.S. Environmental Protection Agency (EPA)
- U.S. Fish and Wildlife Service (USFWS)
- U.S. Geological Survey (USGS)
- U.S. Bureau of Reclamation (BOR)
- U.S. Bureau of Land Management (BLM)
- Yurok Tribe, Karuk Tribe, Hoopa Tribe
- Klamath River Information System (KRIS)
- Oregon Department of Environmental Quality (ODEQ)
- Oregon Department of Fish and Wildlife (ODFW)
- Resource Conservation Districts (RCDs)
- Utah State University's (USU) "Bug Lab"
- Central Coast Salmon Enhancement
- Stoecker Ecological
- Southern California Coastal Water Research Project (SCCWRP)
- Conservation Biology Institute (CBI)

➢Professional judgments from USFS Region 5 watershed assessments used for SONCC and SCC/SCCC CAP workbooks



- Floodplain Connectivity
- Water Quantity/Flow Regime
- Stream Corridor Vegetation

Intra-population Variability of Indicator Values



- CAP workbook structure requires distilling data down to one number per population and indicator, yet substantial variation can exist within population
- Spatial data coordinates (GIS) allow geographic relationships to be examined at multiple scales

Indicator Rankings

- Existing field data for each Indicator are ranked (Very Good, Good, Fair and Poor) according to reference values

- Rules for rankings are from peer-reviewed journals, agency documents or data distributions:

  - California State Coho Recovery Strategy (2004)
  - California State Habitat Restoration Manual (2004)
  - USFS Region 5 and 6 Watershed Condition Assessments
  - Watershed Health Factors Assessment (Rogue Basin Coordinating Council 2006)
  - CDFG Index of Biotic Integrity for Southern California
  - Basin Plans from Regional Water Quality Control Boards
  - University and agency southern steelhead biology studies

Documents to Support Reference Values

GUIDE TO THE REFERENCE VALUES USED IN THE SOUTHERN OREGON/NORTHERN CALIFORNIA COHO SALMON RECOVERY CONSERVATION ACTION PLANNING (CAP) WORKBOOK

PREPARED BY KIER ASSOCIATES AND
NATIONAL MARINE FISHERIES SERVICE/ARCATA

JUNE, 2007

KIER ASSOCIATES
FISHERIES AND WATERSHED PROFESSIONALS

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GUIDE TO THE REFERENCE VALUES USED IN SOUTH-CENTRAL/SOUTHERN CALIFORNIA COAST STEELHEAD CONSERVATION ACTION PLANNING (CAP) WORKBOOKS

PREPARED BY KIER ASSOCIATES AND
NATIONAL MARINE FISHERIES SERVICE

JANUARY 2008

KIER ASSOCIATES
FISHERIES AND WATERSHED PROFESSIONALS

NOAA

- Produced jointly by NMFS staff and Kier Associates
- Reviewed by recovery planning cooperators
- Values for southern California steelhead may need updating as local studies allow fuller understanding of their adaptations

Table 1. Indicators of aquatic habitat suitability for coho salmon and CAP reference values.

Indicators	Poor	Fair	Good	Very Good
Aq Macroinverts (EPT)	<=12	12.1-17.9	18- 23	>23
Aq Macroinverts (Richness)	<25	25-30	30-40	>40
Aq Macroinverts (B-IBI)	<40	40-60	60.1-80	>80
Embeddedness	>45%	30.1-45%	25.1-30%	<=25 %
Pool Depths	<2 Ft	2-3 ft	3-3.3 ft	> 3.3 ft.
Pool Frequency (length)	<35%	35-40%	40-50%	>50
Pool Frequency (area)	<10%	10-20%	20-35%	>35%
Barrier (habitat dry)	>5%	1-5%	<1%	0%
LWD (key pieces/mi.)	>1	1-2	2-3	>3
LWD <20 ft. wide	>35 pieces/mi	35-53 pieces/mi	54-84 pieces/mi	<85 pieces/mi
LWD 20-30 ft. wide	>25 pieces/mi	26-36 pieces/mi	37-64 pieces/mi	<65 pieces/mi
LWD >30 ft. wide	>16 pieces/mi	16-33 pieces/mi	33-60 pieces/mi	<60 pieces/mi
Canopy Cover	<60% shade	60-70% shade	70.1-80% shade	>80% shade
Canopy Type	>40% Open+HW	30-40% Open+HW	20-30% Open+HW	<20% Open+HW
Riparian Condition (conifers >36" dbh / 1000ft for 100 ft wide buffer)	<75	75.0-125	125-200	>200
D50 (median particle size)	<38 mm >128 mm	38-50 & 110-128	50-60 & 95-110	60-95 mm
% Sand <6.4mm (wet)	>30%	25-30%	15-25%	<15%
% Sand <6.4mm (dry)	>25.8%	21.5-25.8%	12.9-21.5%	<12.9%
% Fines <1mm (wet)	>17%	15-17%	12-15%	<12%
% Fines <1mm (dry)	>12.6%	11.1-12.6%	8.9-11.1%	<8.9%
VStar	>0.25	0.21-0.25	0.15 - 0.21	<0.15
Temperature (MWAT)	>17°C	16-17°C	15-16°C	<15°C
Temperature (MWMT)	>18.3°C	17-18.3°C	16-17°C	<16°C
Turbidity	>720 hrs >25 fnu	361-720 >25 fnu	120-360 hrs >25 fnu	<120 hrs >25 fnu
pH (annual maximum)	>8.75	8.5-8.75	8.25-8.5	<8.25

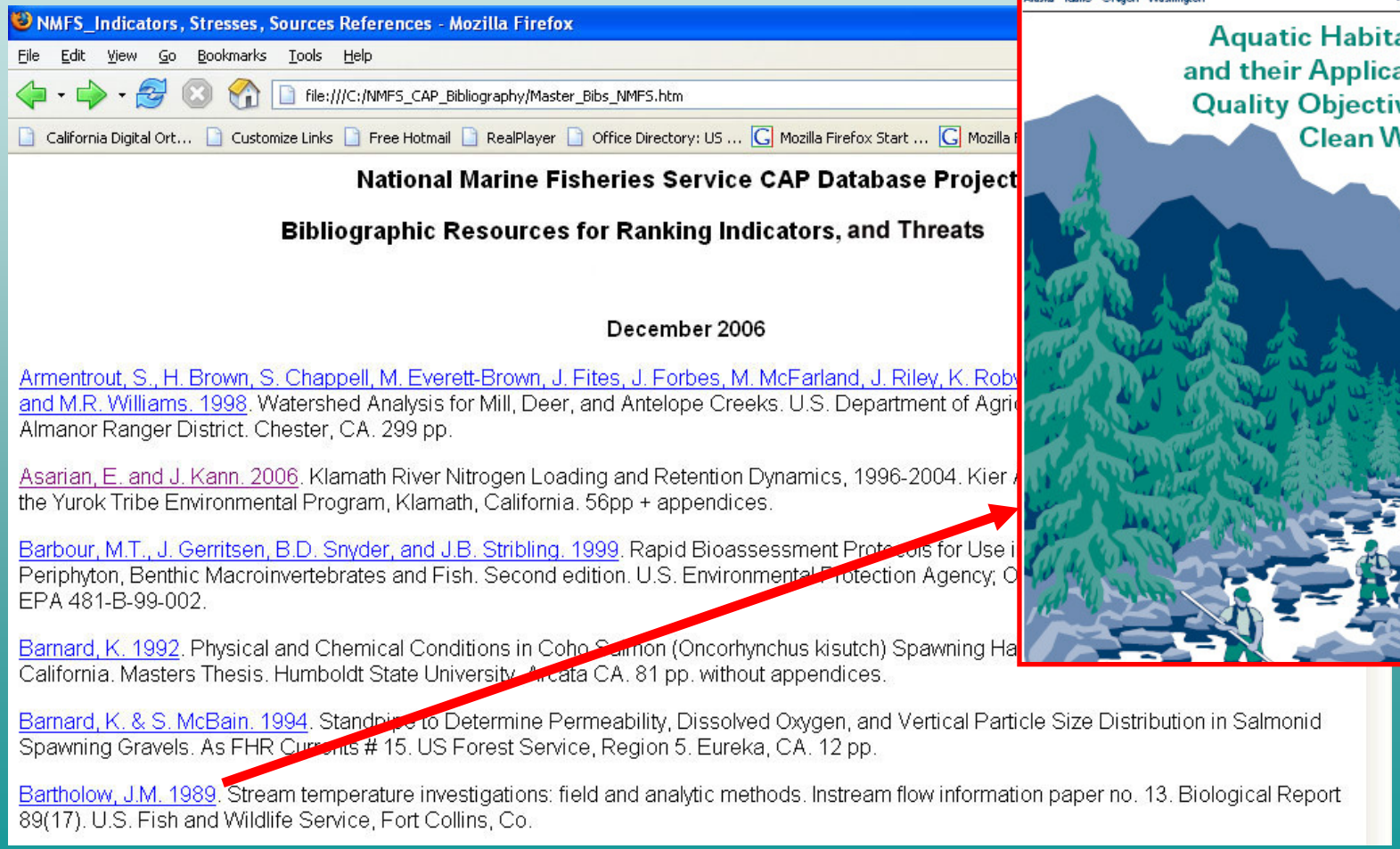
Table 1. Attributes and Indicators of aquatic habitat suitability for southern California steelhead SCCC and SCC DPS population CAP reference values.

Attribute	Indicators	Poor	Fair	Good	Very Good	Target*				
						E	F	J	S	A
Water Quality	Aquatic Insects (EPT)	<10	10-14	14-17	>17		x	x	x	
Water Quality	Aquatic IBI	<40	40-60	60-80	>80		x	x	x	
Hydrologic Function	Reservoir volume as % of precipitation	>40	10-40	0-10	0	x	x	x	x	x
Barriers	Fish Passage (% of Area Accessible)	<60%	60-80%	80-95%	95-100%		x	x	x	x
Sediment Supply	Embeddedness	>35%	25-35%	20-25%	<20 %	x	x	x		x
Floodplain and Channel Structure	Pool Depths (feet)	<2	2-3	3-3.3	> 3.3			x	x	x
Floodplain and Channel Structure	Pool Frequency (length)	<35%	35-40%	40-50%	>50			x	x	x
Floodplain and Channel Structure	Pool Abundance (category)	1-1.99	2-2.99	3-3.99	4			x	x	x
Barriers	Fish Passage (% of Dry Habitat Types)	>5%	1-5%	<1%	0%		x	x	x	x
Riparian Forest Conditions	Canopy Cover	<60%	60-70%	70-80%	>80%		x	x	x	
Riparian Forest Conditions	Riparian Condition (% Forest, Wetlands, or Shrub)	<50%	50-70%	70-80%	>80%		x	x	x	x
Estuarine Function	Lagoon/Estuary Habitat Loss (% historic area remaining)	<50%	50-70%	70-80%	>80%			x	x	x
Water Quality	**Water Temperature (MWMT)**	**>25**	**22.5-25**	**17-22.5**	**<17**		x	x	x	
Water Quality	**pH**					x	x	x	x	x
Water Quality	**D.O. (max dev. % saturation)**	**>20 %**	**14-20 %**	**10-14 %**	**<10 %**		x	x	x	
Water Quality	Ammonia (% of CCC chronic)	100%	50-100%	10-50%	<10%		x	x	x	
Water Quality	Periphyton (annual max Chl a/m^2)	>150	125-150	100-125	<100		x	x	x	
Water Quality	Total Nitrogen (mg/L)	>1.5	0.8-1.5	0.4-0.8	<0.4		x	x	x	
Water Quality	Total Phosphorus (mg/L)	>0.15	0.06-0.15	0.02-0.06	<0.02		x	x	x	
Floodplain and Channel Structure	Floodplain Connectivity (USFS Judgment)	Impaired	Functioning At-risk		Properly Functioning		x	x	x	x
Hydrologic Function	Water Quantity/Flow (USFS Judgment)	Altered	Partially Altered		Unaltered	x	x	x	x	
Riparian Forest Conditions	Stream Corridor Vegetation (USFS Judgment)	Impaired	Functioning At-risk		Properly Functioning		x	x	x	
Disease and Predation	[No available data]									

* List of conservation Targets (life stages) that the indicator applies to (E = Egg, F = Fry, J = Juvenile, S = Smolt, A = Adult)

Electronic Bibliographic Collection

Hundreds of reference documents made available in electronic form so that CAP users and reviewers can access the scientific papers cited as the basis of Indicator and Threat thresholds.



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A Quantitative Tool for Assessing the Integrity of Southern Coastal California Streams

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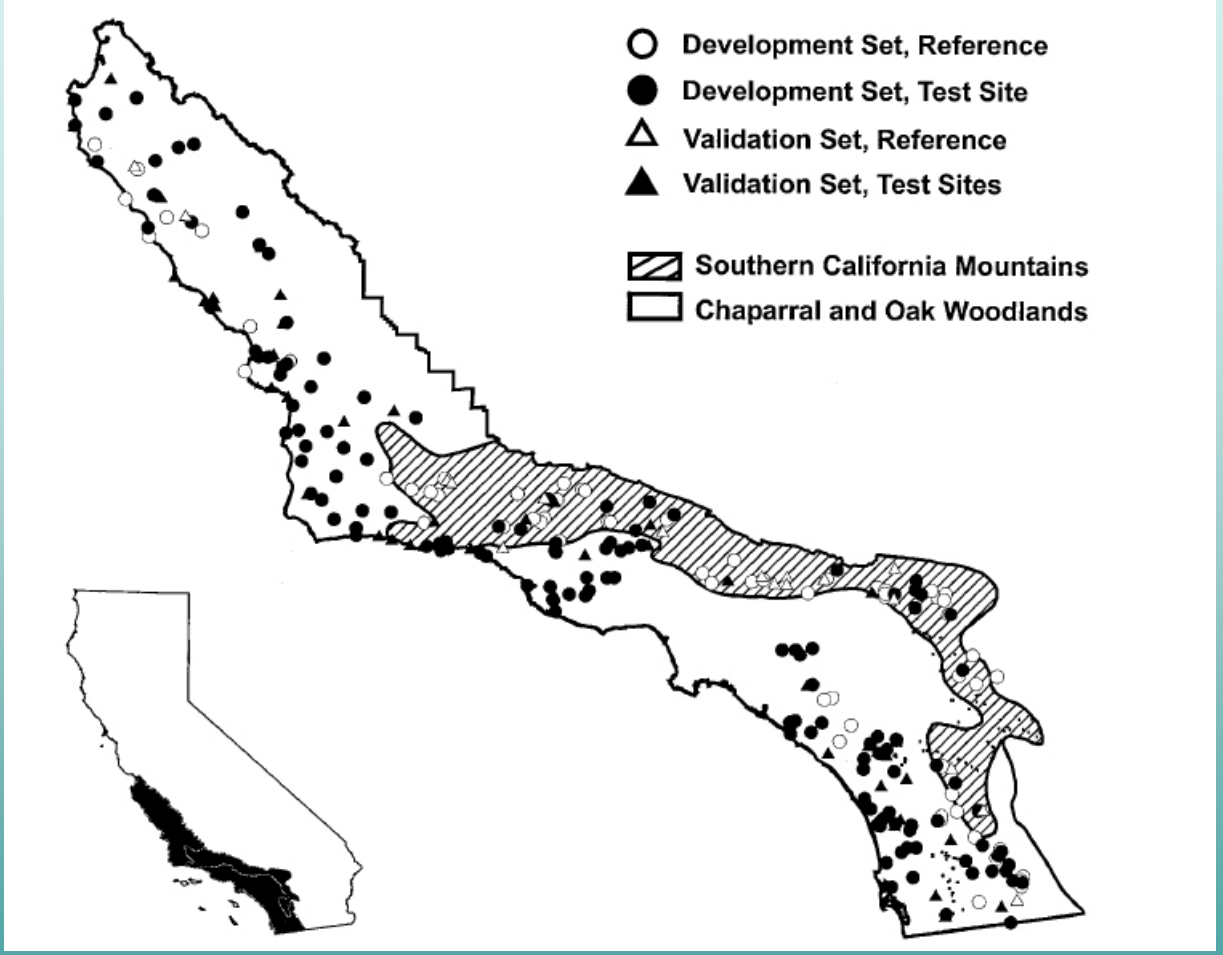
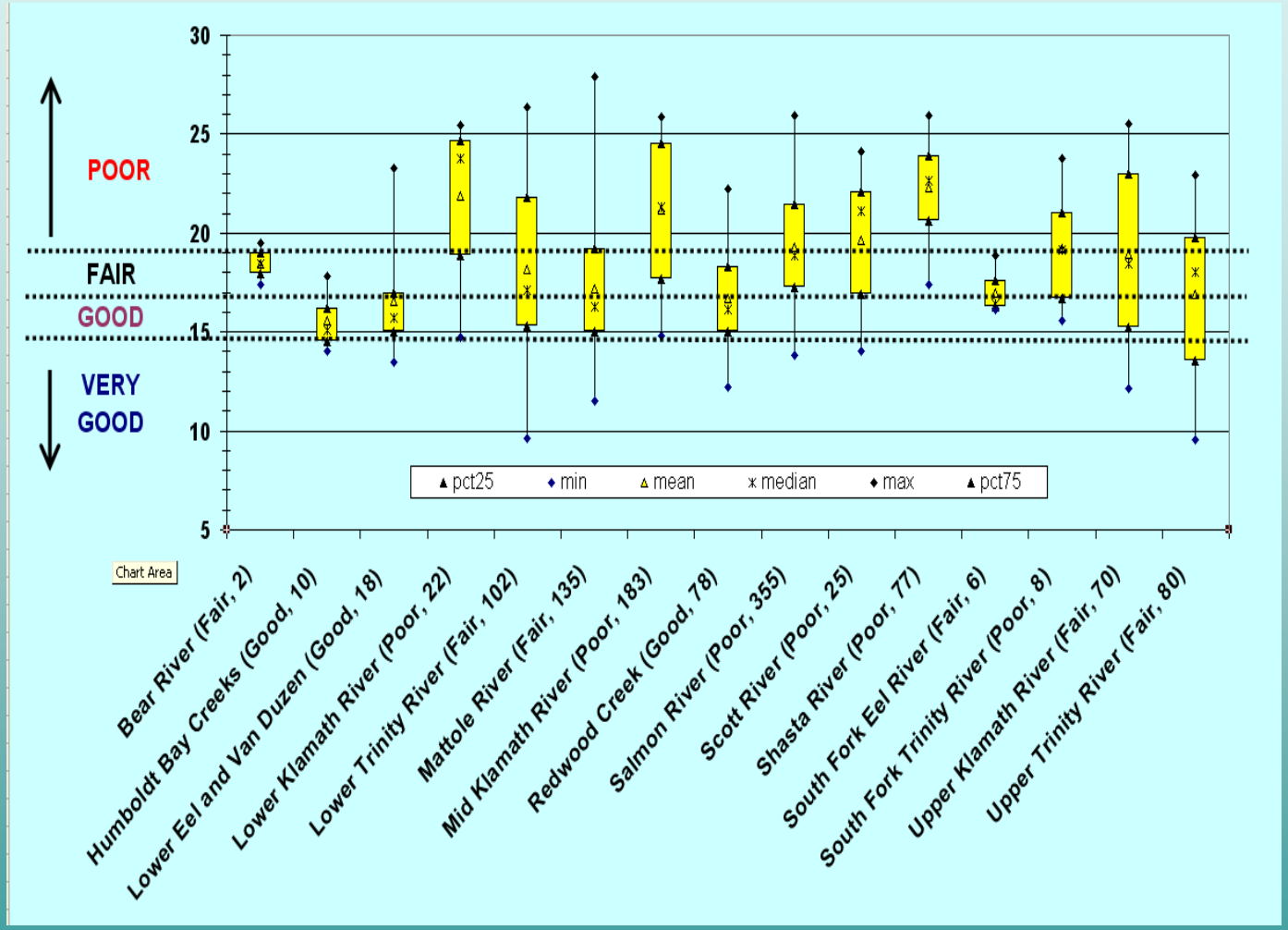
riparian) that quantified stressors acting on study reaches. We screened 61 candidate metrics for inclusion in the B-IBI based on three criteria: sufficient range for scoring, responsiveness to watershed and reach-scale disturbance gradients, and minimal correlation with other responsive metrics. Final metrics included: percent collector-gatherer + collector-filterer individuals, percent noninsect taxa, percent tolerant taxa, Coleoptera richness, predator richness, percent intolerant individuals, and EPT richness. Three metrics had lower scores in chaparral reference sites than in mountain reference sites and were scored on separate scales in the B-IBI. Metrics were scored and assembled into a composite B-IBI, which was then divided into five roughly equal condition categories. PCA analysis was used to demonstrate that the B-IBI was sensitive to composite stressor gradients; we also confirmed that the B-IBI scores were not correlated with elevation, season, or watershed area. Application of the B-IBI

Aquatic Macroinvertebrates

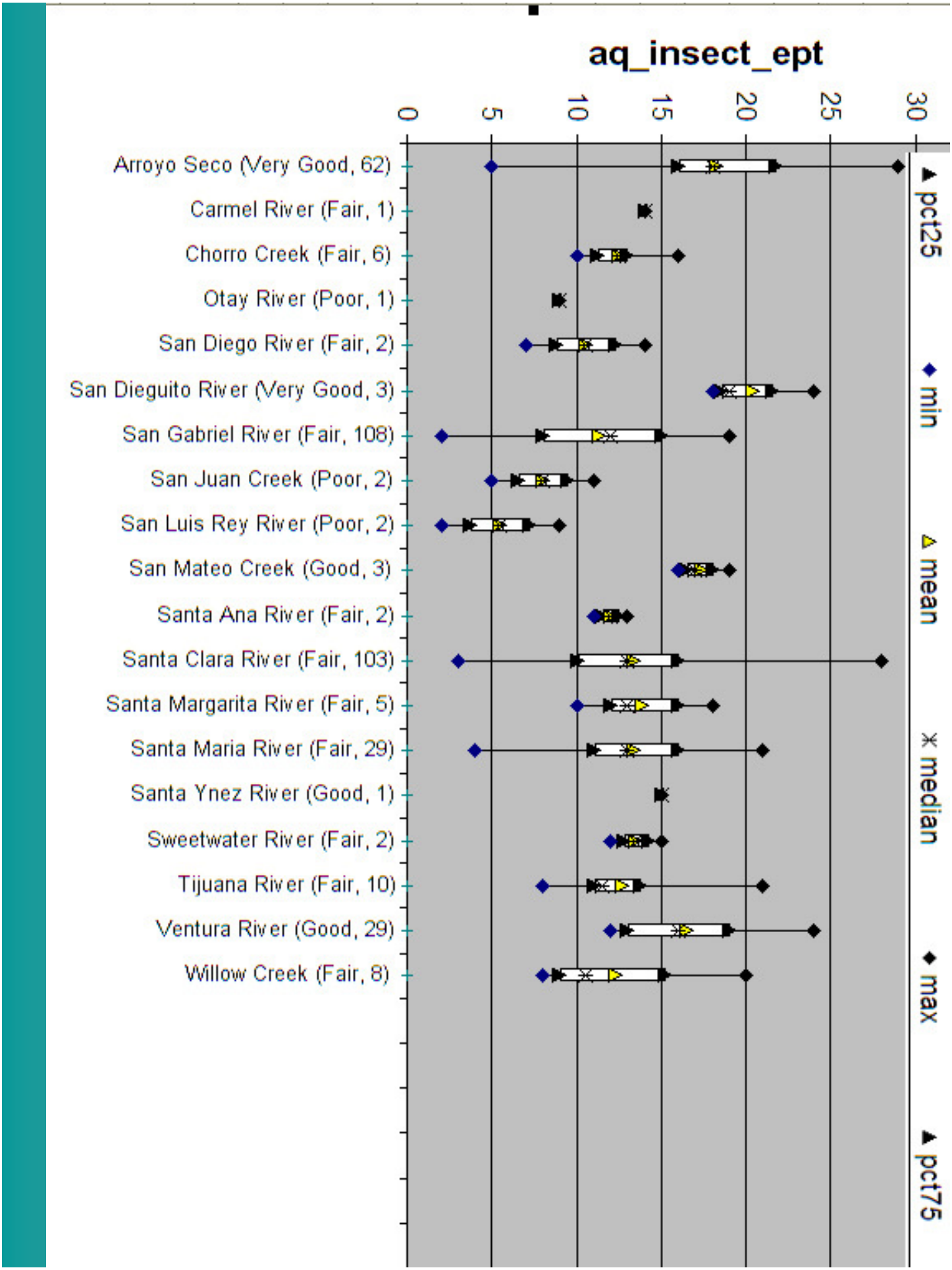


Map from Ode et al. (2005) shows the geographic extent of the southern California aquatic macroinvertebrates samples used to develop regional Index of Biological Integrity (IBI)

Data Visualization Tools: Boxplots



Custom open-source Python scripts create Excel boxplots from data in Access database for each indicator and threat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Arroyo Seco (Very Good, 62)
Carmel River (Fair, 1)
Chorro Creek (Fair, 6)
Otay River (Poor, 1)
San Diego River (Fair, 2)
San Dieguito River (Very Good, 3)
San Gabriel River (Fair, 108)
San Juan Creek (Poor, 2)
San Luis Rey River (Poor, 2)
San Mateo Creek (Good, 3)
Santa Ana River (Fair, 2)
Santa Clara River (Fair, 103)
Santa Margarita River (Fair, 5)
Santa Maria River (Fair, 29)
Santa Ynez River (Good, 1)
Sweetwater River (Fair, 2)
Tijuana River (Fair, 10)
Ventura River (Good, 29)
Willow Creek (Fair, 8)
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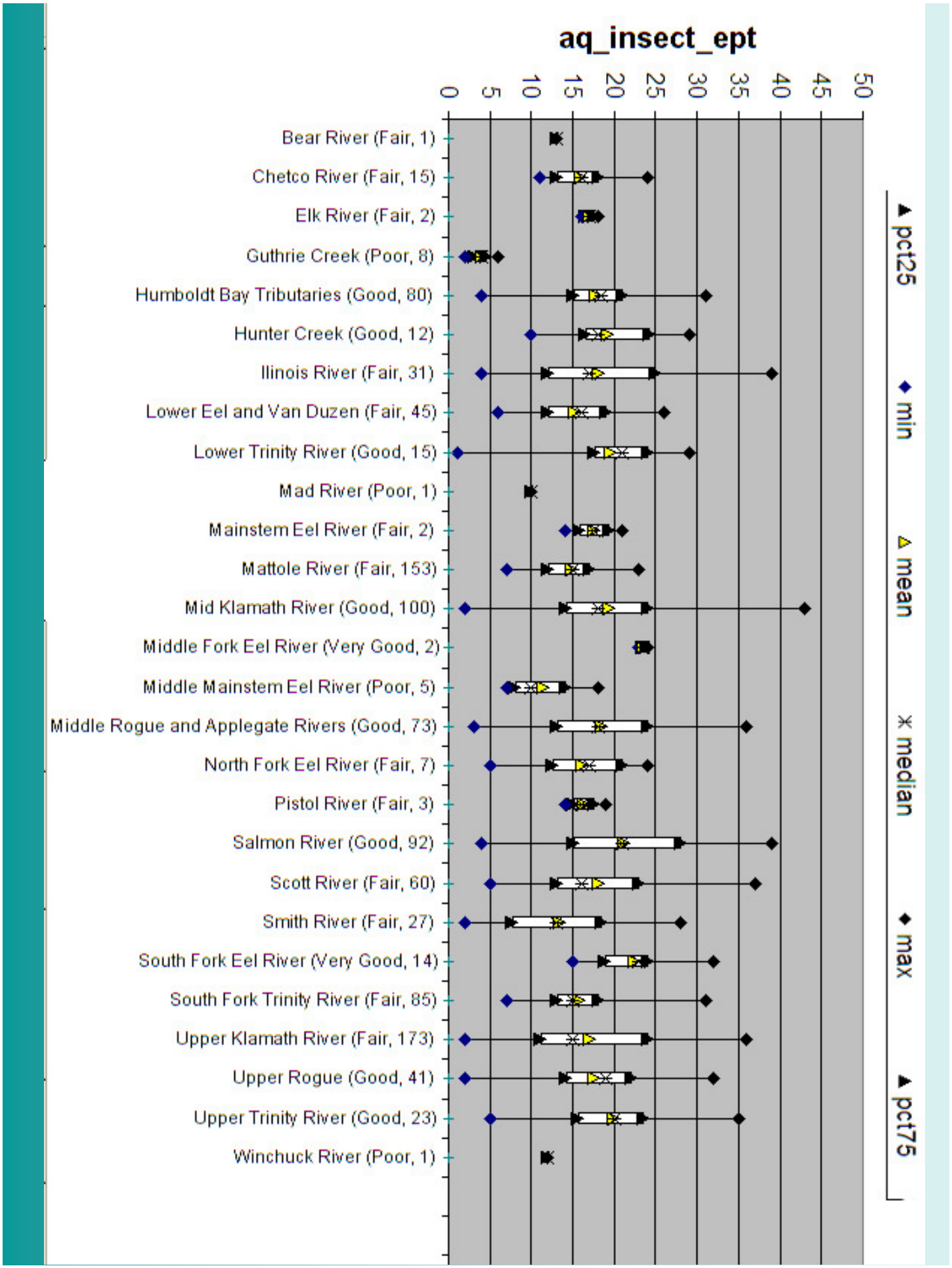
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Bear River (Fair, 1)
Chetco River (Fair, 15)
Elk River (Fair, 2)
Guthrie Creek (Poor, 8)
Humboldt Bay Tributaries (Good, 80)
Hunter Creek (Good, 12)
Ilinois River (Fair, 31)
Lower Eel and Van Duzen (Fair, 45)
Lower Trinity River (Good, 15)
Mad River (Poor, 1)
Mainstem Eel River (Fair, 2)
Mattole River (Fair, 153)
Mid Klamath River (Good, 100)
Middle Fork Eel River (Very Good, 2)
Middle Mainstem Eel River (Poor, 5)
Middle Rogue and Applegate Rivers (Good, 73)
North Fork Eel River (Fair, 7)
Pistol River (Fair, 3)
Salmon River (Good, 92)
Scott River (Fair, 60)
Smith River (Fair, 27)
South Fork Eel River (Very Good, 14)
South Fork Trinity River (Fair, 85)
Upper Klamath River (Fair, 173)
Upper Rogue (Good, 41)
Upper Trinity River (Good, 23)
Winchuck River (Poor, 1)
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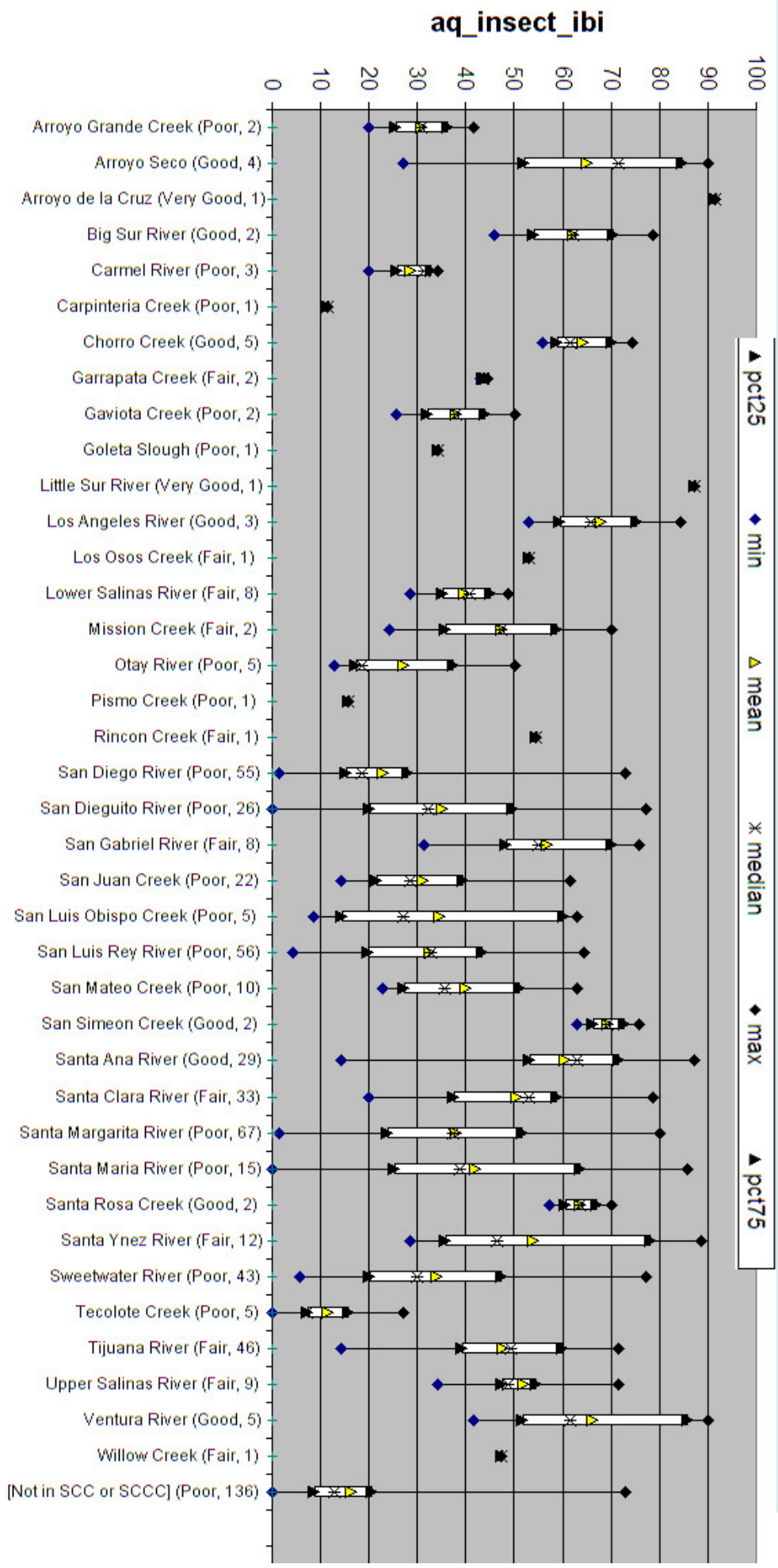
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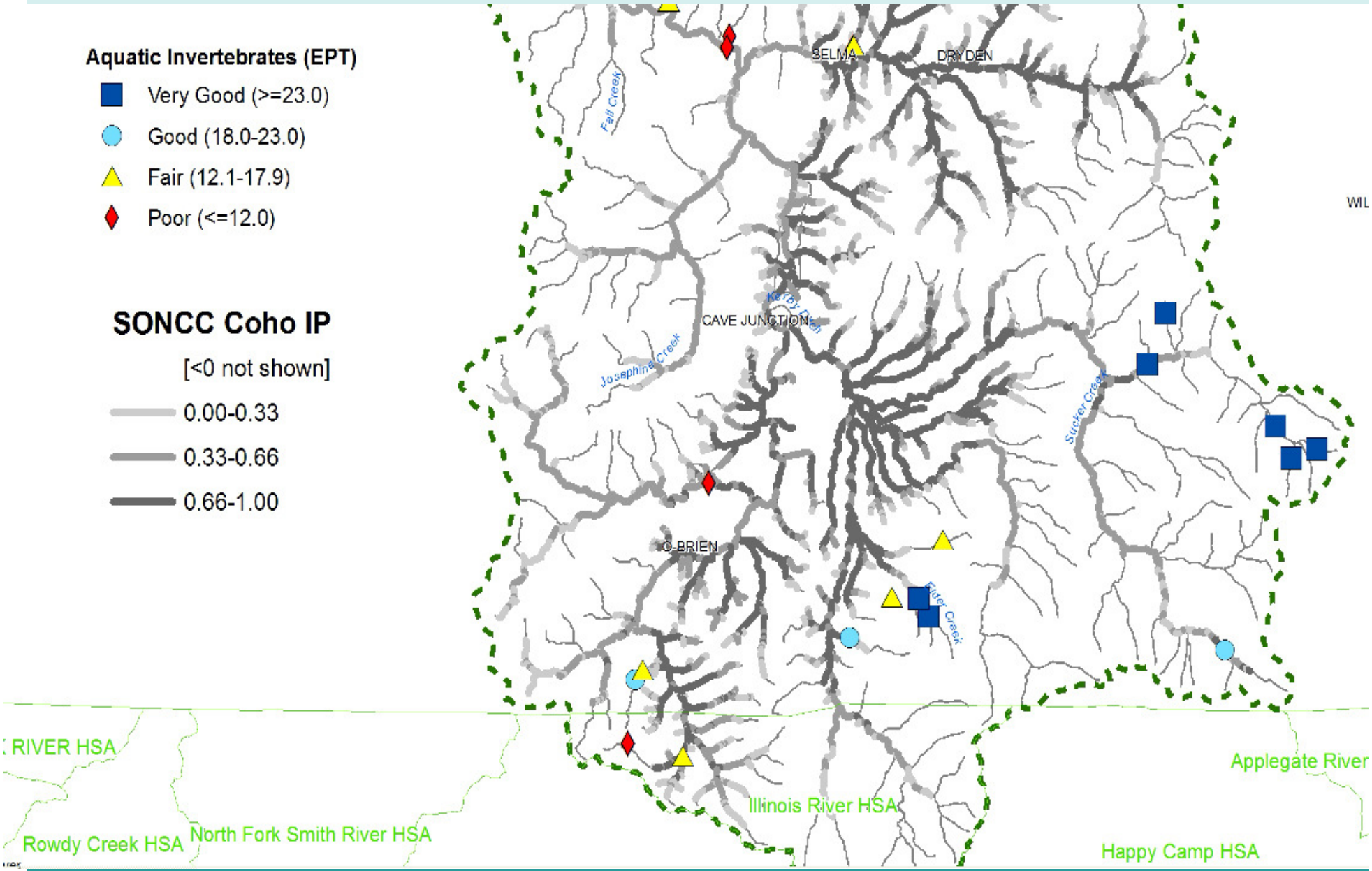
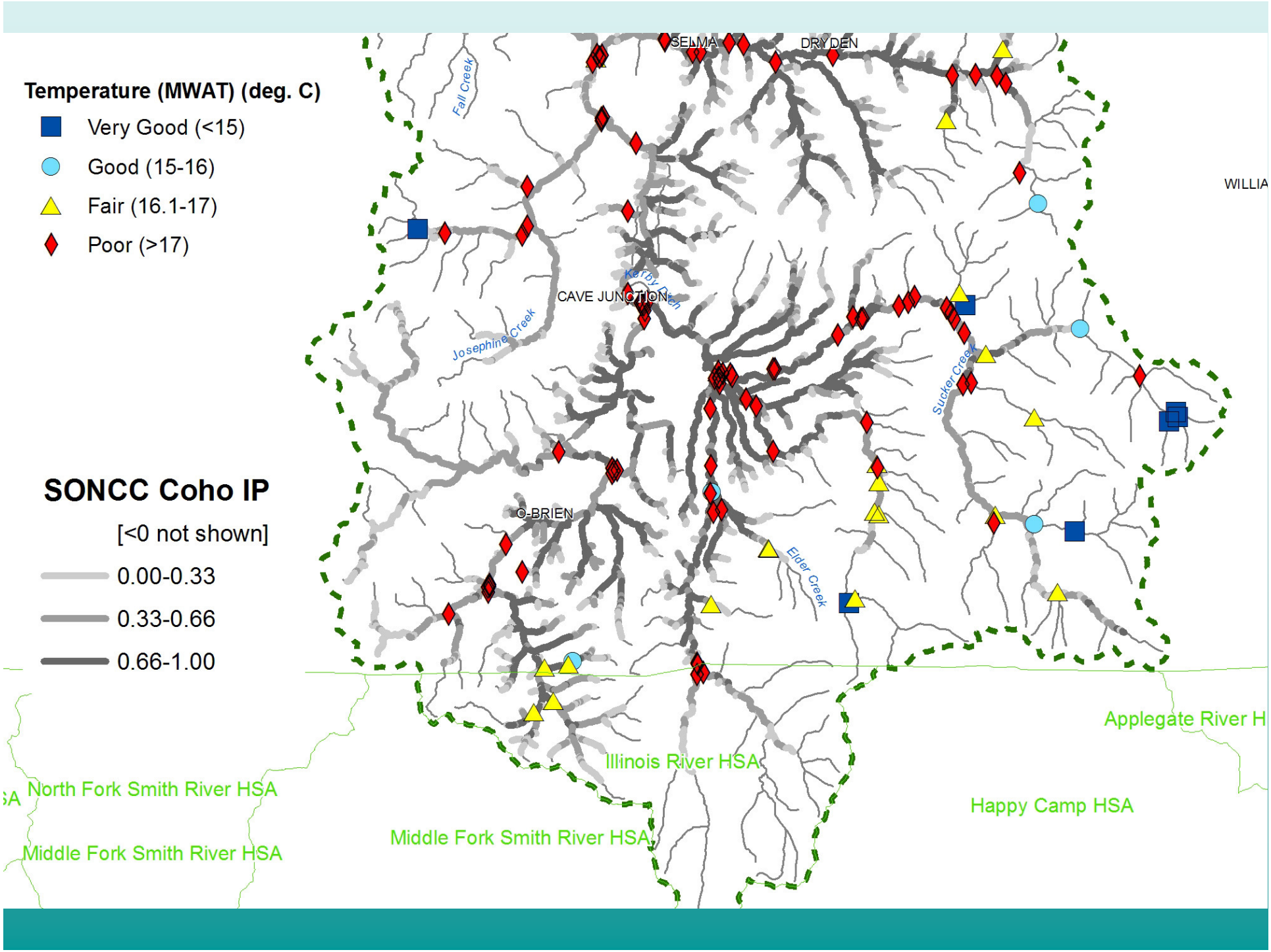
Arroyo Grande Creek (Poor, 2)
Arroyo Seco (Good, 4)
Arroyo de la Cruz (Very Good, 1)
Big Sur River (Good, 2)
Carmel River (Poor, 3)
Carpinteria Creek (Poor, 1)
Chorro Creek (Good, 5)
Garrapata Creek (Fair, 2)
Gaviota Creek (Poor, 2)
Goleta Slough (Poor, 1)
Little Sur River (Very Good, 1)
Los Angeles River (Good, 3)
Los Osos Creek (Fair, 1)
Lower Salinas River (Fair, 8)
Mission Creek (Fair, 2)
Otay River (Poor, 5)
Pismo Creek (Poor, 1)
Rincon Creek (Fair, 1)
San Diego River (Poor, 55)
San Dieguito River (Poor, 26)
San Gabriel River (Fair, 8)
San Juan Creek (Poor, 22)
San Luis Obispo Creek (Poor, 5)
San Luis Rey River (Poor, 56)
San Mateo Creek (Poor, 10)
San Simeon Creek (Good, 2)
Santa Ana River (Good, 29)
Santa Clara River (Fair, 33)
Santa Margarita River (Poor, 67)
Santa Maria River (Poor, 15)
Santa Rosa Creek (Good, 2)
Santa Ynez River (Fair, 12)
Sweetwater River (Poor, 43)
Tecolote Creek (Poor, 5)
Tijuana River (Fair, 46)
Upper Salinas River (Fair, 9)
Ventura River (Good, 5)
Willow Creek (Fair, 1)
[Not in SCC or SCCC] (Poor, 136)
▲ pct25
◆ min
△ mean
✳ median
◆ max
▲ pct75


Aquatic Invertebrates (EPT)
Very Good (>=23.0)
Good (18.0-23.0)
Fair (12.1-17.9)
Poor (<=12.0)
SONCC Coho IP
[<0 not shown]
0.00-0.33
0.33-0.66
0.66-1.00
SELMA
DRYDEN
CAVE JUNCTION
O'BRIEN
Fall Creek
Josephine Creek
Sucker Creek
Fruit Creek
RIVER HSA
Rowdy Creek HSA
North Fork Smith River HSA
Illinois River HSA
Applegate River
Happy Camp HSA


Temperature (MWAT) (deg. C)
Very Good (<15)
Good (15-16)
Fair (16.1-17)
Poor (>17)
SONCC Coho IP
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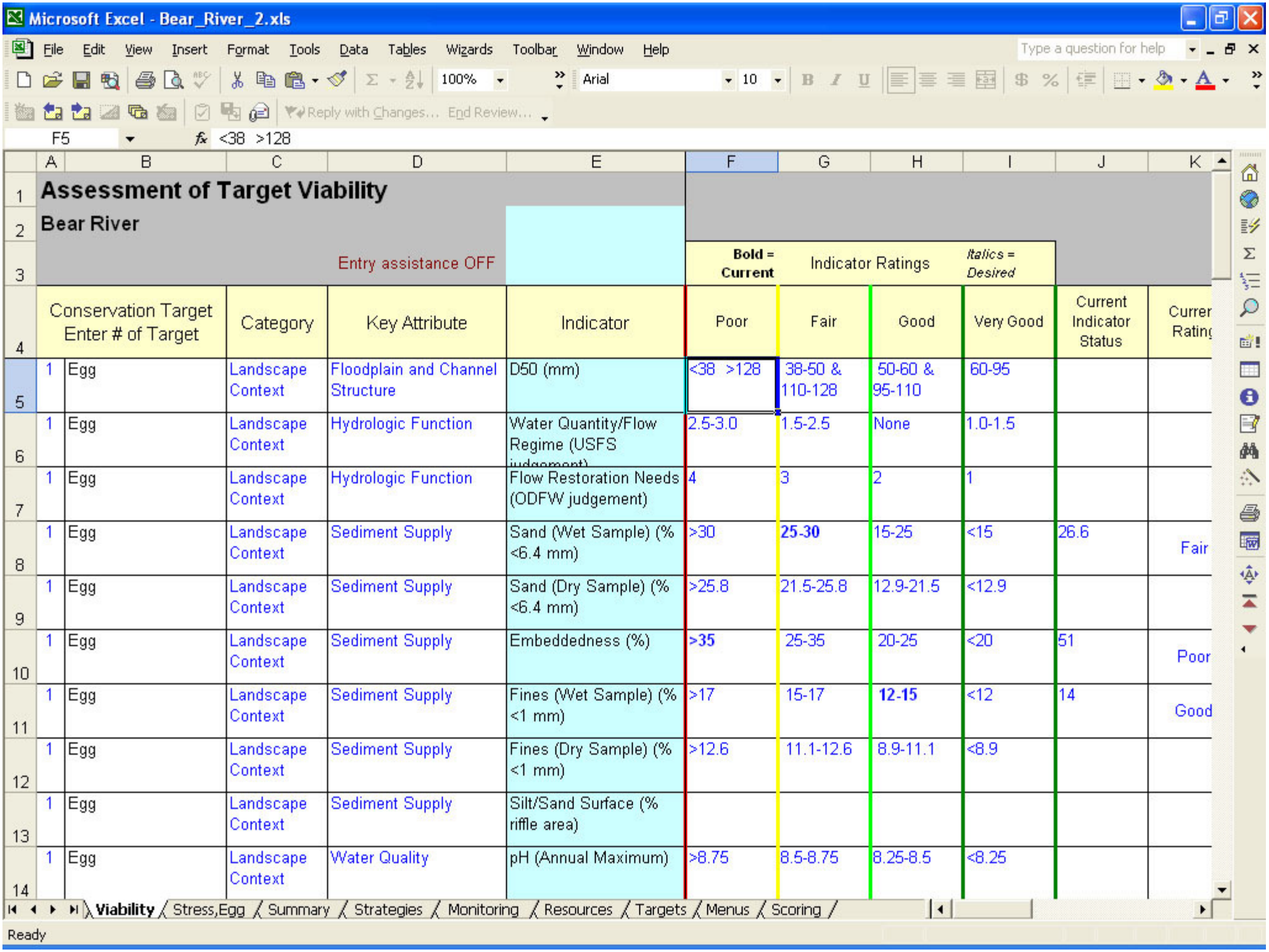
SELMA
DRY DEN
WILLIA
Fall Creek
Kerby Peak
CAVE JUNCTION
Josephine Creek
Sucker Creek
O-BRIEN
Elder Creek
Applegate River H
Illinois River HSA
North Fork Smith River HSA
Middle Fork Smith River HSA
Middle Fork Smith River HSA
Happy Camp HSA



Microsoft Excel - Bear_River_2.xls

File Edit View Insert Format Tools Data Tables Wizards Toolbar Window Help

F5 <38 >128

Assessment of Target Viability

Bear River

Entry assistance OFF

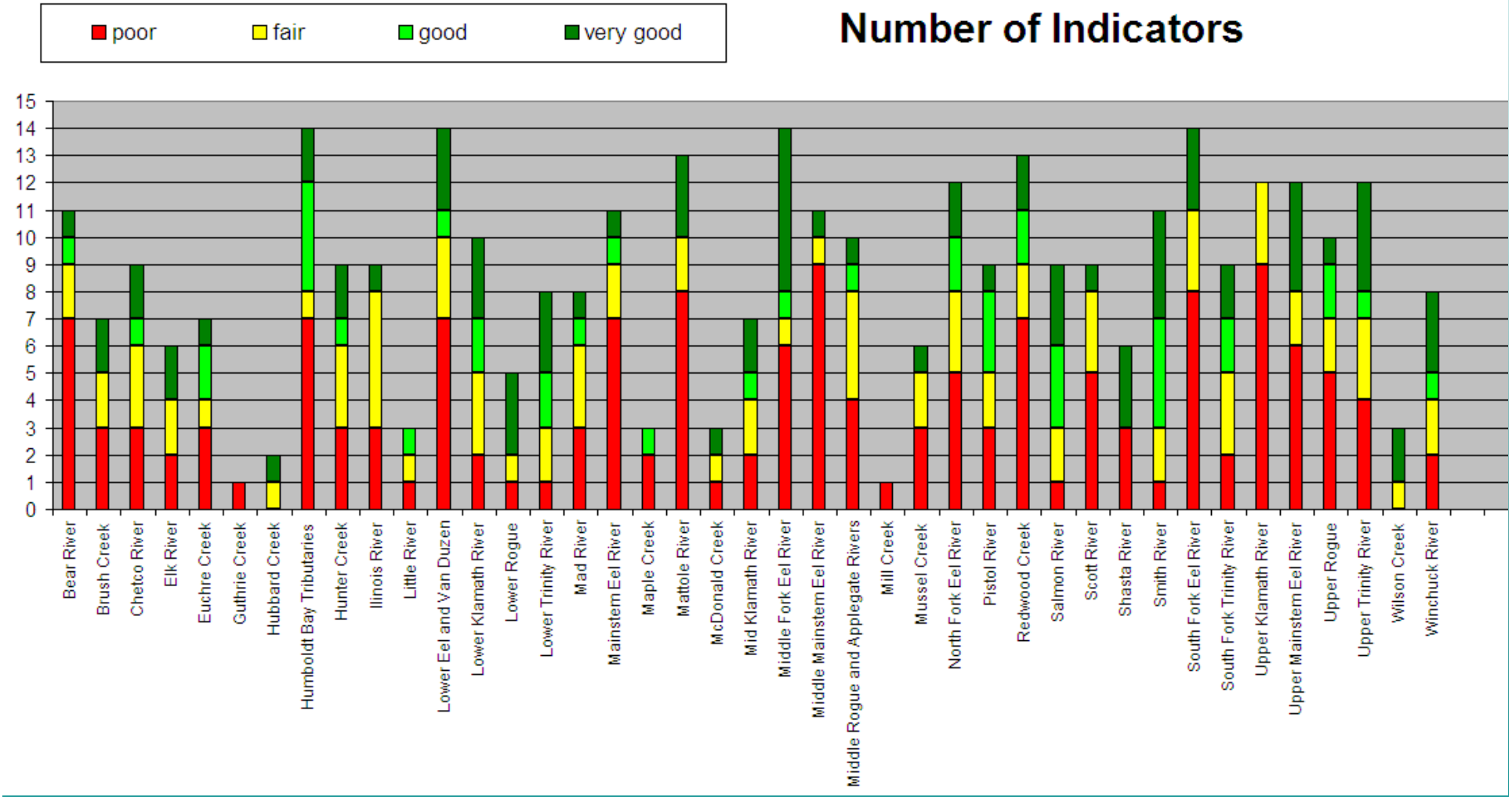
Bold = Current | Indicator Ratings | *Italics = Desired*

	Conservation Target Enter # of Target		Category	Key Attribute	Indicator	Poor	Fair	Good	Very Good	Current Indicator Status	Current Rating
5	1	Egg	Landscape Context	Floodplain and Channel Structure	D50 (mm)	<38 >128	38-50 & 110-128	50-60 & 95-110	60-95		
6	1	Egg	Landscape Context	Hydrologic Function	Water Quantity/Flow Regime (USFS judgement)	2.5-3.0	1.5-2.5	None	1.0-1.5		
7	1	Egg	Landscape Context	Hydrologic Function	Flow Restoration Needs (ODFW judgement)	4	3	2	1		
8	1	Egg	Landscape Context	Sediment Supply	Sand (Wet Sample) (% <6.4 mm)	>30	**25-30**	15-25	<15	26.6	Fair
9	1	Egg	Landscape Context	Sediment Supply	Sand (Dry Sample) (% <6.4 mm)	>25.8	21.5-25.8	12.9-21.5	<12.9		
10	1	Egg	Landscape Context	Sediment Supply	Embeddedness (%)	**>35**	25-35	20-25	<20	51	Poor
11	1	Egg	Landscape Context	Sediment Supply	Fines (Wet Sample) (% <1 mm)	>17	15-17	**12-15**	<12	14	Good
12	1	Egg	Landscape Context	Sediment Supply	Fines (Dry Sample) (% <1 mm)	>12.6	11.1-12.6	8.9-11.1	<8.9		
13	1	Egg	Landscape Context	Sediment Supply	Silt/Sand Surface (% riffle area)						
14	1	Egg	Landscape Context	Water Quality	pH (Annual Maximum)	>8.75	8.5-8.75	8.25-8.5	<8.25		

Viability | Stress,Egg | Summary | Strategies | Monitoring | Resources | Targets | Menus | Scoring

Ready

Data Visualization Tools: Stress Summary Charts



Threat (Source of Stress) Reference Values

The CAP workbook combines threat values with attribute values to derive final threat ranks

Threat (Source of Stress)	Low	Medium	High	Very High
Timber Harvest (% of area harvested)	<10%	10-25%	25-35%	>35%
Dams/Diversions (Hydrologic)(Reservoirs storage as % of precipitation)	0	0-10	10-40	>40
Dams/Diversions (Barriers)(relative % of inaccessible area due to dams)	<25%	25-50%	50-75%	>75%
Roads (Barriers)(relative % of inaccessible area due to roads)	<25%	25-50%	50-75%	>75%
Road Density	<1.6 mi/mi^2	1.6-2.5 mi/mi^2	2.5-3.0 mi/mi^2	>3.0 mi/mi^2
Near-Stream Road density (within 90 m of streams)	<0.1 mi/mi^2	0.1-0.5 mi/mi^2	0.5-1 mi/mi^2	>1 mi/mi^2
Road Stream Crossings	0	0-1 xings/mi	1-2 xings/mi	>2 xings/mi.
Total Impervious Area (% of watershed area)	<5%	5-10%	10-25%	>25%
Agriculture (% of watershed)	<2%	2-5%	5-10%	>10%
Fire (% watershed burned in last 25 years)	<10%	10-15%	15-20%	>20%
Mining/Gravel Extraction (acres of gravel bar disturbed)	0	0.01-100	100-250	>250
Channelization/Diking	Low	Medium	High	Very High

CAP workbooks calculate the attribute stress ranks from indicator values on the viability page. Here the average of 3 fry sediment indicator values (Poor, Poor, and Poor) are averaged to the rank Poor which corresponds to the stress rank Very High.

			Target	Attribute	Indicator	Poor	Fair	Good	Very Good	Current indicator status	Current ranking
16	2	Fry	Landscape Context	Sediment Supply	Sand (% <6.4 mm)	>30	25-30	15-25	<15	44	Poor
17	2	Fry	Landscape Context	Sediment Supply	Embeddedness (%)	>35	25-35	20-25	<20	63	Poor
18	2	Fry	Landscape Context	Sediment Supply	Turbidity (duration = days & ntu)	>30 days >25	20-30 days >25	10-20 days >25	<10 days >25	50 days >25 ntu	Poor

Freshwater Creek

2	Fry	<-- To change targets, c (current target input

Entry assistance OFF

	Stresses	Severity	Scope	Stress Rank	User Override
1	Barriers			-	Low
2	Floodplain and Channel Structure			-	High
3	Hydrologic Function			-	High
4	Riparian Forest Conditions			-	High
5	Sediment Supply			-	Very High
6	Water Quality			-	Low
7					

THREATS: Threats to freshwater habitat quality are characterized on the Stress page by life stage.

Threats - Sources of Stress		Barriers	Floodplain and Channel Structure	Hydrologic Function	Riparian Forest Conditions	Sediment Supply	Water Quality	-	-	Threat to System Rank
Stresses	#..	1	2	3	4	5	6	7	8	
	Rank..	Low	High	High	Low	Very High	Low	-	-	
7	Threat	Roads								Very High
	Common Taxonomy									
	Contribution									
	Irreversibility									
	Threat Rank (override)	Low	Very High	Medium	Low	Very High	Low			
	Threat Rank	Low	High	Medium	Low	Very High	Low	-	-	
8	Threat	Timber Harvest								High
	Common Taxonomy									
	Contribution									
	Irreversibility									
	Threat Rank (override)	High	High	Medium	High	Medium	Low			
	Threat Rank	Low	High	Medium	Low	High	Low	-	-	

Several types of data may be combined for scoring Threat categories.

For example, roads scores are derived from both watershed-wide road density and near-stream road density.

CAP Workbooks Inform Recovery Planning

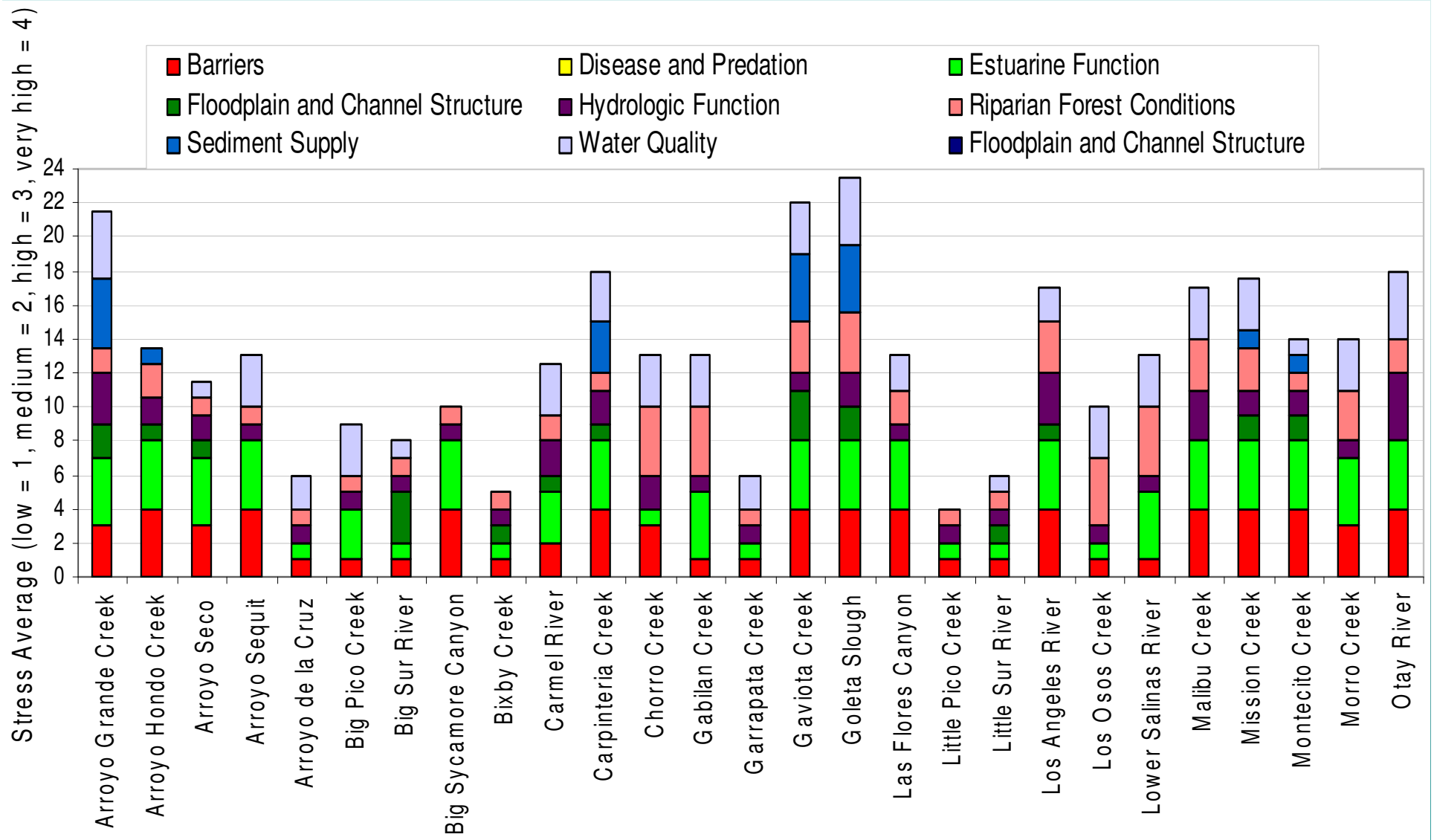
Recovery Plans are being developed utilizing aquatic habitat quality (Indicators) and Sources of Stress (Threats) identified from the CAP workbooks for each population of targeted, at-risk salmonids.

Summary of Threats — Click the page-down icon ▼to the right to view more summary tables.

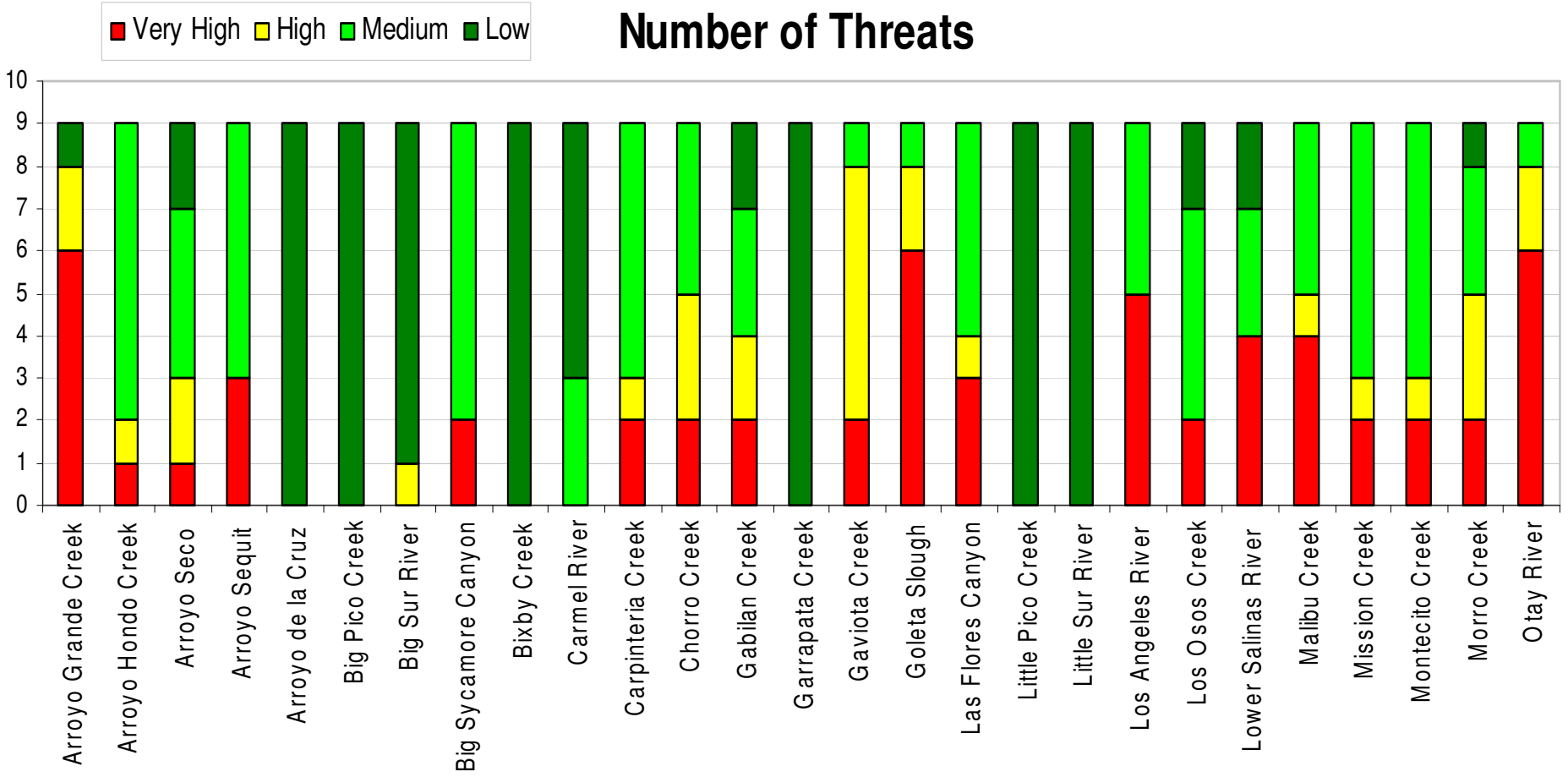
Freshwater Creek

	Threats Across Systems	Egg	Fry	Juvenile	Smolt	Adult				Overall Threat Rank
	Project-specific threats	1	2	3	4	5	6	7	8	
1	Roads	Very High	Very High	Very High	Medium	Very High	-	-	-	Very High
2	Timber Harvest	Very High	Very High	High	High	High	-	-	-	Very High
3	Industrial/Residential	Low	Medium	Medium	High	Medium	-	-	-	Medium
4	Agricultural Practices	-	Medium	Medium	High	Medium	-	-	-	Medium
5	Channelization/Diking	-	Medium	Medium	High	Medium	-	-	-	Medium
6	Dams/Diversion	Low	Low	Low	Low	Low	-	-	-	Low
7	Fire (High Intensity)	Low	Low	Low	Low	Low	-	-	-	Low
8	Mining/Gravel Extraction	Low	Low	Low	Low	Low	-	-	-	Low
9		-	-	-	-	-	-	-	-	-
10		-	-	-	-	-	-	-	-	-

Home / Viability / Stress Smolt / **Summary** / Strategies / Monitoring / Resources / Targets / Menus / Scoring


Barriers
Disease and Predation
Estuarine Function
Floodplain and Channel Structure
Hydrologic Function
Riparian Forest Conditions
Sediment Supply
Water Quality
Floodplain and Channel Structure
Stress Average (low = 1, medium = 2, high = 3, very high = 4)
0
2
4
6
8
10
12
14
16
18
20
22
24
Arroyo Grande Creek
Arroyo Hondo Creek
Arroyo Seco
Arroyo Sequit
Arroyo de la Cruz
Big Pico Creek
Big Sur River
Big Sycamore Canyon
Bixby Creek
Carmel River
Carpinteria Creek
Chorro Creek
Gabilan Creek
Garrapata Creek
Gaviota Creek
Goleta Slough
Las Flores Canyon
Little Pico Creek
Little Sur River
Los Angeles River
Los Osos Creek
Lower Salinas River
Malibu Creek
Mission Creek
Montecito Creek
Morro Creek
Otay River

Data Visualization Tools: Threat Summary Charts



Next Steps for SONCC Coho CAP 2008

- Update SONCC CAP
  - Add new datasets
  - Incorporate professional judgment into MS Access database
- Provide documentation and programming scripts to allow NMFS to conduct future updates
- Produce GIS map outputs to allow examination of data at multiple spatial scales

Conclusions

- Data availability:
  - “More than we thought, less than we hoped”
  - Professional judgment can be used as placeholder to fill data gaps
- CAP workbooks successfully created for 45 SONCC and 55 SCCC/SCC populations
  - The results made sense
- Tool development
  - Automated tools developed for filling out CAP workbooks using large datasets, enabling easy updating
  - New auxiliary tools such as boxplots and summary workbooks provide cross-comparisons within and among populations
  - Tools now available for use with other species / geographic areas

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