Draft Central Valley Salmon and Steelhead Threats Assessment

Water Temperature Management and Modeling Workshop
April 1, 2008

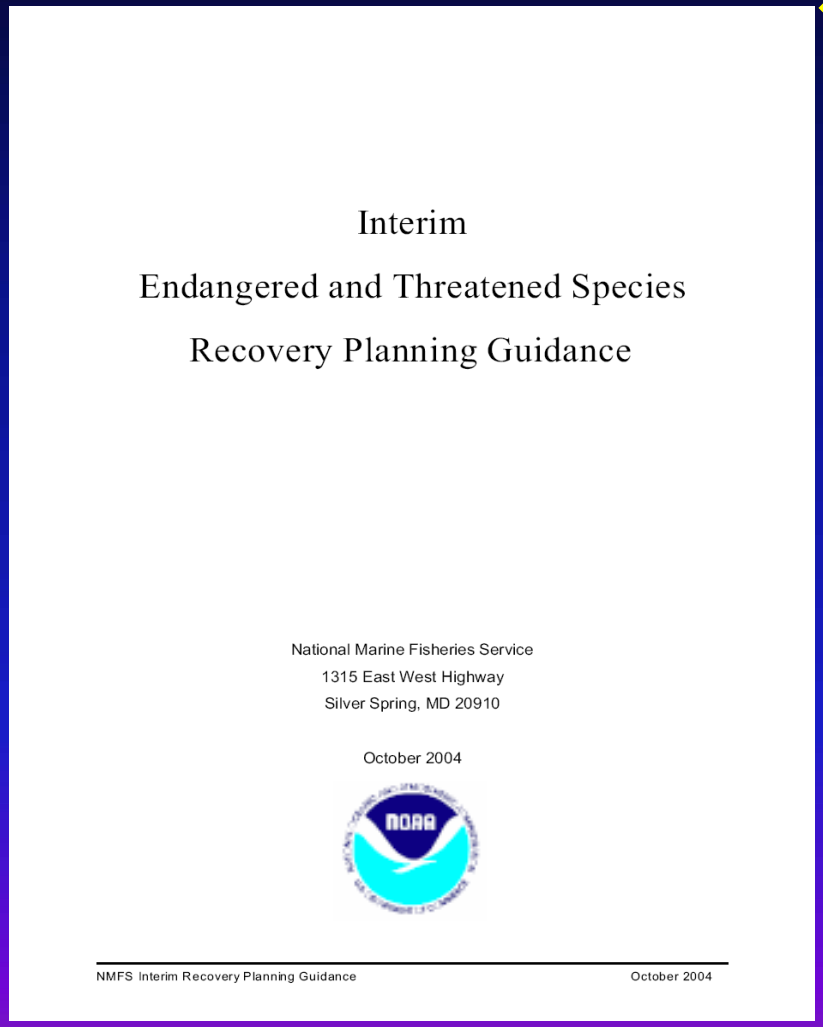
NOAA FISHERIES SERVICE

HDR | SWRI Surface Water Resources, Inc.

Presentation Overview

- Steps for conducting a threats assessment – Stressor Matrix Development for winter-run, spring-run, and steelhead
- Excerpt from winter-run Chinook salmon stressor matrix
- Stressor matrix results focusing on water temperature

Stressor Matrix Development



Interim

Endangered and Threatened Species

Recovery Planning Guidance

National Marine Fisheries Service
1315 East West Highway
Silver Spring, MD 20910

October 2004

NMFS Interim Recovery Planning Guidance October 2004

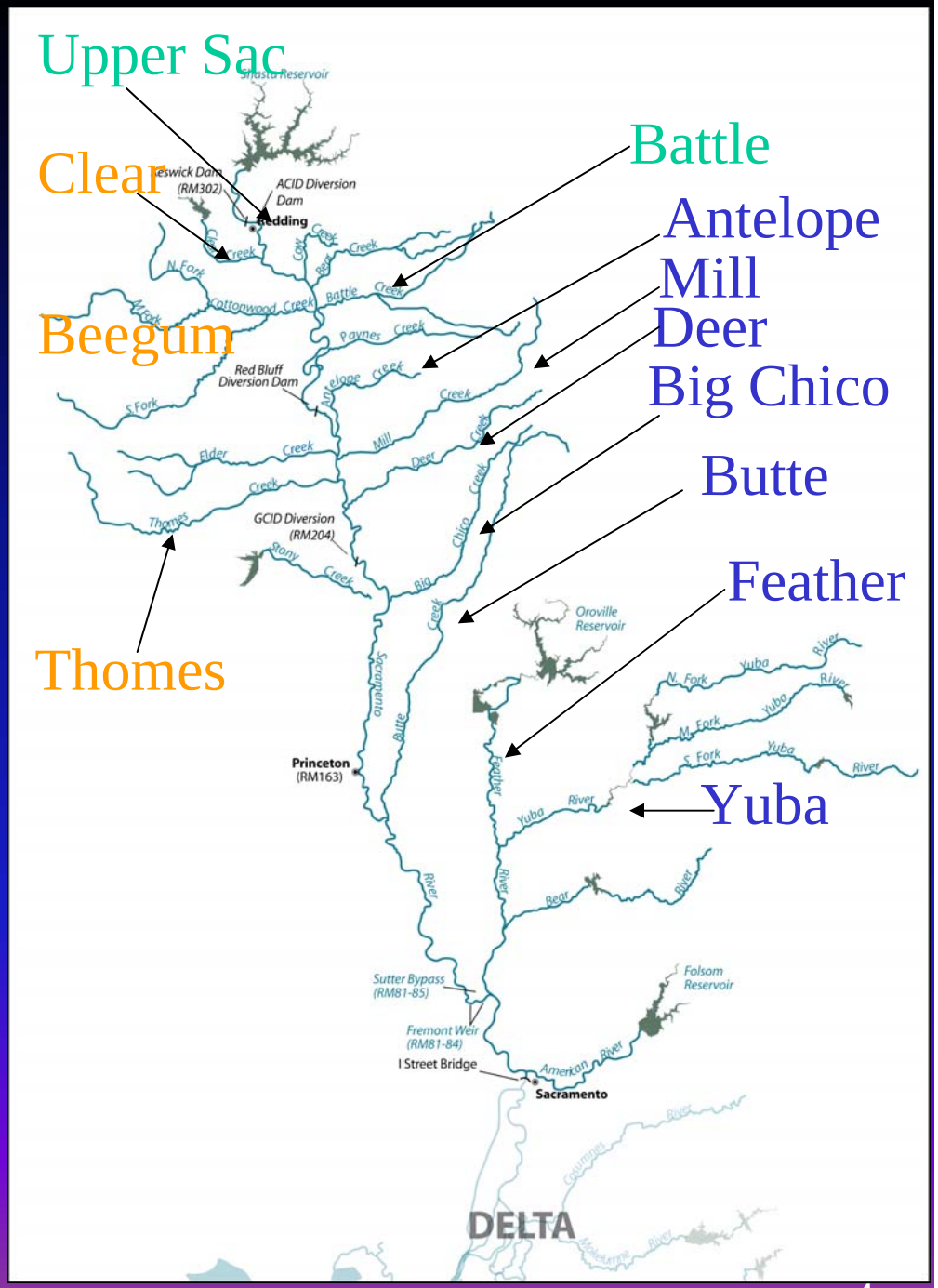
- Steps for Conducting a Threats Assessment
  - Identify, organize, and rank the populations

Stressor Matrix Development

Identify Spring-run Chinook salmon Populations

- 3 Diversity Groups
  - NW California
  - Basalt and Porous Lava
  - Northern Sierra Nevada

(Lindley *et al*. 2007)



Stressor Matrix Development

Rank Populations within each Diversity Group

- Sum of all population weights = 1
- Weighting characteristic scores ranged from 1 to 4

	Pop 1	Pop 2	Pop 3
Abundance	4	1	3
Spatial Structure	2	4	1
Independent vs. Dependent Population	4	1	3
Habitat Quantity/Quality	3	2	3
Restoration Potential	1	4	2
Genetic Integrity	3	4	1
Distinct Life History	2	4	2
Total	19	20	15
Population Weight (Pop Tot/Tot for all)	0.35	0.37	0.28

Stressor Matrix Development

Rank Spring-run Chinook Salmon Populations

NW California Diversity Group (DG)	
Population	Population Weight
Beegum	0.38
Clear	0.38
Thomes	0.25

Basalt and Porous Lava DG	
Population	Population Weight
Battle	0.57
Upper Sac.	0.43

Northern Sierra Nevada DG	
Population	**Population Weight**
Deer	0.17
Mill	0.17
Butte	0.15
Yuba	0.15
Feather	0.13
Antelope	0.13
Big Chico	0.10

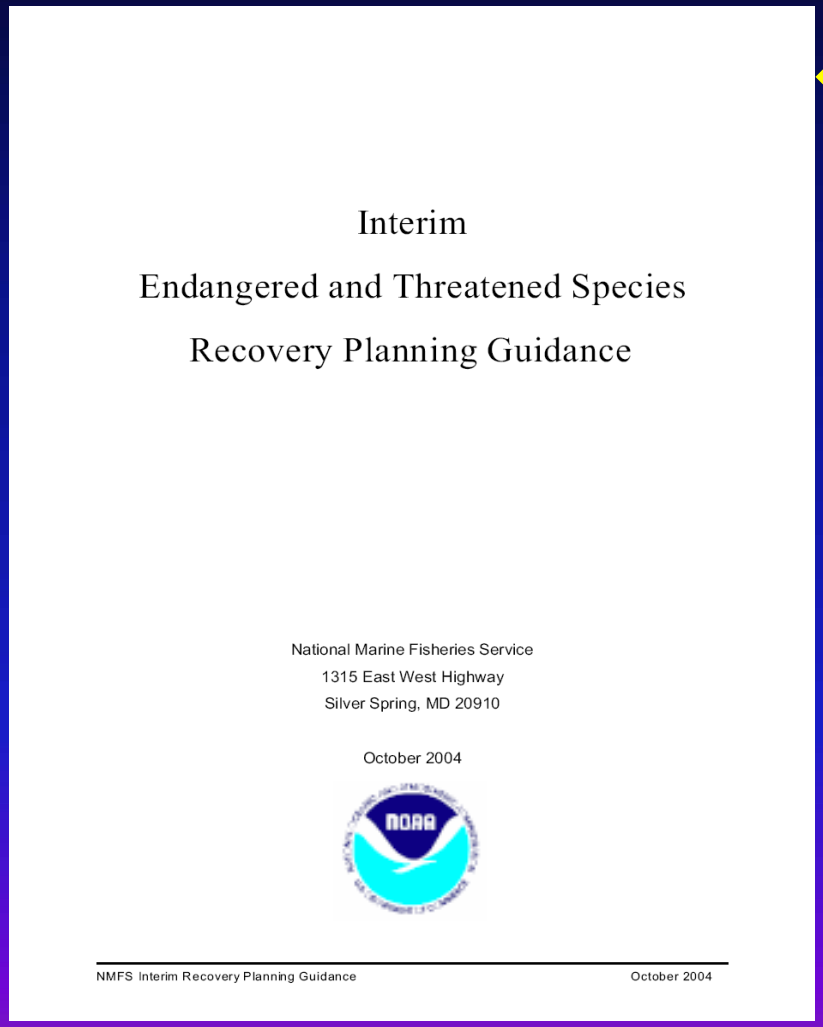
Stressor Matrix Development

Identify Steelhead Populations

Northern Sierra Nevada Diversity Group	Basalt and Porous Lava Diversity Group	Northwestern California Diversity Group	Southern Sierra Nevada Diversity Group
American River Auburn/Coon Creek Dry Creek Feather River Bear River Yuba River Butte Creek Big Chico Creek Deer Creek Mill Creek Antelope Creek	Battle Creek Cow Creek Upper Sacramento River Tributaries[1] Upper Sacramento River (mainstem)	Stony Creek Thomes Creek Cottonwood/Beegum Creek Clear Creek Putah Creek	Mokelumne River Calaveras River Stanislaus River Tuolumne River Merced River San Joaquin River (mainstem)
Source: (Lindley *et al.* 2007)			

[1] Includes steelhead utilizing small tributaries in the Redding area including Stillwater, Churn, Sulphur, Salt, Olney, and Paynes creeks.

Stressor Matrix Development



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  - Identify and rank the populations
  - For each population, rank life stages

Stressor Matrix Development

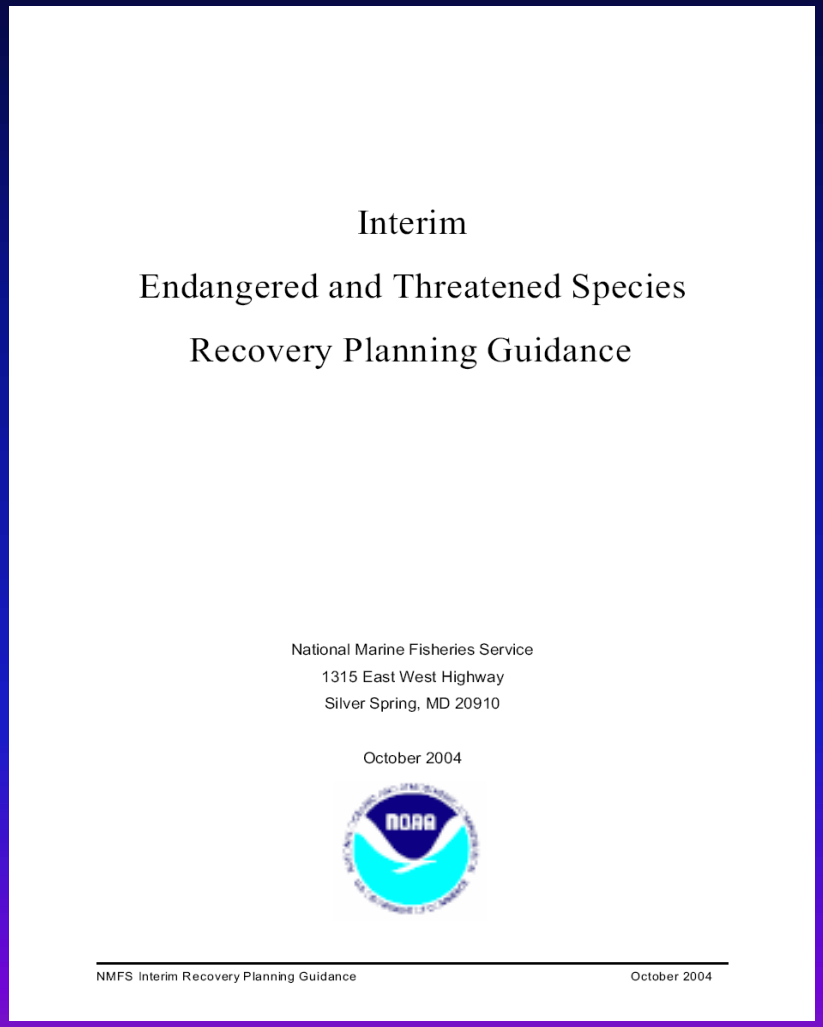
Rank Life Stages

- Individual life stages of each population were ranked based on: (1) the relative importance of each life stage in establishing initial year class strength; and (2) relative vulnerability to current stressors
- Sum of all life stage weights = 1

Example:

Life Stage	Relative Weight
Adult Immigration and Holding	.1
Spawning	.3
Embryo Incubation	.3
Juvenile Rearing and Outmigration	.3

Stressor Matrix Development



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- Steps for Conducting a Threats Assessment
  - Identify and rank the populations
  - For each population, rank life stages
  - For each life stage, identify and rank primary stressors
  - For each primary stressor, identify and rank specific stressors

Stressor Matrix Development

Identify and Rank Stressors

Primary Stressors

- **Passage Impediments/Barriers**
- **Angling/Harvest Impacts**
- **Water Temperature**
- **Water Quality**
- **Flow Conditions**
- **Loss of Riparian Habitat and Instream Cover**
- **Loss of Natural River Morphology**
- **Loss of Floodplain Habitat**
- **Loss of Tidal Marsh Habitat**
- **Spawning Habitat Availability**
- **Invasive Species/Food Web Changes**
- **Entrainment**
- **Predation**
- **Hatchery Effects**
- **Short-term Inwater Construction**
- **Ocean Conditions**

- Individual primary stressors affecting each life stage were ranked
  - Criteria for Ranking Stressors
    - Scope (geographic)
    - Severity
    - Frequency (temporal)
    - Persistence
    - Likelihood
  - Stressors include only those that act on specific life stages and can potentially be alleviated through specific recovery actions.

Stressor Matrix Development

Identify and Rank Stressors

Population	Pop Weight (0-1) Sum to 1	Life Stage	Life Stage Weight (0-1) Sum to 1	Primary Stressor Category	Primary Stressor Weight (0-1) Sum to 1
Sacramento River	1	Adult Immigration and Holding	0.1	Passage Impediments/Barriers	0.475
Sacramento River	1	Adult Immigration and Holding	0.1	Water Temperature	0.100
Sacramento River	1	Adult Immigration and Holding	0.1	Water Quality	0.025
Sacramento River	1	Adult Immigration and Holding	0.1	Angling Impacts	0.050
Sacramento River	1	Adult Immigration and Holding	0.1	Flow Conditions	0.200
Sacramento River	1	Adult Immigration and Staging	0.1	Short-term Inwater Construction	0.150

Stressor Matrix Development

Identify and Rank Stressors

Primary Stressors

- **Passage Impediments/Barriers**
- **Angling/Harvest Impacts**
- **Water Temperature**
- **Water Quality**
- **Flow Conditions**
- **Loss of Riparian Habitat and Instream Cover**
- **Loss of Natural River Morphology and Function**
- **Loss of Floodplain Habitat**
- **Loss of Tidal Marsh Habitat**
- **Spawning Habitat Availability**
- **Invasive Species/Food Web Changes**
- **Entrainment**
- **Predation**
- **Short-term Inwater Construction**
- **Hatchery Effects**
- **Ocean Conditions**

- Individual primary stressors affecting each life stage were ranked
- **Specific stressors within each primary stressor category were ranked**

Winter-run Stressor Matrix

Excerpt

Population	Pop Weight (0-1) Sum to 1	Life Stage	Life Stage Weight (0-1) Sum to 1	Primary Stressor Category	Primary Stressor Weight (0-1) Sum to 1	Specific Stressor	Specific Stressor Weight (0-1) Sum to 1	Composite Weight (X100)	Normalized Weight (Composite * # of specific stressors)
Sacramento River	1	Adult Immigration and Holding	0.1	Passage Impediments/Barriers	0.475	Suisun Marsh Salinity Control Structure	0.05	0.238	1.425
Sacramento River	1	Adult Immigration and Holding	0.1	Passage Impediments/Barriers	0.475	Sacramento Deep Water Ship Channel	0.05	0.238	1.425
Sacramento River	1	Adult Immigration and Holding	0.1	Passage Impediments/Barriers	0.475	Yolo Bypass-Freemont Weir	0.05	0.238	1.425
Sacramento River	1	Adult Immigration and Holding	0.1	Passage Impediments/Barriers	0.475	Sutter Bypass - Tisdale Weir	0.05	0.238	1.425
Sacramento River	1	Adult Immigration and Holding	0.1	Passage Impediments/Barriers	0.475	Red Bluff Diversion Dam	0.15	0.713	4.275
Sacramento River	1	Adult Immigration and Holding	0.1	Passage Impediments/Barriers	0.475	ACID Dam	0.00	0.000	0.000
Sacramento River	1	Adult Immigration and Holding	0.1	Passage Impediments/Barriers	0.475	Keswick Dam	0.65	3.088	18.525
Sacramento River	1	Adult Immigration and Holding	0.1	Water Temperature	0.100	Delta	0.10	0.100	0.400
Sacramento River	1	Adult Immigration and Holding	0.1	Water Temperature	0.100	Lower Sacramento River	0.20	0.200	0.800
Sacramento River	1	Adult Immigration and Holding	0.1	Water Temperature	0.100	Middle Sacramento River	0.30	0.300	1.200
Sacramento River	1	Adult Immigration and Holding	0.1	Water Temperature	0.100	Upper Sacramento River	0.40	0.400	1.600

Results
Winter-run Chinook Salmon

Life stage-specific locations where water temperature ranked as a high or very high stressor, relative to all other stressors* affecting the ESU

	Adult Immigration and Holding	Spawning	Embryo Incubation	Juvenile Rearing and Outmigration
Sacramento		Upper Sac.	Upper Sac.	Middle Sac., Lower Sac.

Blank cells indicate water temperature was not identified as a high or very high stressor to that life stage

Results

Spring-run Chinook Salmon Northwestern California Diversity Group

Population- and life stage-specific locations where water temperature ranked as a high or very high, relative to all other stressors in the diversity group

	Adult Immigration and Holding	Spawning	Embryo Incubation	Juvenile Rearing and Outmigration
Thomes	Delta, Lower Sac., Middle Sac., Thomes	Thomes	Thomes	
Beegum	Delta, Lower Sac., Middle Sac., Upper Sac., Beegum	Beegum	Beegum	Beegum
Clear	Delta, Lower Sac., Middle Sac., Upper Sac., Clear	Clear	Clear	Middle Sac., Lower Sac.

Results

Spring-run Chinook Salmon

Basalt and Porous Lava Diversity Group

Population- and life stage-specific locations where water temperature ranked as a high or very high, relative to all other stressors in the diversity group

	Adult Immigration and Holding	Spawning	Embryo Incubation	Juvenile Rearing and Outmigration
Battle	Delta, Lower Sac., Middle Sac., Upper Sac., Battle		Battle	Battle, Lower Sac., Delta
Mainstem Sac.				Delta

Results - Spring-run Chinook Salmon Northern Sierra Nevada Diversity Group

Population- and life stage-specific locations where water temperature ranked as a high or very high, relative to all other stressors in the diversity group

	Adult Immigration and Holding	Spawning	Embryo Incubation	Juvenile Rearing and Outmigration
Feather	Feather	Feather	Feather	Feather, Lower Sac, Delta
Yuba	Lower Sac., Feather			Feather, Lower Sac, Delta
Butte	Delta, Lower Sac., Butte	Butte	Butte	
Big Chico	Big Chico	Big Chico	Big Chico	
Deer	Delta, Lower Sac., Middle Sac., Deer	Deer		Middle Sac., Lower Sac.
Mill	Delta, Lower Sac., Middle Sac., Mill	Mill		Middle Sac., Lower Sac.
Antelope	Delta, Lower Sac., Middle Sac., Antelope	Antelope	Antelope	Lower Sac.

Results - Central Valley Steelhead Northwestern California Diversity Group

Population- and life stage-specific locations where water temperature ranked as a high or very high, relative to all other stressors in the diversity group

	Adult Immigration and Holding	Spawning	Embryo Incubation	Juvenile Rearing and Outmigration
Putah				Putah
Stony	Delta, Lower Sac., Middle Sac., Stony	Stony	Stony	Stony, Delta
Thomes	Delta, Lower Sac., Middle Sac., Thomes	Tuolumne	Tuolumne	
Beegum	Delta, Lower Sac., Middle Sac., Upper Sac., Beegum	Beegum		Beegum
Clear	Delta, Lower Sac., Middle Sac., Upper Sac., Clear	Clear	Clear	Middle Sac., Lower Sac.

Results - Central Valley Steelhead Basalt and Porous Lava Diversity Group

Population- and life stage-specific locations where water temperature ranked as a high or very high, relative to all other stressors in the diversity group

	Adult Immigration and Holding	Spawning	Embryo Incubation	Juvenile Rearing and Outmigration
Mainstem Sac.	Lower Sac., Middle Sac.		Upper Sac.	Lower Sac., Delta
Battle	Delta, Lower Sac., Middle Sac., Upper Sac., Battle		Battle	Battle, Lower Sac., Delta
Cow	Cow	Cow	Cow	Cow
Upper Sac. Tribs.	Upper Sac. Tribs.	Upper Sac. Tribs.	Upper Sac. Tribs.	Upper Sac. Tribs., Middle Sac.

Results - Central Valley Steelhead Northern Sierra Nevada Diversity Group

Population- and life stage-specific locations where water temperature ranked as a high or very high, relative to all other stressors in the diversity group

	Adult Immigration and Holding	Spawning	Embryo Incubation	Juvenile Rearing and Outmigration
American	American		American	American, Delta
Auburn/Coon			Auburn/Coon	Auburn/Coon
Bear	Bear	Bear	Bear	Bear
Feather	Feather	Feather	Feather	Feather, Lower Sac., Delta
Yuba	Delta, Lower Sac., Feather			Feather, Lower Sac., Delta
Butte	Butte	Butte	Butte	
Big Chico	Delta, Lower Sac., Middle Sac., Big Chico	Big Chico Creek	Big Chico	
Deer	Delta, Lower Sac., Middle Sac., Deer	Deer	Deer	Middle Sac., Lower Sac.
Mill	Delta, Lower Sac., Middle Sac., Mill	Mill	Mill	Middle Sac., Lower Sac.
Antelope	Delta, Lower Sac., Middle Sac., Antelope	Antelope	Antelope	Middle Sac., Lower Sac.
Dry (Sac)	Dry	Dry	Dry	Dry

Results - Central Valley Steelhead Southern Sierra Nevada Diversity Group

Population- and life stage-specific locations where water temperature ranked as a high or very high, relative to all other stressors in the diversity group

	Adult Immigration and Holding	Spawning	Embryo Incubation	Juvenile Rearing and Outmigration
Mokelumne		Mok.	Mok.	Mok.
Calaveras	Delta, Calaveras		Calaveras	Calaveras, Delta
Stanislaus	Delta, San Joaquin	Stanislaus		Stanislaus, San Joaquin, Delta
Tuolumne	Delta, San Joaquin, Tuolumne	Tuolumne		Tuolumne, San Joaquin, Delta
Merced	Delta, San Joaquin, Merced	Merced		Merced, San Joaquin, Delta
San Joaquin	Delta, San Joaquin		San Joaquin	San Joaquin, Delta

Summary/Conclusions

- Water temperature ranked as a high or very high stressor for all of the populations; and for multiple life stages for nearly all populations
- Although water temperature was likely a stressor for CV Chinook salmon and steelhead historically, all life stages of today's fish are largely confined to the valley floor, making water temperature management crucial to their survival