Reintroduction of Salmon into their Historic Habitats (Two-Part Session)

A Concurrent Session at the 35th Annual Salmonid Restoration Conference held in Davis, CA from March 29 – April 1, 2017.

Session Overview

- Session Coordinators:
  - Curtis Knight, CalTrout
  - Rob Lusardi, Ph.D., CalTrout/UC Davis

Climate change, aging water infrastructure, successive years of drought, and increasing demand for water resources has precipitated strong declines in salmonids throughout California. Compounding this, longitudinal and lateral disconnections from historical spawning and rearing habitat has triggered a loss of salmonid life history diversity, making species less resilient to change. As a result, reintroductions of salmonids to historical habitat has occurred or is proposed as a recovery strategy. Dam removal, trap and haul above high head dams, reintroduction of captive bred animals, and improving lateral connectivity to historical floodplain habitat are proposed methods to improve salmonid life history diversity, abundance, population redundancy and, ultimately, resilience to change. We seek abstracts that examine the methods, science, and policy implications of salmonid reintroductions to historical habitat.

Presentations

Part 2 of Morning session

(Slide 4) Achieving Reintroduction through the Federal Power Act
Steve Edmondson, NMFS

NOAA FISHERIES

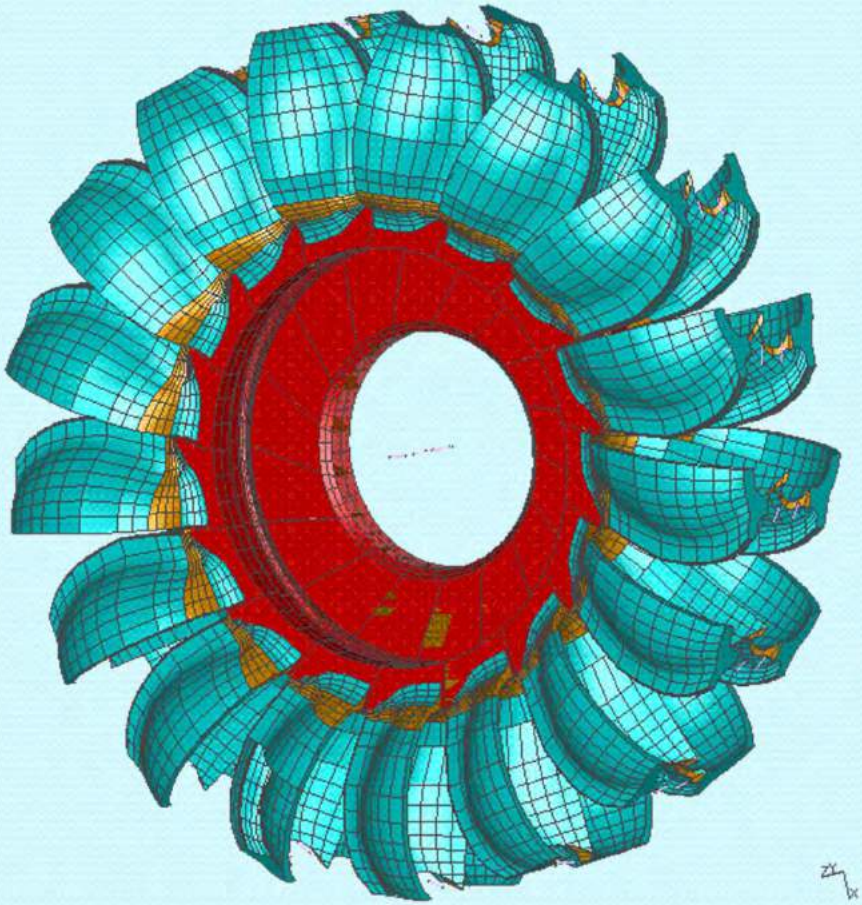
California
Central Valley
Office

Achieving Reintroduction through the Federal Power Act

Salmonid Restoration Federation
April 1, 2017, Davis, CA

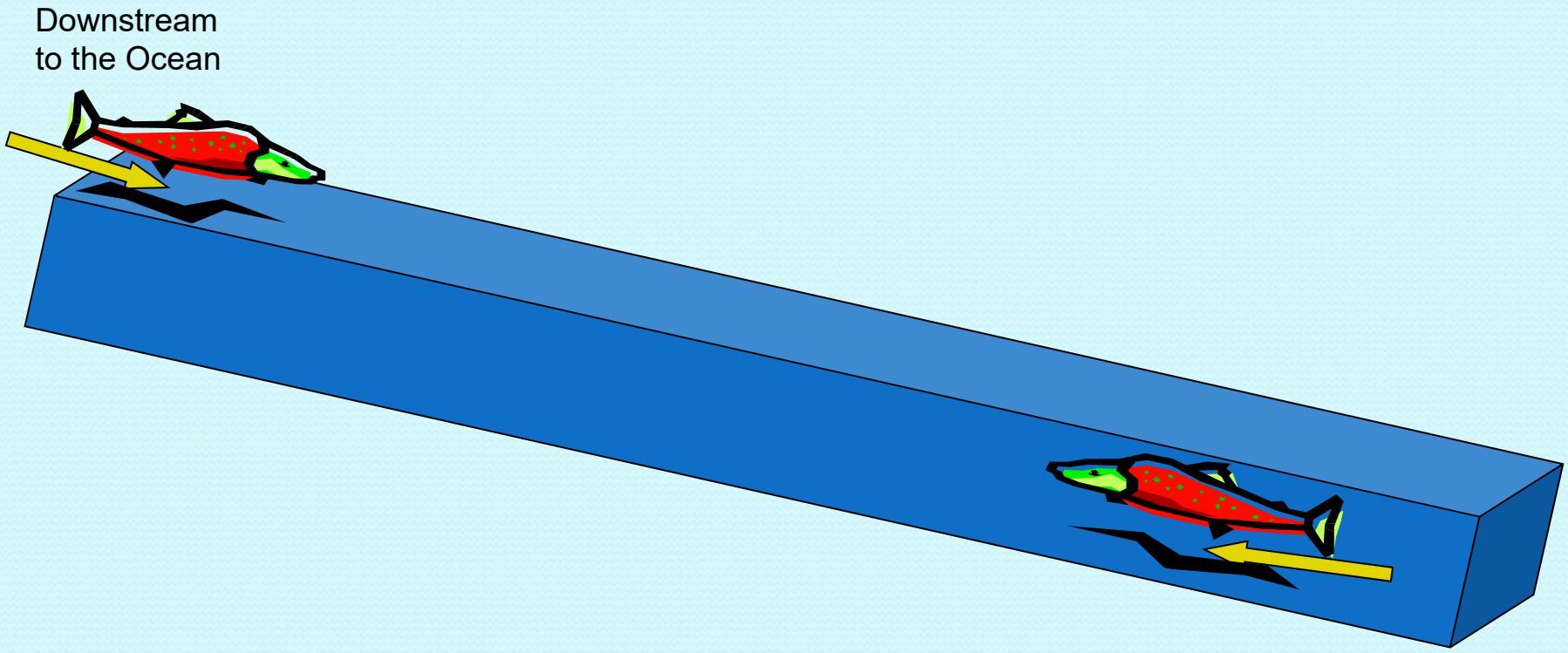
Steve Edmondson – NOAA/NMFS

Distracting Animation

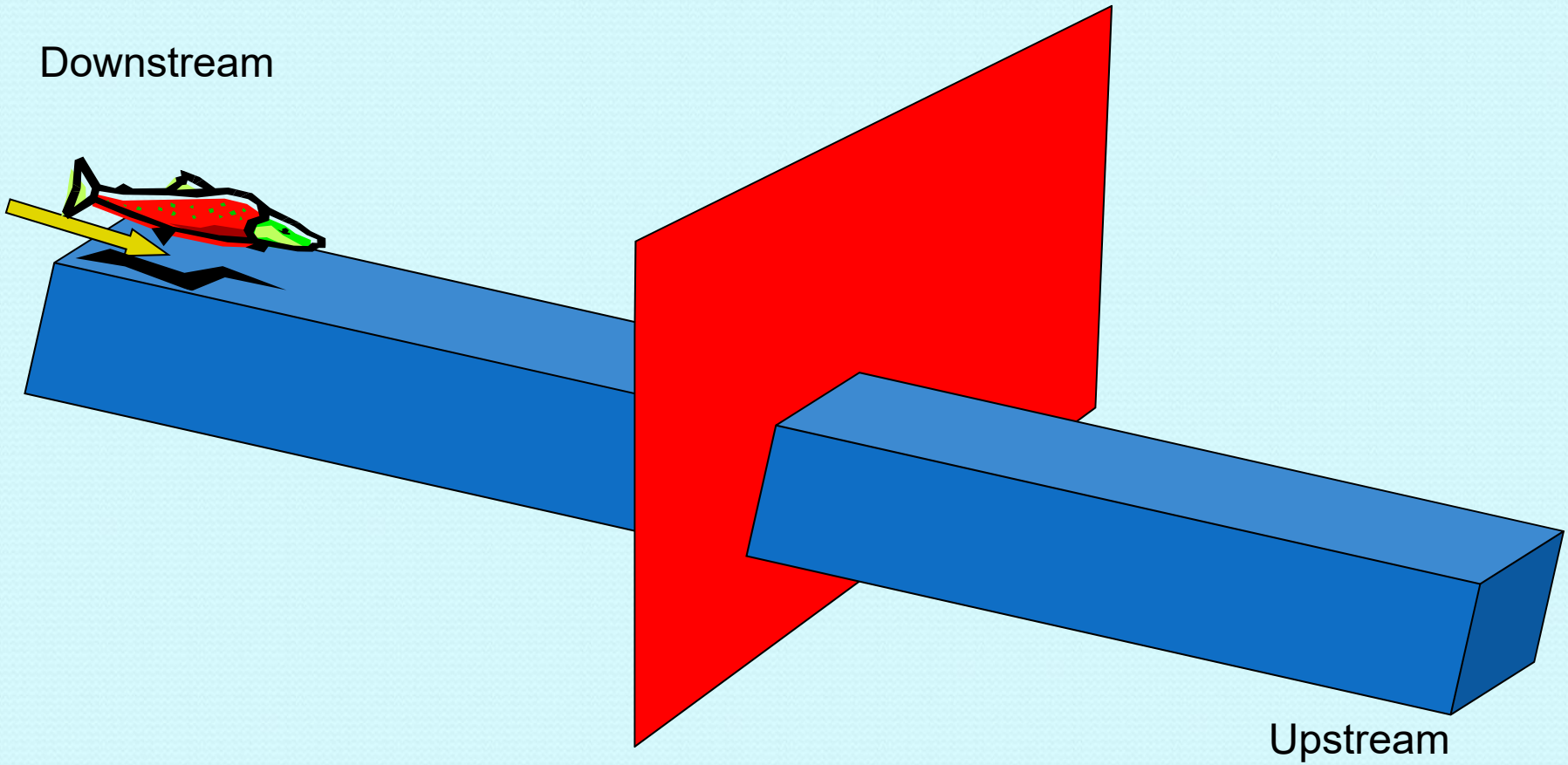


Salmon are Anadromous

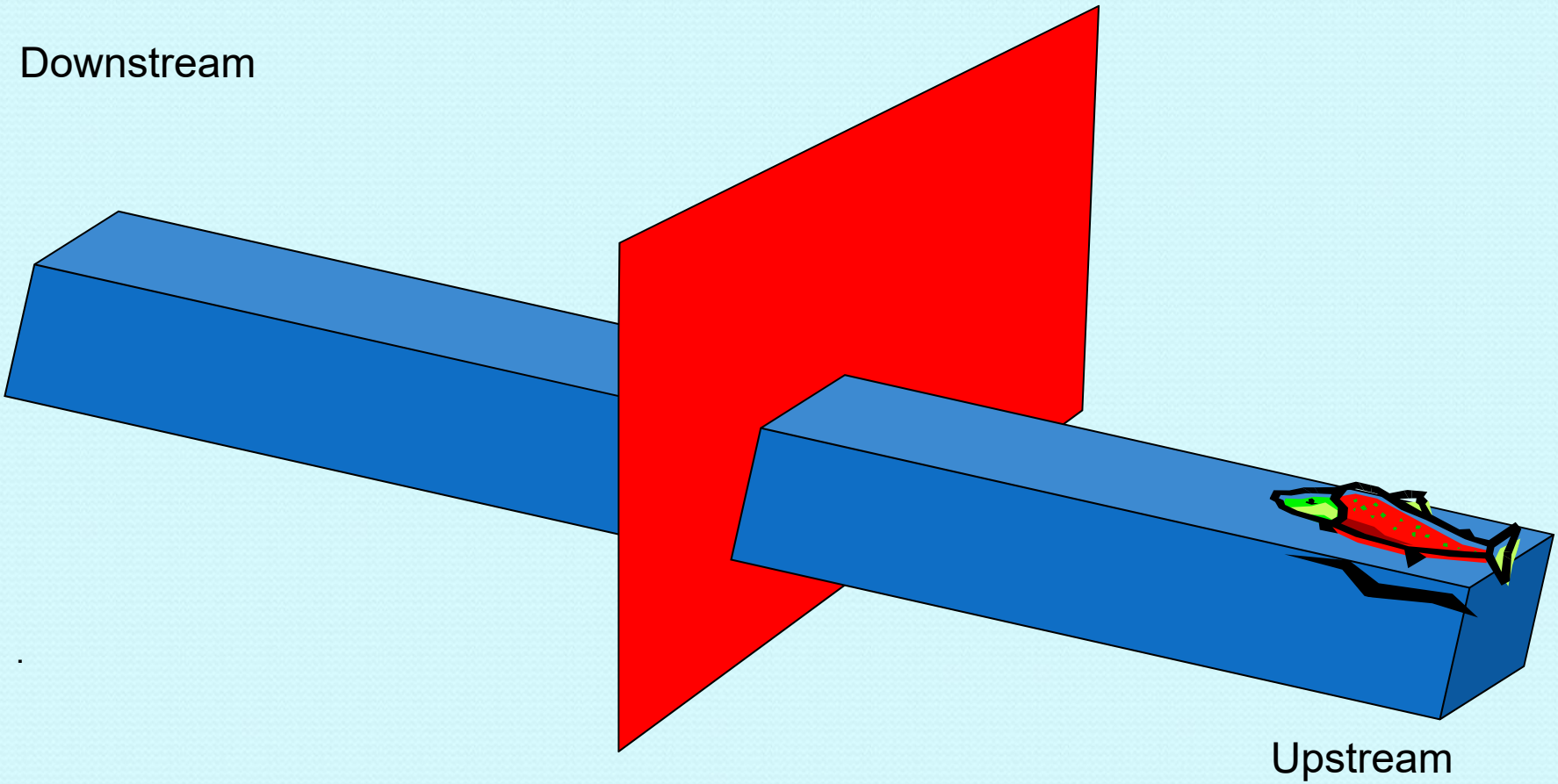
Those species of fish whose life cycle
involve migration between salt and fresh water.



What happens when salmon encounter dams???



What happens when salmon encounter dams???



.

How do get around a barrier?

-safe, timely and effective-

1. Removal (seasonal or permanent)
2. Stationary Passage Facility
3. Mobile Passage Facility

It all depends on the application

Historical Perspective

NOAA FISHERIES

- The history of fishways is rooted in the common law of ancient times.
- English common law: the right of fishery – held in the public trust.
- The fishery (industry of catching fish) provided a critical food source and an important source for commerce.

Lion Heart (Richard the First)

Embodied into the English code that for salmon passage there be "left in all weirs a gap of such size that a 3-year old pig might turn round in it without touching snout nor tail."

Looking Back

530-533

- The Digest of Justinian *Public Trust Doctorine*

1215

- Magna Carta ended Monarchy's ownership of fisheries and supported the "right of fishery."

1620- 1776

- Colonial period - Dam owners in the New World required to provide fishways

Looking Back

1776 -

- Independence - Enforcement of fishway requirement passed from sovereign to the States.

1915

- . Under California Fish and Game Code section 5937 (“5937”), “The owner of any dam shall allow sufficient water at all times to pass through a fishway, or in the absence of a fishway, allow sufficient water to pass over, around, or through the dam to keep in good condition any fish that may be planted or exist below the dam.”

1920

Federal Water Power Act in 1920

History of Non-federal Hydropower Regulation

- **Before passage of the Federal Water Power Act in 1920, developers needed a special act of Congress to build and operate a hydroelectric power plant on navigable streams, or federal lands.**
- **Congress had authorized construction of the first hydroelectric project in 1884.**
- **Demand for electric power suddenly increased during World War I.**
- **In 1920, Congress responded to this demand by enacting the Federal Water Power Act, which established the Federal Power Commission (FPC).**
- **The FPC was responsible for licensing non-federal hydroelectric power projects that affect navigable waters, occupy federal lands, use water or water power at a government dam, or affect the interests of interstate commerce.**

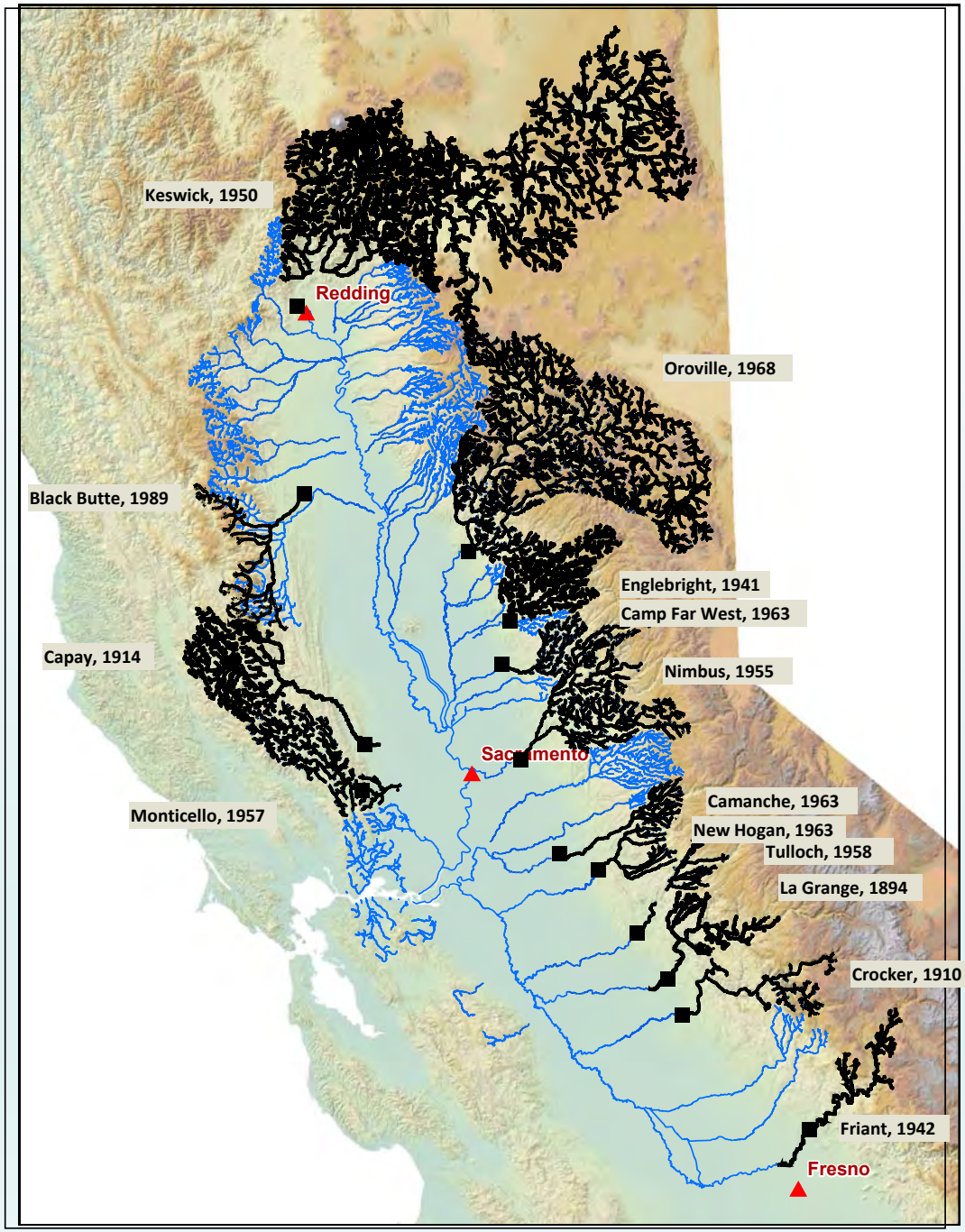
- **1935, Congress amended the Federal Water Power Act of 1920 as Part 1 of the Federal Power Act extending the FPC's authority to regulate interstate aspects of the electric power industry.**
- **1977, Congress abolishes the FPC and creates the Federal Energy Regulatory Commission (FERC). FERC's authority includes the licensing of non-federal hydroelectric power projects.**
- **1978, Public Utilities Regulatory Policies Act (PURPA), required public utilities to purchase power produced by qualifying facilities at the utilities avoided costs.**
- **1980, Energy Resource Act and Energy Security Act, provided financial and regulatory incentives that made small hydro attractive to entrepreneur developers.**

- **1986, Congress passed the Electrical Consumers Protection Act (ECPA), which amended the Federal Power Act:**
  - **required FERC to base its license conditions on the recommendations from federal and state fish & wildlife agencies, and to negotiate disagreements with agencies (10j).**
  - **requires equal consideration to environmental, recreation, fish and wildlife, and other non-power values.**
- **1992, Congress enacts the National Energy Policy Act**
  - **prohibits licensees from using eminent domain in parks, recreational areas or wildlife refuges.**
  - **provided for third party contracts for environmental documents.**
  - **recovery of agency costs incurred in licensing process.**

Most recently, Energy Policy Act of 2005 included review of mandatory conditions and filing alternatives

Central Valley Example

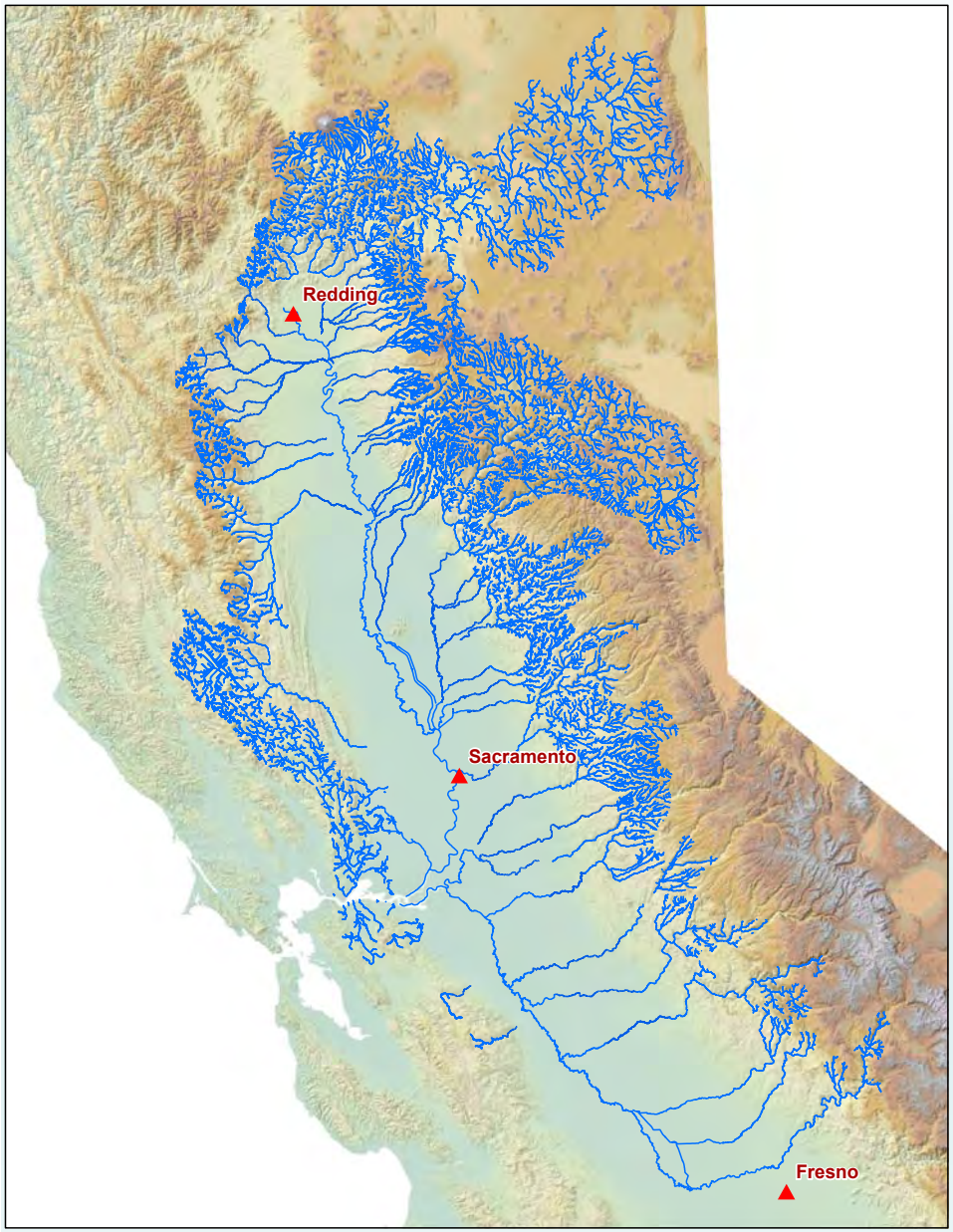
NOAA Fisheries
Habitat Conservation Div.
Santa Rosa Field Office
GIS Department
October 2009



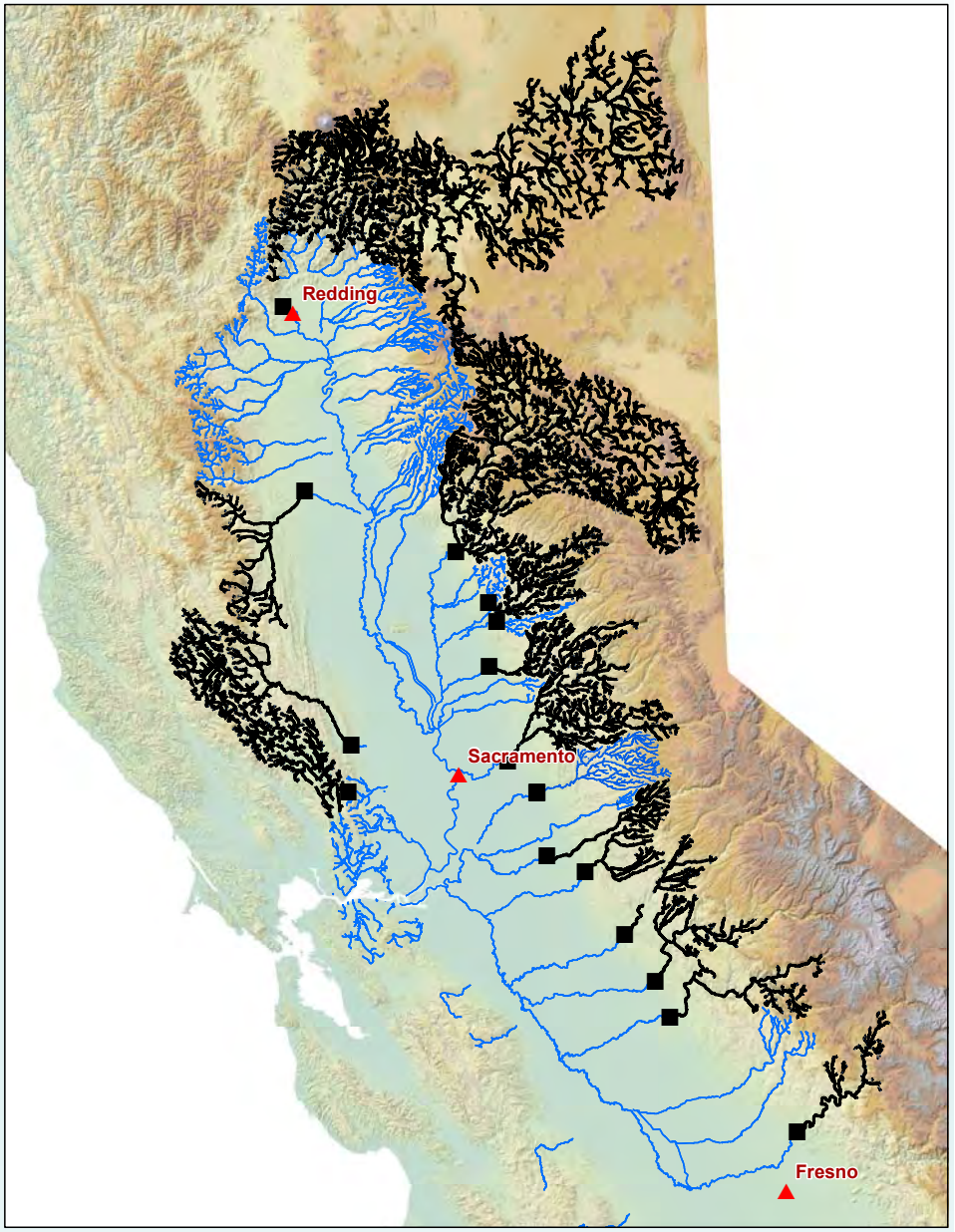
Source:
Lindley et al.: Historical population structure of Central Valley steelhead and its alteration by dams. SWFSC, 2007

Intrinsic Potential Model of Potentially suitable Historical Habitat

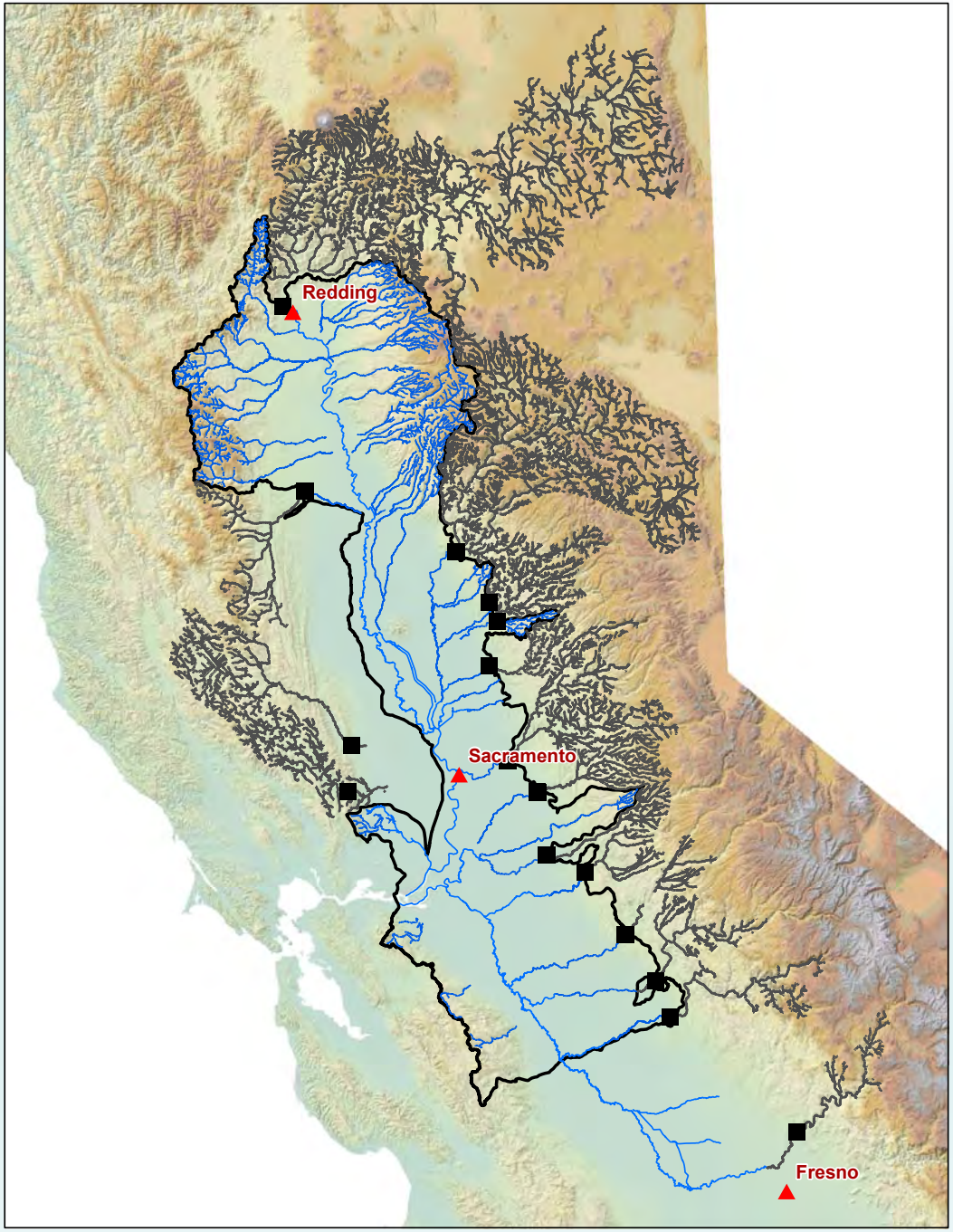
Then



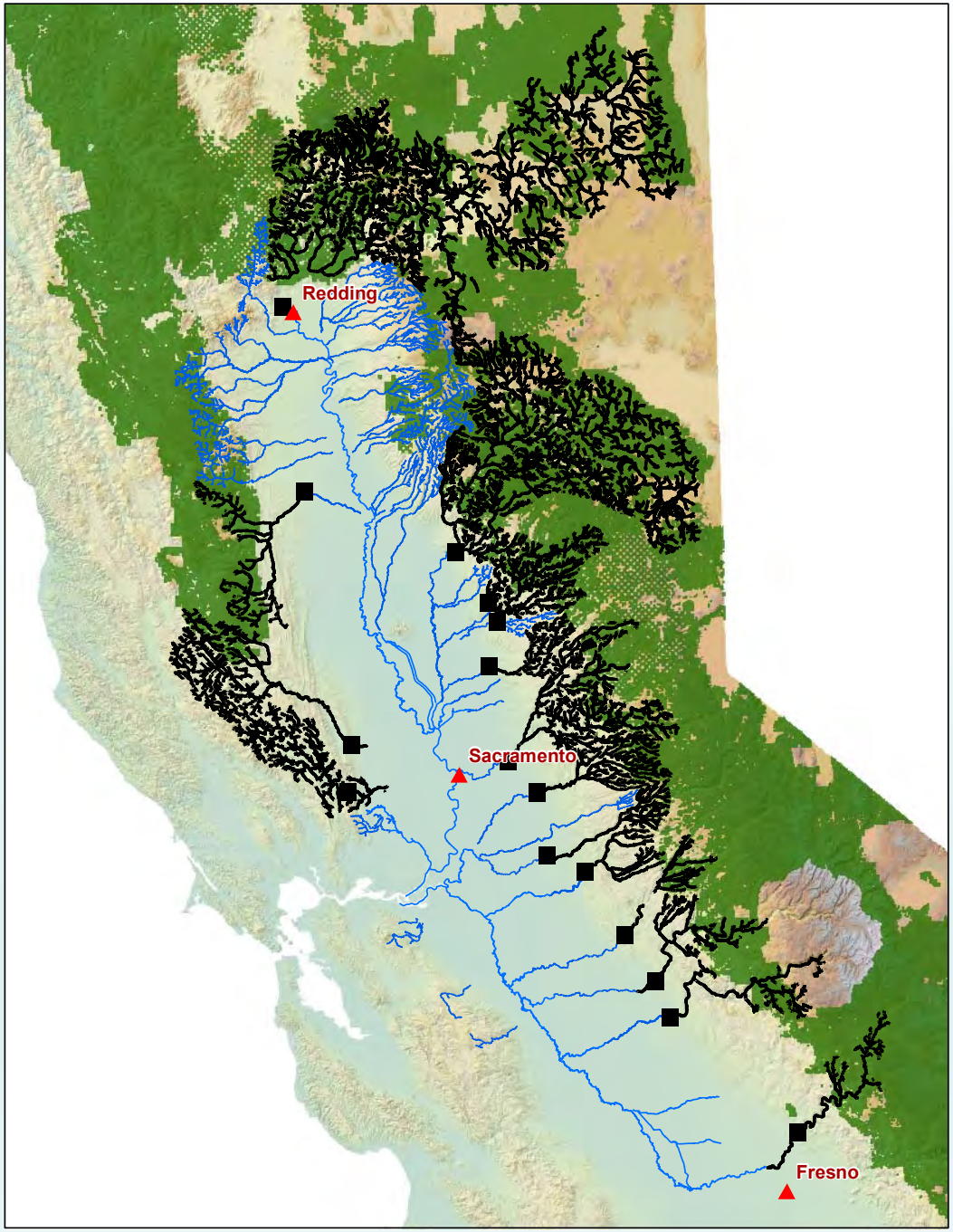
Now



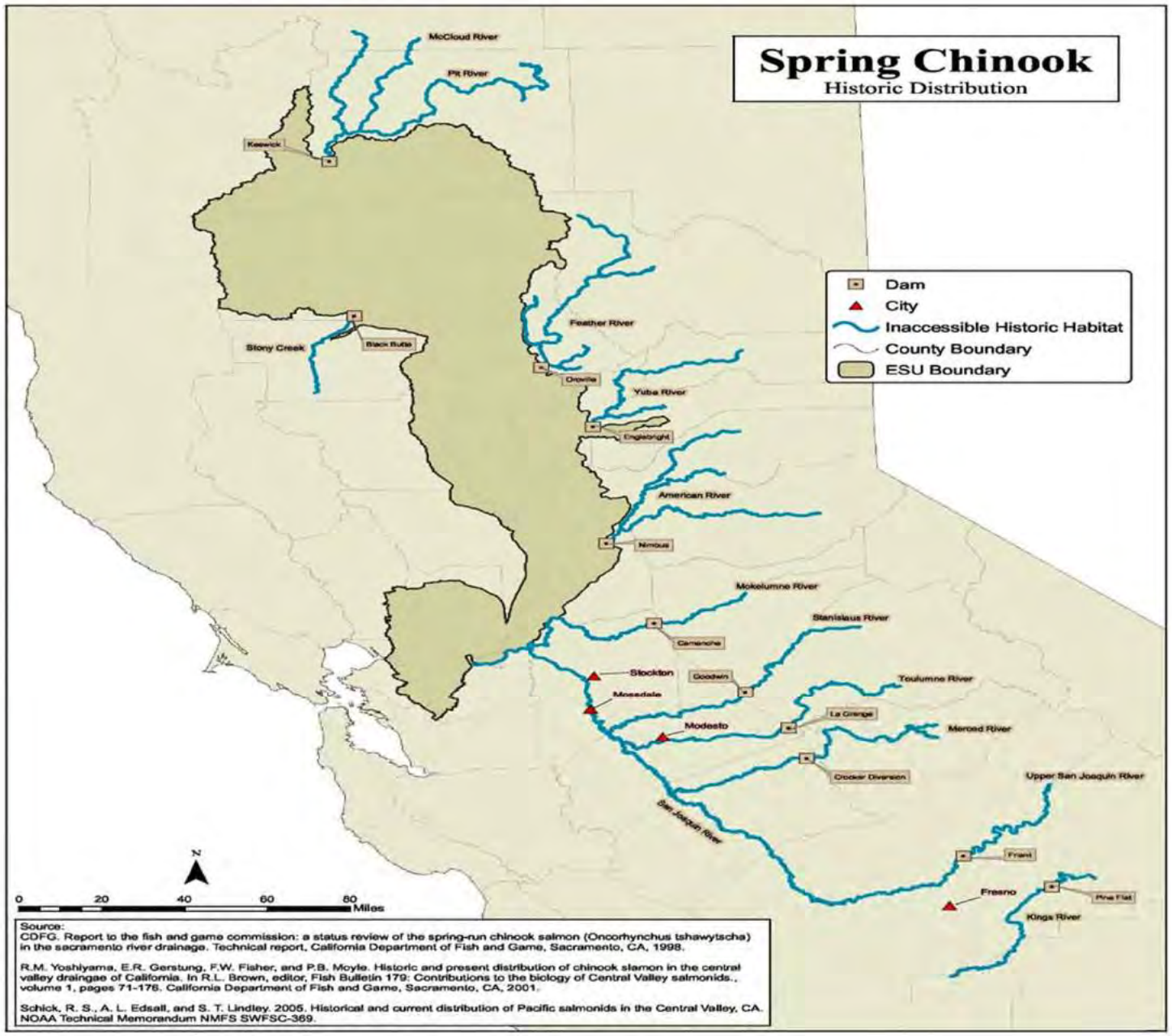
NOAA Fisheries
Habitat Conservation Div.
Santa Rosa Field Office
GIS Department
October 2009

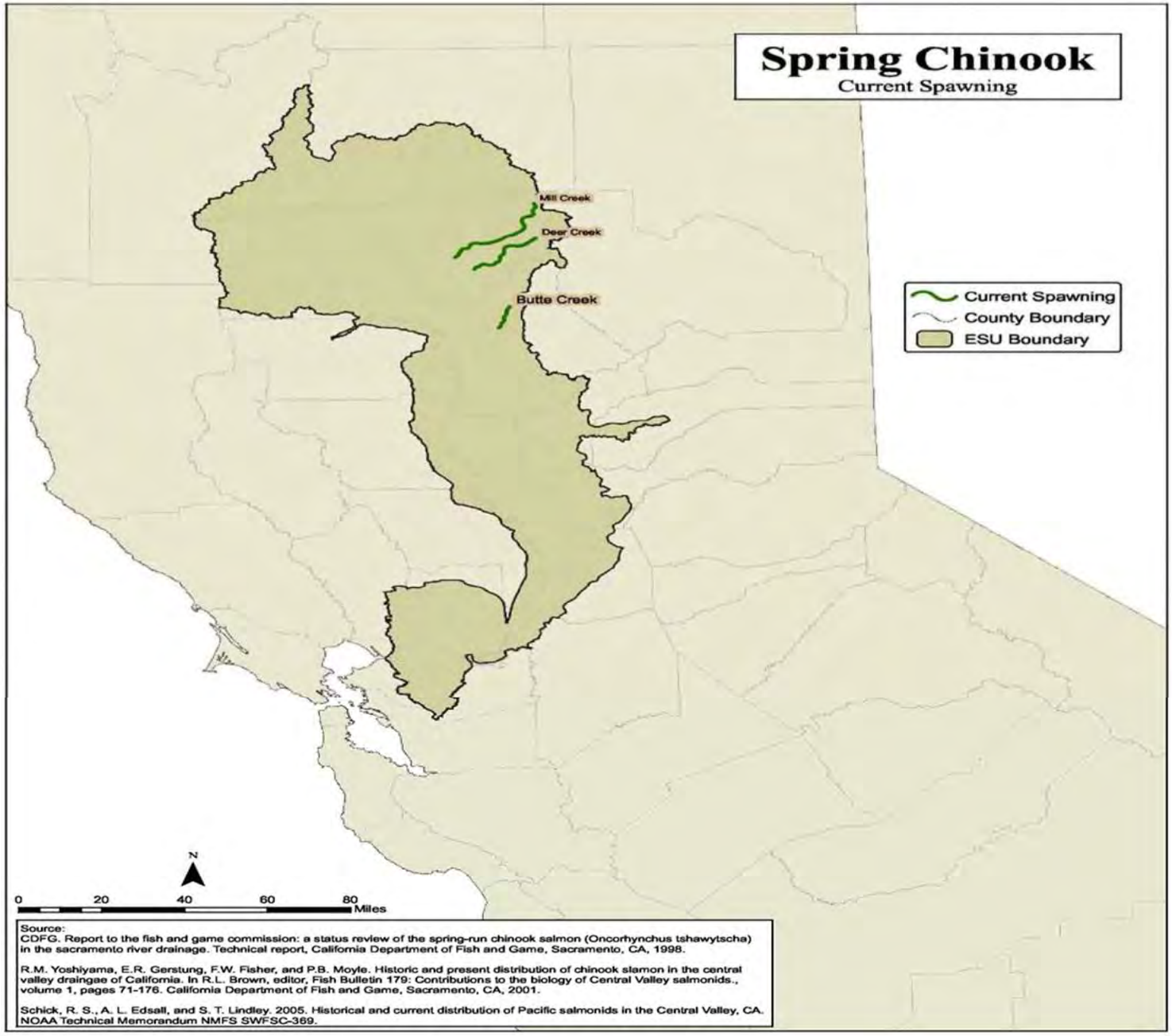


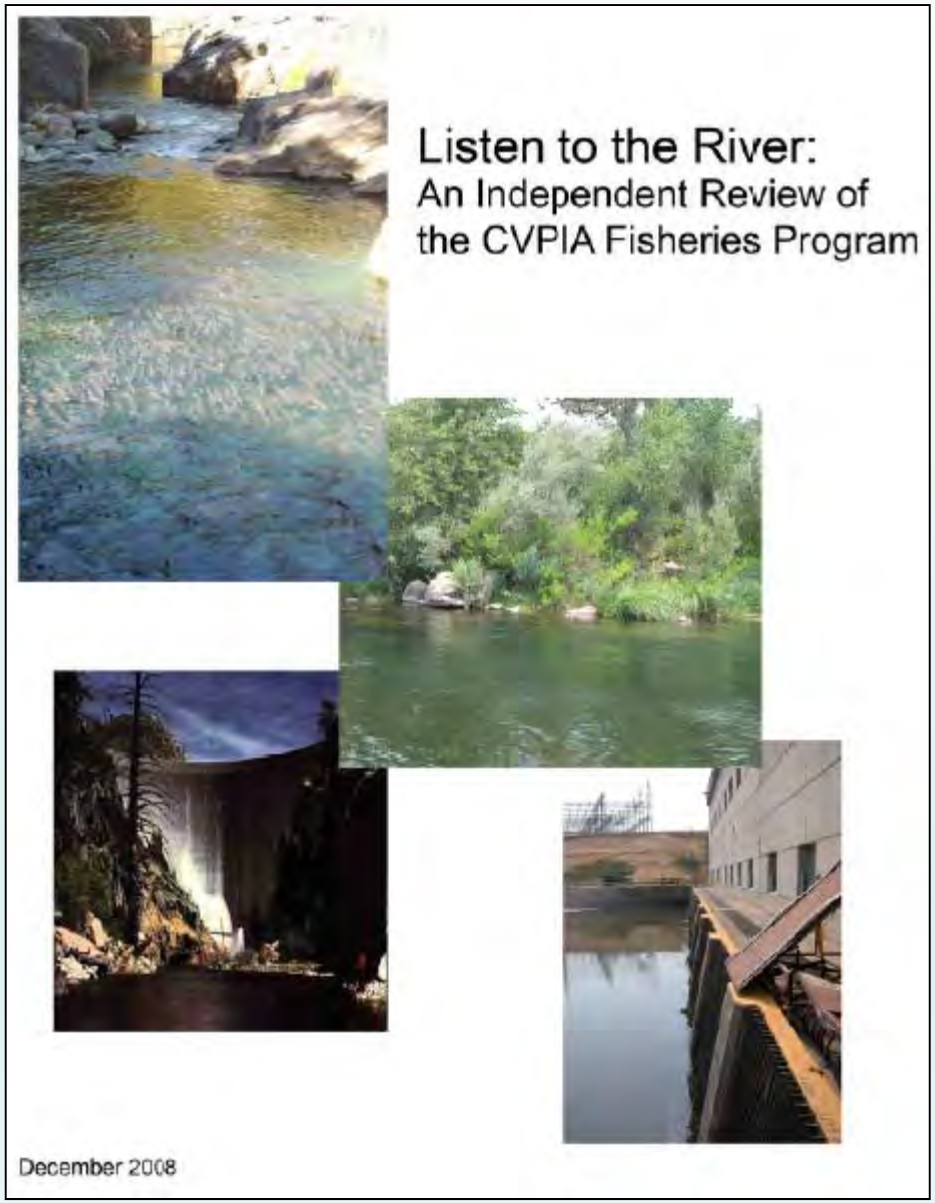
Central Valley DPS Defined by Rim Dams



Most of the Habitat above Rim Dams is Managed by the U.S. Forest Service


Spring Chinook
Historic Distribution
McCloud River
Pit River
Keswick
Feather River
Stony Creek
Black Butte
Oroville
Yuba River
Englebright
American River
Nimbus
Mokelumne River
Stanislaus River
Camanche
Stockton
Goodwin
Toulumne River
Modesto
La Grange
Merced River
Crocker Diversion
Upper San Joaquin River
San Joaquin River
Friant
Fresno
Pine Flat
Kings River
Dam
City
Inaccessible Historic Habitat
County Boundary
ESU Boundary
N
0 20 40 60 80
Miles
Source:
CDFG. Report to the fish and game commission: a status review of the spring-run chinook salmon (Oncorhynchus tshawytscha) in the sacramento river drainage. Technical report, California Department of Fish and Game, Sacramento, CA, 1998.
R.M. Yoshiyama, E.R. Gerstung, F.W. Fisher, and P.B. Moyle. Historic and present distribution of chinook slamon in the central valley draingae of California. In R.L. Brown, editor, Fish Bulletin 179: Contributions to the biology of Central Valley salmonids., volume 1, pages 71-176. California Department of Fish and Game, Sacramento, CA, 2001.
Schick, R. S., A. L. Edsall, and S. T. Lindley. 2005. Historical and current distribution of Pacific salmonids in the Central Valley, CA. NOAA Technical Memorandum NMFS SWFSC-369.


Spring Chinook
Current Spawning
Mill Creek
Deer Creek
Butte Creek
Current Spawning
County Boundary
ESU Boundary
N
0
20
40
60
80
Miles
Source:
CDFG. Report to the fish and game commission: a status review of the spring-run chinook salmon (Oncorhynchus tshawytscha) in the sacramento river drainage. Technical report, California Department of Fish and Game, Sacramento, CA, 1998.
R.M. Yoshiyama, E.R. Gerstung, F.W. Fisher, and P.B. Moyle. Historic and present distribution of chinook slamon in the central valley draingae of California. In R.L. Brown, editor, Fish Bulletin 179: Contributions to the biology of Central Valley salmonids., volume 1, pages 71-176. California Department of Fish and Game, Sacramento, CA, 2001.
Schick, R. S., A. L. Edsall, and S. T. Lindley. 2005. Historical and current distribution of Pacific salmonids in the Central Valley, CA. NOAA Technical Memorandum NMFS SWFSC-369.

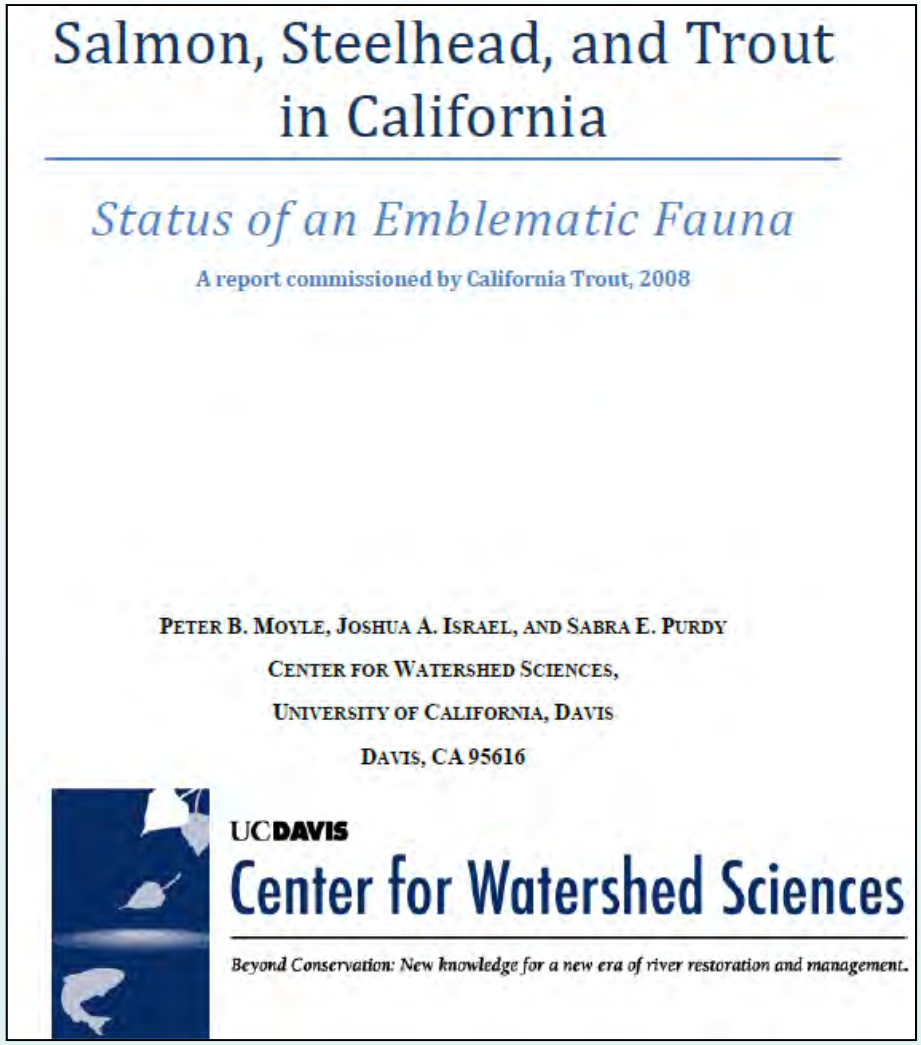


"It seems unlikely that these populations can be restored without providing access to at least some of that unutilized habitat."

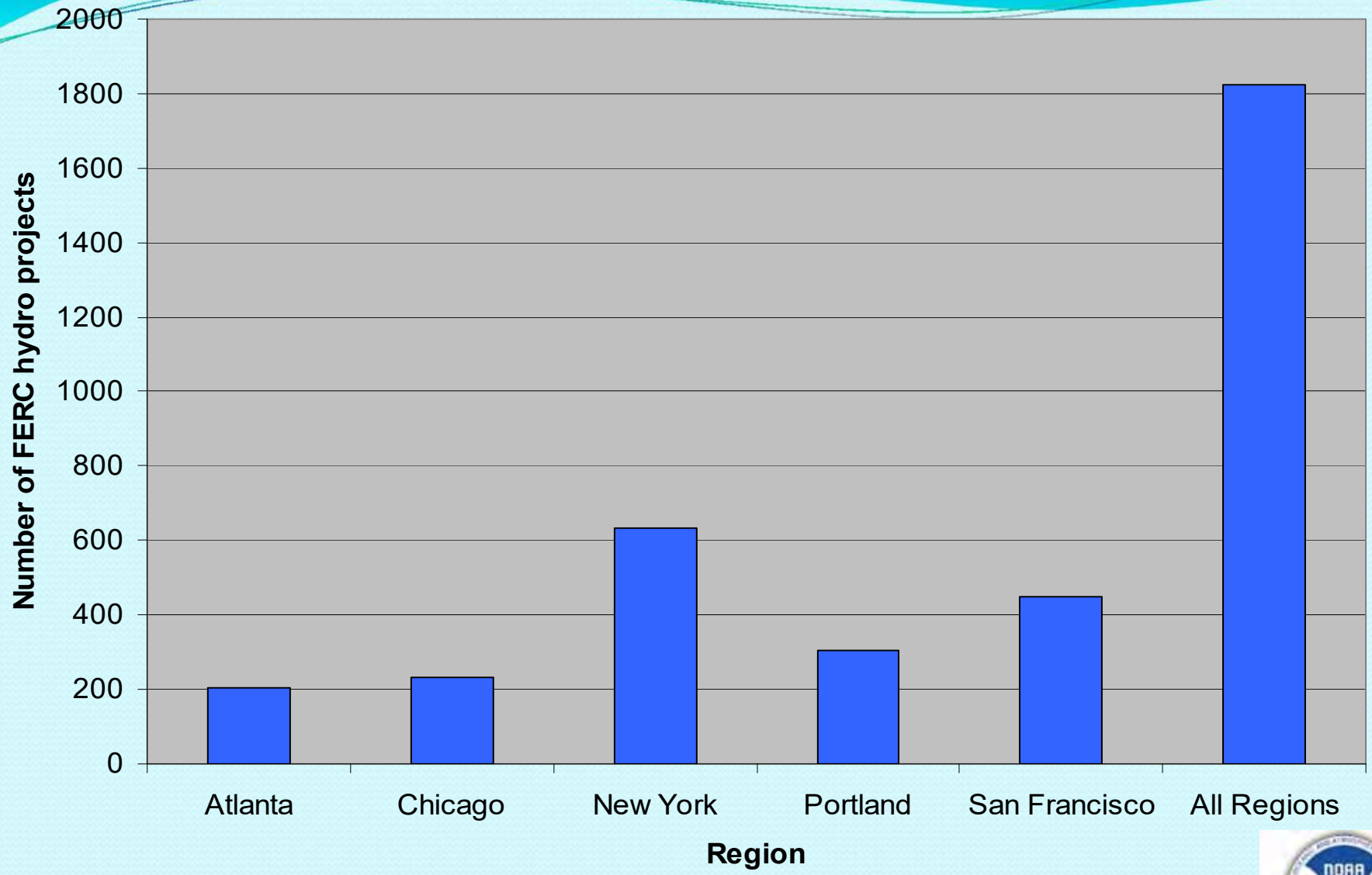
"…they [USBR&USFWS] will need to investigate the feasibility, benefits, costs and risks of investing in passage to spawning and rearing habitat upstream of the dams."

(Cummins et al. 2008)

From Moyle et al. 2008:



"Lindley et al. (2007) indicate that climate change models show a likely elimination of suitable habitat in much of the extant range. This means the Chinook will need to get higher in the watersheds than current infrastructure (dams) allows. Barrier removal or some kind of trap and truck operation will thus likely be a major part of spring Chinook conservation in the next century."



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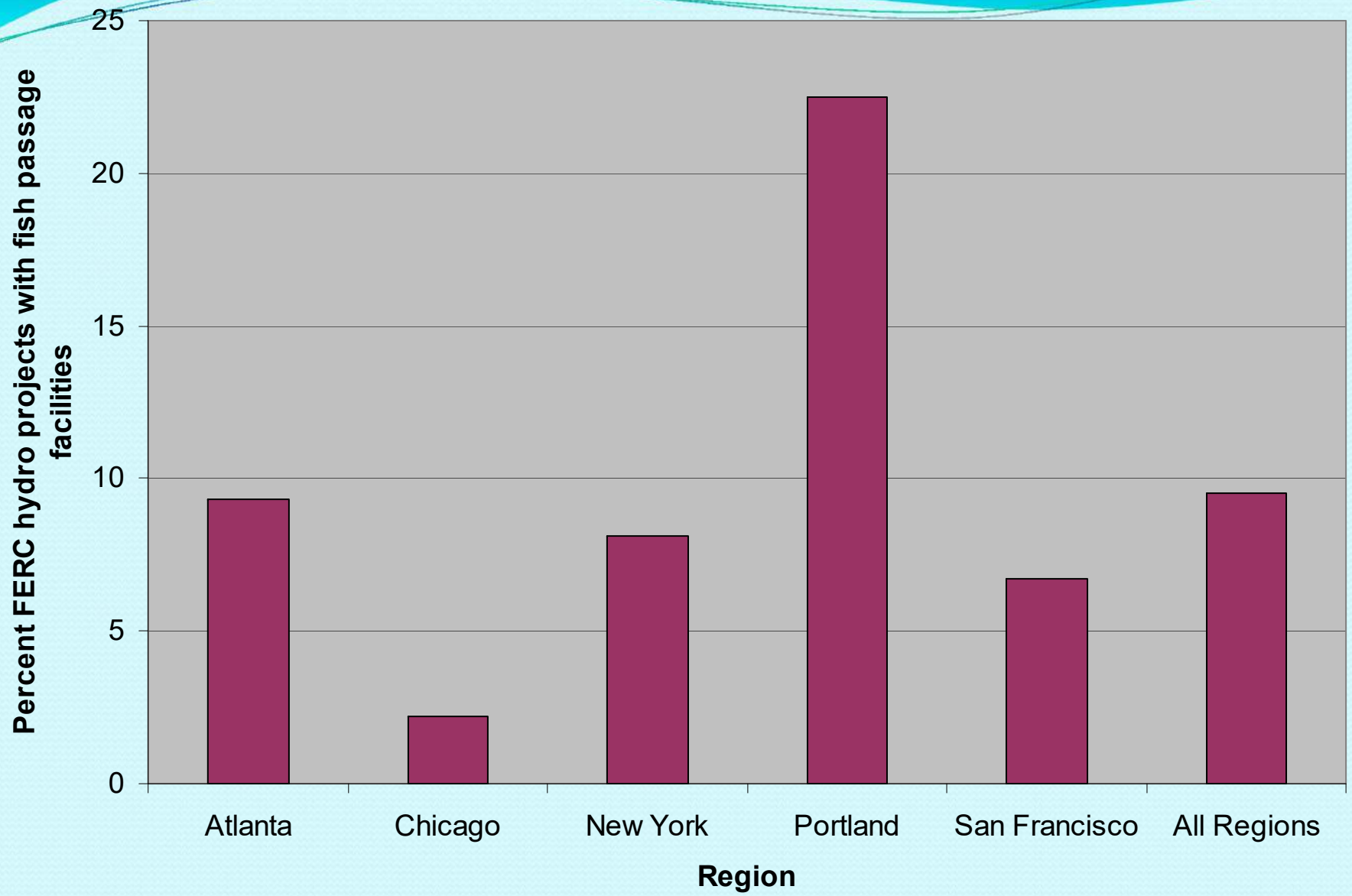
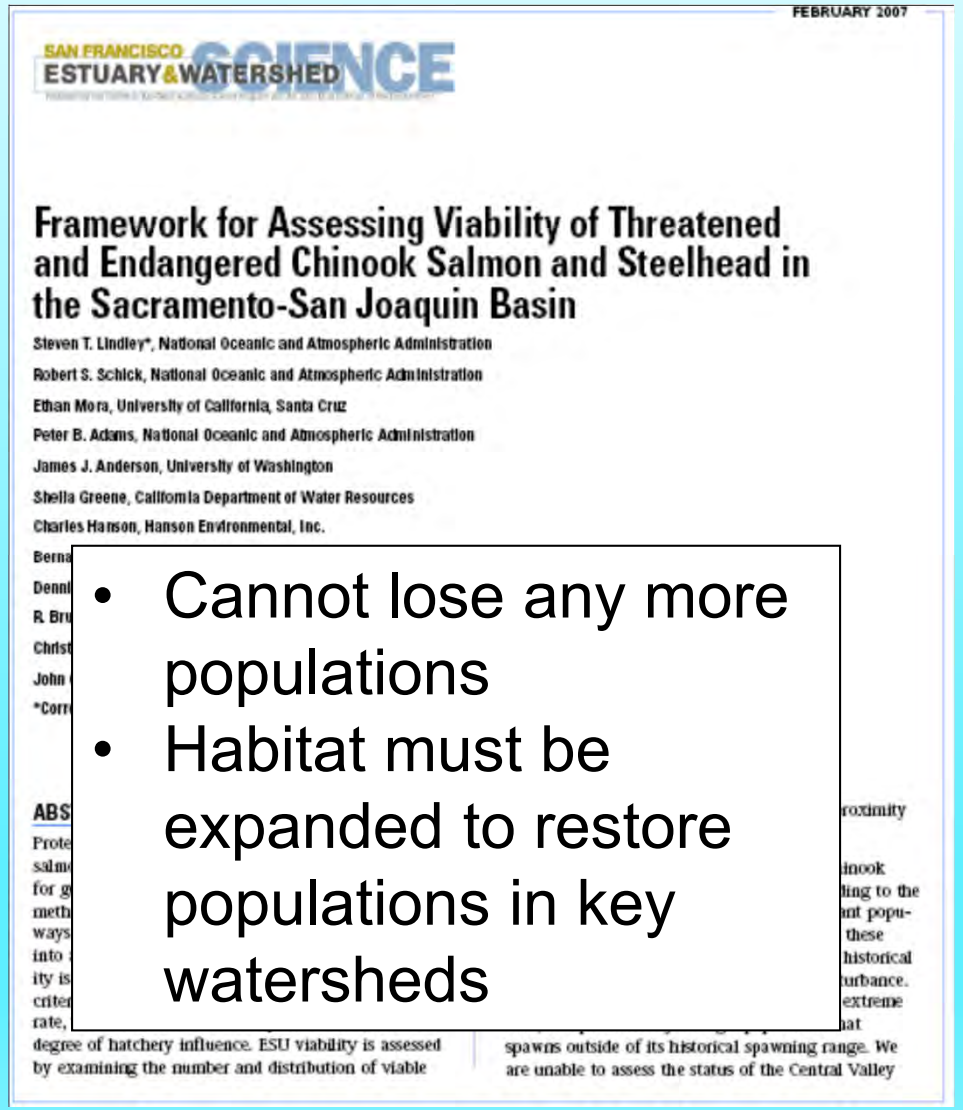

Percent FERC hydro projects with fish passage facilities
25
20
15
10
5
0
Atlanta
Chicago
New York
Portland
San Francisco
All Regions
Region

For instance, in California's Central Valley (Sacramento and San Joaquin Watersheds) dams block as much as 95% of historic salmonid spawning habitat. As a result, anadromous salmon are extirpated from approximately 5,700 miles of their historic habitat in the Central Valley. In most cases the habitat remaining is of much lower quality than the habitat lost and is subject to further degradation by direct and indirect impacts of hydroelectric operations. According to a FERC review a total of 149 FERC licensed and exempted projects are located in the Central Valley. Although most of the 149 projects are small (114 have capacities less than 5 MW), total reservoir storage is about 40 percent of all surface water storage in the Central Valley. Most storage is located at relatively few projects. Twenty nine projects account for 95 percent of the FERC-licensed storage in the Valley.



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.
Berna
Denni
R. Bru
Christ
John
*Corr

- Cannot lose any more populations
- Habitat must be expanded to restore populations in key watersheds

ABS

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historical
urbance.
extreme
hat

degree of hatchery influence. ESU viability is assessed by examining the number and distribution of viable

spawns outside of its historical spawning range. We are unable to assess the status of the Central Valley

Recovery Strategy

- Secure existing populations (and habitat)
- Reintroduce fish to historic habitats

Recovery criteria cannot be met without passage to historic habitat

"*To recover Central Valley salmon and steelhead ESUs, some populations will need to be established in areas now blocked by dams or insufficient flows. Assuming that most of these dams will remain in place for the foreseeable future, it will be necessary to move fish around the dams*." Lindley et al. 2007

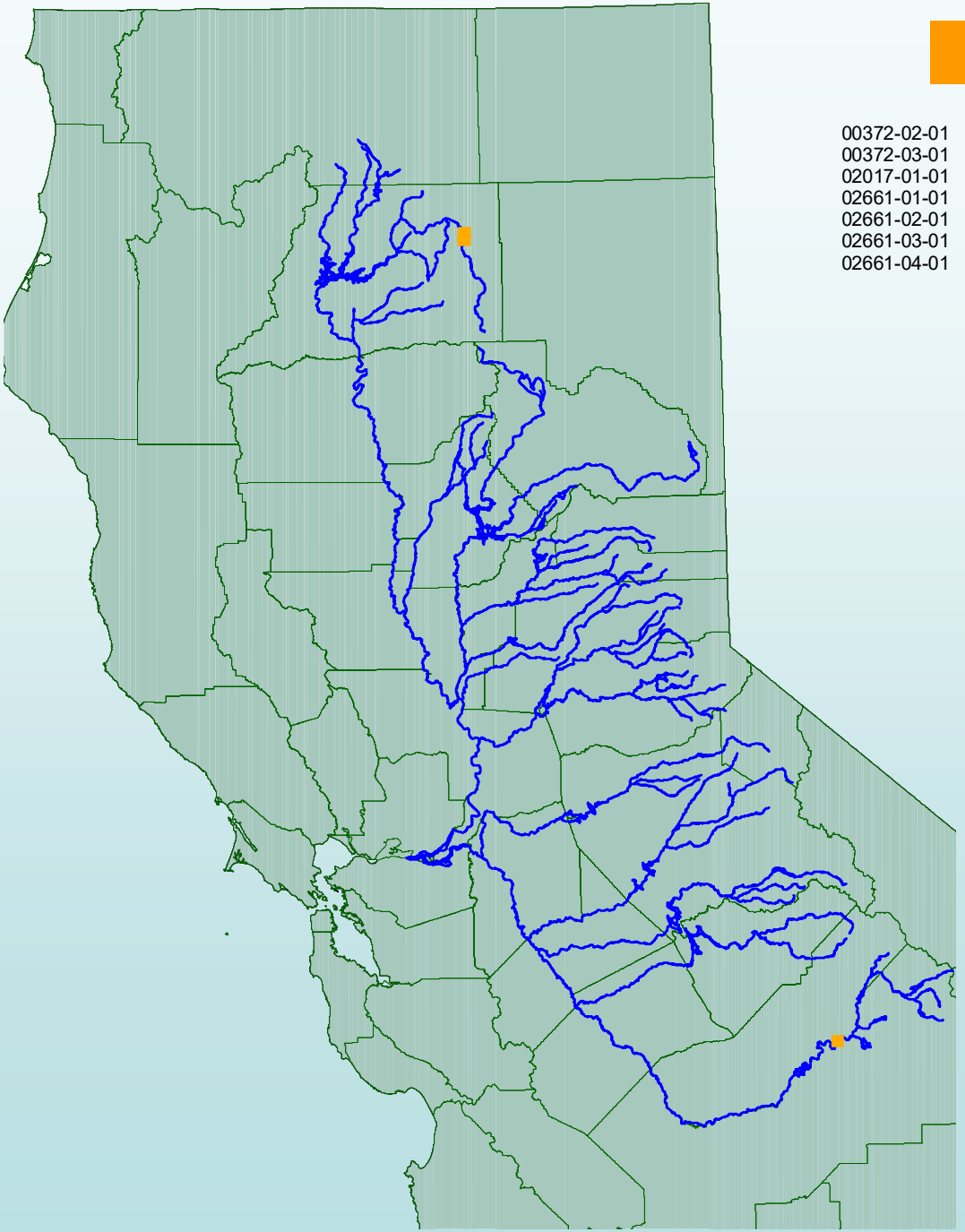
Recovery Criteria

Species level:

- At least 2 viable populations per diversity group

Population level:

- Abundance
- Productivity
- Diversity (hatchery influence)



1997-2001

00372-02-01 North Fork Diversion; 2000
00372-03-01 South Fork Diversion; 2000
02017-01-01 Big Creek Dam No. 7; 1999
02661-01-01 Hat Creek No. 1 Forebay; 2000
02661-02-01 Hat Creek No. 1 Diversion; 2000
02661-03-01 Crystal Lake; 2000
02661-04-01 Hat Creek No. 2 Diversion; 2000

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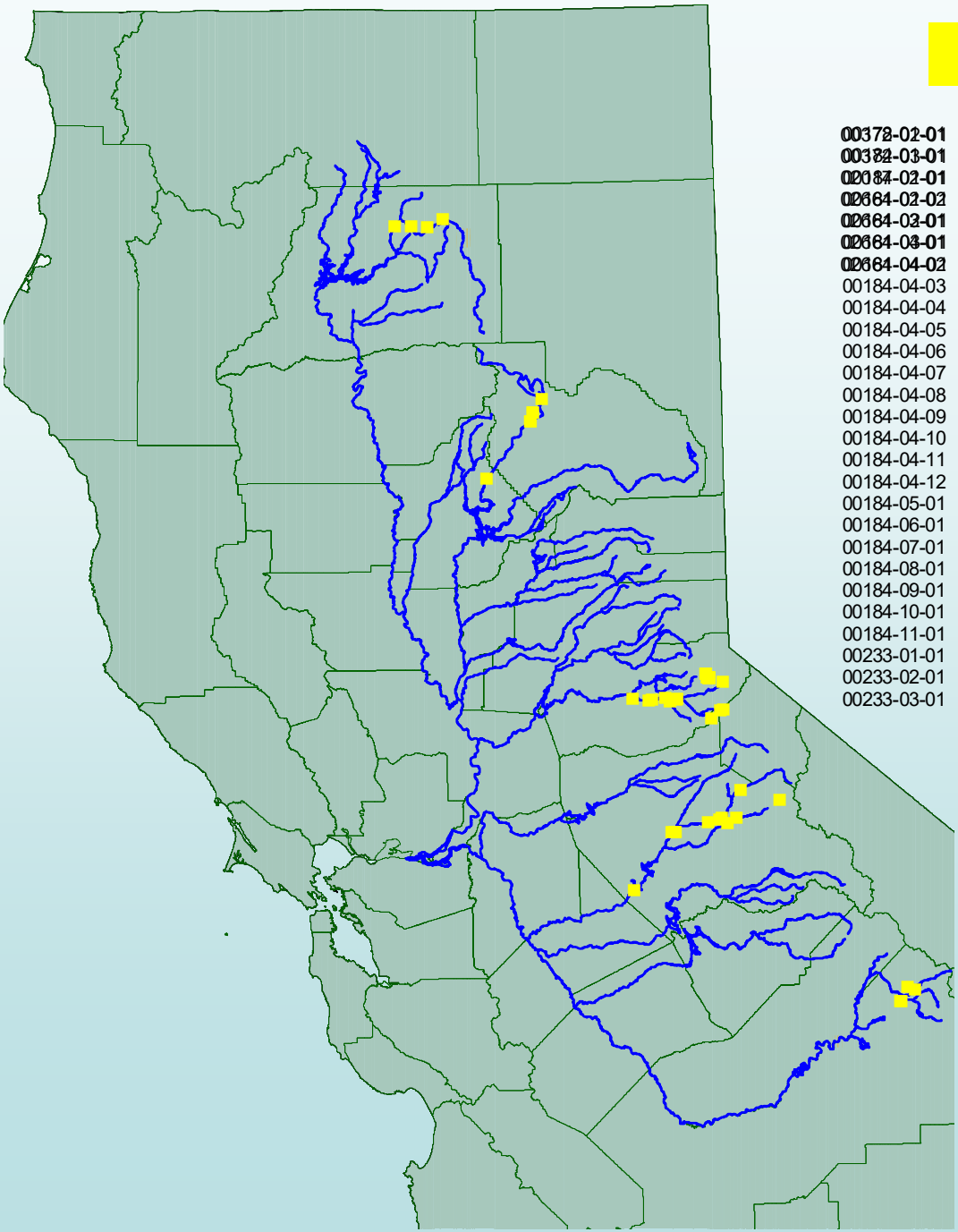

2002-2006

00172-02-01	North Fork Diversion; 2000
00182-03-01	South Fork Diversion; 2000
00184-02-01	Eagle Lake Main No. 2; 1999
00184-02-02	Eagle Lake Auxiliary; 2000
00184-03-01	Silver Lake; 2002
00184-03-01	Crystal Lakes; 2002
00184-04-02	Medley Lakes Auxiliary No. 2; 2002
00184-04-03	Medley Lakes Auxiliary No.; 2002
00184-04-04	Medley Lakes Auxiliary No.; 2002
00184-04-05	Medley Lakes Auxiliary No.; 2002
00184-04-06	Medley Lakes Auxiliary No.; 2002
00184-04-07	Medley Lakes Auxiliary No.; 2002
00184-04-08	Medley Lakes Auxiliary No.; 2002
00184-04-09	Medley Lakes Auxiliary No.; 2002
00184-04-10	Medley Lakes Auxiliary No.; 2002
00184-04-11	Medley Lakes Auxiliary No.; 2002
00184-04-12	Medley Lakes Auxiliary No.; 2002
00184-05-01	El Dorado Forebay; 2002
00184-06-01	El Dorado Diversion; 2002
00184-07-01	Alder Creek Diversion; 2002
00184-08-01	Mill Creek Feeder Diversion; 2002
00184-09-01	Carpenter Creek Feeder Div; 2002
00184-10-01	Ogilby Creek Feeder Divers; 2002
00184-11-01	Esmeralda Creek Feeder Div; 2002
00233-01-01	Pit No. 3 Diversion; 2003
00233-02-01	Pit No. 4 Diversion; 2003
00233-03-01	Pit No. 5 Diversion; 2003
00233-04-01	Pit No. 5 Open Conduit; 2003
00344-03-01	East Fork Diversion; 2003
00344-04-01	South Fork Diversion; 2003
00344-05-01	Black Wheel Creek Diversion; 2003
00382-02-01	Kern River Diversion Weir; 2005
00382-03-01	Borel Settling Basin Dike; 2005
00382-03-02	Borel Settling Basin Overf; 2005
02005-01-01	Beardsley; 2004
02005-02-01	Beardsley Afterbay; 2004
02005-03-01	Donnells; 2004
02067-01-01	Tulloch; 2004
02086-01-01	Vermilion; 2003
02086-01-02	Warm Creek Diversion; 2003
02105-01-01	Lake Almanor; 2004
02105-02-01	Butt Valley; 2004
02105-03-01	Belden Forebay; 2004
02107-01-01	Poe; 2003
02130-01-01	Stanislaus Forebay West; 2004
02130-01-02	Stanislaus Forebay East; 2004
02130-02-01	Stanislaus Afterbay; 2004
02130-03-01	Relief; 2004
02130-04-01	Sand Bar Diversion; 2004
02130-05-01	Strawberry; 2004
02130-06-01	Philadelphia Diversion; 2004
02153-01-01	Santa Felicia; 2004
02174-01-01	Portal Forebay Main; 2005
02174-01-02	Portal Forebay Dike; 2005

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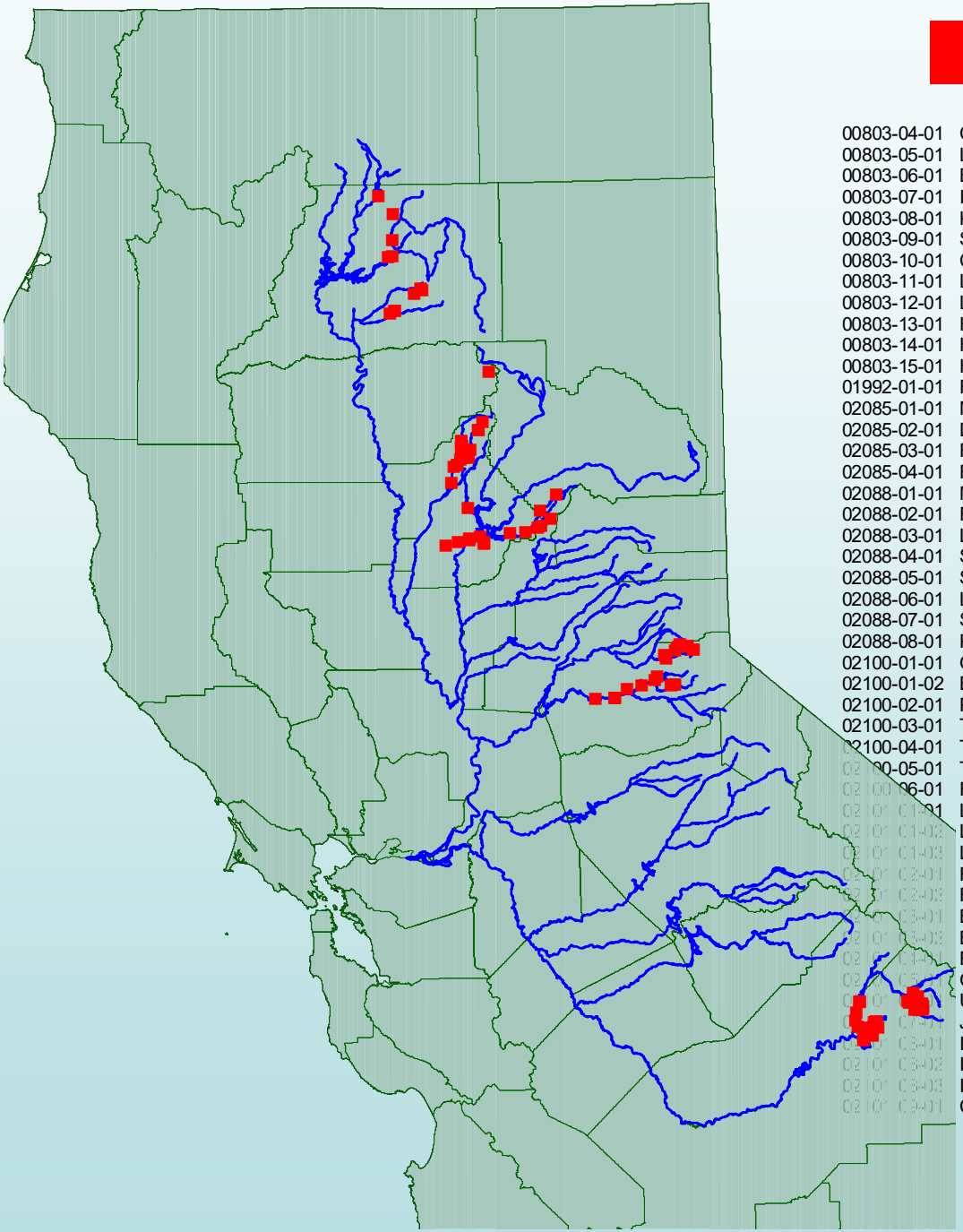

2007-2011

00803-04-01	Cunningham Ravine Feeder; 2009
00803-05-01	Little West Fork Feeder;2009
00803-06-01	Butte Creek Diversion; 2009
00803-07-01	Inskip Creek Feeder; 2009
00803-08-01	Kelsey Creek Feeder; 2009
00803-09-01	Stevens Creek Feeder; 2009
00803-10-01	Clear Creek Feeder; 2009
00803-11-01	Little Butte Creek Feeder; 2009
00803-12-01	Lower Centerville Diversion; 2009
00803-13-01	Header; 2009
00803-14-01	Hendricks Head; 2009
00803-15-01	Hendricks Diversion; 2009
01992-01-01	Fire Mountain Lodge No. 2; 2010
02085-01-01	Mammoth Pool; 2007
02085-02-01	Daulton Creek Diversion; 2007
02085-03-01	Rock Creek Diversion; 2007
02085-04-01	Ross Creek Diversion; 2007
02088-01-01	Miner's Ranch; 2009
02088-02-01	Forbestown Diversion; 2009
02088-03-01	Lost Creek; 2009
02088-04-01	Slate Creek; 2009
02088-05-01	South Fork Diversion; 2009
02088-06-01	Little Grass Valley; 2009
02088-07-01	Sly Creek; 2009
02088-08-01	Ponderosa; 2009
02100-01-01	Oroville; 2007
02100-01-02	Bidwell Bar Canyon Saddle; 2007
02100-02-01	Parish Camp Saddle; 2007
02100-03-01	Thermalito Diversion; 2007
02100-04-01	Thermalito Forebay; 2007
02100-05-01	Thermalito Afterbay; 2007
02100-06-01	Fish Barrier; 2007
02100-01-01	Loon Lake Main; 2007
02100-01-02	Loon Lake Auxiliary; 2007
02100-01-03	Loon Lake Dike; 2007
02100-02-01	Rubicon Main; 2007
02100-02-02	Rubicon Auxiliary; 2007
02100-03-01	Buck Island Main; 2007
02100-03-02	Buck Island Auxiliary; 2007
02100-04-01	Robbs Peak; 2007
02100-05-01	Gerle Creek; 2007
02100-06-01	Union Valley; 2007
02100-07-01	Junction; 2007
02100-03-01	Ice House Main; 2007
02100-03-02	Ice House Dike No. 1; 2007
02100-03-03	Ice House Dike No. 2; 2007
02100-03-01	Camino; 2007
02101-10-01	Brush Creek; 2007
02101-11-01	Slab Creek; 2007
02106-01-01	McCloud Diversion; 2011
02106-02-01	Iron Canyon; 2011
02106-03-01	Pit No. 6 Diversion; 2011
02106-04-01	Pit No. 7 Diversion; 2011
02106-05-01	Pit No. 7 Afterbay; 2011
02155-01-01	Chili Bar; 2007
02175-01-01	Big Creek Dam No. 1; 2009
02175-01-02	Big Creek Dam No. 2; 2009
02175-01-03	Big Creek Dam No. 3; 2009
02175-01-04	Big Creek Dam No. 3A; 2009
02175-02-01	Big Creek Dam No. 4; 2009
02175-03-01	Eley Creek Diversion; 2009
02175-04-01	Balsam Creek Diversion; 2009
02175-05-01	Adit 8 Creek Diversion; 2009
06885-01-01	Cinnamon Ranch Desilting P; 2009
06885-02-01	Birch Creek Diversion; 2009
00067-01-01	Shaver Lake Main; 2009
00067-01-02	Shaver Dike; 2009
00067-02-01	Bear Creek Diversion; 2009
00067-03-01	Mono Creek Diversion; 2009
00067-04-01	Florence Lake; 2009
00067-05-01	Crater Creek Diversion; 2009
00067-06-01	North Slide Creek Diversion; 2009
00067-07-01	South Slide Creek Diversion; 2009
00067-08-01	Hooper Creek Diversion; 2009
00067-09-01	Tombstone Creek Diversion; 2009
00067-10-01	Chinquapin Creek Diversion; 2009
00067-11-01	Camp 62 Creek Diversion; 2009
00067-12-01	Bolsillo Creek Diversion; 2009
00067-13-01	Pitman Creek Diversion; 2009
00067-14-01	Big Creek Dam No. 5; 2009
00067-15-01	Balsam Meadow Forebay Main; 2009
00067-15-02	Balsam Meadow Forebay Dike; 2009
00120-01-01	Big Creek Dam No. 6; 2009
00606-01-01	Kilarc Forebay; 2027
00606-02-01	Kilarc Main Canal Diversion; 2007
00606-03-01	North Canyon Creek Diversion; 2007
00606-04-01	South Canyon Creek Diversion; 2007
00606-05-01	Cow Creek Forebay; 2007
00606-06-01	Mill Creek Diversion; 2007
00606-07-01	South Cow Creek Diversion; 2007
00803-01-01	Round Valley; 2009
00803-02-01	Philbrook Main; 2009
00803-02-02	Philbrook Saddle; 2009
00803-03-01	De Sabla Forebay; 2009

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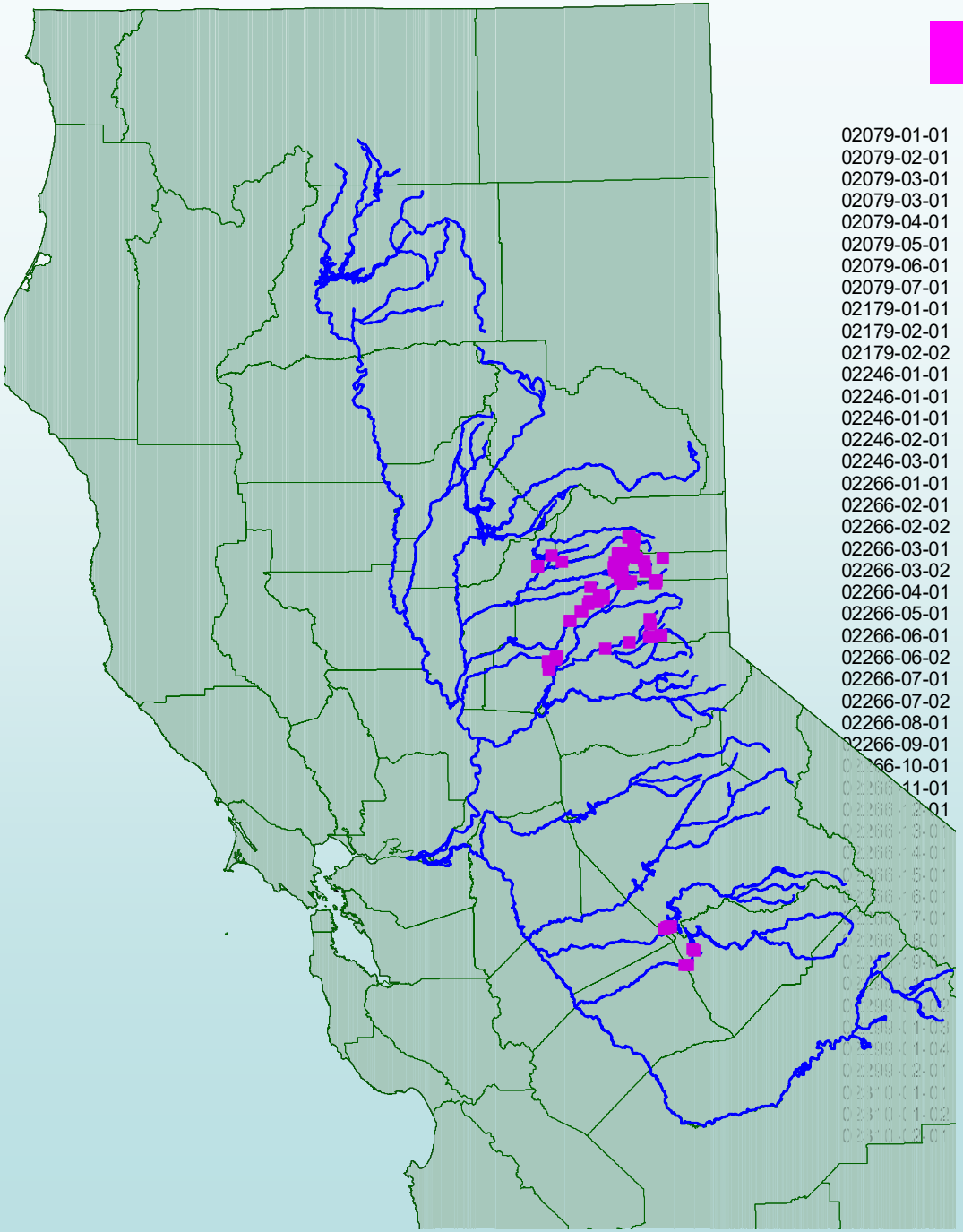

2012-2016

02079-01-01	French Meadows; 2013
02079-02-01	Duncan Creek Diversion; 2013
02079-03-01	Hell Hole; 2013
02079-03-01	Hell Hole; 2013
02079-04-01	South Fork Long Canyon Div2013
02079-05-01	North Fork Long Canyon Div; 2013
02079-06-01	Middle Fork Interbay; 2013
02079-07-01	Ralston Afterbay; 2013
02179-01-01	McSwain; 2014
02179-02-01	Exchequer Main; 2014
02179-02-02	Exchequer Dike; 2014
02246-01-01	New Bullards Bar; 2016
02246-01-01	New Bullards Bar; 2016
02246-01-01	New Bullards Bar; 2016
02246-02-01	Our House; 2016
02246-03-01	Log Cabin; 2016
02266-01-01	Jackson Meadows; 2013
02266-02-01	Bowman Main; 2013
02266-02-02	Bowman Arch; 2013
02266-03-01	Milton Main; 2013
02266-03-02	Milton South; 2013
02266-04-01	Jackson Lake; 2013
02266-05-01	French Lake; 2013
02266-06-01	Faucherie Lake Main; 2013
02266-06-02	Faucherie Spillway Auxilia; 2013
02266-07-01	Sawmill Main; 2013
02266-07-02	Sawmill Spillway; 2013
02266-08-01	Wilson Creek Forebay; 2013
02266-09-01	Bowman Diversion; 2013
C2266-10-01	Texas Creek Diversion; 2013
C2266-11-01	Clear Creek Diversion; 2013
C2266-12-01	Fall Creek Diversion; 2013
C2266-13-01	Rucker Creek Diversion; 2013
C2266-14-01	Trap Creek Diversion; 2013
C2266-15-01	Dutch Flat Forebay; 2013
C2266-16-01	Dutch Flat Afterbay; 2013
C2266-17-01	Chicago Park Forebay; 2013
C2266-18-01	Little York Basin; 2013
C2266-19-01	Rollins; 2013
C2299-01-01	Don Pedro Main; 2016
C2299-01-02	Don Pedro Dike A; 2016
C2299-01-03	Don Pedro Dike B; 2016
C2299-01-04	Don Pedro Dike C; 2016
C2299-02-01	Gasburg Creek Dike; 2016
C2310-01-01	Upper Rock Lake Main; 2013
C2310-01-02	Upper Rock Lake Auxiliary; 2013
C2310-01-03	Lower Rock Lake; 2013
02310-03-01	Culbertson Lake; 2013
02310-04-01	Upper Lindsey; 2013
02310-05-01	Middle Lindsey; 2013
02310-06-01	Lower Lindsey; 2013
02310-07-01	Upper Feeley; 2013
02310-08-01	Lower Feeley; 2013
02310-09-01	Blue Lake; 2013
02310-10-01	Rucker Lake; 2013
02310-11-01	Fuller Lake; 2013
02310-12-01	Spaulding No. 3 Forebay; 2013
02310-13-01	Spaulding No. 3 Afterbay; 2013
02310-14-01	Kidd Lake Main; 2013
02310-14-02	Kidd Lake Auxiliary; 2013
02310-15-01	Upper Peak Lake; 2013
02310-16-01	Lower Peak Lake Main; 2013
02310-16-02	Lower Peak Lake Auxiliary; 2013
02310-17-01	White Rock Lake; 2013
02310-18-01	Meadow Lake; 2013
02310-19-01	Lake Sterling; 2013
02310-20-01	Lake Fordyce; 2013
02310-21-01	Jordan Creek Diversion; 2013
02310-22-01	Lake Spaulding No. 1; 2013
02310-22-01	Lake Spaulding No. 1; 2013
02310-22-02	Lake Spaulding No. 2; 2013
02310-22-03	Lake Spaulding No. 3 Auxil; 2013
02310-23-01	Lake Valley Main; 2013
02310-23-02	Lake Valley Auxiliary; 2013
02310-24-01	Kelly Lake; 2013
02310-25-01	Lake Valley Diversion; 2013
02310-26-01	Drum Forebay; 2013
02310-26-01	Drum Forebay; 2013
02310-27-01	Drum Afterbay; 2013
02310-28-01	Drum Afterbay Toe; 2013
02310-29-01	Bear River Canal Diversion; 2013
02310-30-01	Halsey Forebay No. 1; 2013
02310-30-02	Halsey Forebay No. 2; 2013
02310-31-01	Halsey Afterbay; 2013
02310-32-01	Rock Creek Main; 2013
02310-32-02	Rock Creek South Wing Auxi; 2013
02310-32-03	Rock Creek North Wing Auxi; 2013
02310-33-01	Wise Forebay; 2013
02310-33-01	Wise Forebay; 2013
02310-34-01	Deer Creek Forebay; 2013
02310-36-01	Towle Canal Diversion; 2013
02310-37-01	Alta Forebay; 2013
02467-01-01	Merced Falls; 2014

NMFS-SWR
Habitat Conservation Division

Fish Passage Decision Analysis

Sequential analysis for determining appropriateness of fish passage

- Determine if there is an appreciable quantity of historic habitat partially or completely blocked.
- Determine if the blocked habitat is potentially viable.
- Determine if fish passage is technologically feasible.
- Determine the quantity of viable habitat and whether access to this habitat will contribute to resource goals for this watershed or fishery. Require appropriate fishways.