NMFS' Proposed Analytical Approach for the Central Valley Project and State Water Project Operations Criteria and Plan Consultation (OCAP)

CALFED Science Program Review Panel

August 5, 2008

Brian Ellrott

NOAA Fisheries

Background

- NMFS issues OCAP biological opinion (BO) in 2004
- Three reviews of the BO, one evaluation of the reviews

❑Center for Independent Experts (CIE) – Maguire

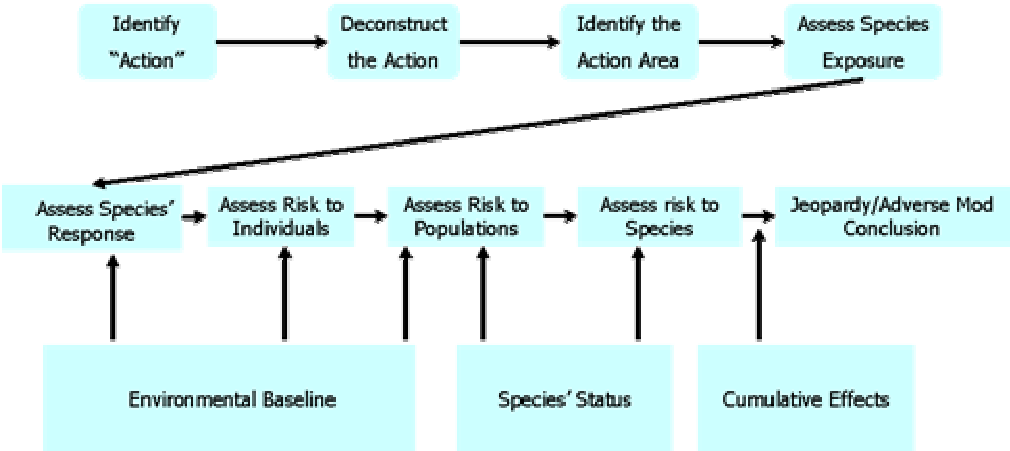
❑CIE – McMahon

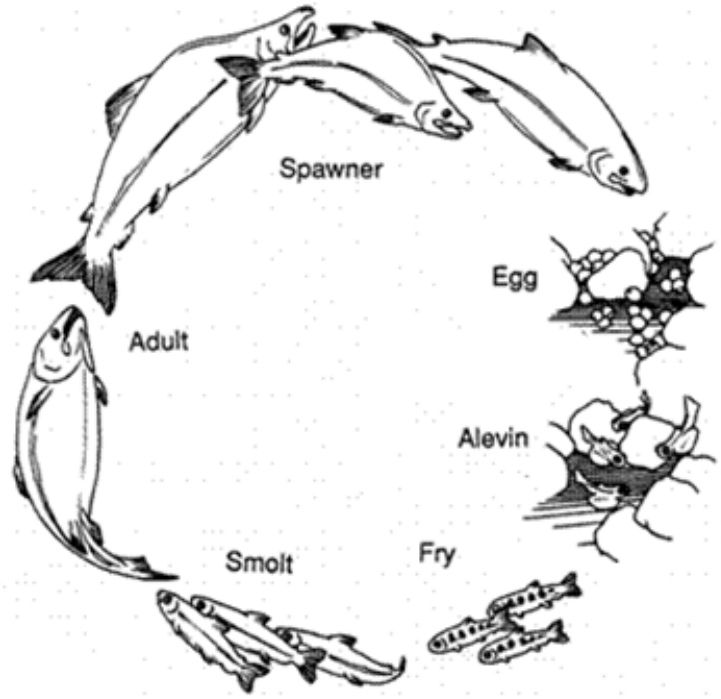
❑Technical Review Panel convened by CALFED

❑NMFS Science Center Summary Evaluation

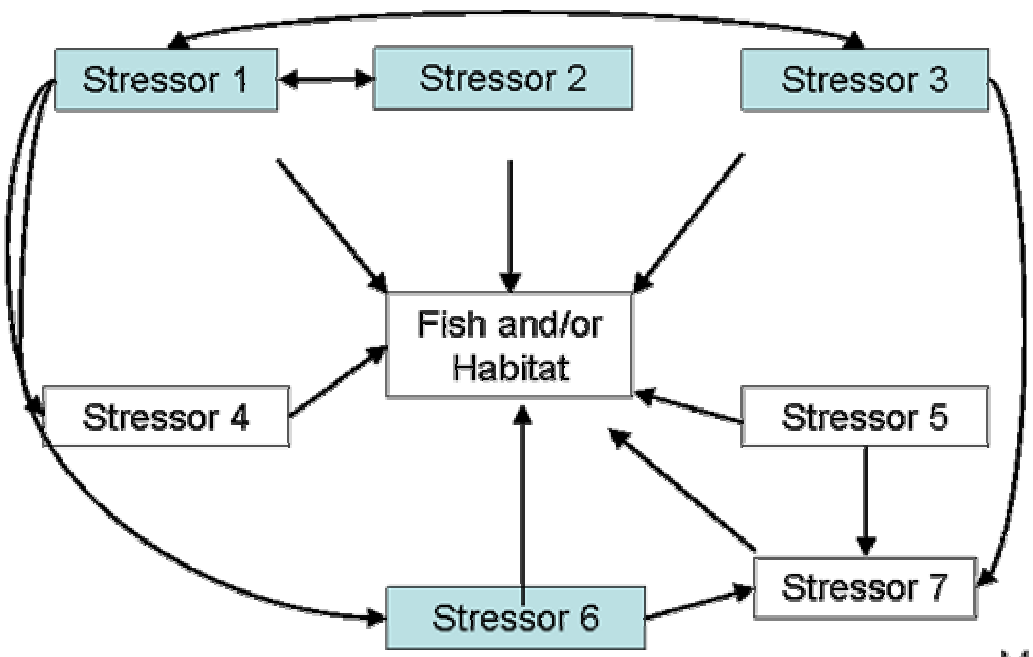
- ❑ Conceptual model
- ❑ Analytic framework
- ❑ Life cycle model
- ❑ Climate change
- ❑ Ocean conditions
- ❑ Uncertainty
- ❑ Genetic and spatial diversity not considered enough

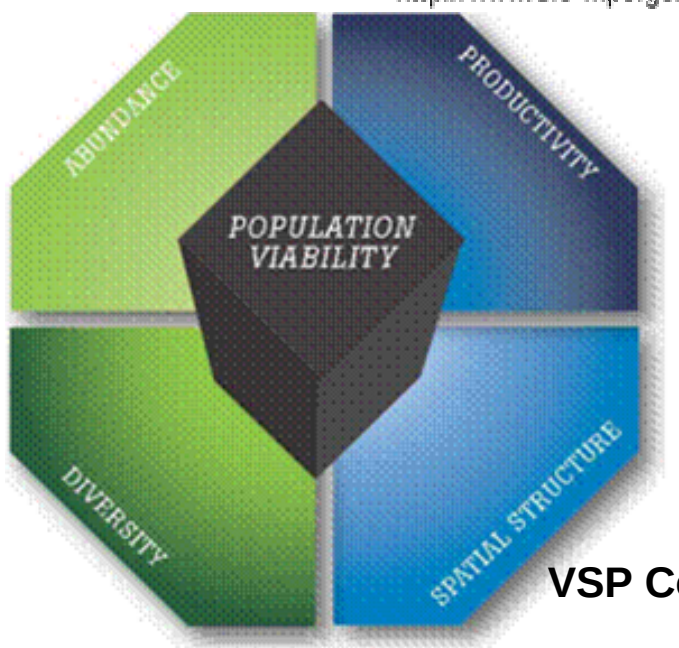
Models and Concepts





http://www.dfo-mpo.gc.ca/

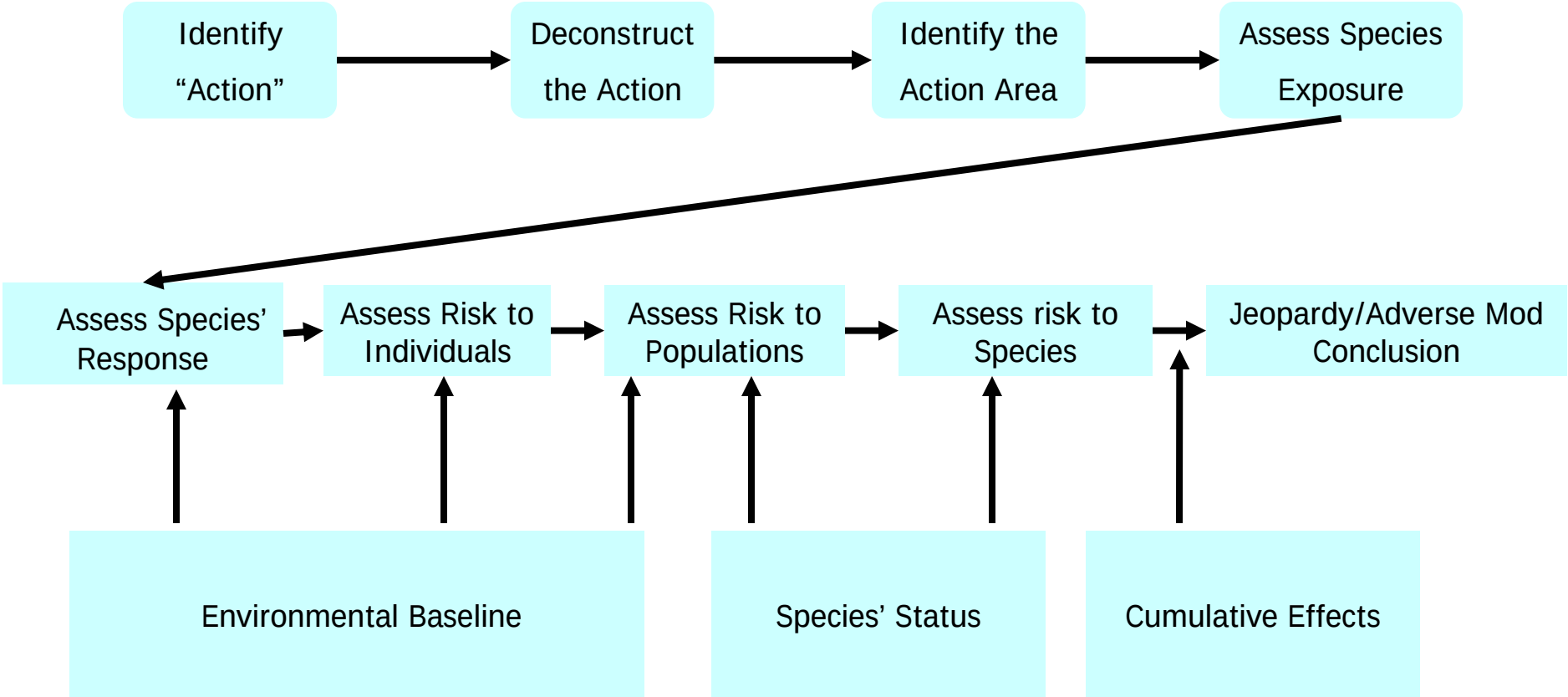




VSP Concept

McElhany *et al.* 2000 NOAA Tech Memo NWFSC-42

Conceptual Model of OCAP Consultation



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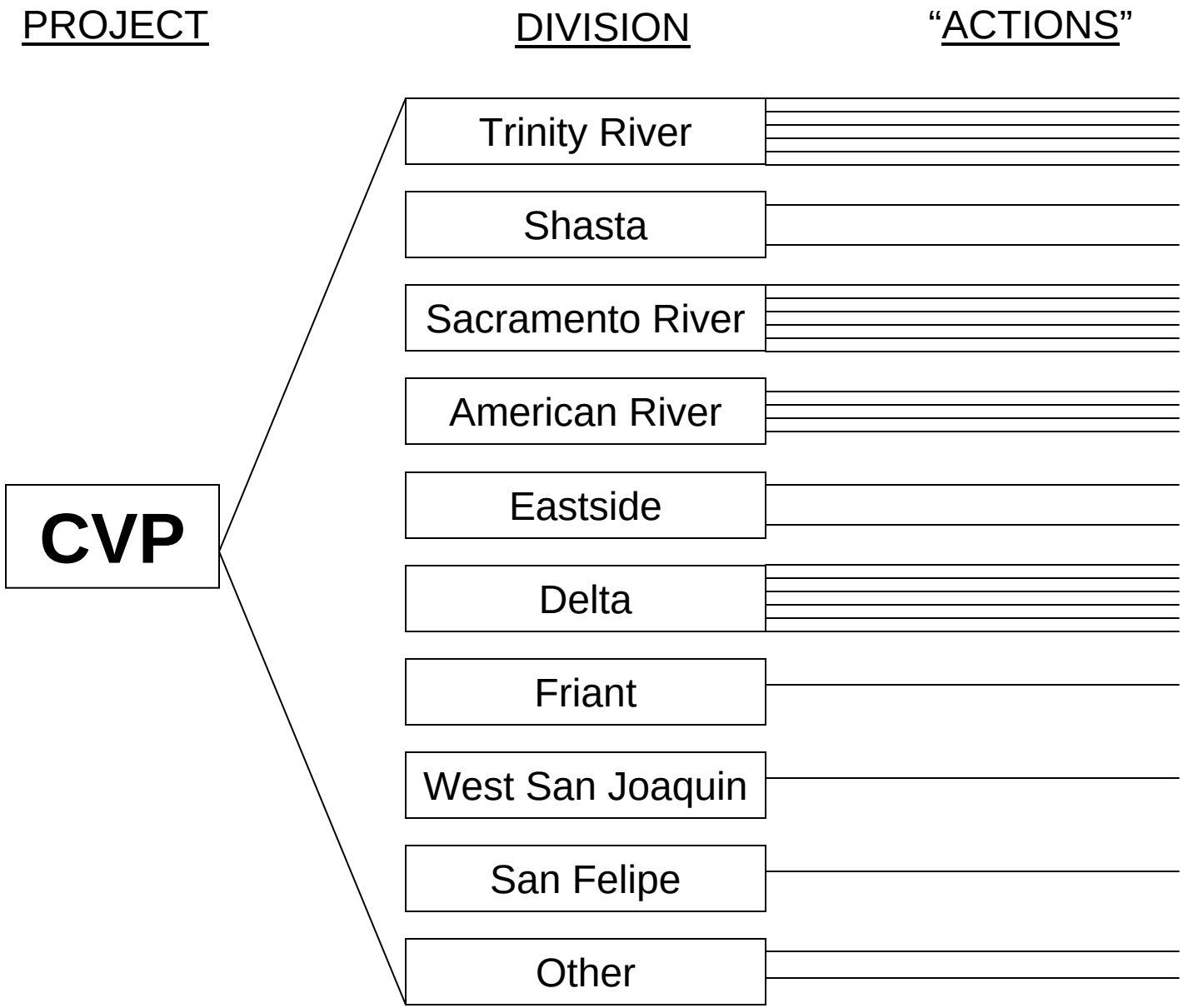
- Assess Cumulative Effects
- Make Determinations



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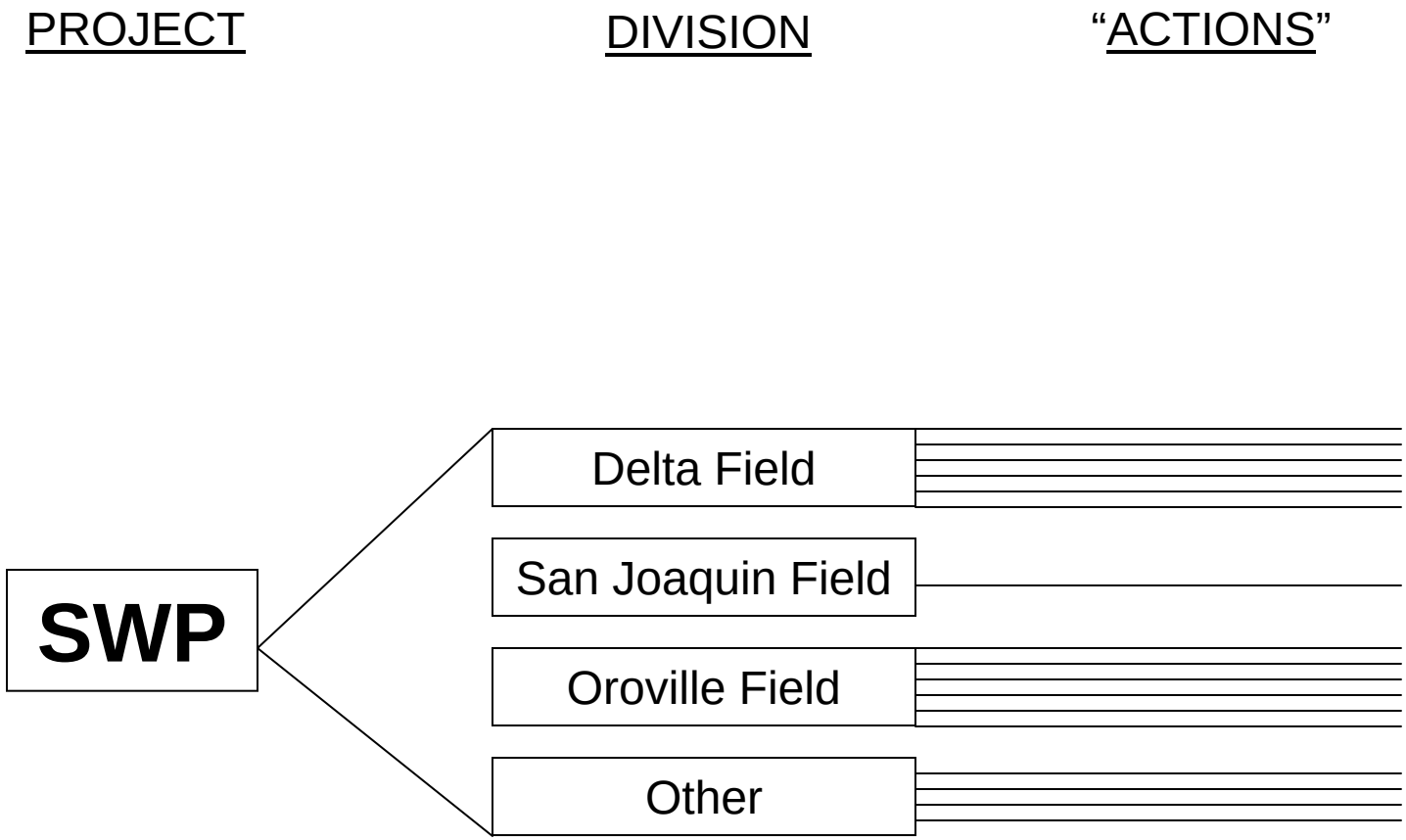

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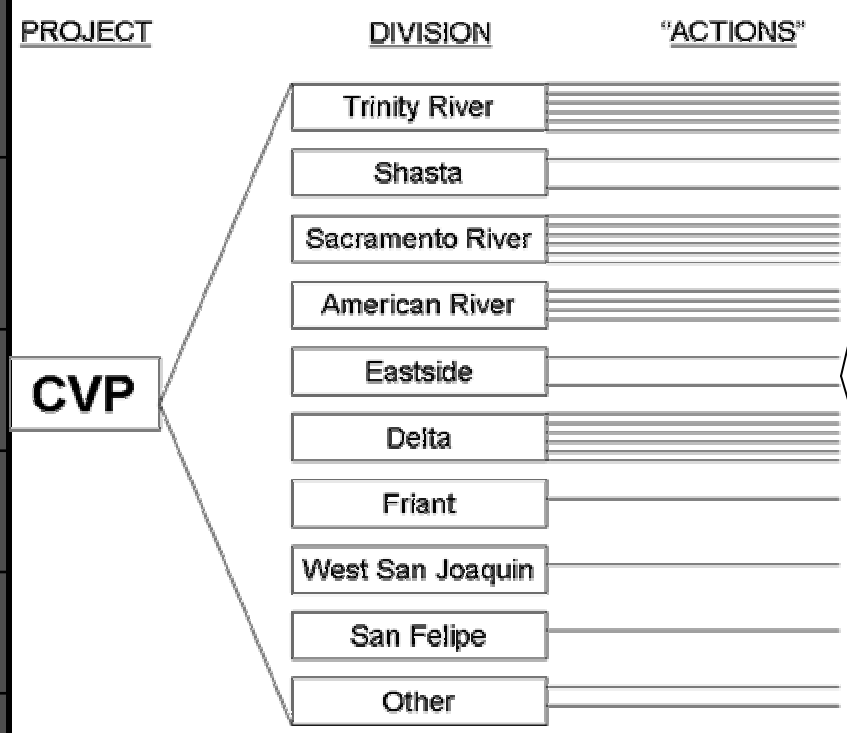
Make Determinations

CVP Purposes:

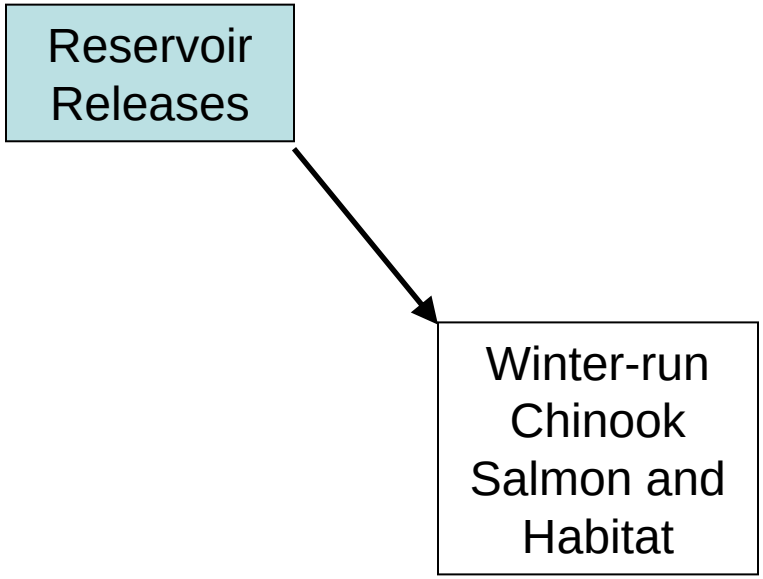
- ❑ Flood Control
- ❑ Fish and Wildlife
- ❑ Navigation
- ❑ Power Generation
- ❑ Irrigation and Domestic



Water Management

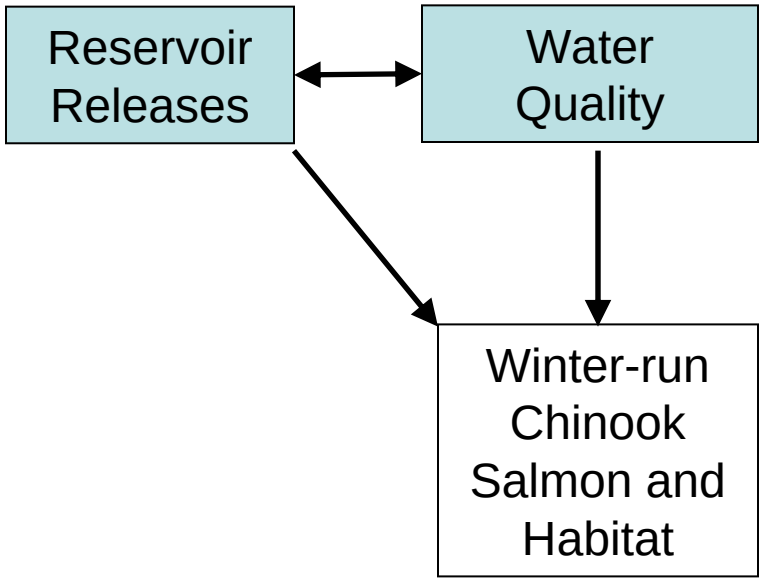
- Reservoir Operations
- Dam Releases
- Diversions
- Temperature Objectives
- Water Quality Criteria

Potential Physical, Chemical, and Biotic Stressors



- Altered Hydrology
- Flow-Dependent Habitat Availability
  - Holding, Spawning, Incubating, Rearing
- Habitat Quality

Potential Physical, Chemical, and Biotic Stressors



- ❑ Heavy Metals
- ❑ Agricultural Runoff
- ❑ Spawning Gravel Water Quality

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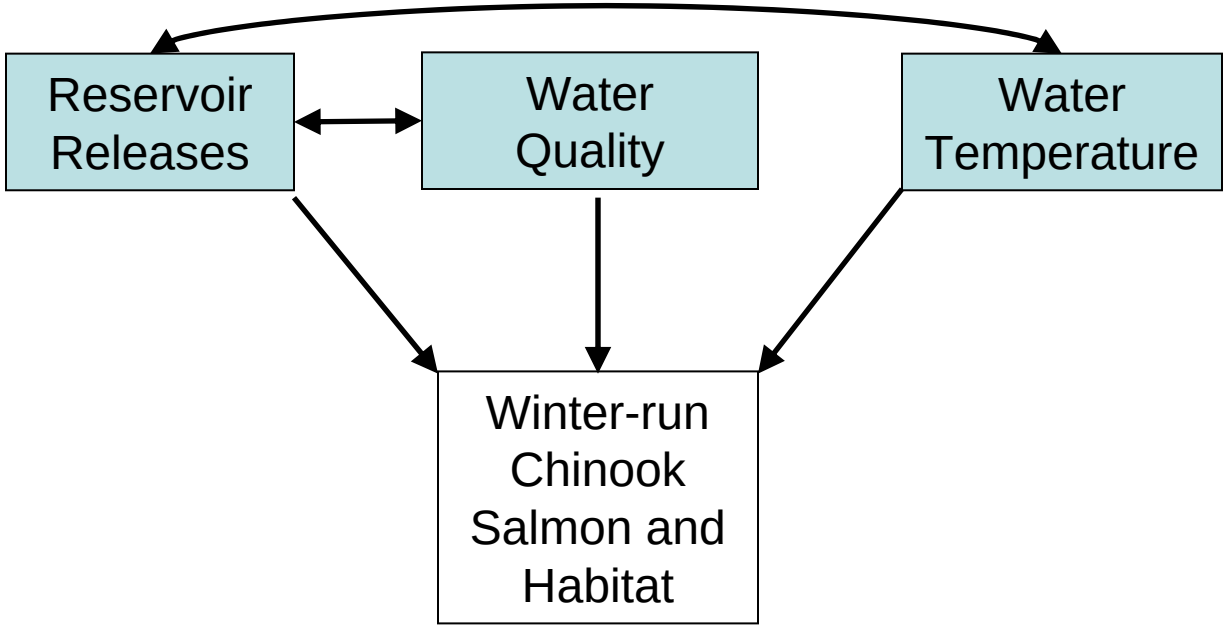
Potential Physical, Chemical, and Biotic Stressors



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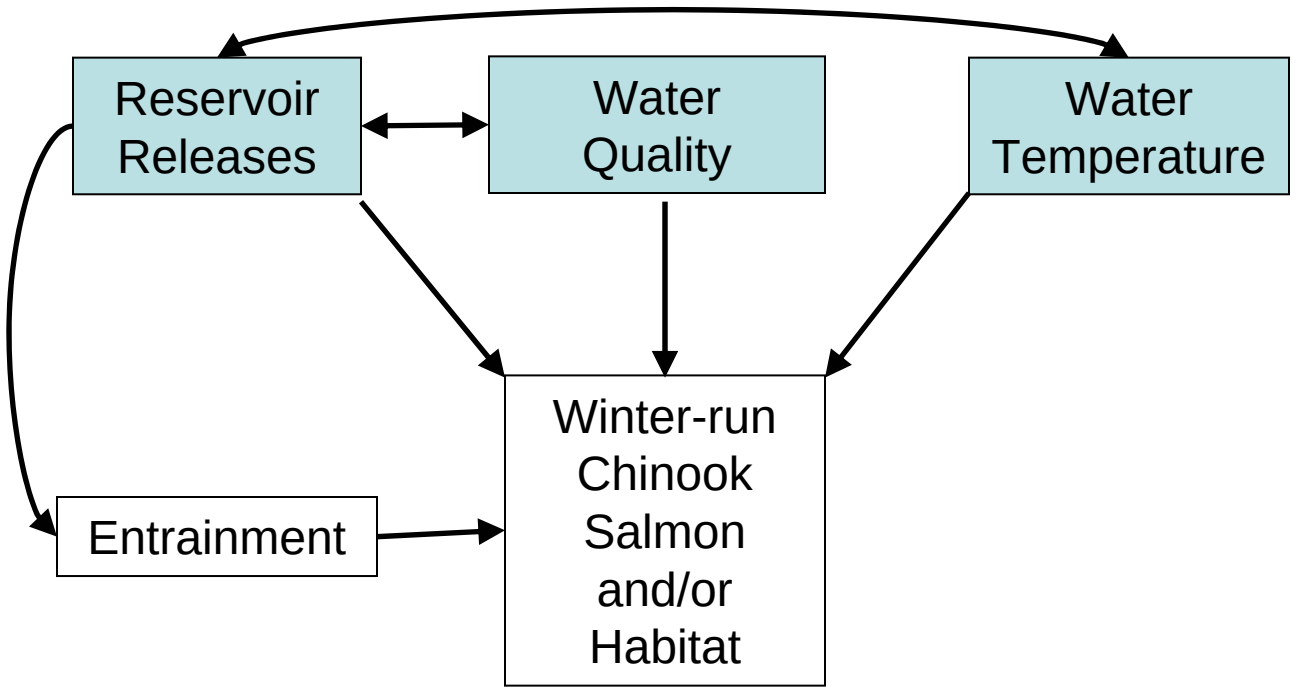

Stressors Affecting Fish and Habitat

Stressors Affecting Fish

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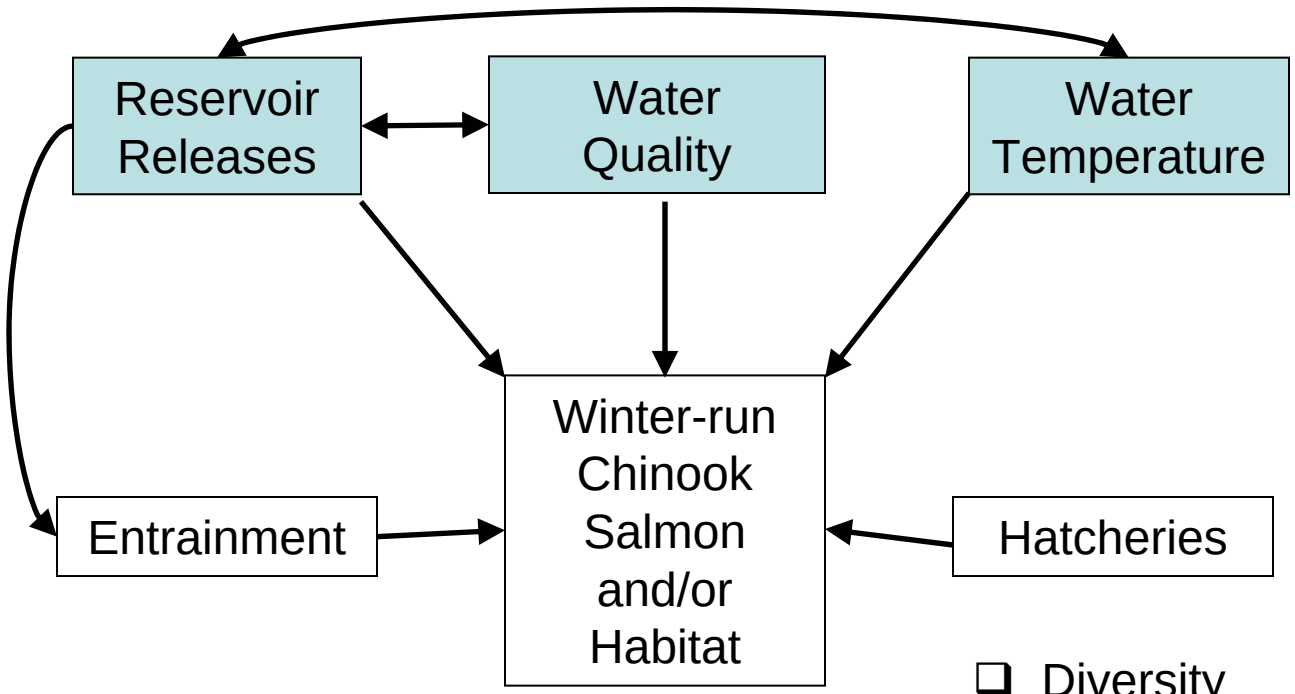

- ❑ Diversity
- ❑ Competition
- ❑ Predation

Stressors Affecting Fish and Habitat

Stressors Affecting Fish

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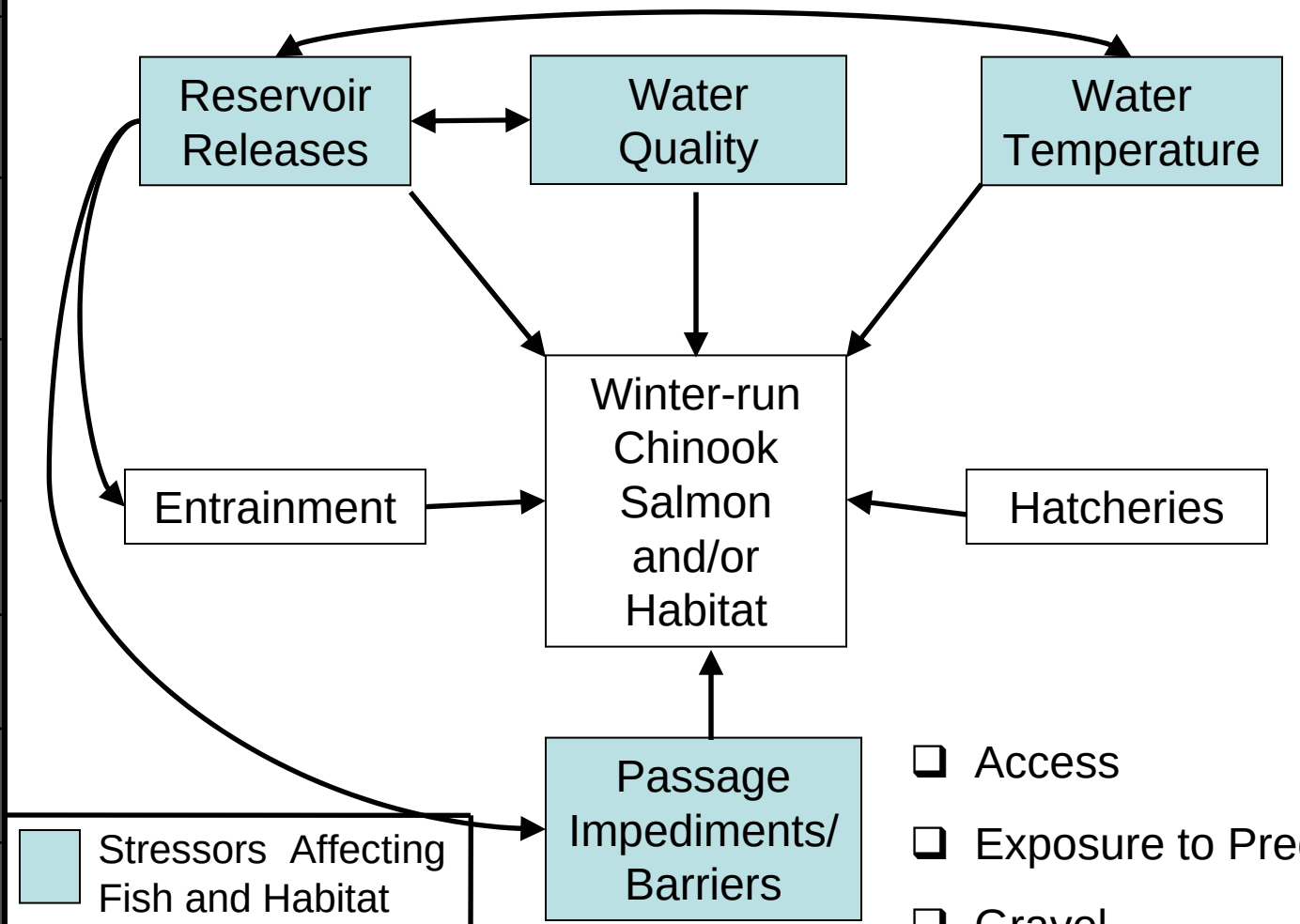
Potential Physical, Chemical, and Biotic Stressors



- ❑ Access
- ❑ Exposure to Predators
- ❑ Gravel
- ❑ Food Resources

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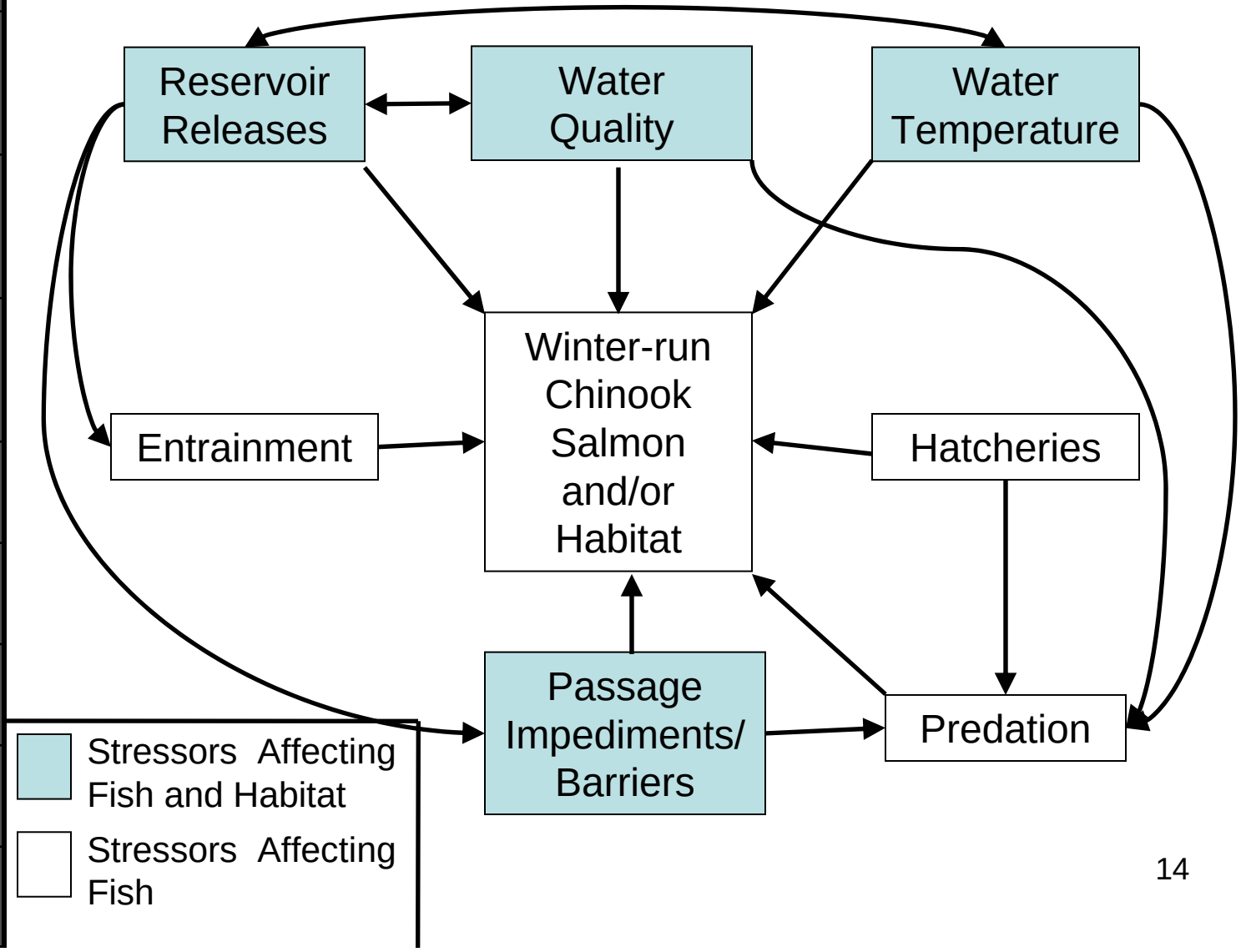

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Make Determinations

Exposure: Co-occurrence between listed resources (fish or habitat) and the direct or indirect physical, chemical, and biotic effects of an Action

- ❑ How many individuals are likely to be exposed
- ❑ Which populations those individuals represent
- ❑ The specific stressors associated with the exposure
- ❑ Where the exposure is likely to occur
- ❑ When the exposure is likely to occur
- ❑ Nature of stressor (direct, indirect, or synergistic with other stressors)

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PROJECT	DIVISION	"ACTIONS"
CVP	Trinity River	
	Shasta	
	Sacramento River	
	American River	
	Eastside	
	Delta	
	Friant	
	West San Joaquin	
	San Felipe	
	Other	

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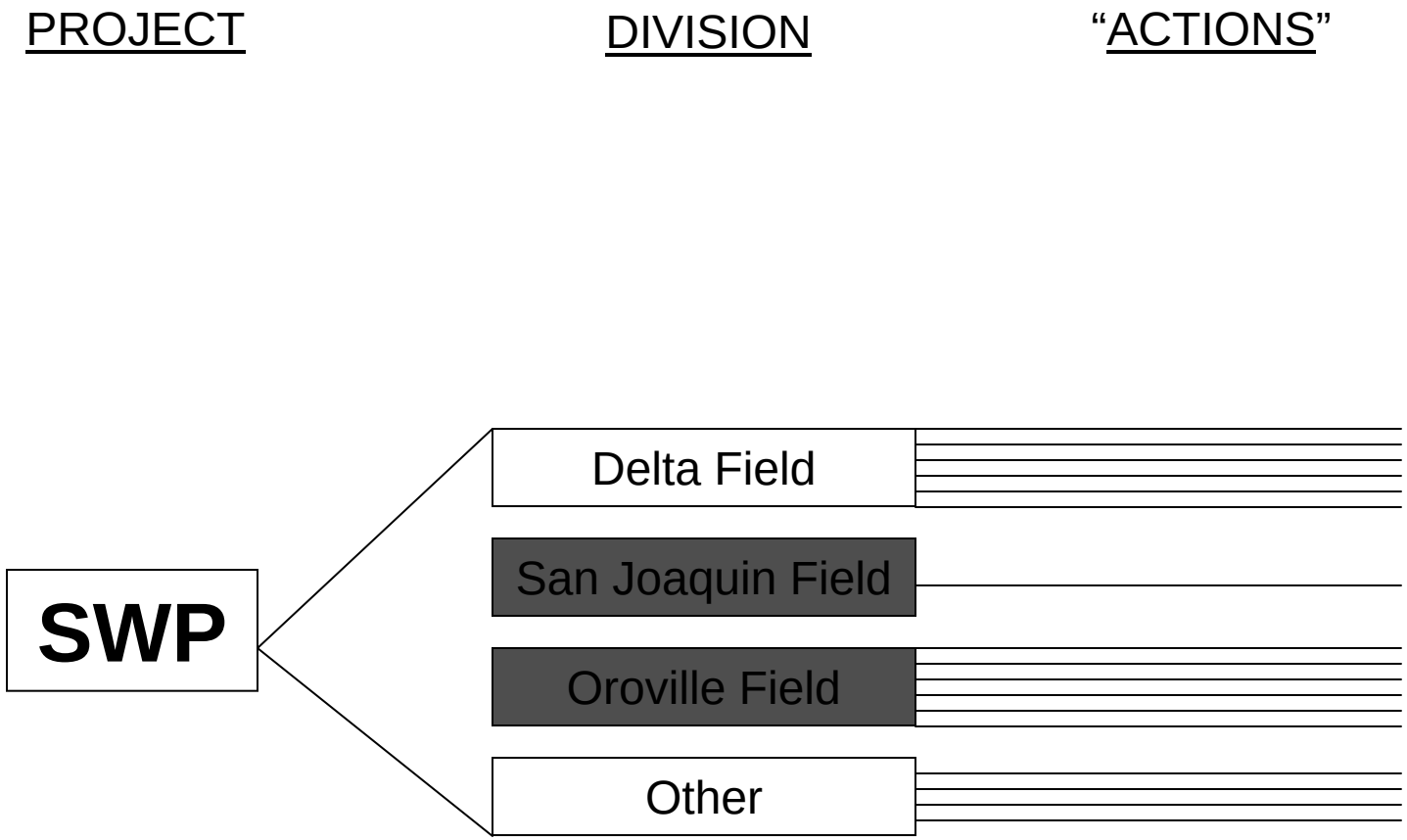

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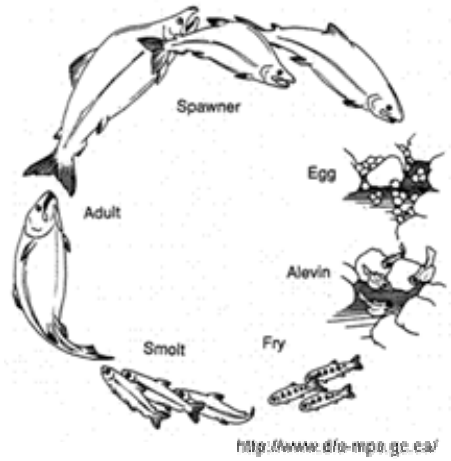
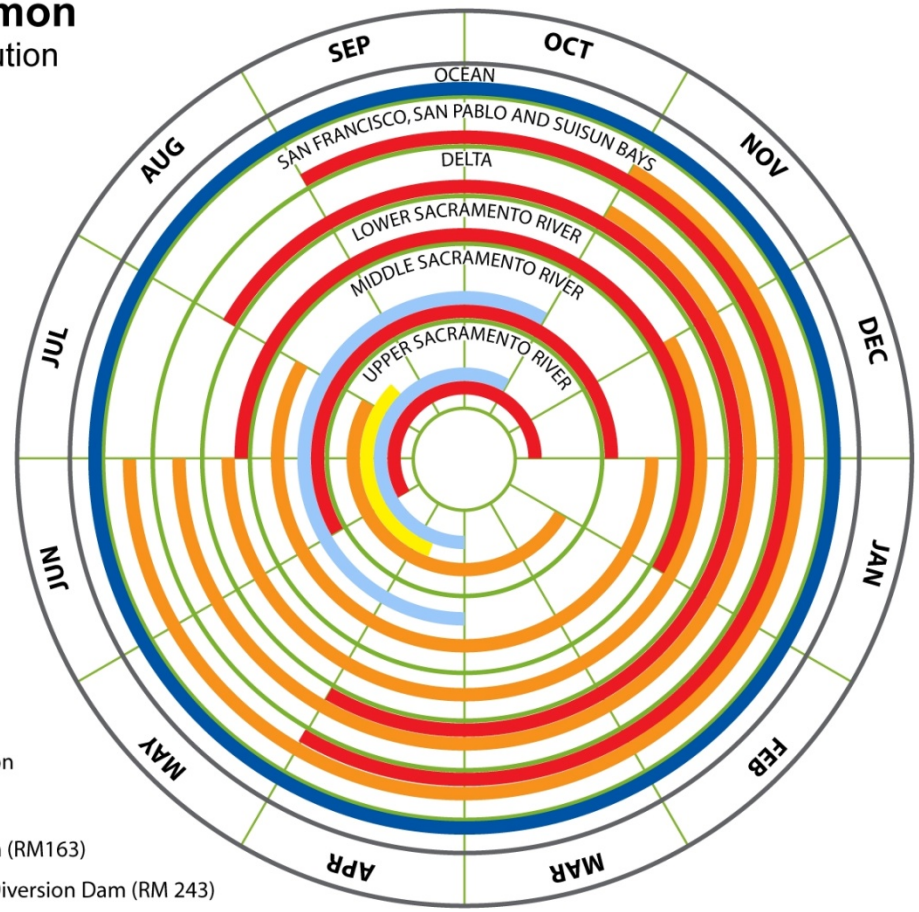
Winter-Run Chinook Salmon

Geographic and Temporal Distribution





- Sub-Adults and Adults
- Adult Immigration and Staging
- Spawning
- Embryo Incubation
- Juvenile Rearing and Outmigration

Delta: Chipps Island to Sacramento (RM 59)

Lower Sacramento River: Sacramento to Princeton (RM163)

Middle Sacramento River: Princeton to Red Bluff Diversion Dam (RM 243)

Upper Sacramento River: Red Bluff Diversion Dam to Keswick Dam (RM 302)

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Make Determinations

Life Stage	Location	Temporal Consideration	Stressor
Adult Immigration and Holding	Delta (Chipps Island to Sacramento)	November – June	Water Temperature
Adult Immigration and Holding	Delta (Chipps to Sacramento)	November – June	Passage Impediments/Bar-riers (DCC)
Adult Immigration and Holding	Lower Sacramento River (Sacramento to Princeton)	December – June	Water Temperature
Adult Immigration and Holding	Lower Sacramento River (Sacramento to Princeton)	December – June	Passage Impediments/Bar-riers (SDWSC)
Adult Immigration and Holding	Middle Sacramento River (Princeton to RBDD)	January – July	Water Temperature
Adult Immigration and Holding	Middle Sacramento River (Princeton to RBDD)	January – July	Passage Impediments/Bar-riers

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Life Stage	Location	Temporal Consideration	Stressor	Response Analysis Method
Adult Immigration and Holding	Delta (Chipps Island to Sacramento)	November – June	Water Temperature	Literature-based Analysis of Modeled and Actual Temps.
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Adult Immigration and Holding	Middle Sacramento River (Princeton to RBDD)	January – July	Passage Impediments/Bar-riers	Qualitative

Effects

Make Determinations

Literature-based Analysis of Actual Water Temperatures

- Assumption
  - Near- and long-term[1] water temperatures with implementation of the CVP/SWP will likely be similar to, or warmer than, previous water temperatures

- Data describing the thermal regime of the Sacramento River and Delta, **including diurnal variability**, is available at http://cdec.water.ca.gov/

[1]Long-term water temperature conditions will be affected by several factors including climate change, increased water demand, increased storage, and water temperature management.

Identify the "Action"

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Literature-based Analysis of Actual Water Temperatures

Bay-Delta Modeling Forum

Technical Publication 01-1

Temperature Effects on Chinook Salmon and Steelhead: a Review Focusing on California's Central Valley Populations

Christopher A. Myrick[1]
Joseph J. Cech, Jr.[2]

http://www.cwemf.org/Pubs/TempReview.pdf

EPA

Issue Paper 5

Summary of Technical Literature Examining the Physiological Effects of Temperature on Salmonids

Prepared as Part of EPA Region 10 Temperature Water Quality Criteria Guidance Development Project

Dale McCullough, Columbia River Intertribal Fish Commission

Shelley Spalding, U.S. Fish and Wildlife Service

Debra Sturdevant, Oregon Department of Environmental Quality

Mark Hicks, Washington Department of Ecology

http://yosemite.epa.gov/r10/water.nsf/

Assess the Risk to "Species"

Assess Cumulative Effects

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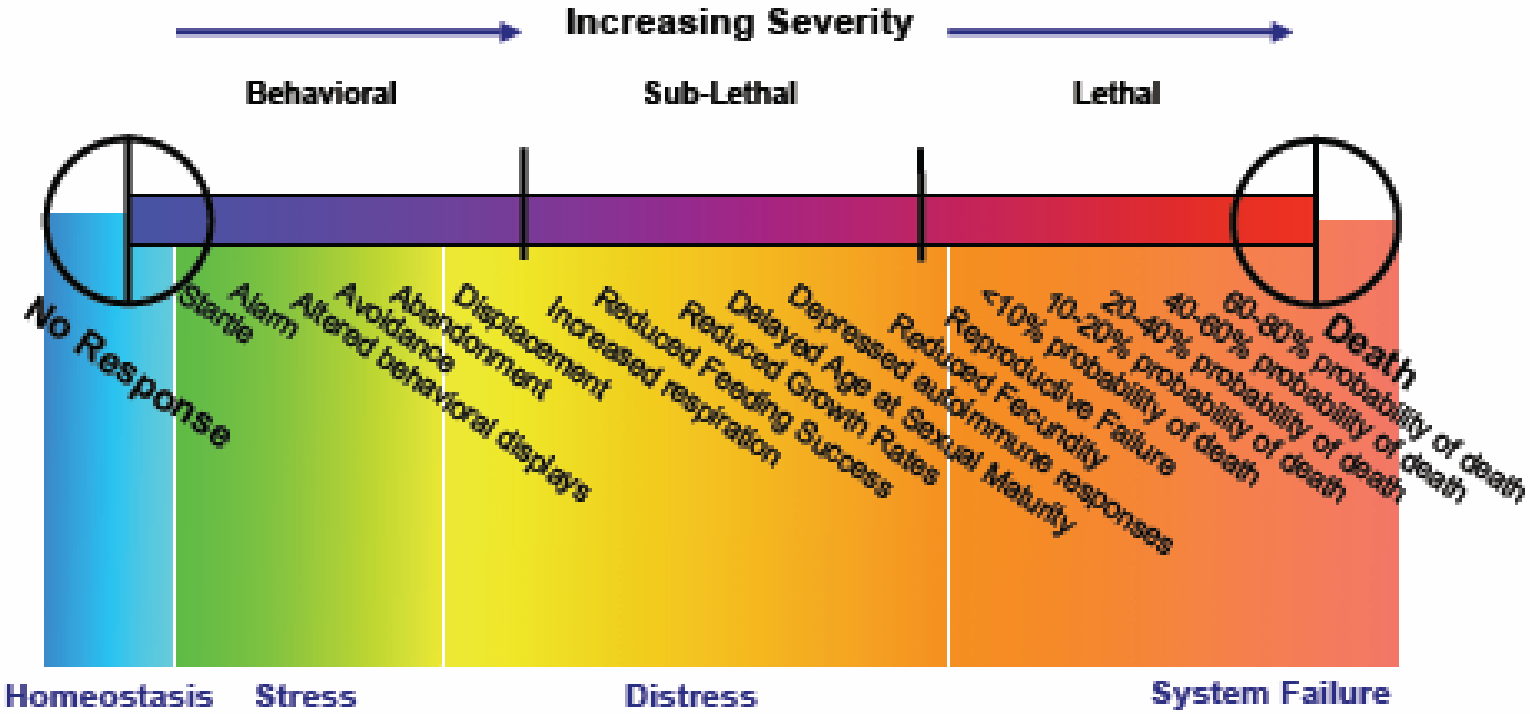

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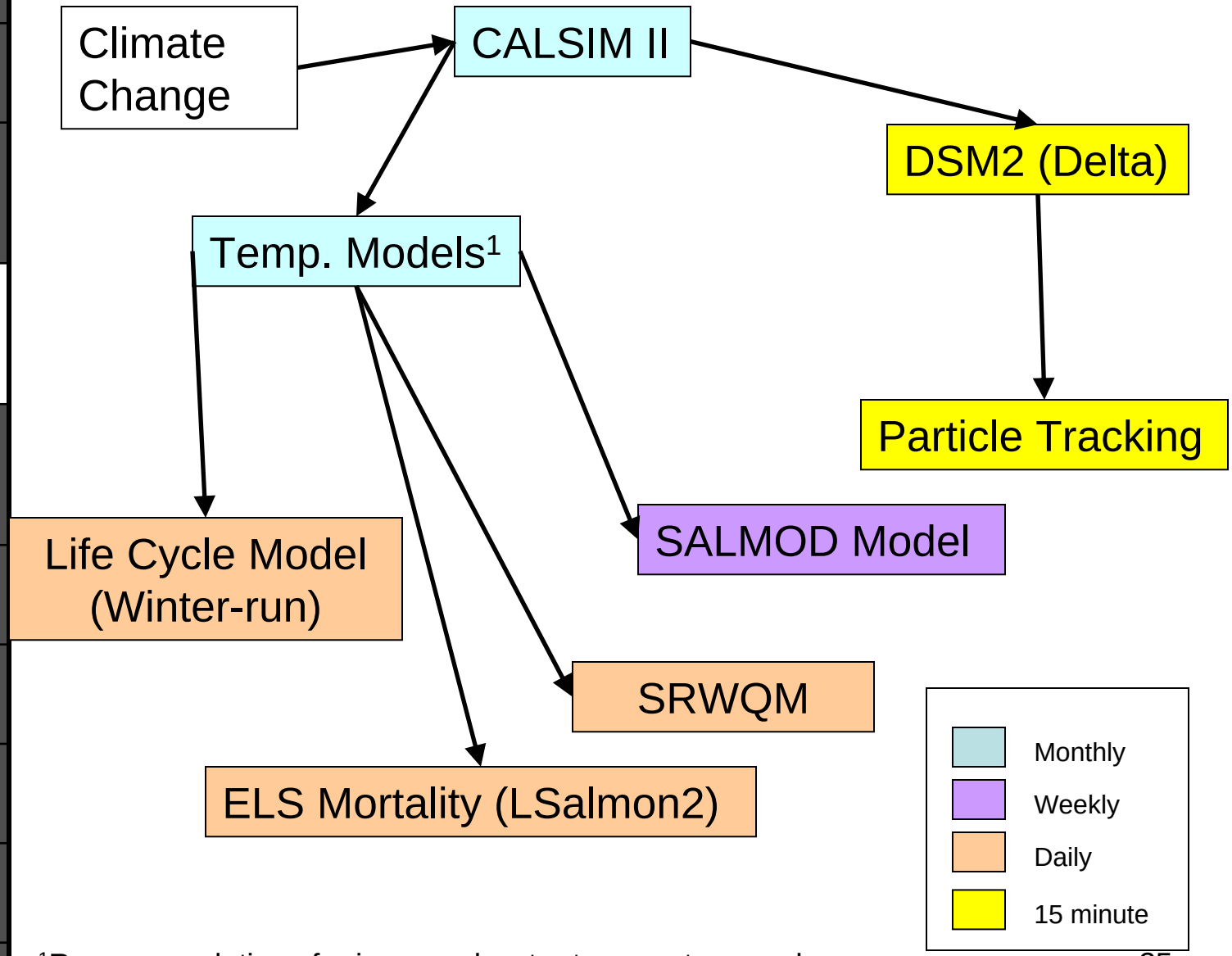
Quantitative Analytical Tools



[1]Recommendations for improved water temperature analyses were developed at a CALFED Workshop held on April 1, 2008.

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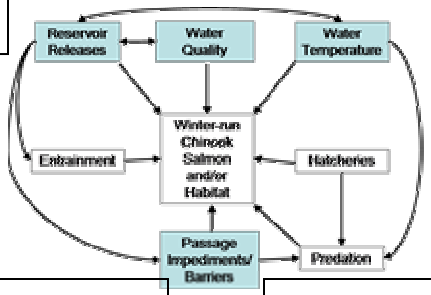
	Past	Present	Future
Exogenous Stress Regime	Mining Striped bass	 Levees POD Climate Change-Ocean	
	Natural Stress Regime (WT, Ocean, Predators, etc)		
Demographic Response	Dramatic Reductions in: ❑ Abundance ❑ Productivity ❑ Spatial Structure ❑ Diversity	Further Reductions in: ❑ Abundance ❑ Productivity ❑ Spatial Structure ❑ Diversity	?

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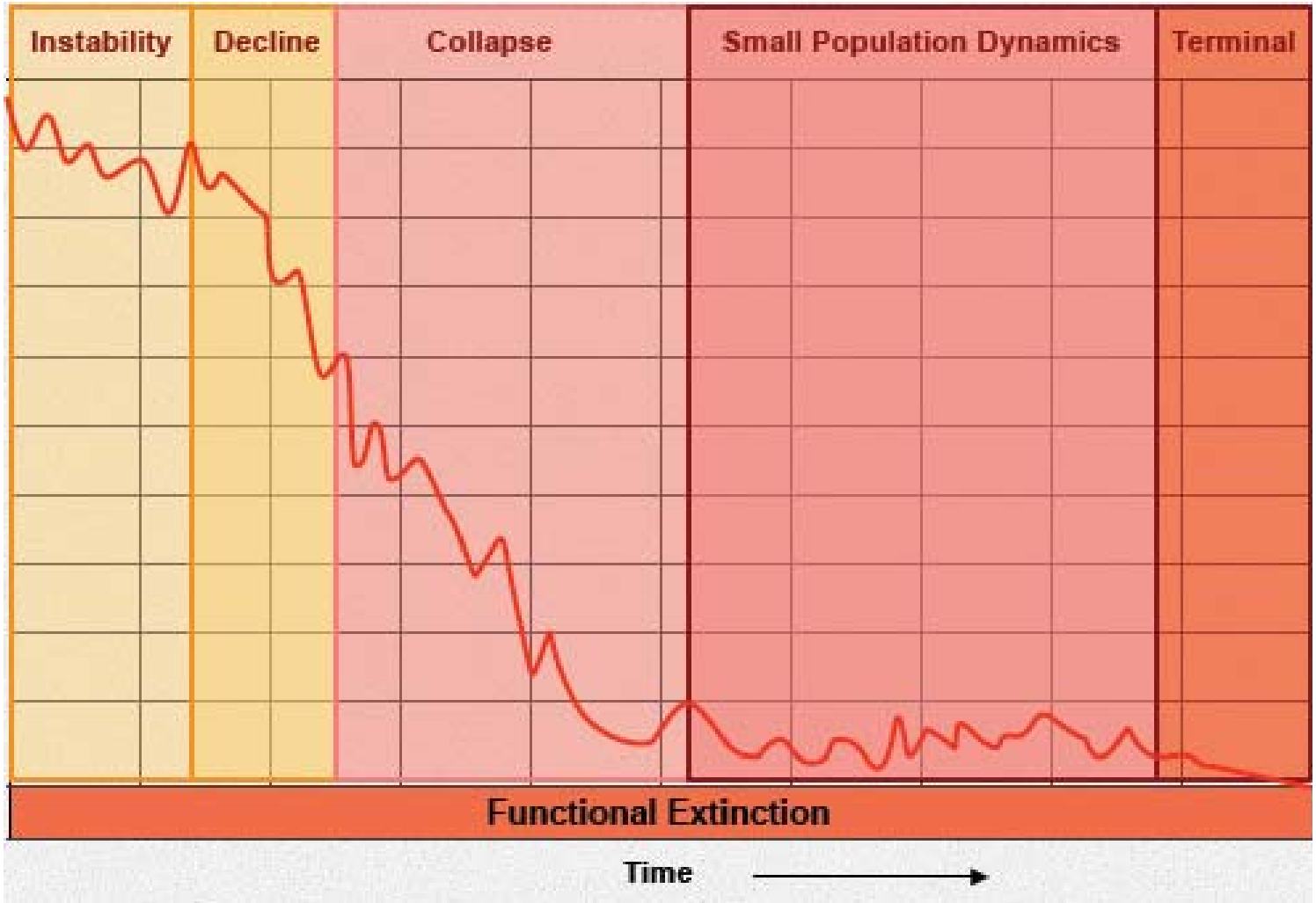
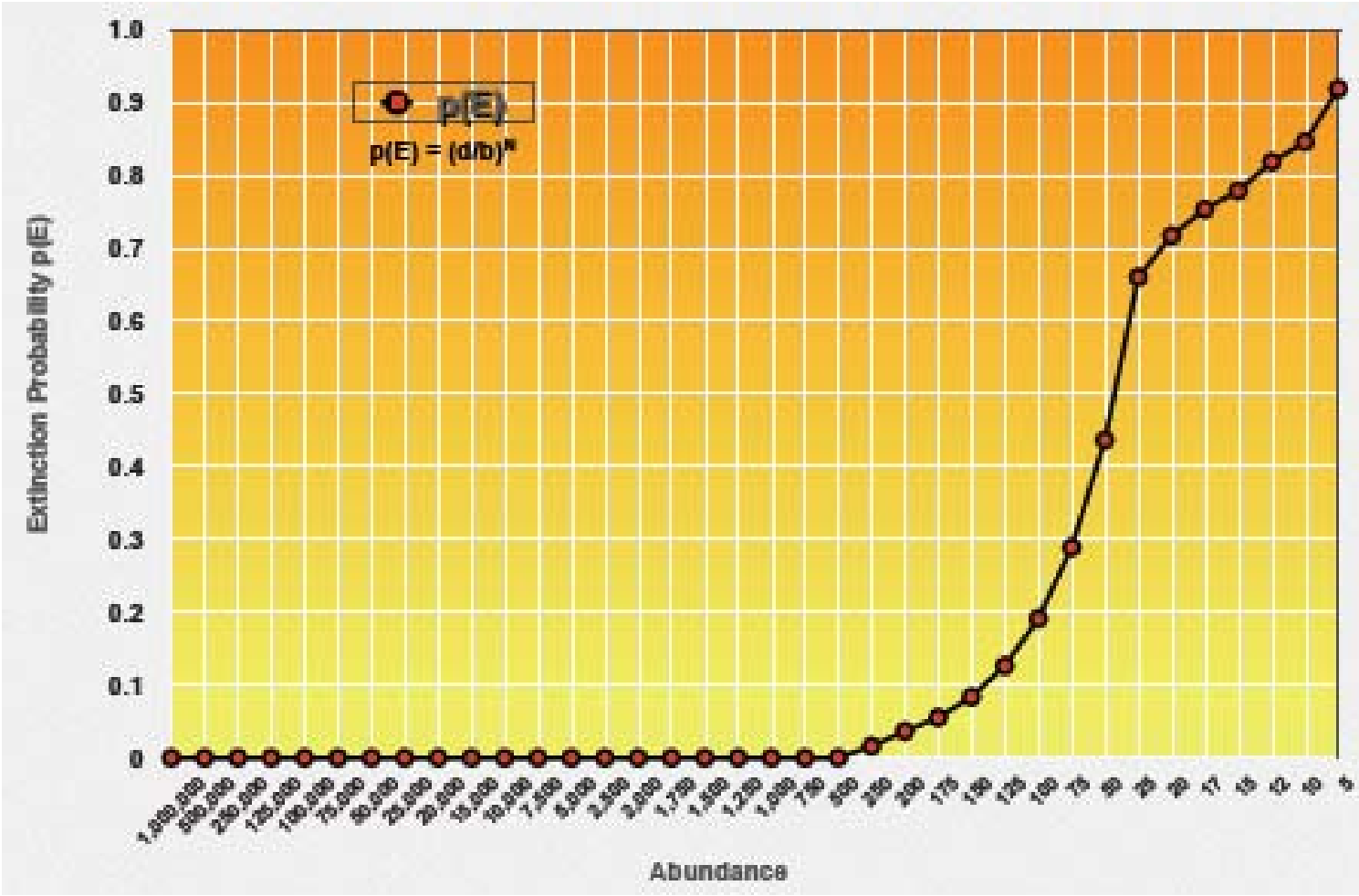


Demographic Stochasticity, Population Size, and Extinction Probability



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FEBRUARY 2007

SAN FRANCISCO ESTUARY & WATERSHED SCIENCE

Framework for Assessing Viability of Threatened and Endangered Chinook Salmon and Steelhead in the Sacramento-San Joaquin Basin

Steven T. Lindley*, National Oceanic and Atmospheric Administration
Robert S. Schick, National Oceanic and Atmospheric Administration
Ethan Mora, University of California, Santa Cruz
Peter B. Adams, National Oceanic and Atmospheric Administration
James J. Anderson, University of Washington
Sheila Greene, California Department of Water Resources
Charles Hanson, Hanson Environmental, Inc.
Bernard P. May, University of California, Davis
Dennis R. McEwan, California Department of Fish and Game
R. Bruce MacFarlane, National Oceanic and Atmospheric Administration
Christina Swanson, The Bay Institute
John G. Williams, Independent consultant
*Corresponding author: stevelindley@noaa.gov

ABSTRACT

Protected evolutionarily significant units (ESUs) of salmonids require objective and measurable criteria for guiding their recovery. In this report, we develop a method for assessing population viability and two ways to integrate these population-level assessments into an assessment of ESU viability. Population viability is assessed with quantitative extinction models or criteria relating to population size, population growth rate, the occurrence of catastrophic declines, and the degree of hatchery influence. ESU viability is assessed by examining the number and distribution of viable populations across the landscape and their proximity to sources of catastrophic disturbance.

Central Valley spring-run and winter-run Chinook salmon ESUs are not currently viable, according to the criteria-based assessment. In both ESUs, extant populations may be at low risk of extinction, but these populations represent a small portion of the historical ESUs, and are vulnerable to catastrophic disturbance. The winter-run Chinook salmon ESU, in the extreme case, is represented by a single population that spawns outside of its historical spawning range. We are unable to assess the status of the Central Valley

Identify the "Action"

Deconstruct the "Action"

Assess the Risk to Individuals

Life Stage	Location	Temporal Consideration	Stressor	Response Analysis Method	Response	Probable Fitness Reduction (Risk to Individuals)
Adult Immigration and Holding	Delta (Chipps Island to Sacramento)	November – June	Water Temperature	Literature-based Analysis of Modeled and Actual Temps.	No Response, Behavioral, Sub-Lethal, or Lethal?	Yes or No?
Adult Immigration and Holding	Delta (Chipps to Sacramento)	November – June	Passage Impediments/Barriers (DCC)	Qualitative		
Adult Immigration and Holding	Lower Sacramento River (Sacramento to Princeton)	December – June	Water Temperature	Literature-based Analysis of Modeled and Actual Temps.		
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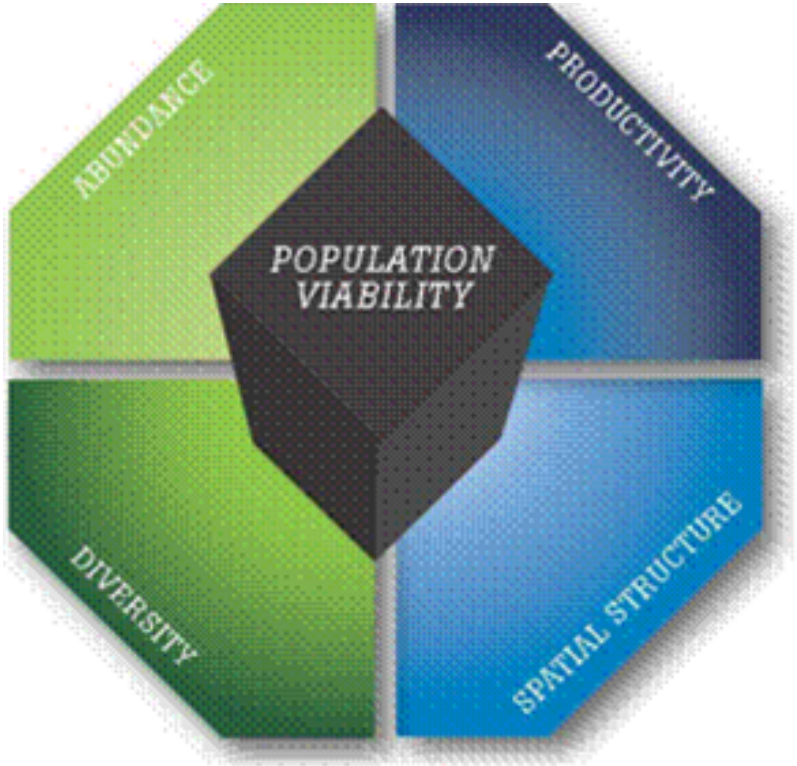
Assess Cumulative Effects

Make Determinations

Fitness: Changes in an individual's growth, survival, or reproductive success

Assess the Risk to Populations

Viable Salmonid Populations (VSP)



McElhany *et al.* 2000 NOAA Tech Memo NWFSC-42

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Life Stage	Location	Temporal Consideration	Stressor	Response Analysis Method	Response	Probable Fitness Reduction (Risk to Individuals)	VSP Parameters Affected (Risk to Populations)
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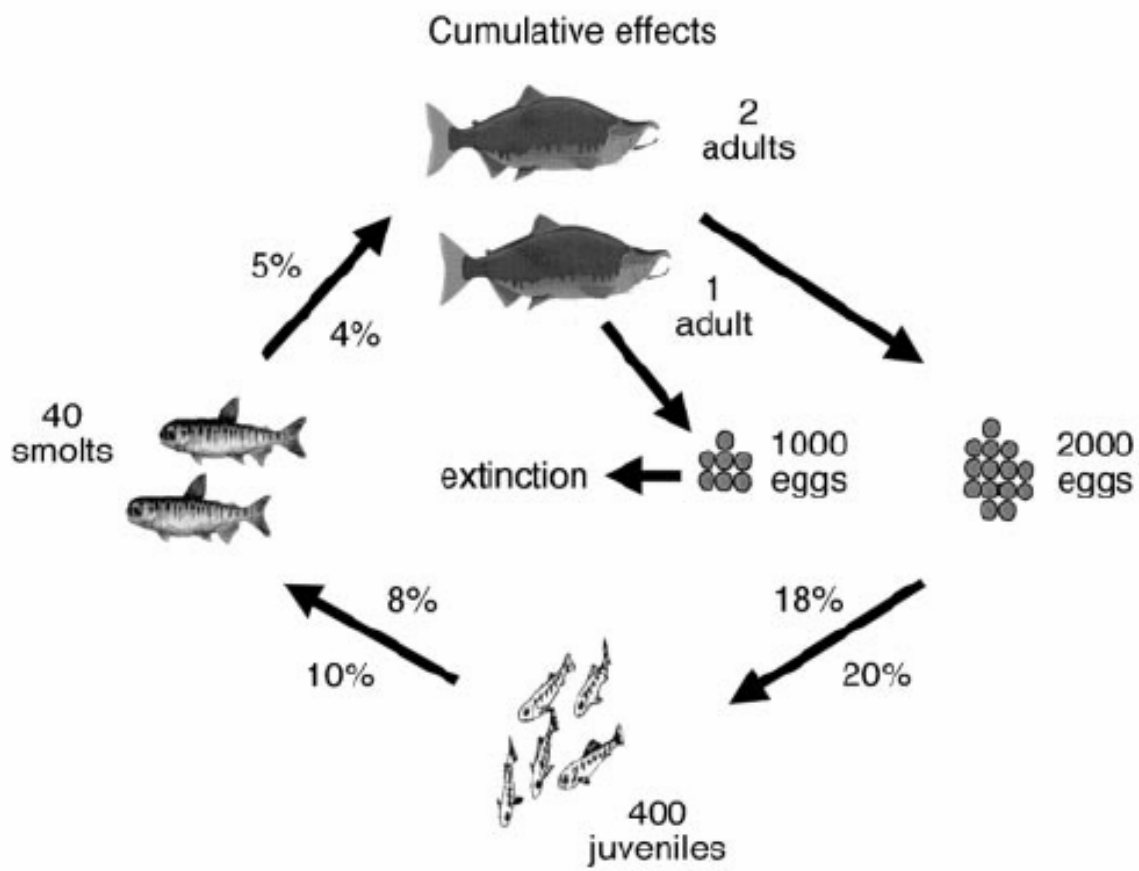
- Assess Cumulative Effects
- Make Determinations



Naiman and Turner. 2000. Ecol Appl 10(4): 958-970.

Assessing whether potential changes in fitness at individual life stages, will constitute a population-level effect will be based on the weight of evidence for the entire life cycle.

- ❑ Qualitative
- ❑ Quantitative
- ❑ Uncertainty

Identify the "Action"

Deconstruct the "Action"

Identify the "Action" Area

Assess the "Species" Exposure

Assess the "Species" Response

Environmental Baseline/Species Status

Assess the Risk to Individuals

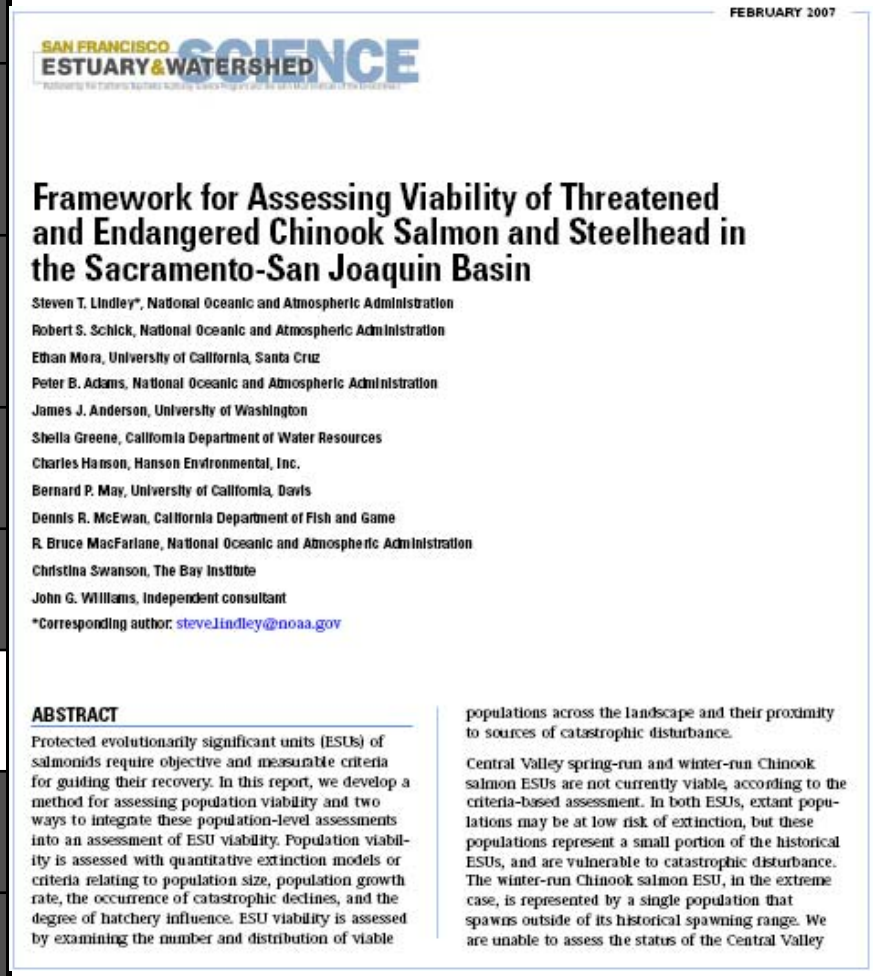
Assess the Risk to Populations

Assess the Risk to "Species"

Assess Cumulative Effects

Make Determinations

Section 7 of the ESA requires BOs to present a conclusion as to whether it is reasonable to expect the proposed action is not likely to appreciably reduce the species' likelihood of both **surviving and recovering** in the wild…



FEBRUARY 2007

SAN FRANCISCO ESTUARY&WATERSHED SCIENCE

Framework for Assessing Viability of Threatened and Endangered Chinook Salmon and Steelhead in the Sacramento-San Joaquin Basin

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ABSTRACT

Protected evolutionarily significant units (ESUs) of salmonids require objective and measurable criteria for guiding their recovery. In this report, we develop a method for assessing population viability and two ways to integrate these population-level assessments into an assessment of ESU viability. Population viability is assessed with quantitative extinction models or criteria relating to population size, population growth rate, the occurrence of catastrophic declines, and the degree of hatchery influence. ESU viability is assessed by examining the number and distribution of viable populations across the landscape and their proximity to sources of catastrophic disturbance.

Central Valley spring-run and winter-run Chinook salmon ESUs are not currently viable, according to the criteria-based assessment. In both ESUs, extant populations may be at low risk of extinction, but these populations represent a small portion of the historical ESUs, and are vulnerable to catastrophic disturbance. The winter-run Chinook salmon ESU, in the extreme case, is represented by a single population that spawns outside of its historical spawning range. We are unable to assess the status of the Central Valley

"…*every extant population be viewed as necessary for the recovery of the ESU*" (Lindley *et al*. 2007)

Identify the "Action"

Deconstruct the "Action"

Identify the "Action" Area

Assess the "Species" Exposure

Assess the "Species" Response

Environmental Baseline/Species Status

Assess the Risk to Individuals

Assess the Risk to Populations

Assess the Risk to "Species"

Assess Cumulative Effects

Make Determinations

Climate Change

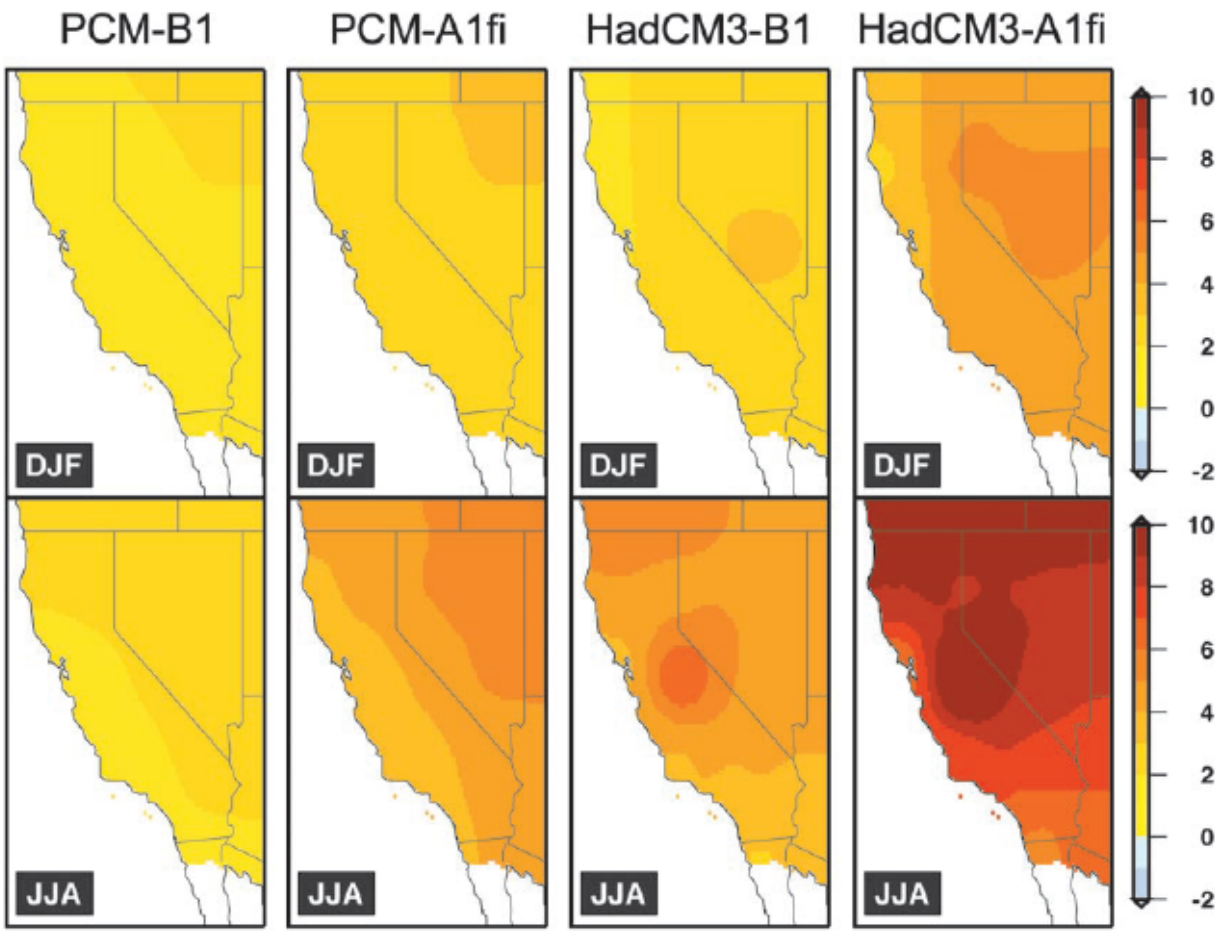

Fig. 1. Downscaled winter (DJF) and summer (JJA) temperature change (°C) for 2070–2099, relative to 1961–1990 for a 1/8° grid. Statewide, SRES B1 to A1fi winter temperature projections for the end of the century are 2.2–3°C and 2.3–4°C for PCM and HadCM3, respectively, compared with previous projections of 1.2–2.5°C and 3–3.5°C for PCM and HadCM2, respectively. End-of-century B1 to A1fi summer temperature projections are 2.2–4°C and 4.6–8.3°C for PCM and HadCM3, respectively, compared with previous projections of 1.3–3°C and 3–4°C for PCM and HadCM2, respectively (11–14).

Hayhoe, K., D. Cayan, C. B. Field, P. C. Frumhoff, E. P. Maurer, N. L. Miller, S. C. Moser, S. H. Schneider, K. N. Cahil, E. E. Cleland, L. Dale, R. Drapek, R. M. Hanemann, L. S. Kalkstein,
J. Lenihan, C. K. Lunch, R. P. Neilson, S. C. Sheridan, and J. H. Verville. 2004. Emissions pathways, climate change, and impacts on California. Proceedings of the National Academy of Sciences, USA **101**:12442--12427.

Make Determinations

Jeopardy Standard (ESA Section 7(a)(2))

…insure that any Federal action is not likely to, directly or indirectly, reduce appreciably the likelihood of both the survival and recovery of any endangered or threatened species in the wild…

Supporting a Determination

- ❑ Reasoning and evidence supporting the determination
- ❑ Addressing counter-arguments