Innovative Approaches to Understanding and Improving Salmon-Habitat Relationships

A Concurrent Session at the 34th Annual Salmonid Restoration Conference held in Fortuna, CA from April 6-9, 2016.

Session Overview

- Session Coordinator:
  - Cynthia Le Doux-Bloom, Ph.D., AECOM

Evolving our science-based understanding of salmon-habitat relationships is paramount to successful recovery. Recovery can be undermined across spatiotemporal scales by poor planning, untested restoration and hatchery-release practices, and competition from introduced species. The purpose of the session is to learn about innovative approaches currently being piloted or implemented which are aimed at increasing our understanding and ability to improve salmon-habitat relationships. This session will highlight new concepts focusing around timber regulation and forest restoration, recovery strategies, extirpation prevention, lagoon habitat-use, smolt release timing, and the impacts of the introduced brown trout.

Presentations

(Slide 6) The Progress and Promise of the Timber Regulation & Forest Restoration Program to Implement Planning Watershed Pilot Projects
Richard Gienger, Sierra Club, and Russ Henly, Ph.D., California Natural Resources Agency

(Slide 25) Life on the Edge: Recovering Southern California Steelhead
Mark Capelli, South-Central/Southern California Steelhead Recovery Coordinator, National Marine Fisheries Service, West Coast Region

(Slide 59) P.A.C.T. – A Trans-agency, Trans-discipline Program to Prevent Coho Salmon Extirpation in the Central California Coast
Stephen Swales, Ph.D., California Department of Fish and Wildlife

The Effects of Early Sandbar Formation on the Ecology and Population Dynamics of Steelhead and Coho Salmon in the Scott Creek Lagoon
Ann-Marie K. Osterback, Ph.D., Southwest Fisheries Science Center, NOAA Fisheries
*presentation not included

(Slide 90) Effects of Staggered Release Timing of Hatchery Coho Salmon Smolts on Subsequent Adult Returns to Scott Creek, California: Spreading Risk to Cope with Variable Ocean Conditions
Brian Spence, Ph.D., NOAA Fisheries, Southwest Fisheries Science Center, Fisheries Ecology Division

(Slide 115) Assessing the Impact of Brown Trout on the Trinity River, CA
Justin Alvarez, Hoopa Valley Tribal Fisheries

INNOVATIVE APPROACHES

Understanding & Improving Salmon-Habitat Relationships




Cynthia Le Doux-Bloom, Ph.D.
Senior Fish & Wildlife Scientist

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THANK YOU

AECOM

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PLANNING WATERSHED PILOT PROJECTS

Timber Regulation and Forest Restoration Program

April 8, 2016

Salmonid Restoration Federation Annual Meeting

Richard Gienger
Russ Henly

Overview of Assembly Bill 1492

- Passed in late 2012
- Addressed 3 areas:
  - Wildland fire liability issues;
  - Extended life of THPs
  - **Created the Timber Regulation and Forest Restoration Program under the Natural Resources Agency and CalEPA**

Timber Regulation and Forest Restoration Program

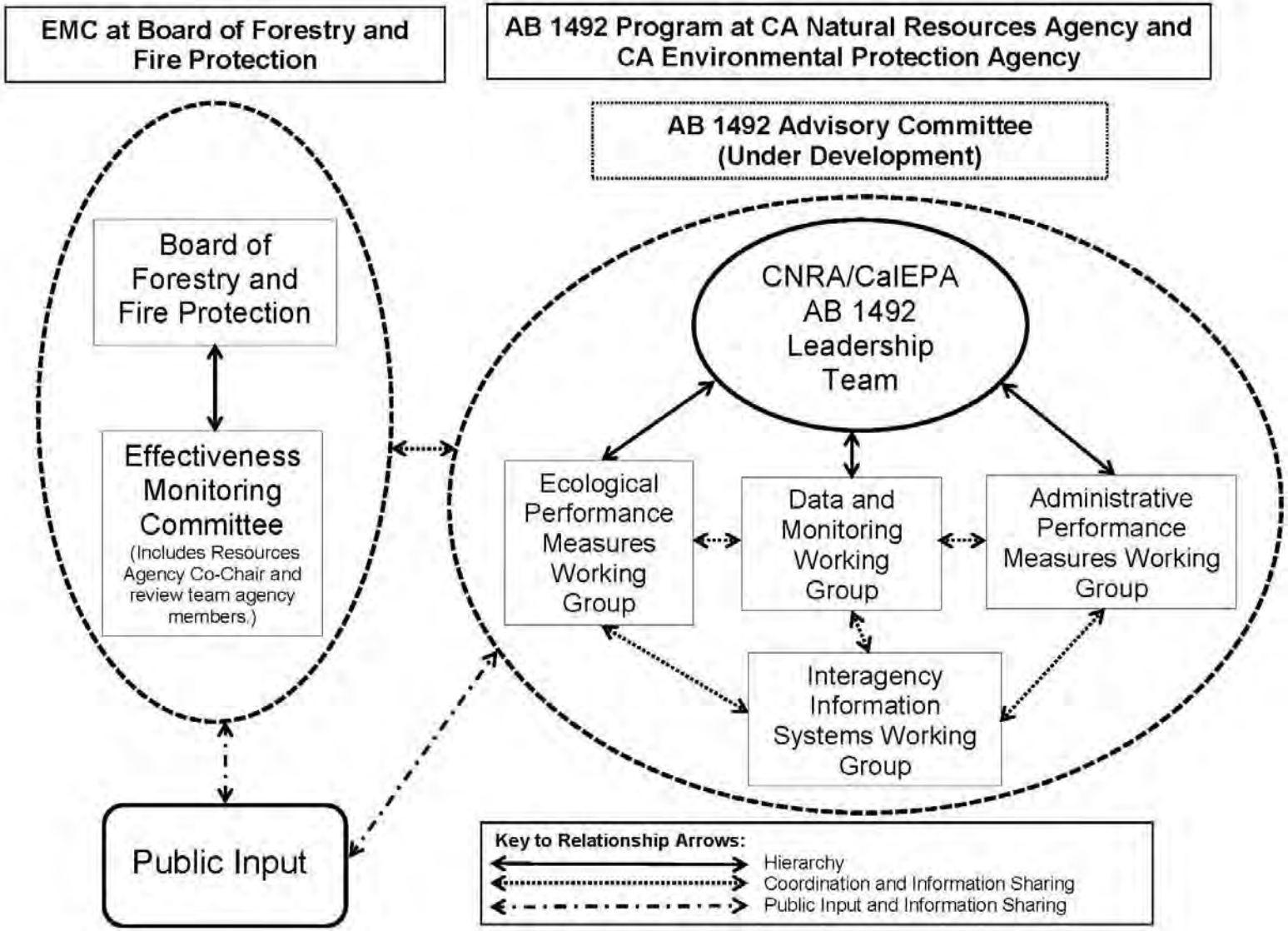
- Four major elements:
  - Revenue-generating mechanism
  - Direction to:
    - (a) improve the efficiency, transparency, and data collection of the State's timber harvest review team agencies and departments; and
    - (b) develop ecological performance measures.
  - A forest restoration grant program
  - Requirements for periodic reporting to the Legislature

Timber Regulation and Forest Restoration Fund (TRFRF)

- 1% assessment on all lumber and engineered wood products sold at retail in California.
- Funding for timber harvest regulation programs at all Review Team Agencies shifted to TRFRF beginning 2013.
- Revenues for FY 2014/15: $37 million.
- Fund balance at end of FY 2014/15: $26 million.
- Estimated revenues for FY 2015/16: $40 million.

The AB 1492 Accountability Triangle

AB 1492 Program and EMC



Planning Watershed Pilot Projects

Forest Planning Watershed Pilot Projects Concept Paper

REVISED Public Review Draft

Timber Regulation and Forest Restoration Program

December 2, 2015

Introduction

This concept paper describes potential approaches to conducting planning-watershed-based pilot projects to identify opportunities to increase efficiencies for timber harvest planning and permitting processes and for forest restoration. This is the second draft of a concept paper, and we continue to solicit public input on its suggested approaches. This version has been revised following public input, including at our October 14 public workshop and written comments received.[1] A second public workshop, which will focus on this new draft concept paper, is scheduled for December 15.

The specific substantive areas to be addressed by the pilot projects include:

- Data collection and characterization;
- Identification of information and methods used for cumulative environmental impacts assessment; and
- Identification of restoration opportunities in forested landscapes.

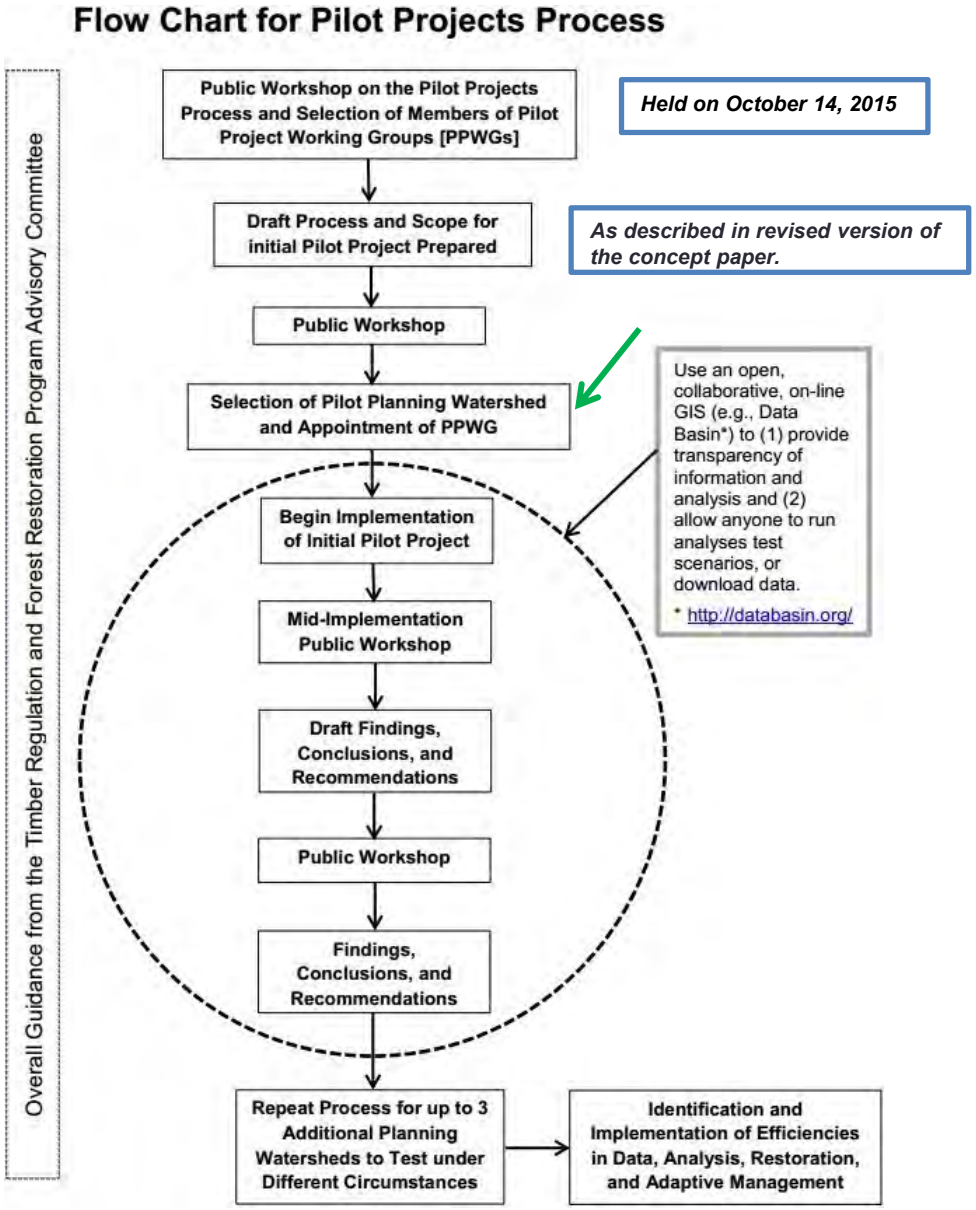
The work will be based primarily on existing information found in timber harvesting plans (THPs), spatial datasets, and reports. The pilot projects will be collaborative, multi-disciplinary efforts, guided by broad-based Pilot Project Working Groups (PPGWs), that provide opportunity for public participation. Pilot projects for these purposes have been reflected in past Assembly bills considered by the California Legislature (e.g., AB 2575, AB 380, AB 875), but none of these bills ultimately became law.

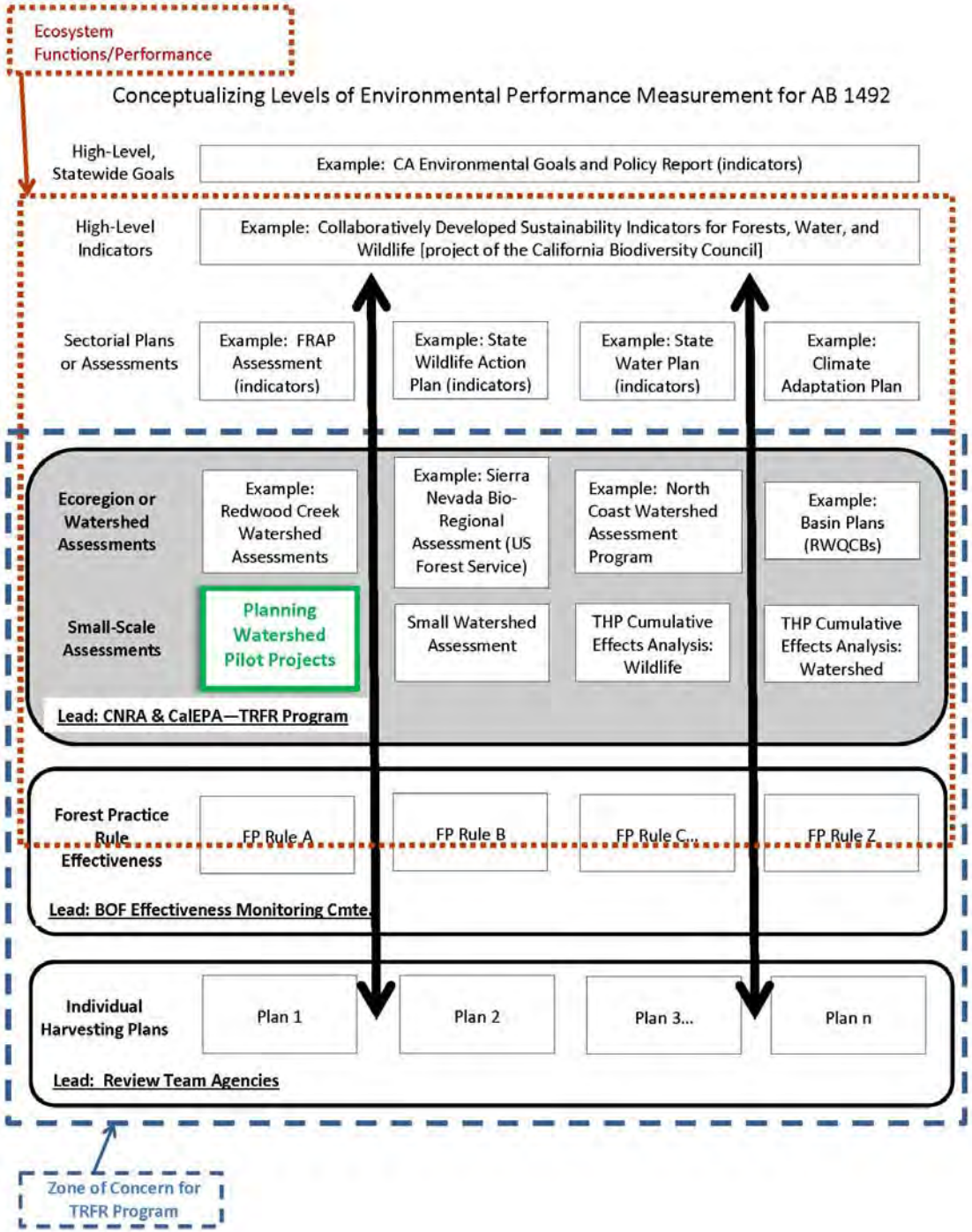
Many of the comments received on the first draft Concept Paper and from the October 14 workshop were related to the scope of the planning watershed pilot projects. Some

Planning Watershed Pilot Projects

- Collaborative and multi-disciplinary (Pilot Project Working Group or PPWG);
- Data collection and characterization;
- ID of information and methods used for cumulative impacts assessment;
- ID of specific restoration opportunities;
- Explore use of on-line collaborative GIS tools;
- Draft concept paper provides details, including identifying 6 critical questions.

Public Process




Ecosystem Functions/Performance
Conceptualizing Levels of Environmental Performance Measurement for AB 1492
High-Level, Statewide Goals
Example: CA Environmental Goals and Policy Report (indicators)
High-Level Indicators
Example: Collaboratively Developed Sustainability Indicators for Forests, Water, and Wildlife [project of the California Biodiversity Council]
Sectorial Plans or Assessments
Example: FRAP Assessment (indicators)
Example: State Wildlife Action Plan (indicators)
Example: State Water Plan (indicators)
Example: Climate Adaptation Plan
Ecoregion or Watershed Assessments
Example: Redwood Creek Watershed Assessments
Example: Sierra Nevada Bio-Regional Assessment (US Forest Service)
Example: North Coast Watershed Assessment Program
Example: Basin Plans (RWQCBs)
Small-Scale Assessments
Planning Watershed Pilot Projects
Small Watershed Assessment
THP Cumulative Effects Analysis: Wildlife
THP Cumulative Effects Analysis: Watershed
Lead: CNRA & CalEPA—TRFR Program
Forest Practice Rule Effectiveness
FP Rule A
FP Rule B
FP Rule C...
FP Rule Z
Lead: BOF Effectiveness Monitoring Cmte.
Individual Harvesting Plans
Plan 1
Plan 2
Plan 3...
Plan n
Lead: Review Team Agencies
Zone of Concern for TRFR Program

Pilot Project Working Group

Composition

- State review team agencies (CAL FIRE, DFW, CGS, Water Boards)
- Federal agencies
- Environmental community
- Timber industry
- Professional foresters
- Scientists
- Watershed restoration practitioners
- Owners or managers of forestland in the pilot watershed
- Tribal representatives
- Fishing community

Pilot Project Working Group

Selection and Appointment

- Openly solicit nominations and applications;
- Selection and appointment by Natural Resources Agency;
- The location and characteristics of the pilot planning watershed will be a factor in making appointments;
- Members will be appointed for the duration of the pilot watershed; approximately 2 years;
- Reimbursement for travel costs;
- Budget proposal at Legislature to fund and authorize per diem compensation to members.

Pilot Project Working Group

Role of the PPWG Includes:

- Guides the overall work of the pilot project;
- Refines the critical questions;
- Develops a scope of work for the pilot project, including types of information to be collected and the products to be produced;
- Evaluates information sources;
- Works with the interagency team to ground truth preliminary office results and determine if there are significant gaps in existing information;
- Identifies restoration opportunities;
- Interprets results and makes recommendations.

Pilot Project Working Group

Meeting Processes

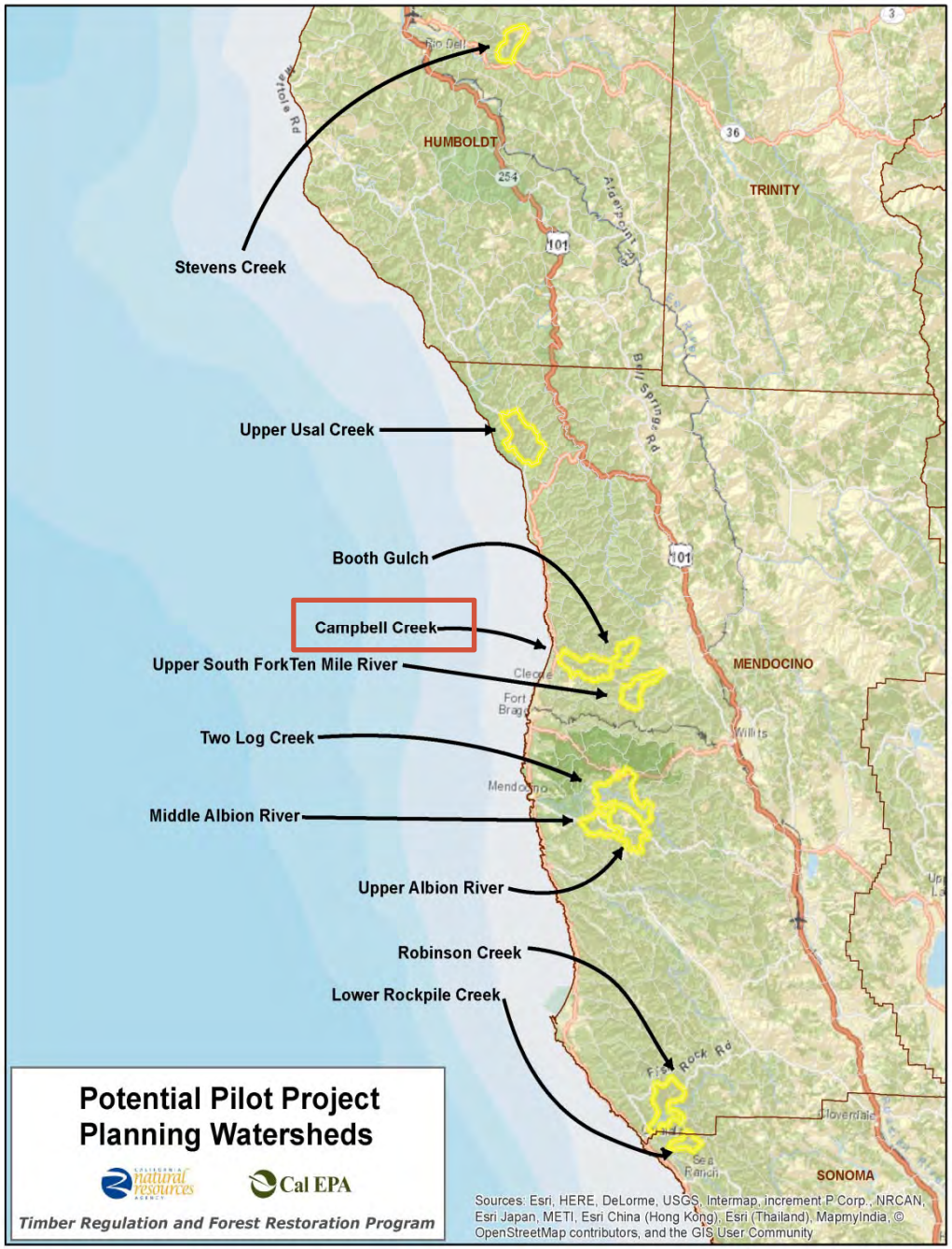
- Open to public and noticed in advance;
- Meetings will be webcast;
- Use a consensus process to the extent practicable.
- Findings and recommendations will be posted to the TRFR Program website;
- If needed scientific expertise not available through PPWG members or agency staff, we will seek provide this expertise through other means.

Selecting a Planning Watershed: Introduction

- **Narrowed focus to North Coast Planning Watersheds**
  - **High level of interest from the public**
  - **Important listed species**
  - **Variety of ownership regimes**
  - **Availability of geologic maps and studies conducted within the area**

Final Candidates-- Ten potential planning watersheds based on:

- Rate of harvest
- Range of silviculture
- Timberland owners
- Logical watershed boundaries
- *Selected Campbell Creek on Ten Mile*



Next Steps

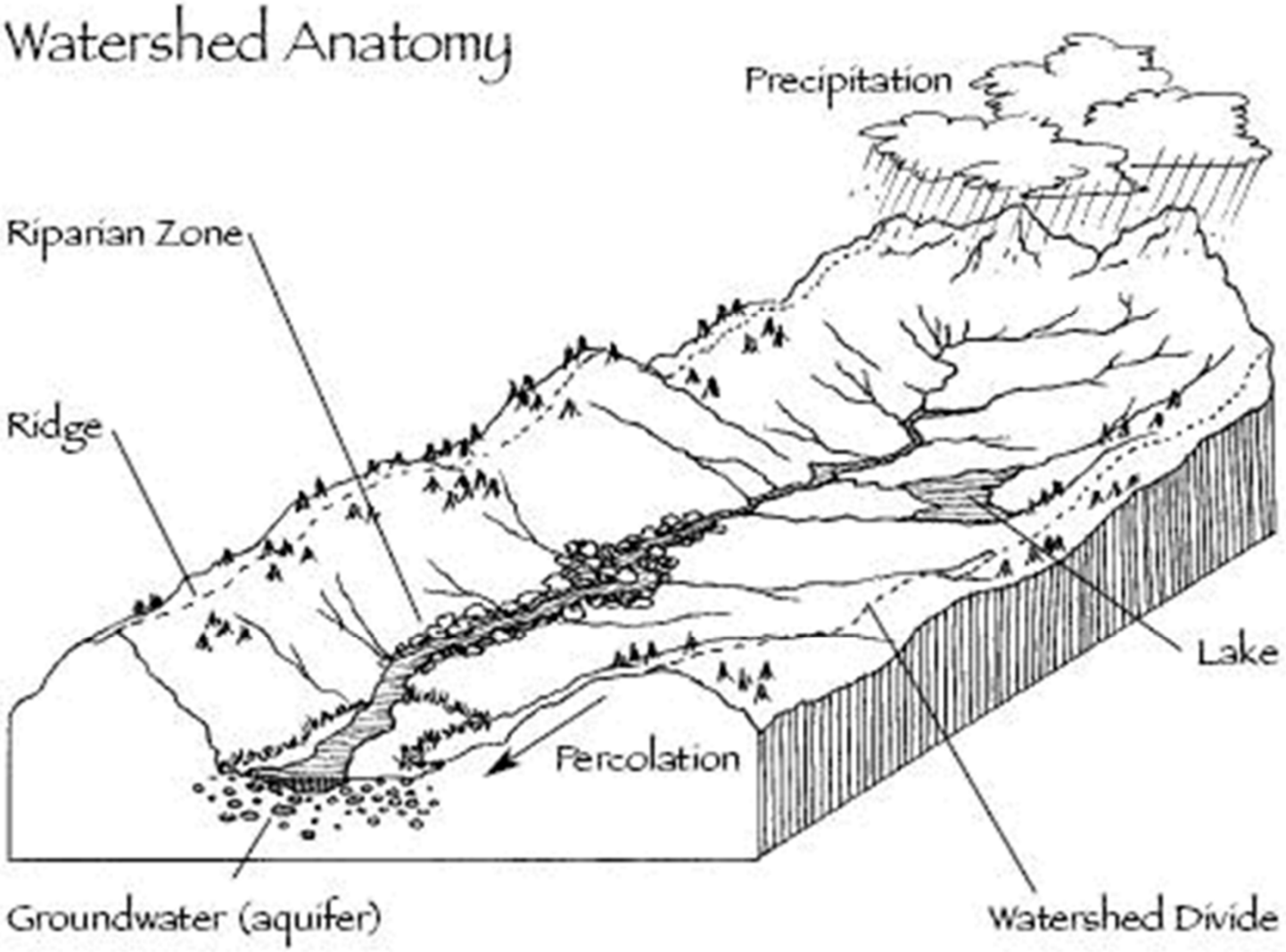
- Complete revisions to draft concept paper based on comments received;
- Put out call for members for PPWG;
- Appoint PPWG;
- Start working!

Visit our Website

resources.ca.gov/forestry

- Detailed information on our program and activities;
- Sign up for our email listserve.

Thank you!

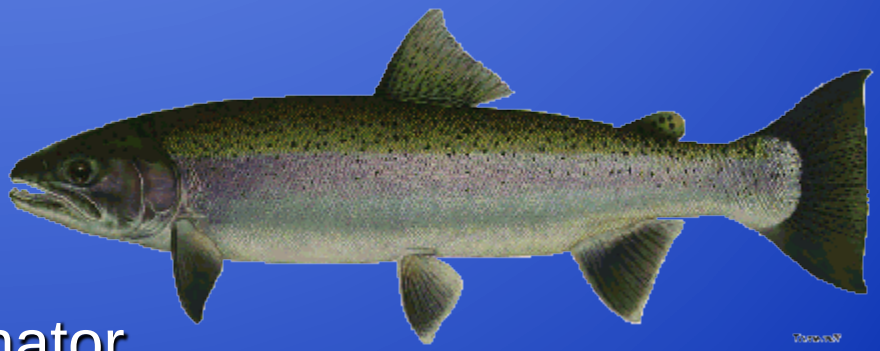

Watershed Anatomy
Precipitation
Riparian Zone
Ridge
Lake
Percolation
Groundwater (aquifer)
Watershed Divide

Life on the Edge: Recovering Southern California Steelhead

National Marine Fisheries Service

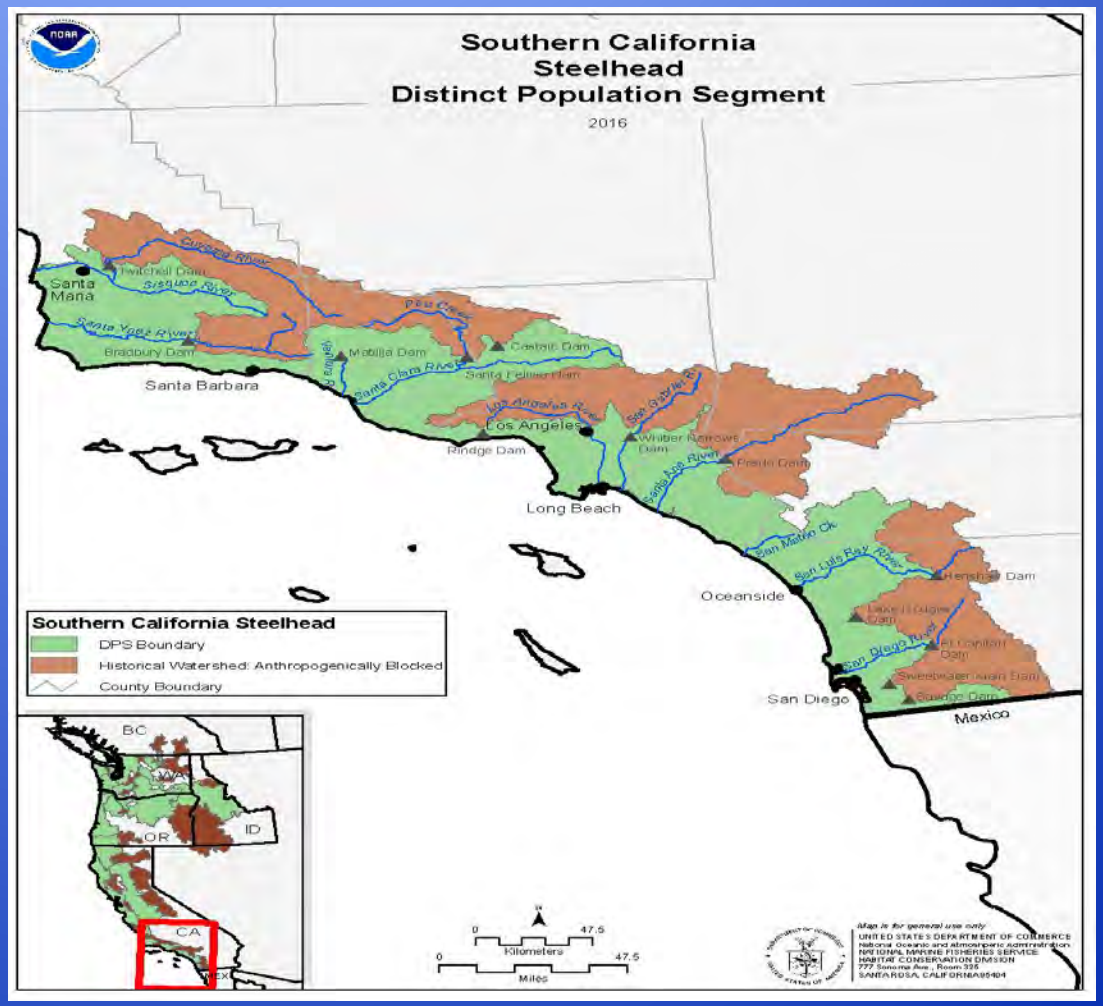
Fortuna, California
April 8, 2016

Mark H. Capelli
Steelhead Recovery Coordinator



Southern California Steelhead Recovery Planning Domain

Southern California DPS



Phase I : Technical Recovery Team

Phase I: Scientific Framework

1. TRT appointed by Regional Administrator and chaired by Dr. David Boughton, NOAA Fisheries Santa Cruz Laboratory

Dr. David A. Boughton	Dr. .Peter A. Adams
Dr. Eric Anderson	Dr. Craig Fusaro
Dr. Edward Keller	Dr. Elise Kelley
Leo Lentsch	Dr. Jennifer Nielsen
Katie Perry (DFG)	Dr. Helen Regan
Dr. Jerry Smith	Dr. Camm Swift
Dr. Lisa Thompson	Dr. Fred Watson

2. TRT consists of 12 scientists including a representative from the Department of Fish and Game

Viable Salmonid Population (VSP)

Abundance

Biological Productivity

Biological Diversity

Spatial Distribution

Phase I: Population Characterization

Principal Tasks

1. Characterize *historic* (unimpaired) ***O. mykiss*** populations

2. Delineate *geographic* extent of each historic (unimpaired) ***O. mykiss*** population

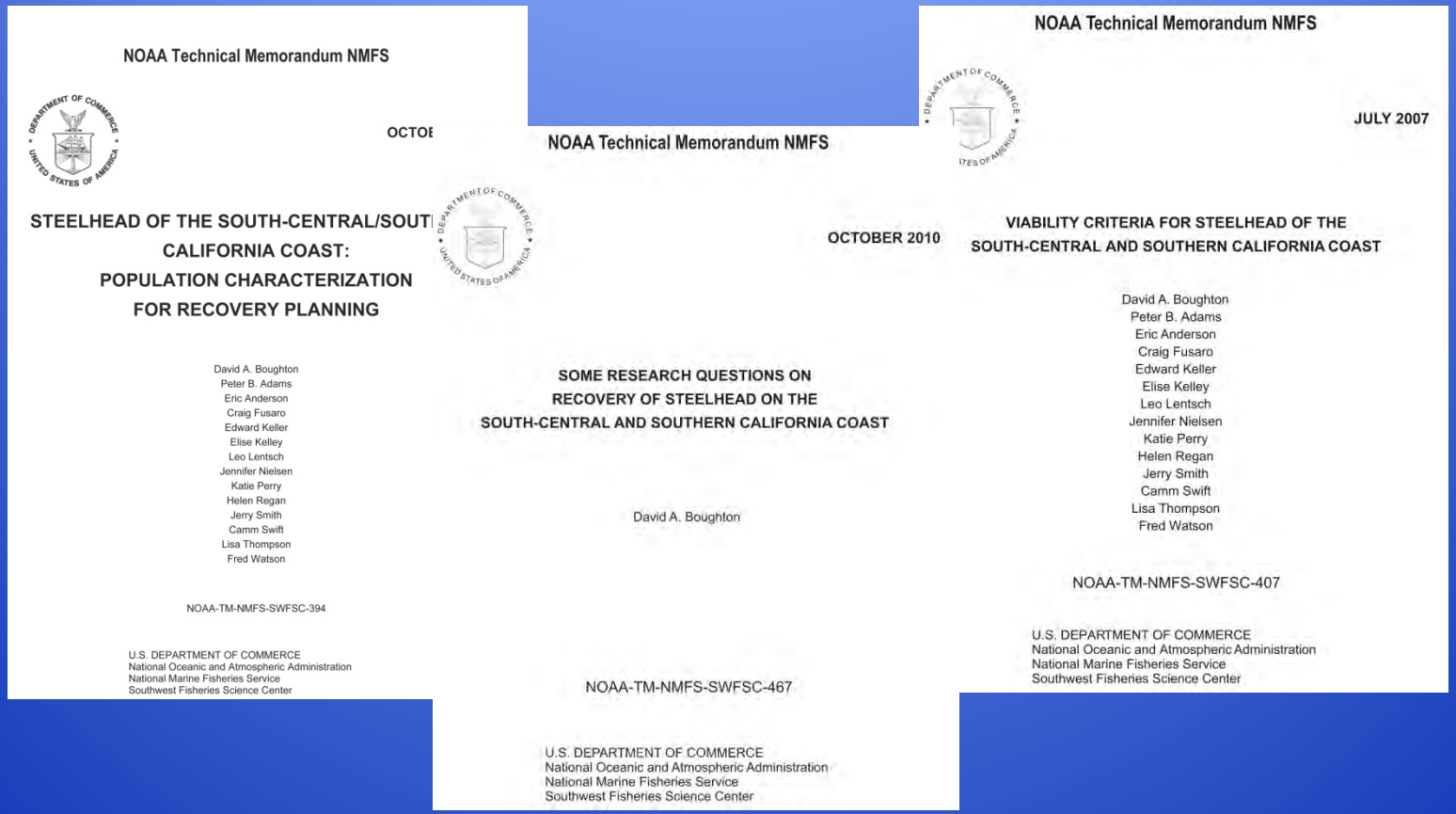
Phase I: Population Characterization

Principal Tasks

3. Estimate potential *relative viability* of each ***O. mykiss*** population in an unimpaired state

4. Develop scientifically based *viability criteria* for populations and the DPS/ESU

Phase I: Population Characterization



NOAA Technical Memorandum NMFS

OCTOI

STEELHEAD OF THE SOUTH-CENTRAL/SOUT
CALIFORNIA COAST:
POPULATION CHARACTERIZATION
FOR RECOVERY PLANNING

David A. Boughton
Peter B. Adams
Eric Anderson
Craig Fusaro
Edward Keller
Elise Kelley
Leo Lentsch
Jennifer Nielsen
Katie Perry
Helen Regan
Jerry Smith
Camm Swift
Lisa Thompson
Fred Watson

NOAA-TM-NMFS-SWFSC-394

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Southwest Fisheries Science Center

NOAA Technical Memorandum NMFS

OCTOBER 2010

SOME RESEARCH QUESTIONS ON
RECOVERY OF STEELHEAD ON THE
SOUTH-CENTRAL AND SOUTHERN CALIFORNIA COAST

David A. Boughton

NOAA-TM-NMFS-SWFSC-467

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Southwest Fisheries Science Center

NOAA Technical Memorandum NMFS

JULY 2007

VIABILITY CRITERIA FOR STEELHEAD OF THE
SOUTH-CENTRAL AND SOUTHERN CALIFORNIA COAST

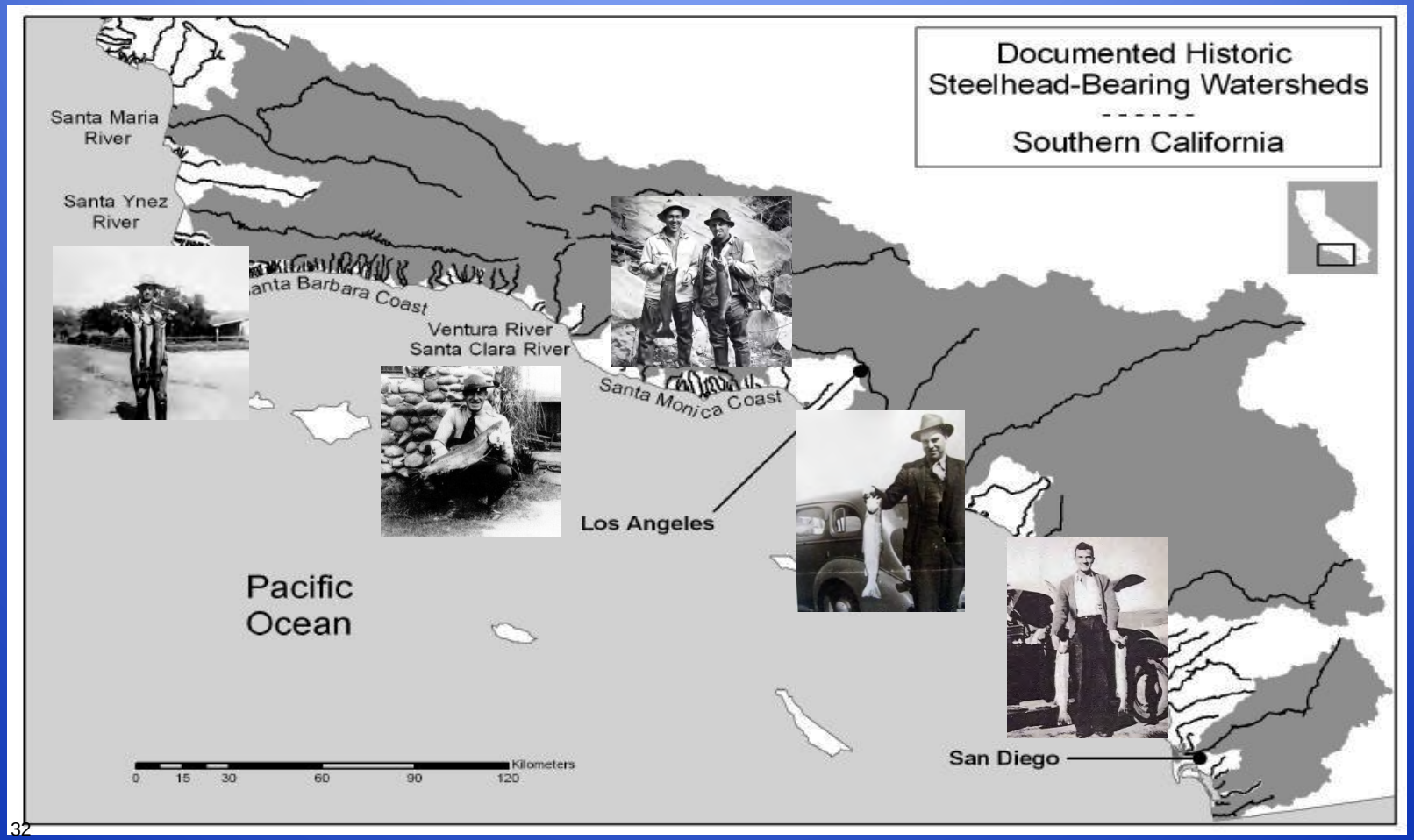
David A. Boughton
Peter B. Adams
Eric Anderson
Craig Fusaro
Edward Keller
Elise Kelley
Leo Lentsch
Jennifer Nielsen
Katie Perry
Helen Regan
Jerry Smith
Camm Swift
Lisa Thompson
Fred Watson

NOAA-TM-NMFS-SWFSC-407

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Southwest Fisheries Science Center

Principal Findings: Population Characterization

- *Historic* distribution of *O. mykiss* widespread



Principal Findings: Population Characterization

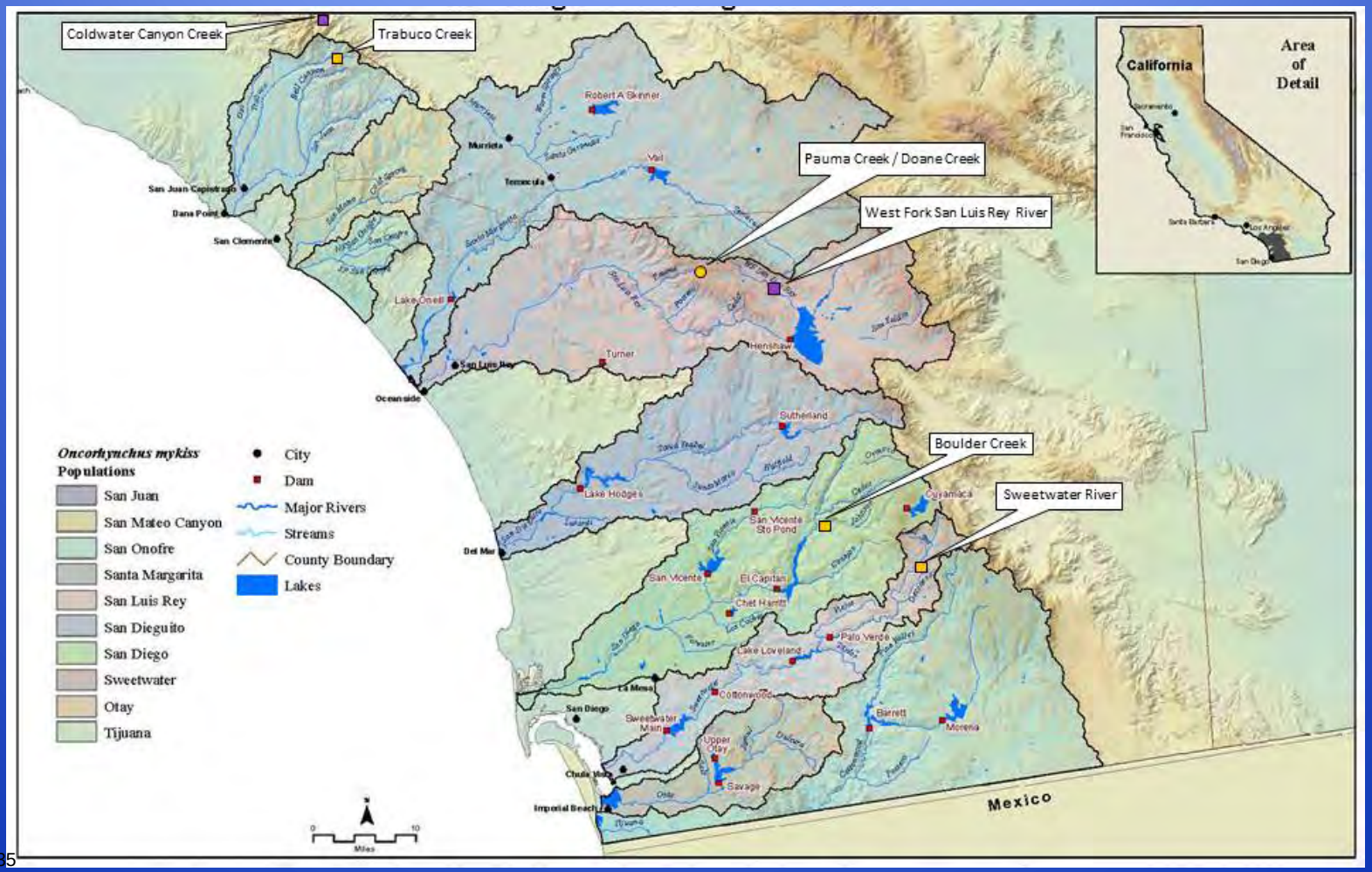
- *Current* distribution of *O. mykiss* is still widespread

Principal Findings: Population Characterization

- Above barrier *O. mykiss* most *closely related* to below barrier populations

- Above barrier *O. mykiss* (in most watersheds)*not descendent* from planted hatchery rainbow trout

Principal Findings: Population Characterization

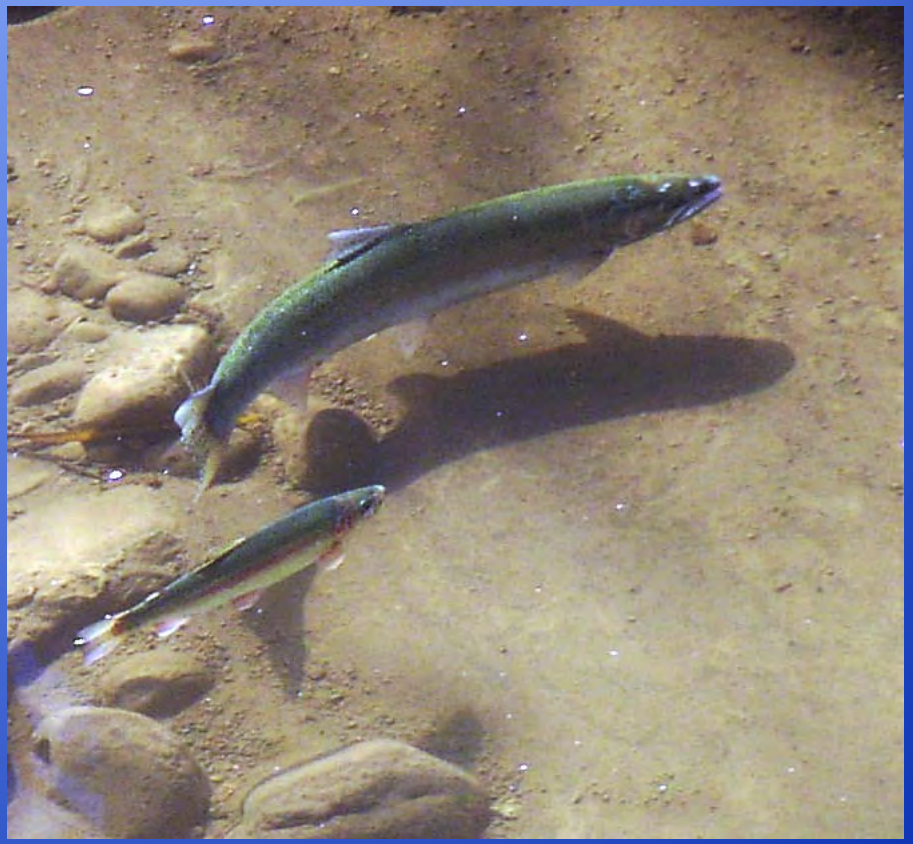


Adadia-Cardoso, *et al*. 2016

Principal Findings: Population Characterization

- *O. mykiss* populations above artificial barriers have the potential to *resume* an anadromous life-history

- Above artificial barrier *O. mykiss* are an *integral* component of anadromous populations



Mission Creek: Anadromous & Resident

Principal Findings: Population Characterization

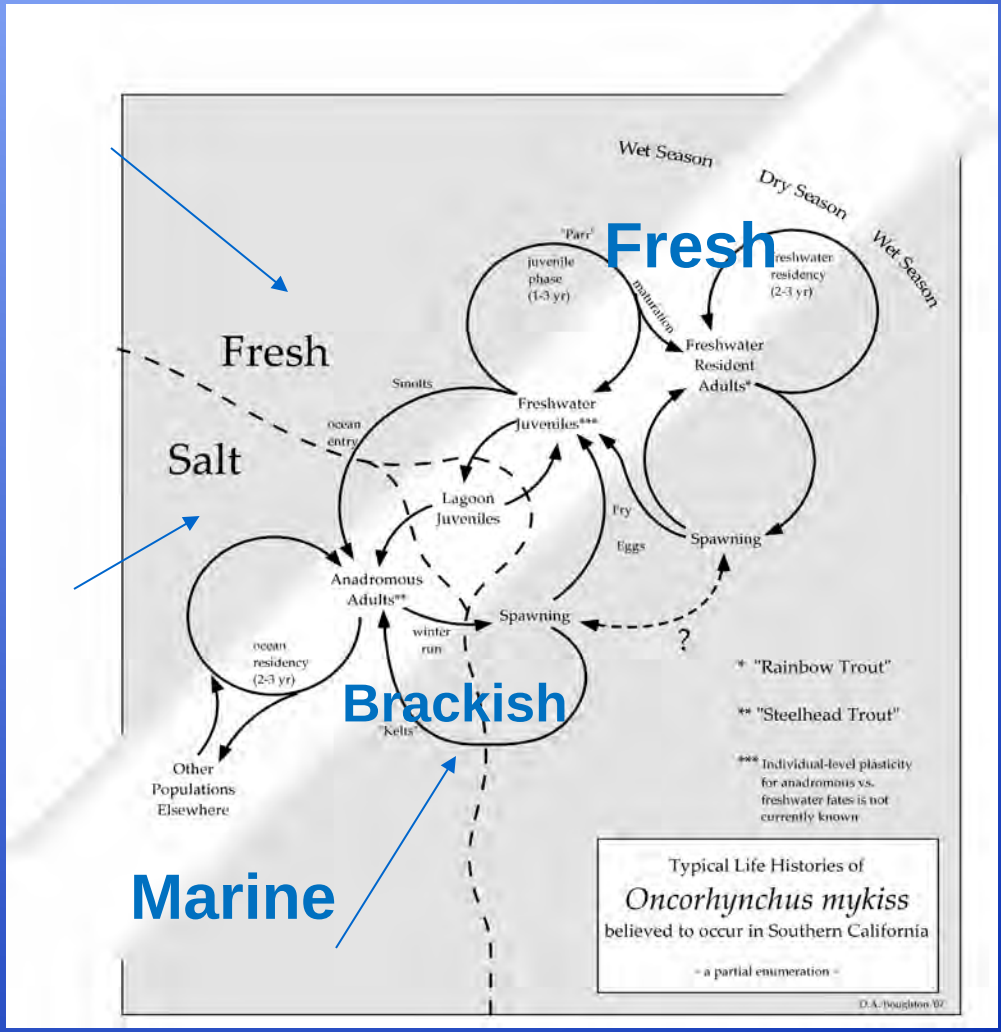
Variable Life-Histories:

Anadromous

Fresh-Water

Lagoon-Anadromous

Variations



ESU-DPS Viability Criteria

Basic Recovery Goals

- Preserve over-all species diversity (genetic, phenotypic, life-history)
- Prevent extinction of the DPS due to catastrophic disturbance (wildfires, flooding, droughts)

Note: 1000-year recovery planning time-frame

ESU-DPS Viability Criteria

Basic Strategy

- Restore *O. mykiss* populations in *representative* diverse biogeographic regions (diversity)

- Restore *multiple* *O. mykiss* populations in each biogeographic regions (redundancy)

ESU-DPS Viability Criteria

Southern California Biogeographic Population Groups:

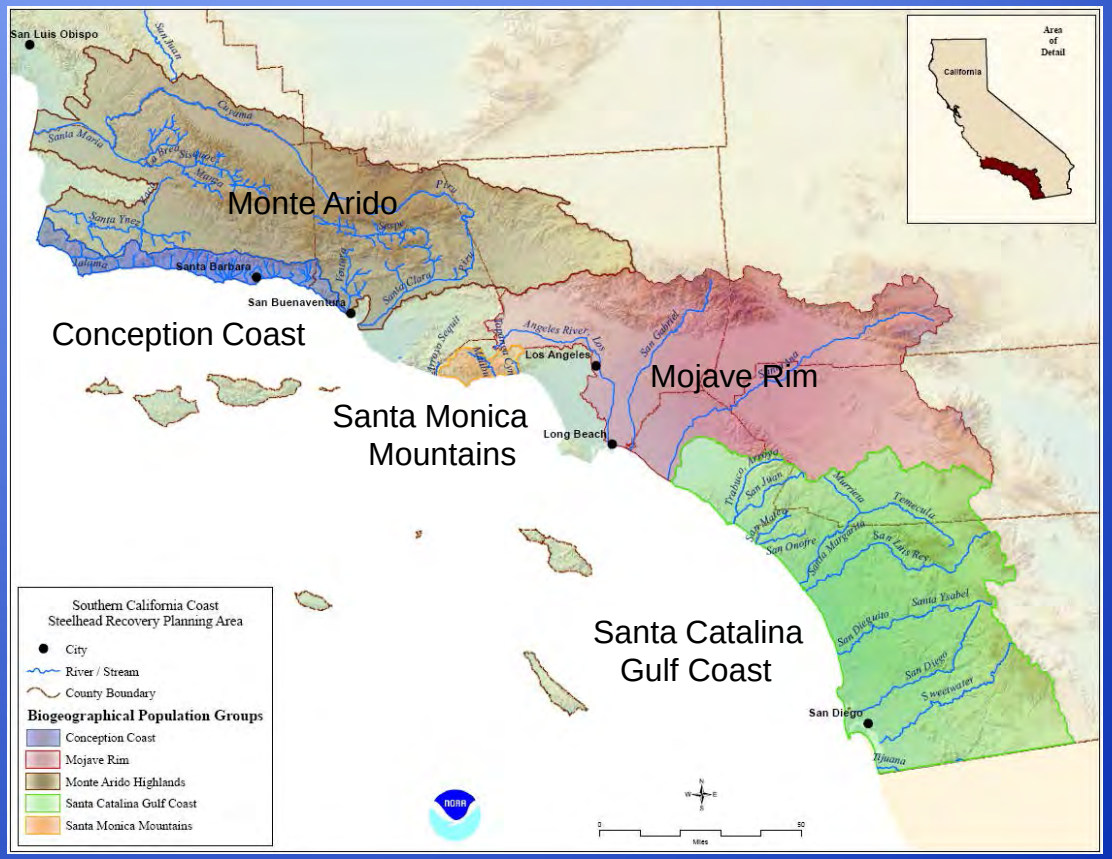
1 - Monte Arido

2 - Conception Coast

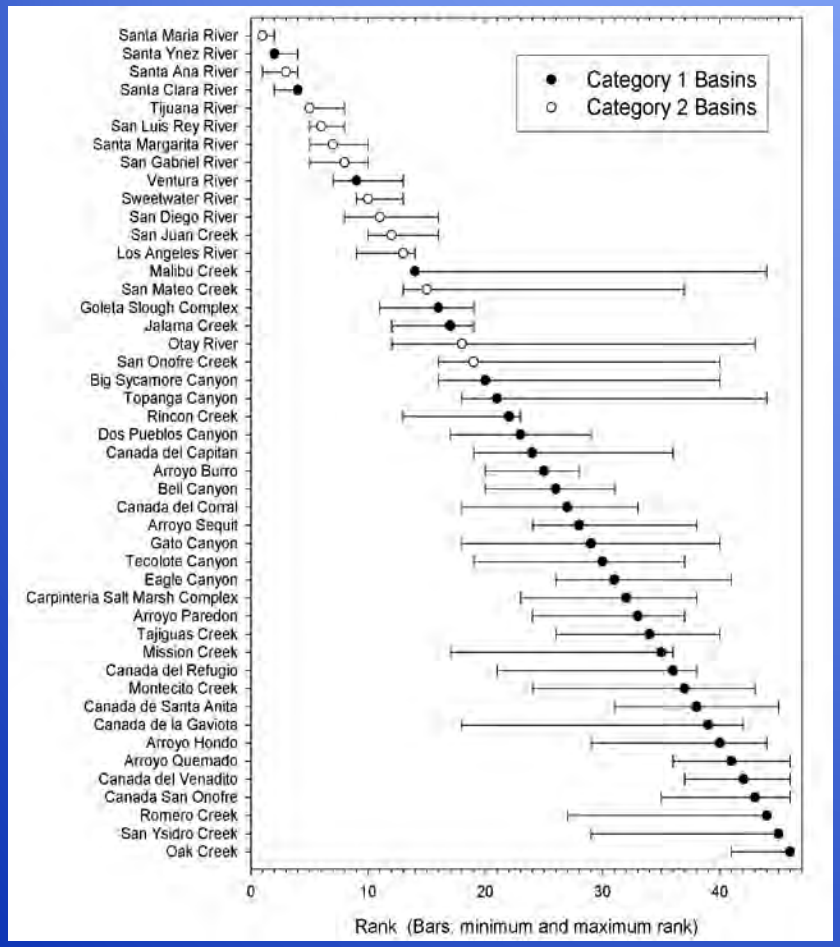
3 - Santa Monica Mountains

4 - Mojave Rim

5 - Santa Catalina Gulf Coast



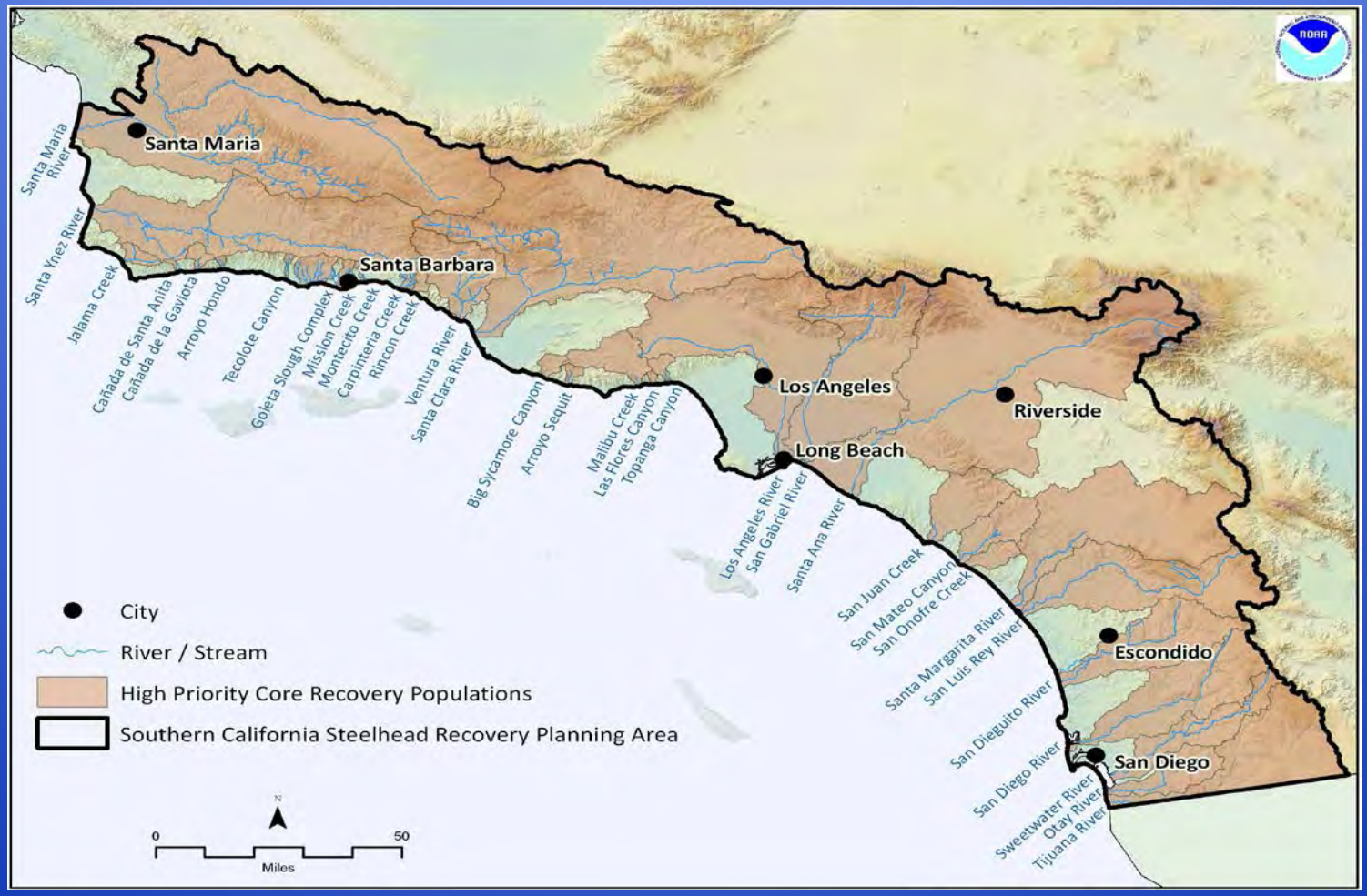
ESU-DPS Viability Criteria



Relative Intrinsic Potential Viability

San Dieguito River

ESU-DPS Viability Criteria



ESU-DPS Viability Criteria

DPS Level – Viability Criteria

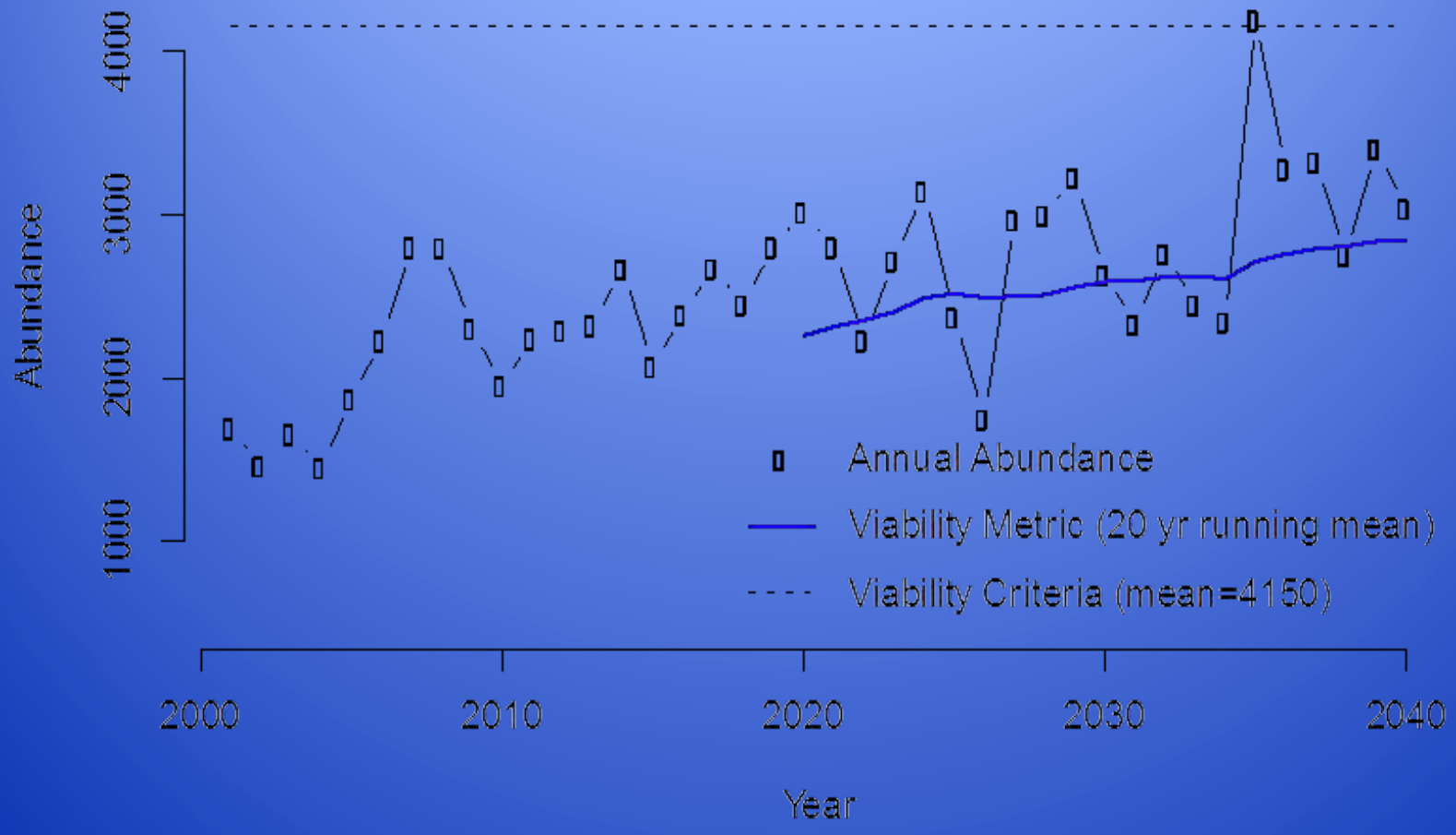
- Minimum number of populations in each biogeographic region
- Minimum geographic separation (wildland fire analysis)
- BPGs Exhibit life history diversity

< 5% extinction risk in 1000 years

Population Viability Criteria

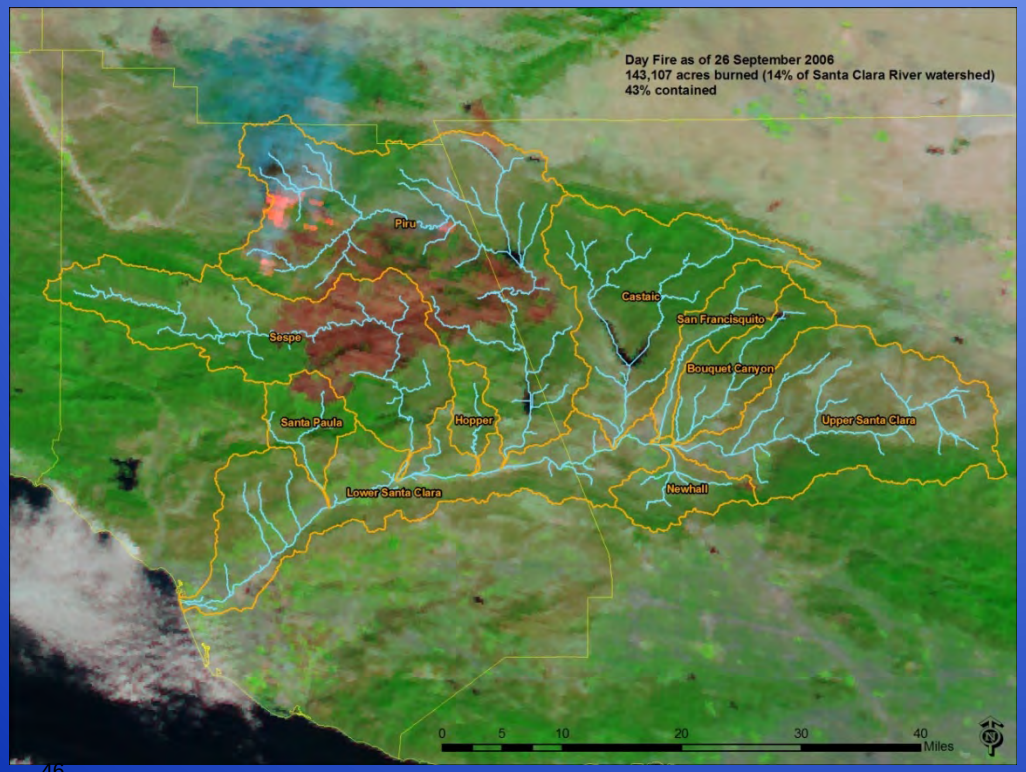
- Run Size: N > 4,150 annually
- < 5% extinction risk in 100 years
- Persistence: Multi-Decadal oceanic and climatic cycles
- Anadromous Fraction: 100%
- Hatchery Influence : < 5%

Population Viability Criteria



Steelhead Recovery Planning Recommendations

Ecosystem-based management of sediment and hydrographic regimes



Steelhead Recovery Planning Recommendations

Identify and maintain sustainable refugia against severe droughts and heat waves

Sespe Creek

San Gabriel River

Santa Margarita River

Steelhead Recovery Planning Recommendations

Secure and improve estuarine/lagoon habitat

Ventura River Estuary

Tijuana River Estuary

Steelhead Recovery Planning Recommendations

Conduct steelhead population monitoring and research

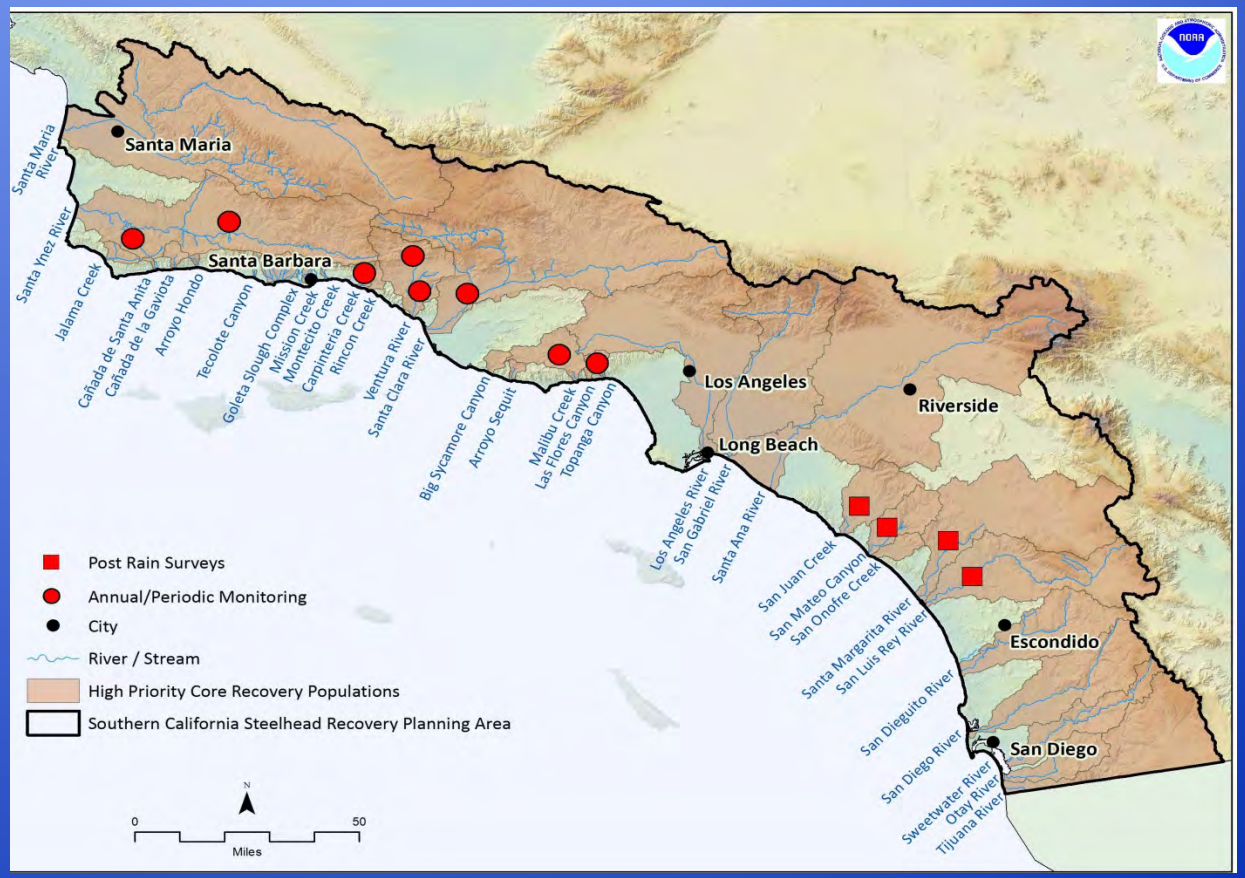
Ventura River Estuary

Coyote Creek

Southern California Steelhead Monitoring

Current Monitoring/Surveying Efforts

- Santa Ynez
- Carpinteria
- Ventura
- Santa Clara
- Malibu Creek
- Topanga Creek
- Sa Juan
- San Mateo
- Santa Margarita
- San Luis Rey



Southern California Steelhead Research

Priority Research Topics

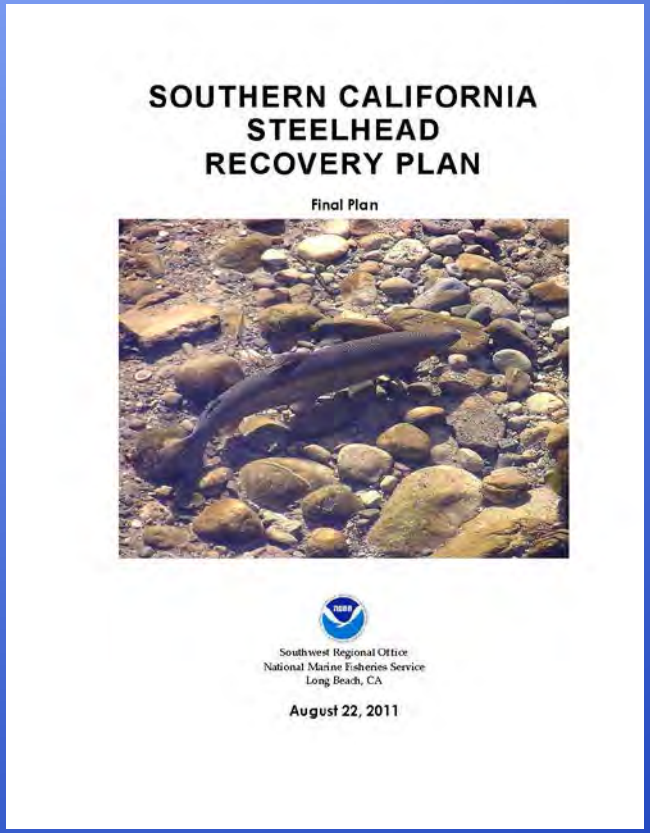
- Expression of life-history forms
- Dispersal between watersheds
- Role of intermittent streams
- Role of lagoons/estuaries

Sweetwater River

Steelhead Recovery Planning

Phase II Recovery Plans:

Templates for Recovery and De-listing



Steelhead Recovery Planning

Watershed-Wide Threats Assessment

THREAT SOURCES	Threat Source Rankings: San Luis Obispo BPG Component Watersheds (north to south)											
	San Carpoforo Creek*	Arroyo de la Cruz*	Little Pico Creek*	Pico Creek	San Simeon Creek	Santa Rosa Creek	Morro Creek	Chorro Creek	Los Osos Creek	San Luis Obispo Creek	Pismo Creek	Arroyo Grande Creek
Agricultural Development												
Groundwater Extraction												
Dams and Surface Water Diversions												
Levees and Channelization												
Other Passage Barriers												
Urban Development												
Roads												
Recreational Facilities												
Urban Effluents												
Agricultural Effluents												

High Priority Steelhead Recovery Actions

- Volitional fish passage
- Flow restoration
- Flood control management
- Riparian corridor restoration
- Sediment restoration
- Non-native species control
- Estuary restoration

Ventura River 1946

Steelhead Recovery Planning

Pacific Lamprey

Other Federally Listed Species Species of Special Concern

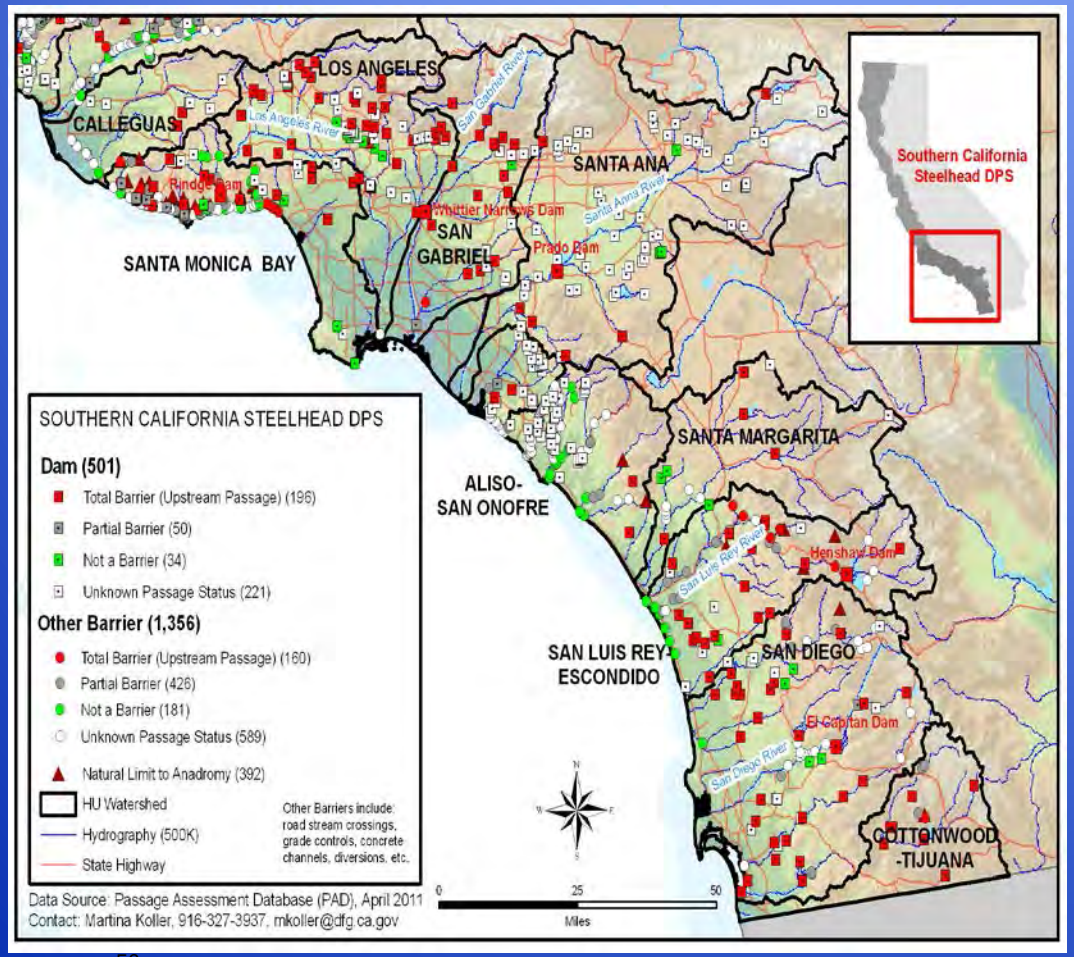
California Red-legged Frog

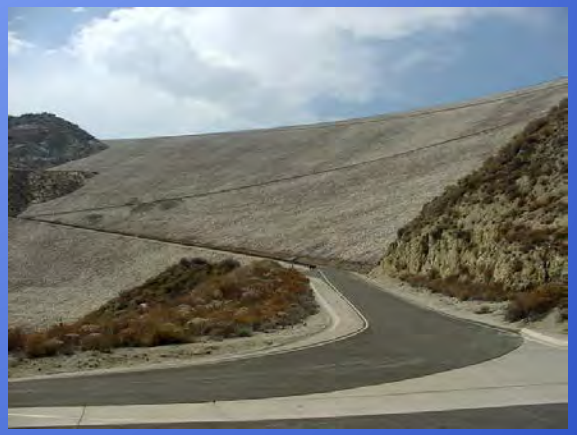
Tidewater Goby

Snowy Plover

Arroyo Toad

Southern California Steelhead Threats

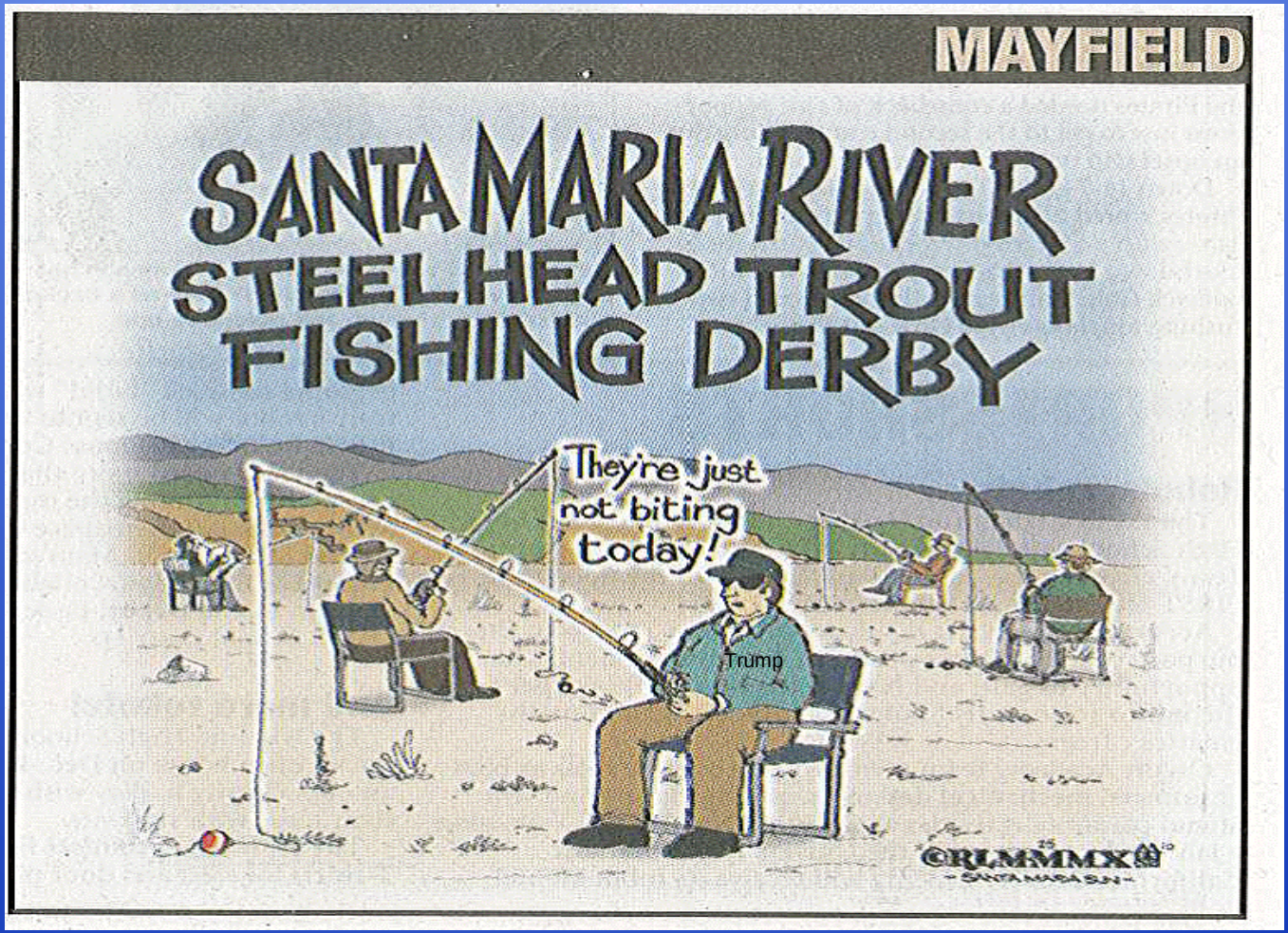




Santa Ana River

Arroyo Trabuco Creek

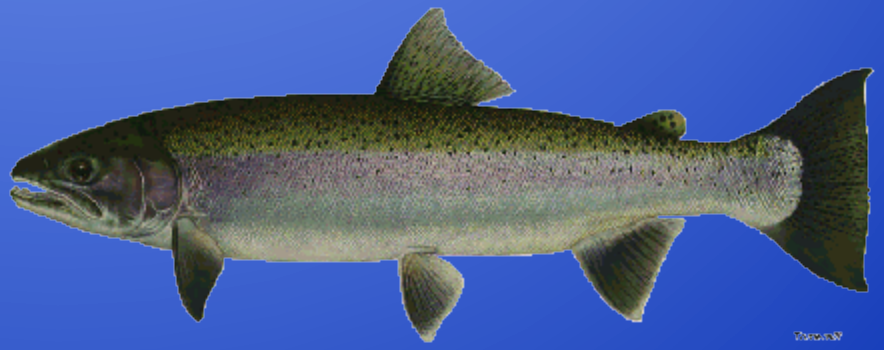
Steelhead Recovery Planning



Life on the Edge: Recovering Southern California Steelhead

National Marine Fisheries Service

Fortuna, California
April 8, 2016



Mark H. Capelli
Steelhead Recovery Coordinator

P.A.C.T. – A TRANS-AGENCY, TRANS-DISCIPLINE PROGRAM TO PREVENT COHO SALMON EXTIRPATION IN THE CENTRAL CALIFORNIA COAST

Stephen Swales* & Charlotte Ambrose†

*California Department of Fish & Wildlife

†NOAA Fisheries

The PACT Program for CCC Coho

P – PRIORITY

A – ACTION

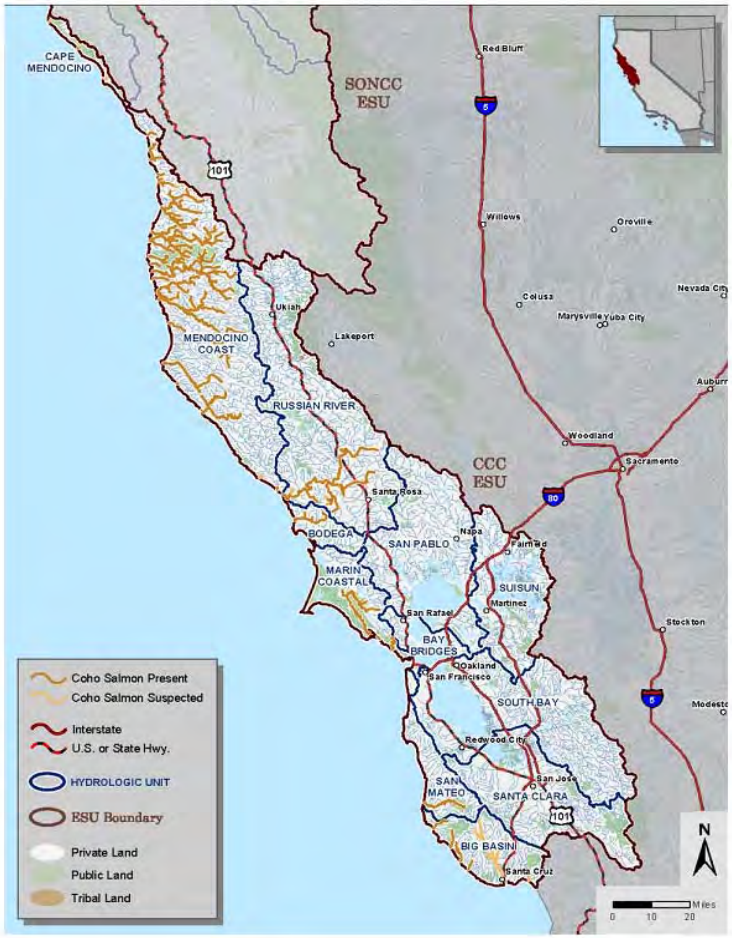
C – COHO

T – TEAM

Conservation Status of CCC COHO Salmon

- First listed as ESA Threatened in 1996
- In 2005 CCC coho were reclassified as Endangered under both ESA and CESA

FIGURE 2-4: Present distribution of coho salmon in the CCC Coho ESU



2.8 BIOLOGY

Central California Coho Salmon – heading towards extinction?

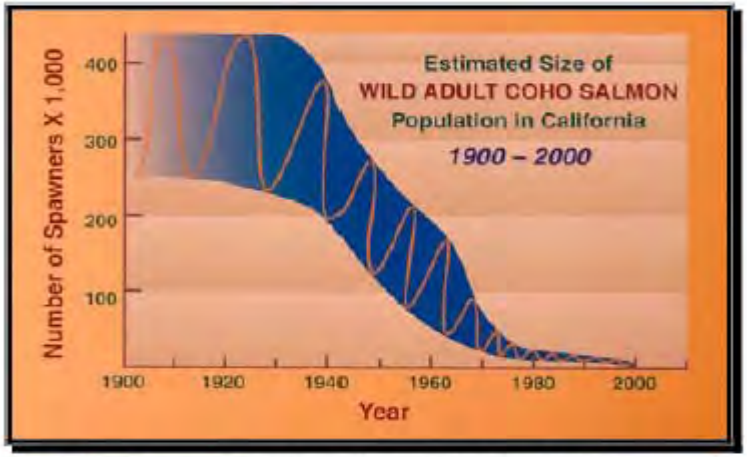
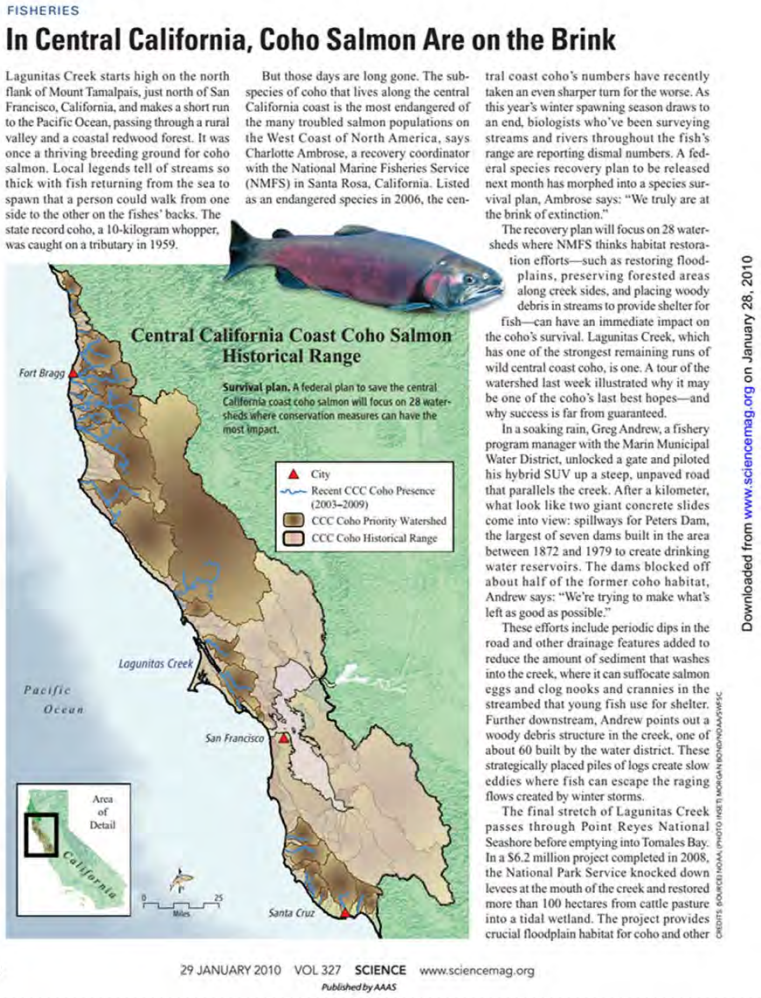


Figure 2: Visual Representation of Extinction Vortex of Coho Salmon (Peter Moyle, pers. comm.)

Status: Highly vulnerable to extinction within next 50 years. Present trends suggest that most or all populations in small coastal streams will disappear in next 25-50 years without increased intervention and protection of watersheds."

Moyle et al. 2008.



FISHERIES

In Central California, Coho Salmon Are on the Brink

Lagunitas Creek starts high on the north flank of Mount Tamalpais, just north of San Francisco, California, and makes a short run to the Pacific Ocean, passing through a rural valley and a coastal redwood forest. It was once a thriving breeding ground for coho salmon. Local legends tell of streams so thick with fish returning from the sea to spawn that a person could walk from one side to the other on the fishes' backs. The state record coho, a 10-kilogram whopper, was caught on a tributary in 1959.

But those days are long gone. The subspecies of coho that lives along the central California coast is the most endangered of the many troubled salmon populations on the West Coast of North America, says Charlotte Ambrose, a recovery coordinator with the National Marine Fisheries Service (NMFS) in Santa Rosa, California. Listed as an endangered species in 2006, the central coast coho's numbers have recently taken an even sharper turn for the worse. As this year's winter spawning season draws to an end, biologists who've been surveying streams and rivers throughout the fish's range are reporting dismal numbers. A federal species recovery plan to be released next month has morphed into a species survival plan, Ambrose says: "We truly are at the brink of extinction."

The recovery plan will focus on 28 watersheds where NMFS thinks habitat restoration efforts—such as restoring floodplains, preserving forested areas along creek sides, and placing woody debris in streams to provide shelter for fish—can have an immediate impact on the coho's survival. Lagunitas Creek, which has one of the strongest remaining runs of wild central coast coho, is one. A tour of the watershed last week illustrated why it may be one of the coho's last best hopes—and why success is far from guaranteed.

In a soaking rain, Greg Andrew, a fishery program manager with the Marin Municipal Water District, unlocked a gate and piloted his hybrid SUV up a steep, unpaved road that parallels the creek. After a kilometer, what look like two giant concrete slides come into view: spillways for Peters Dam, the largest of seven dams built in the area between 1872 and 1979 to create drinking water reservoirs. The dams blocked off about half of the former coho habitat, Andrew says: "We're trying to make what's left as good as possible."

These efforts include periodic dips in the road and other drainage features added to reduce the amount of sediment that washes into the creek, where it can suffocate salmon eggs and clog nooks and crannies in the streambed that young fish use for shelter. Further downstream, Andrew points out a woody debris structure in the creek, one of about 60 built by the water district. These strategically placed piles of logs create slow eddies where fish can escape the raging flows created by winter storms.

The final stretch of Lagunitas Creek passes through Point Reyes National Seashore before emptying into Tomales Bay. In a $6.2 million project completed in 2008, the National Park Service knocked down levees at the mouth of the creek and restored more than 100 hectares from cattle pasture into a tidal wetland. The project provides crucial floodplain habitat for coho and other

Central California Coast Coho Salmon Historical Range

Survival plan. A federal plan to save the central California coast coho salmon will focus on 28 watersheds where conservation measures can have the most impact.

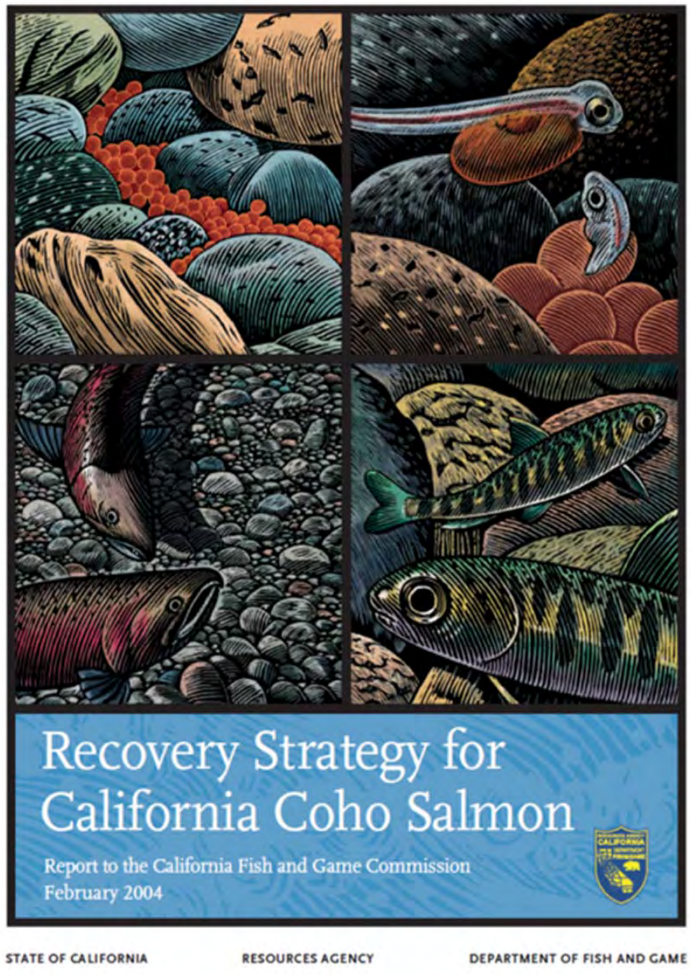
City
Recent CCC Coho Presence (2003–2009)
CCC Coho Priority Watershed
CCC Coho Historical Range

Fort Bragg
Lagunitas Creek
Pacific Ocean
San Francisco
Santa Cruz
Area of Detail
California
0 25 Miles

CREDITS: (SOURCE) NOAA; (PHOTO) HOLLY MORGAN BOND/NOAA/SWFSC

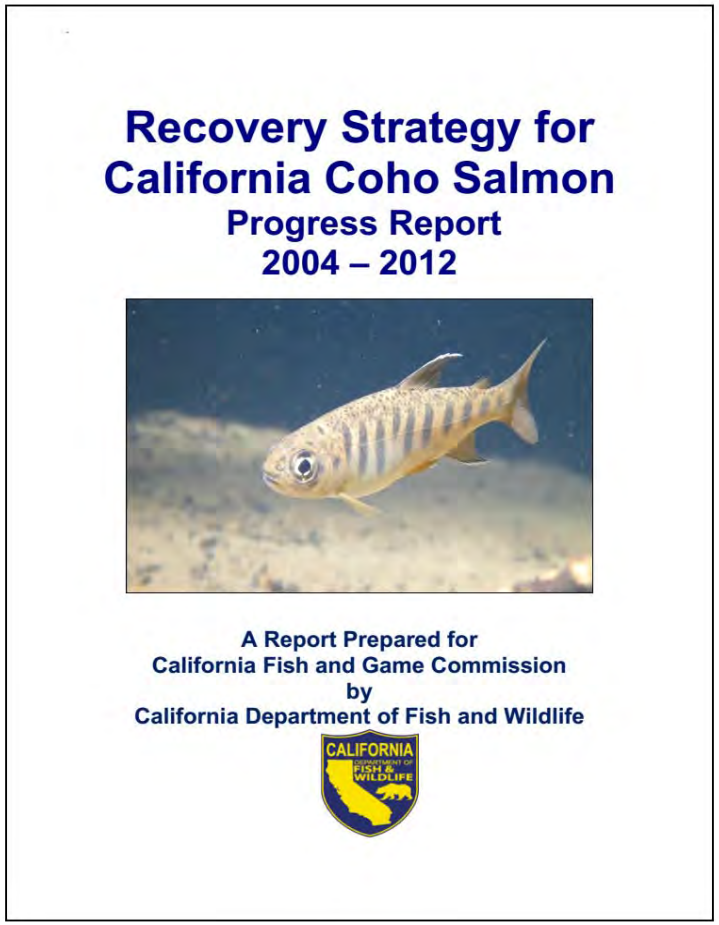
CDFW Coho Recovery Plan, 2004

- Coho salmon populations throughout California have declined considerably over recent years
- "Coho salmon in the CCC Coho ESU are in serious danger of extinction throughout all or a significant portion of their range."



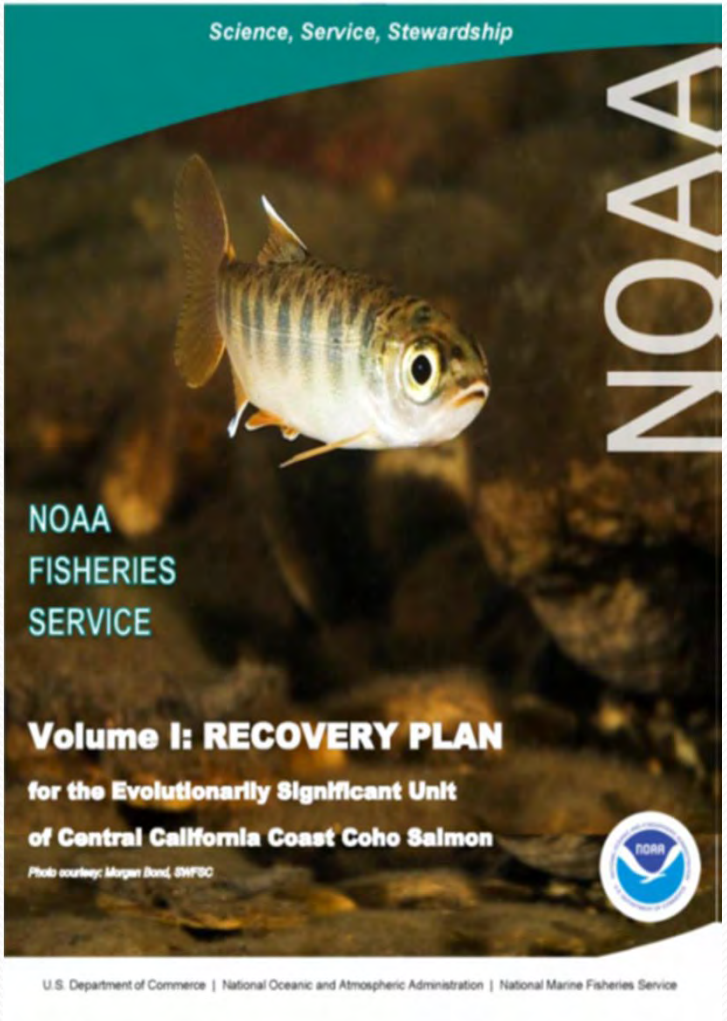
Recovery Strategy 2015 Update

- The numbers of adult coho salmon in monitored streams in the SONCC and CCC ESUs have continued to decline since 2004.
- The overall picture of coho salmon in California is one of severely depleted populations, particularly in the southern part of the range.



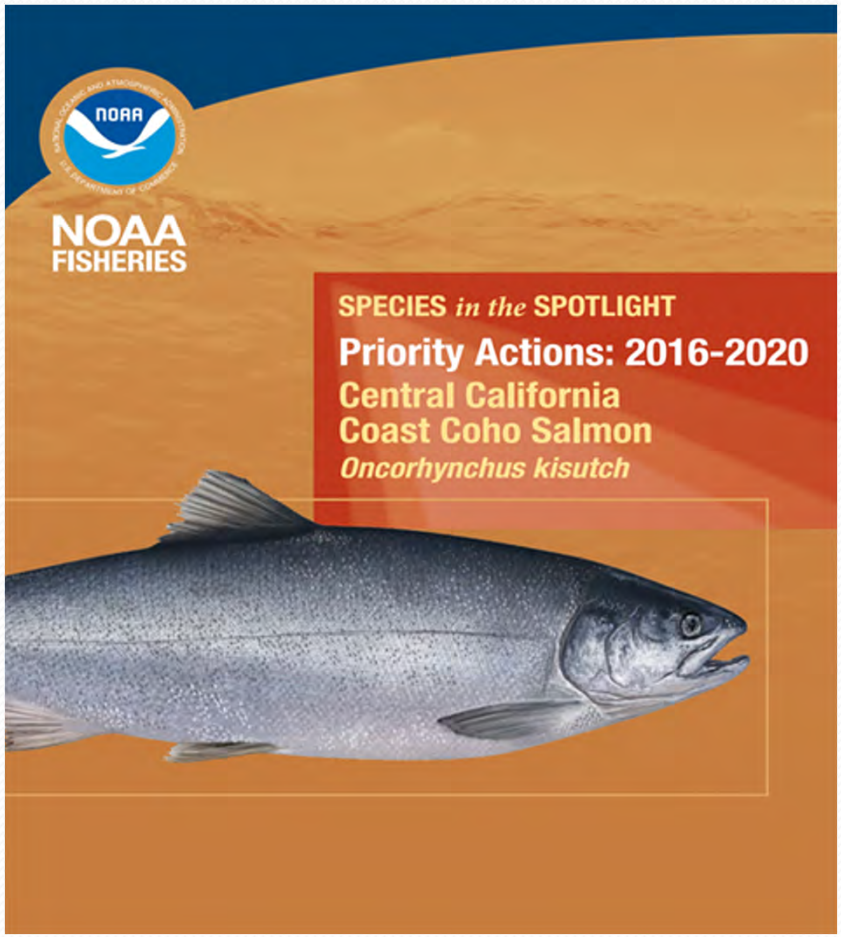
NOAA CCC Coho Recovery Plan, 2012

"The impending extinction of CCC coho salmon is a call to shift our focus from long term recovery to include a short term strategy to prevent extinction. The situation is dire, but not hopeless."



CCC Coho - NOAA Fisheries - 2015 'Species in the Spotlight'

- Coho salmon in the Central California Coast ESU are one of 8 species highlighted nationally in this new program
- This designation seeks to highlight species which are most at risk of extinction and to target efforts vital for stabilizing populations and preventing extinction
- Main themes - Conservation hatcheries, habitat restoration and monitoring



Priority Action Coho Team (PACT)

PACT was formally established in 2013 by CDFW & NOAA Fisheries, but the ongoing drought has delayed progress

Mission is to prevent further extirpations of coho in the CCC ESU

PACT Structure

- The structure of this effort involves the formation of a Priority Action Coho Team (PACT) organized and managed using a three-tiered system including:

1) A series of **Technical Work Groups** (TWGs) comprised of representatives of agencies, private and public stakeholders

2) A joint CDFW/NOAA **Coordination Group**

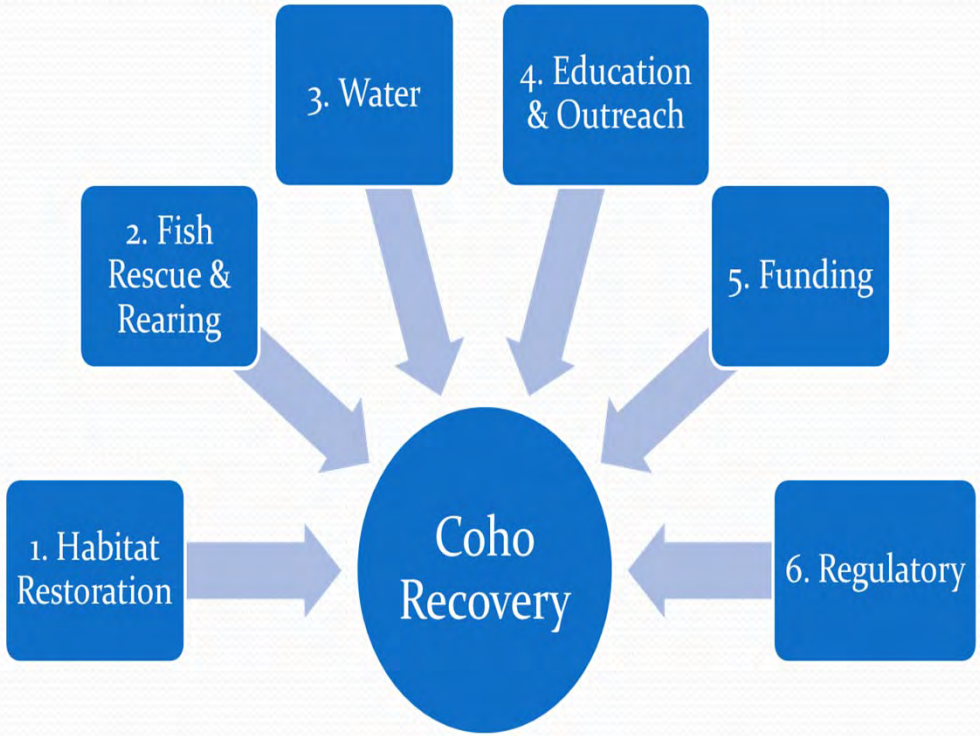
3) A joint CDFW/NOAA **Management Committee**

PACT Objectives & Function

- **Objectives : To develop and implement priority short-term actions which will prevent the local extirpation of coho salmon populations in the CCC Federal ESU**
- **Who is Involved? Federal and State agencies (NOAA, CDFW), NGO's, Water Agencies, other stakeholders**
- **Progress to date: Coordination and management groups have been set up and have met to decide on the course of action**
- **Technical Work Groups have been set up and have developed a list of proposed recovery actions**

PACT Technical Working Groups

1. **Habitat Protection and Restoration**
2. **Captive Rearing, & Fish Rescue**
3. **Water Flow and Conservation**
4. **Regulations, Permitting and Enforcement**
5. **Funding opportunities**
6. **Outreach and Education.**



Roles and Tasks of Technical Work Groups

- To identify the highest priority restoration actions for immediate implementation
- Prioritize actions which build from State and Federal recovery plans
- Focus restoration activities on coho declines within geographical areas
- To report out and produce a list of priority recovery actions for implementation

Habitat Protection & Restoration

- Major aim is to develop a list of priority habitat restoration projects, taken from CDFW and NOAA coho salmon recovery plans, to be strategically implemented in identified CCC coho salmon ESU watersheds.

Goals and Objectives

- Coordinate CDFW/NOAA short-term habitat restoration efforts (Core Habitat TWG with Agency Support group)
- Develop a prioritized list of watershed restoration projects for immediate and short-term implementation
- Develop a strategy to implement identified tasks
- Submit the products to the Coordination Committee to be integrated with the other TWG efforts

Captive Rearing and Fish Rescue

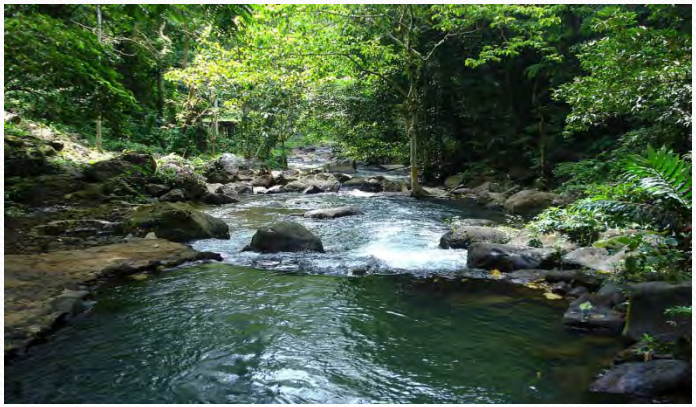
- To develop a framework for captive rearing efforts of selected coho salmon populations in the CCC ESU to prevent their extirpation and preserve their genotypes for the benefit of CCC coho salmon ESU recovery.
- To create an inter-agency Coho Salmon Rescue Strategy for the CCC ESU

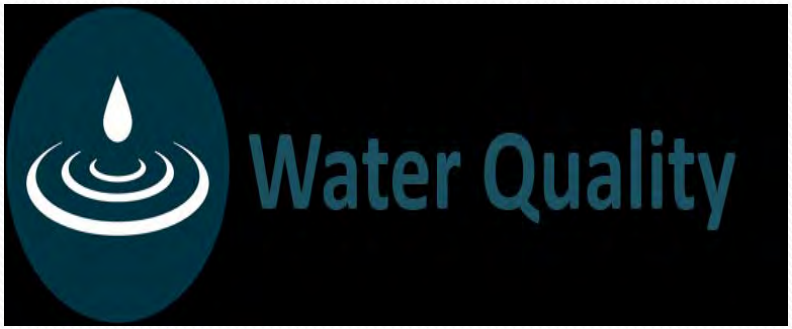
Goals and Objectives

- Coordinate CDFW/NOAA Fisheries coho rescue and captive rearing efforts and identify specific entities that can assist
- Develop a specific protocol for Central California Coast Evolutionarily Significant Unit (CCC ESU) coho salmon rescues in accordance with the effective Interagency Anadromous Fish Rescue Strategy
- Develop a list of CCC ESU coho populations that may benefit from captive rearing
- Formulate ESU-wide recommendations and region-specific recommendations

Water Flow and Conservation

- To develop a list of actions that will result in immediate benefits to stream flow conditions and water quality in CCC coho salmon ESU watersheds
- Implement instream flow conservation recommendations





Goals and Objectives

- Identify information relevant to instream flow issues affecting coho salmon streams and prioritize actions based on those findings
- Assess existing stream flow gauging information and locations for additional gauging needed in each watershed
- Assess existing surface water diversions, impoundments and sources of groundwater use and the bypass flow conditions associated with them
- Determine available instream flow recommendations and completed instream flow studies

Education & Outreach

- To promote outreach and education regarding CCC coho salmon declines and PACT activities
- Provide guidance and liaise with the general public on coho recovery activities and potential involvement

Goals and Objectives

- Conduct internal CDFW/NOAA outreach to ensure agency messages are concordant
- Develop outreach products, including; standard power point presentations and other outreach materials
- Outline the use of media, recognition programs, interpretive opportunities
- Finalize a PACT logo

Regulations, Permitting and Enforcement

- Objective to identify opportunities that will facilitate efficient permitting of restoration projects and improvements to regulatory mechanisms
- Develop Regulation, Enforcement, Permitting Recommendations

High Priority Recommendations

- Streamline Restoration Permitting
- Improve Communication between regulatory and enforcement staff
- Outreach to County District Attorneys to ensure case prosecution
- Develop a Multi-Agency Task Force to address high priority watershed issues

Funding

- To identify a list of potential funding sources available for coho salmon recovery programs in the CCC ESU
- Submit applications for funding

Goals and Objectives

- Coordinate with all funding agencies to get detailed application materials and information to compile into a spreadsheet to disseminate to restoration partners
- Update this list on annual basis to reflect current and outdated opportunities
- Meet with management and coordination group to see what interest there is in prioritizing funds for projects outlined in other TWG groups

PACT

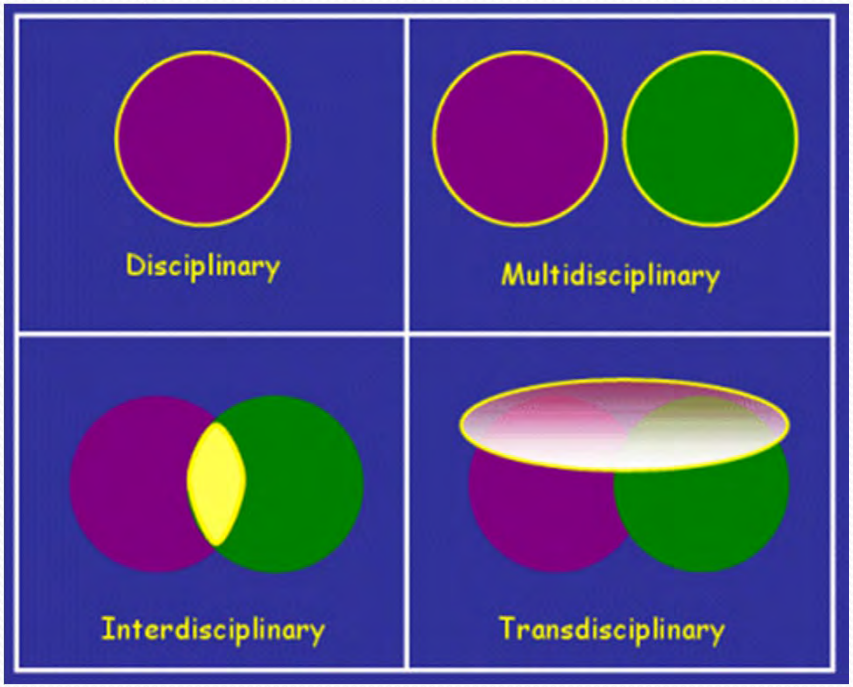
KEY ELEMENTS

Inter-agency Collaboration

- CDFW and NOAA are the primary coordinating agencies
- Will work closely together to develop the PACT program
- Other state and federal agencies may also potentially become involved:

Trans-boundary, Trans-discipline

- Transdisciplinary: Focus on an issue, such as pollution or species recovery, both within and beyond discipline boundaries with the possibility of new perspectives

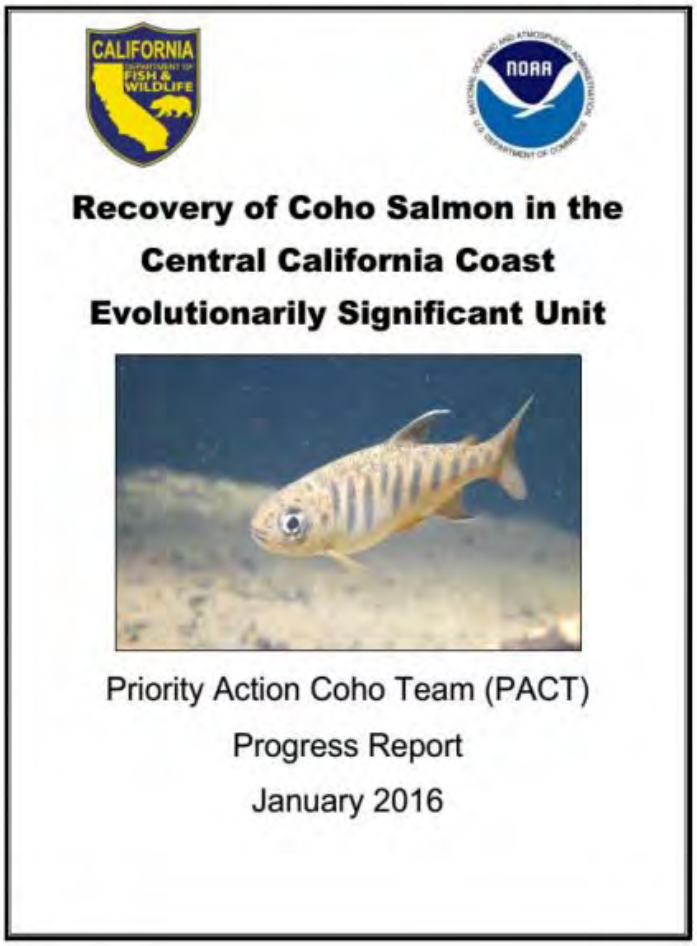


Best Available Science

- Adopt best available science in developing and implementing recovery measures
- People who refer to 'out-of-the-box' see the box … People who don't know the box even exists are the innovative thinkers

The Current Situation

- Reports and recommendations from the six TWGs have been finalized
- Submitted to joint CDFW/NOAA Management Group for approval
- Implementation phase expected to begin in 2016




California Coho Salmon
ANY
QUESTIONS?
~Keep ~Them ~Running~
Priority Action Coho Team

NOAA Fisheries Service

Effects of staggered release timing of hatchery coho salmon on subsequent adult returns to Scott Creek, CA: spreading risk to cope with variable ocean conditions

Brian Spence, Joseph Kiernan, and Erick Sturm

Southwest Fisheries Science Center
Fisheries Ecology Division – Santa Cruz, California

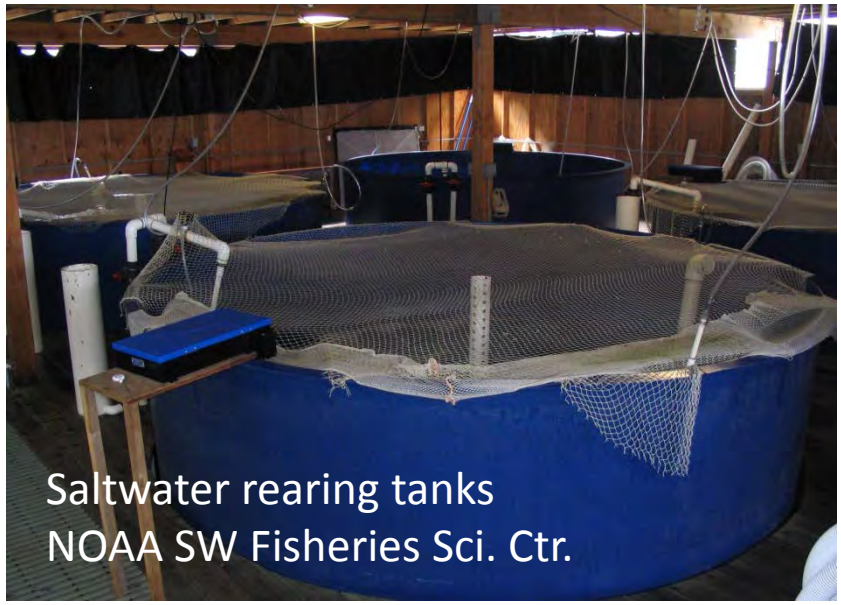
Scott Creek coho salmon captive brood program


Kingfish Flat Hatchery

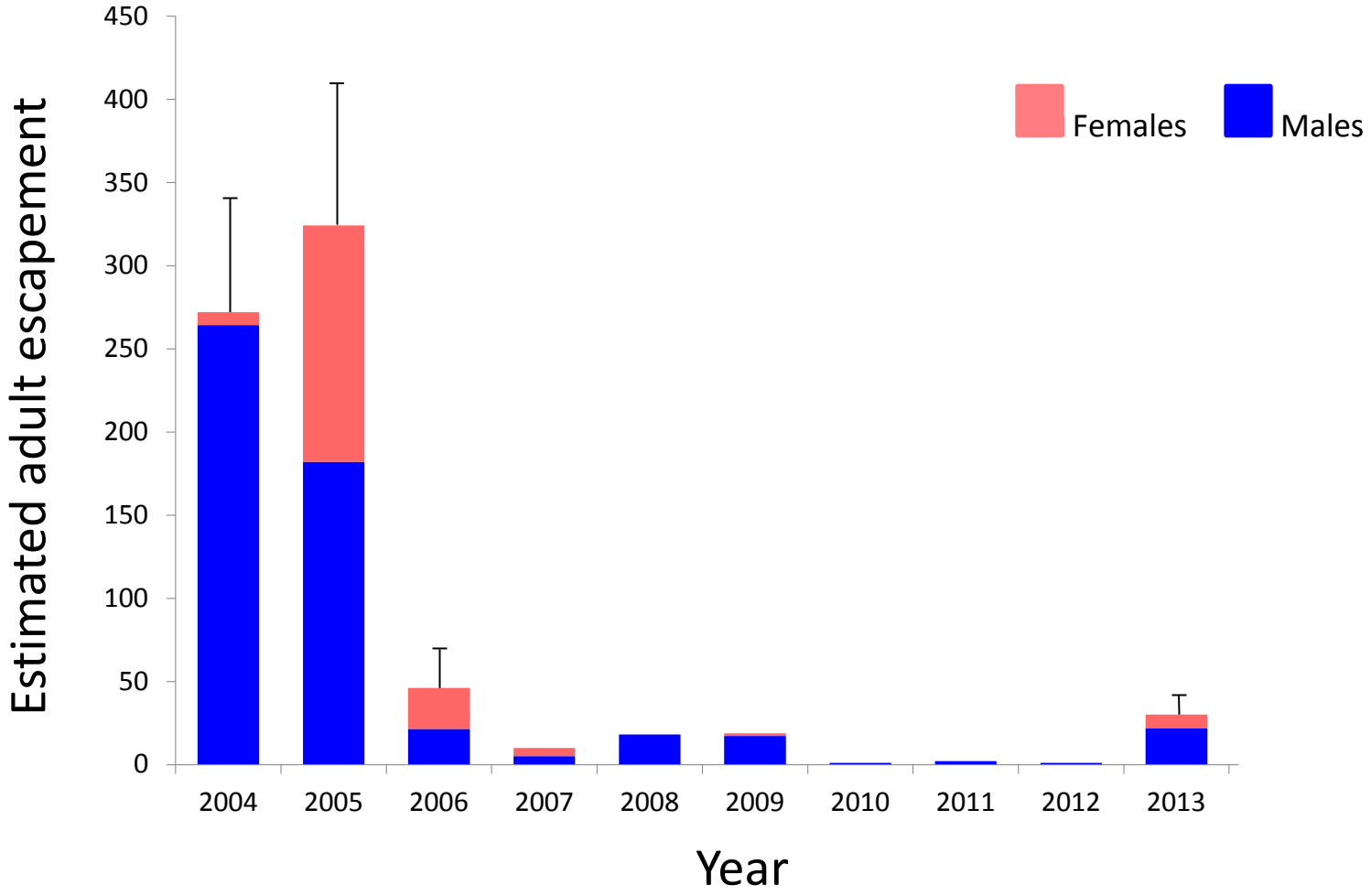

Wild male spawner


Outdoor raceway

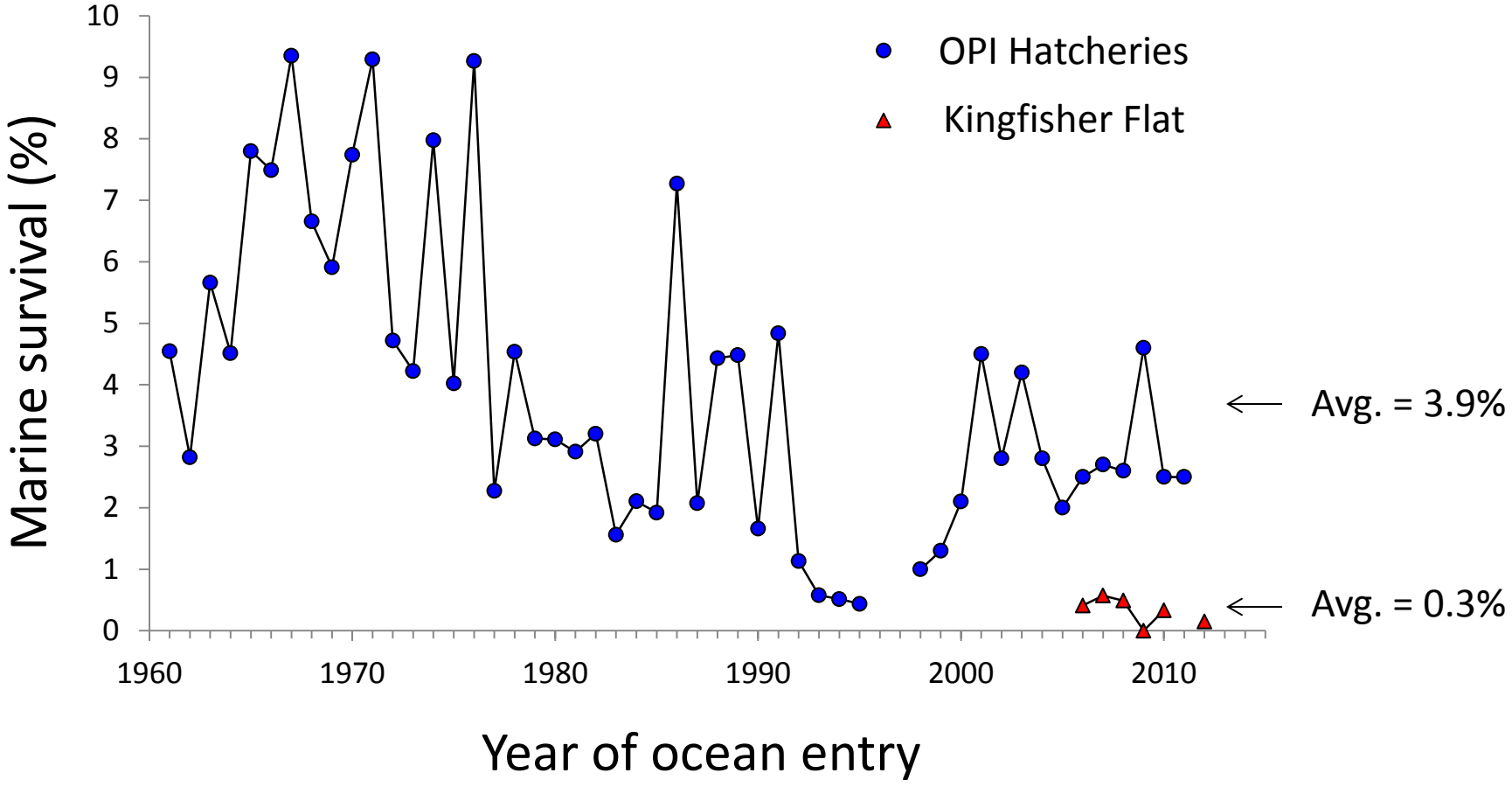

Indoor troughs

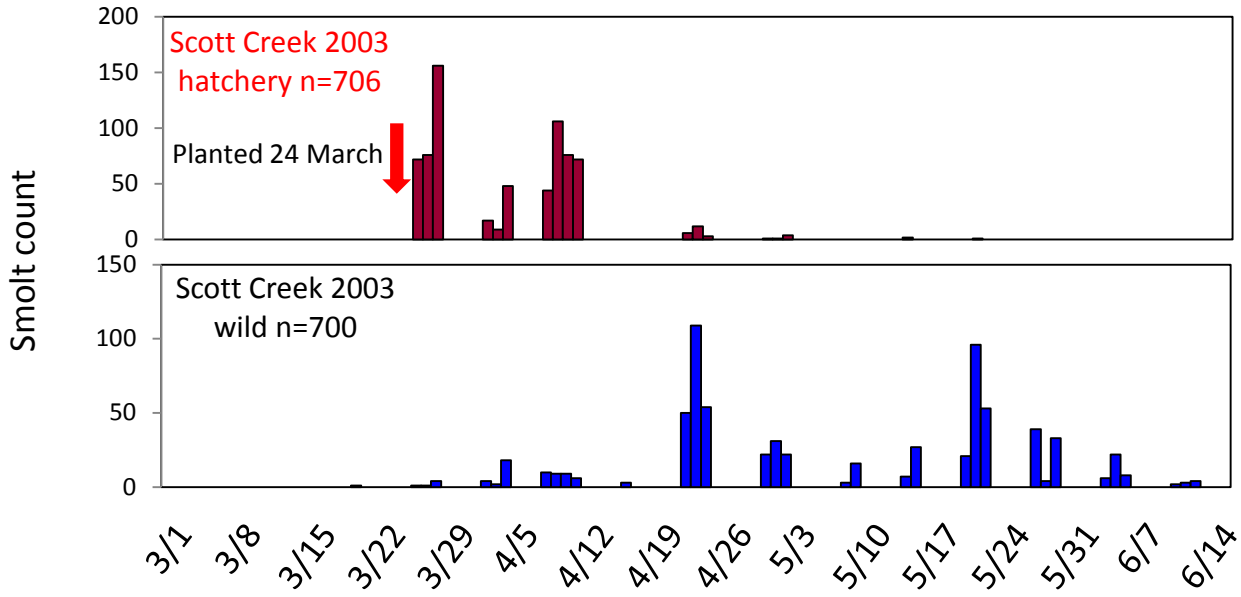

Saltwater rearing tanks
NOAA SW Fisheries Sci. Ctr.

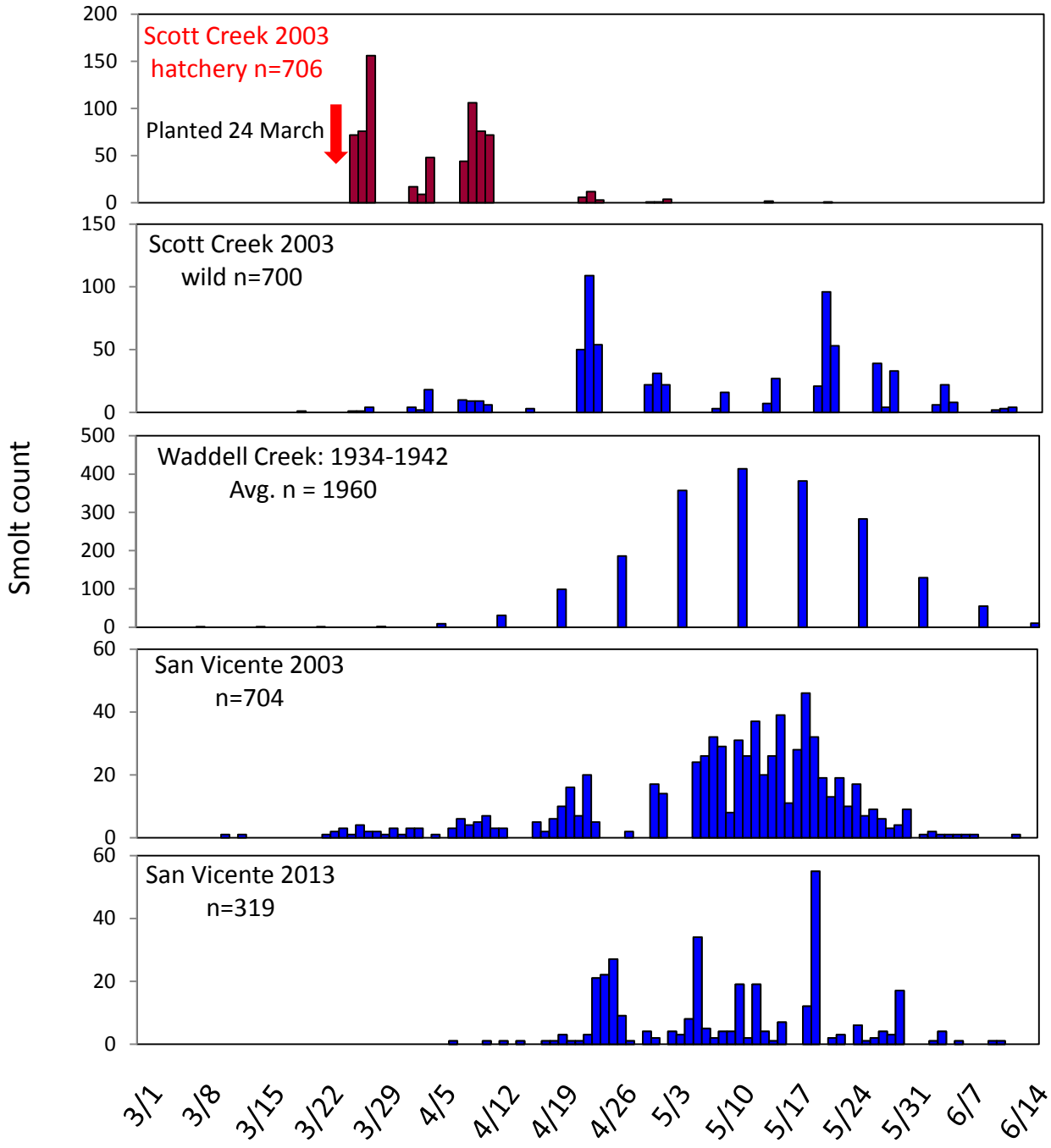
Adult returns to Scott Creek: 2004-2013



Estimated survival of smolts: OPI vs. Scott Creek

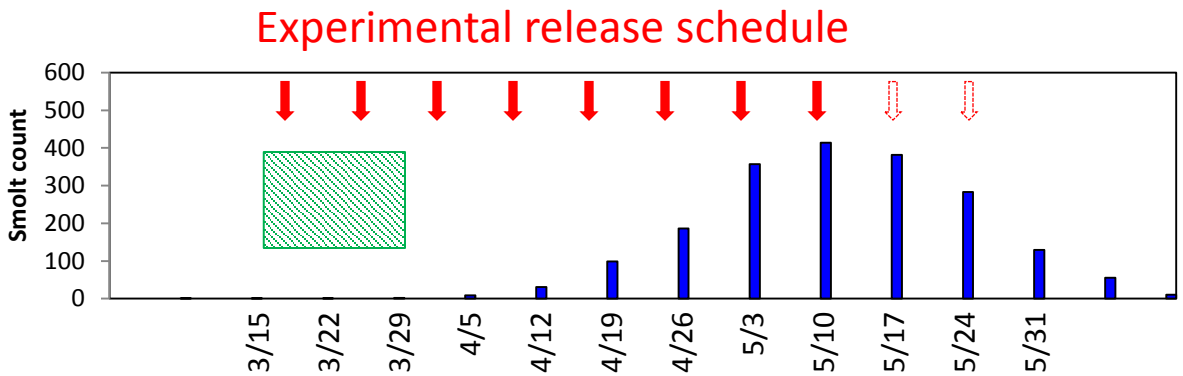



Smolt count
Scott Creek 2003
hatchery n=706
Planted 24 March
Scott Creek 2003
wild n=700
200
150
100
50
0
150
100
50
0
3/1
3/8
3/15
3/22
3/29
4/5
4/12
4/19
4/26
5/3
5/10
5/17
5/24
5/31
6/7
6/14


Smolt count
Scott Creek 2003
hatchery n=706
Planted 24 March
Scott Creek 2003
wild n=700
Waddell Creek: 1934-1942
Avg. n = 1960
San Vicente 2003
n=704
San Vicente 2013
n=319
200
150
100
50
0
150
100
50
0
500
400
300
200
100
0
60
40
20
0
60
40
20
0
3/1
3/8
3/15
3/22
3/29
4/5
4/12
4/19
4/26
5/3
5/10
5/17
5/24
5/31
6/7
6/14

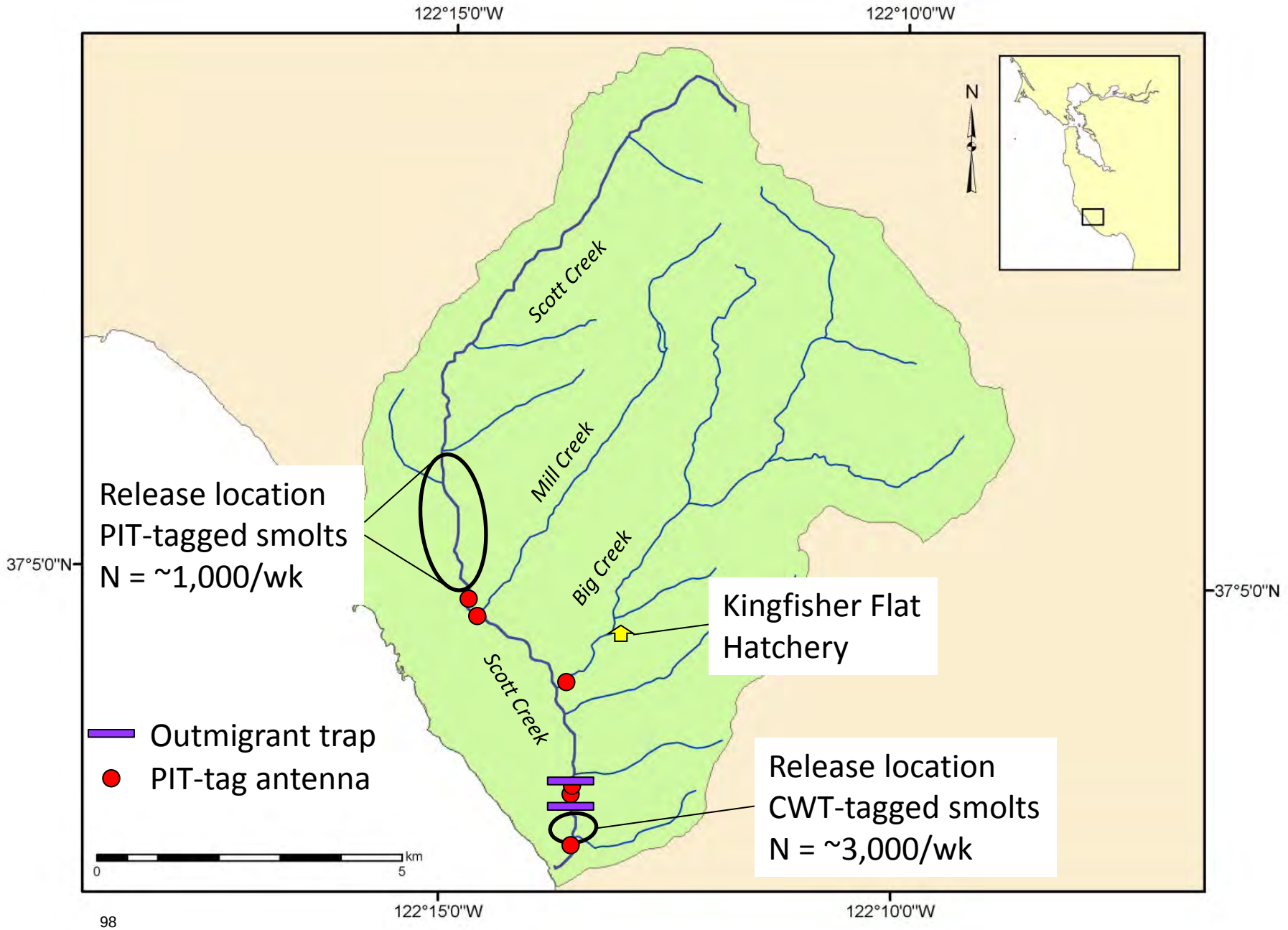
Study Design: 2013-2014

- ~30,000 coho smolts released over 8 weeks (mid-March to mid-May)

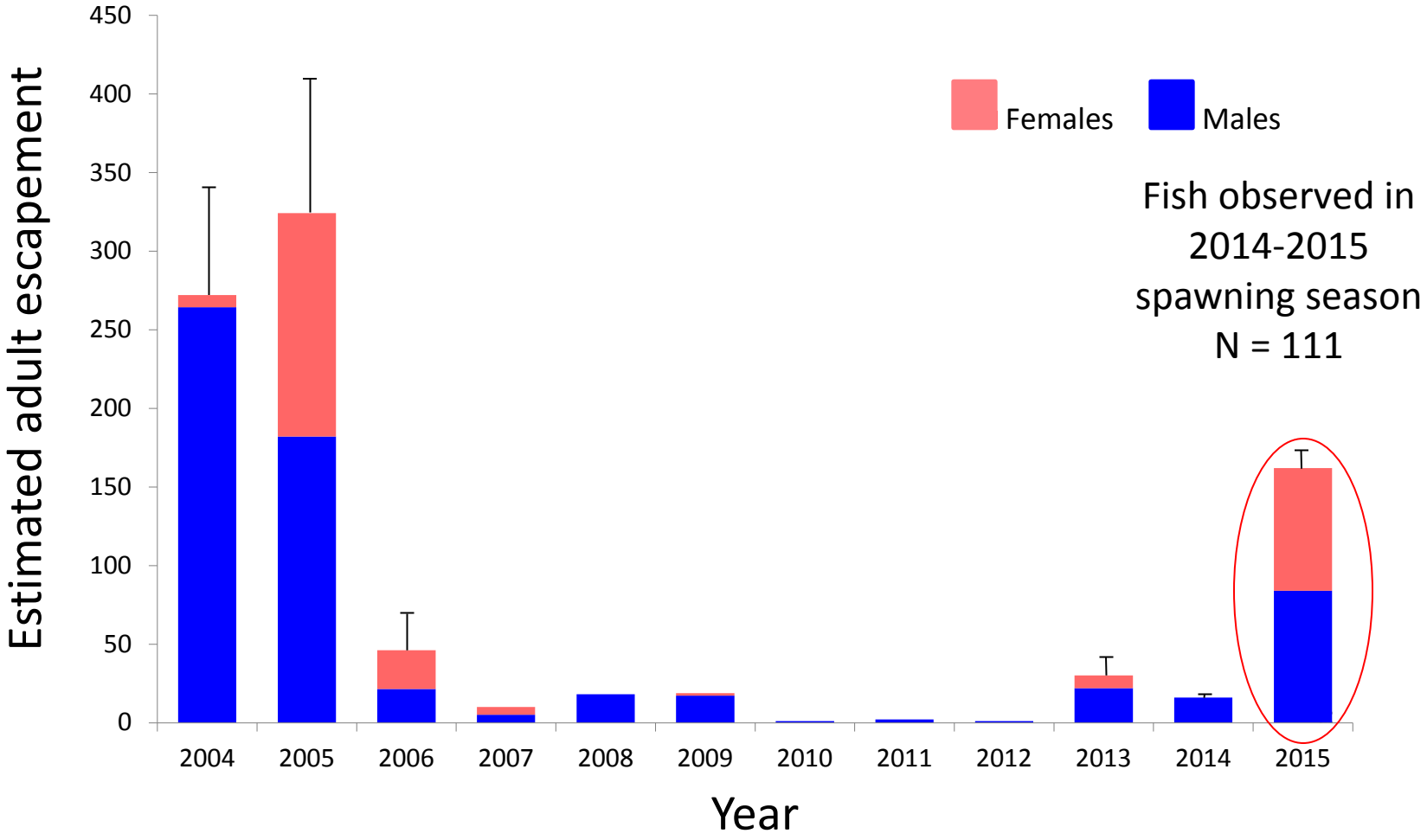


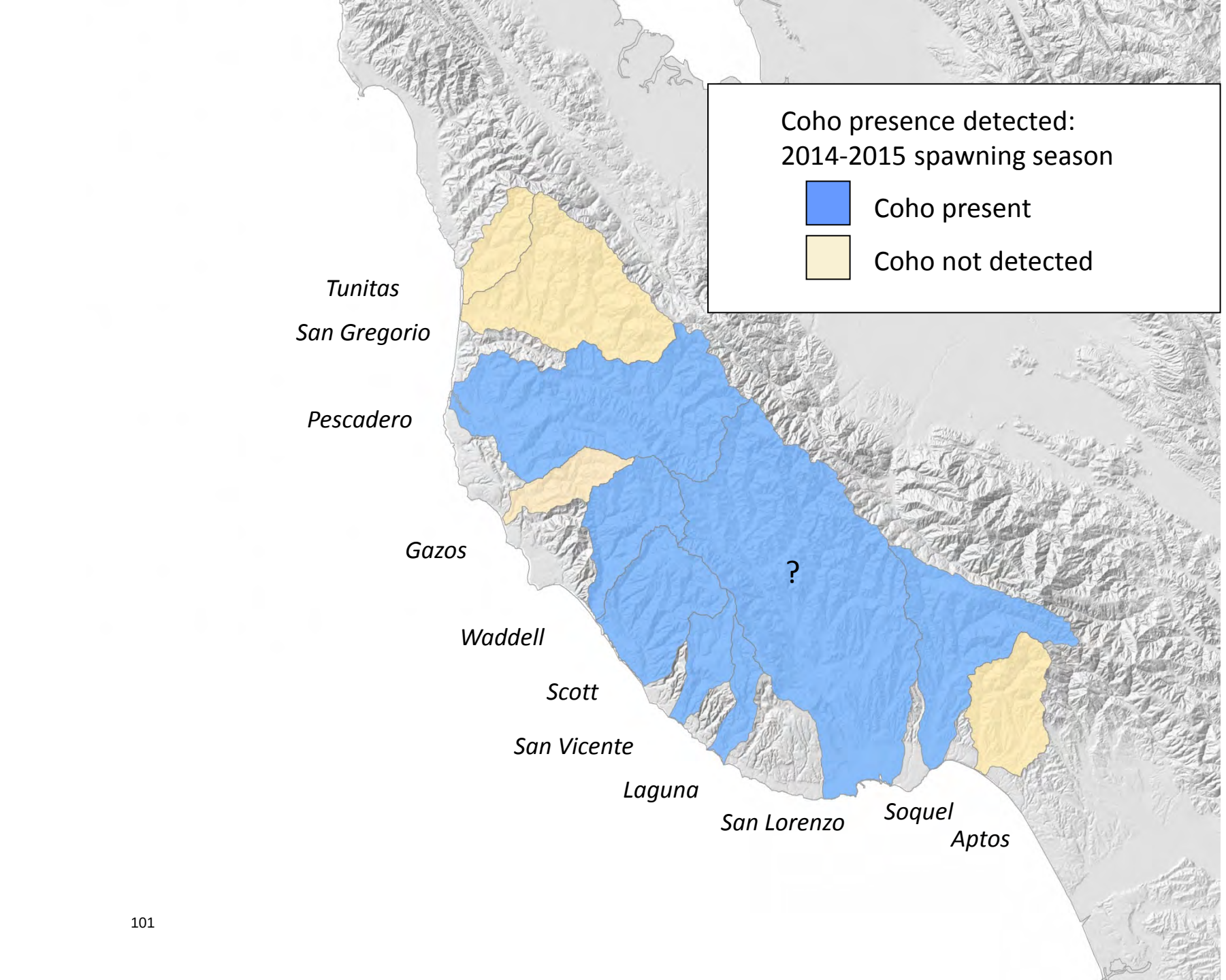
Waddell Creek: 1934-1942

- Batch (week)-specific CWT to assess marine survival
- PIT-tags (25-35%) to track instream movements of smolts
- Weir captures, spawner surveys, PIT-antennas to track and enumerate returning adults

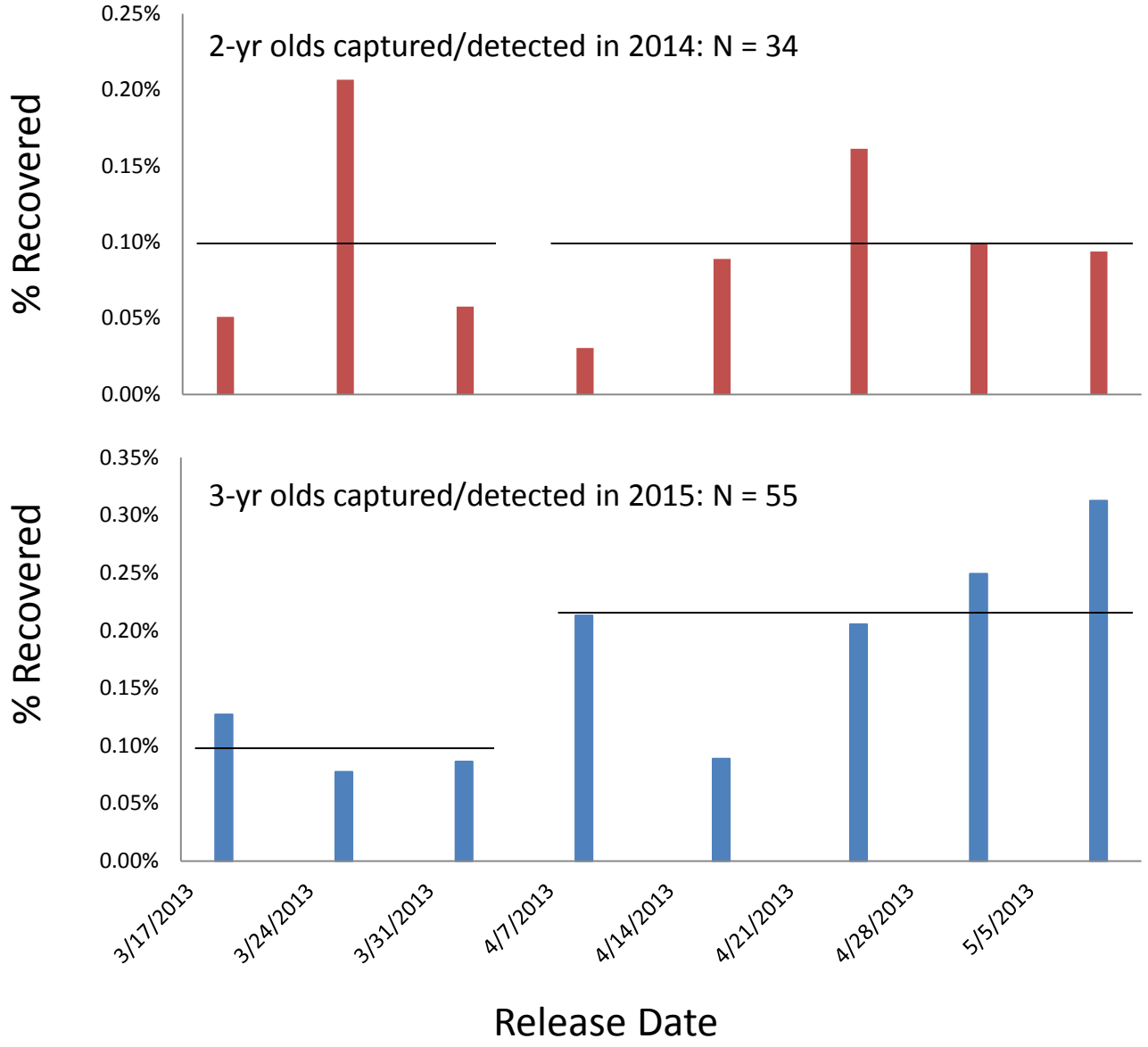

122°15'0"W
122°10'0"W
N
Scott Creek
Mill Creek
Big Creek
Scott Creek
Release location
PIT-tagged smolts
N = ~1,000/wk
Kingfisher Flat
Hatchery
Outmigrant trap
PIT-tag antenna
Release location
CWT-tagged smolts
N = ~3,000/wk
km
0
5
37°5'0"N
37°5'0"N
122°15'0"W
122°10'0"W

2004-2015 Adult returns to Scott Creek

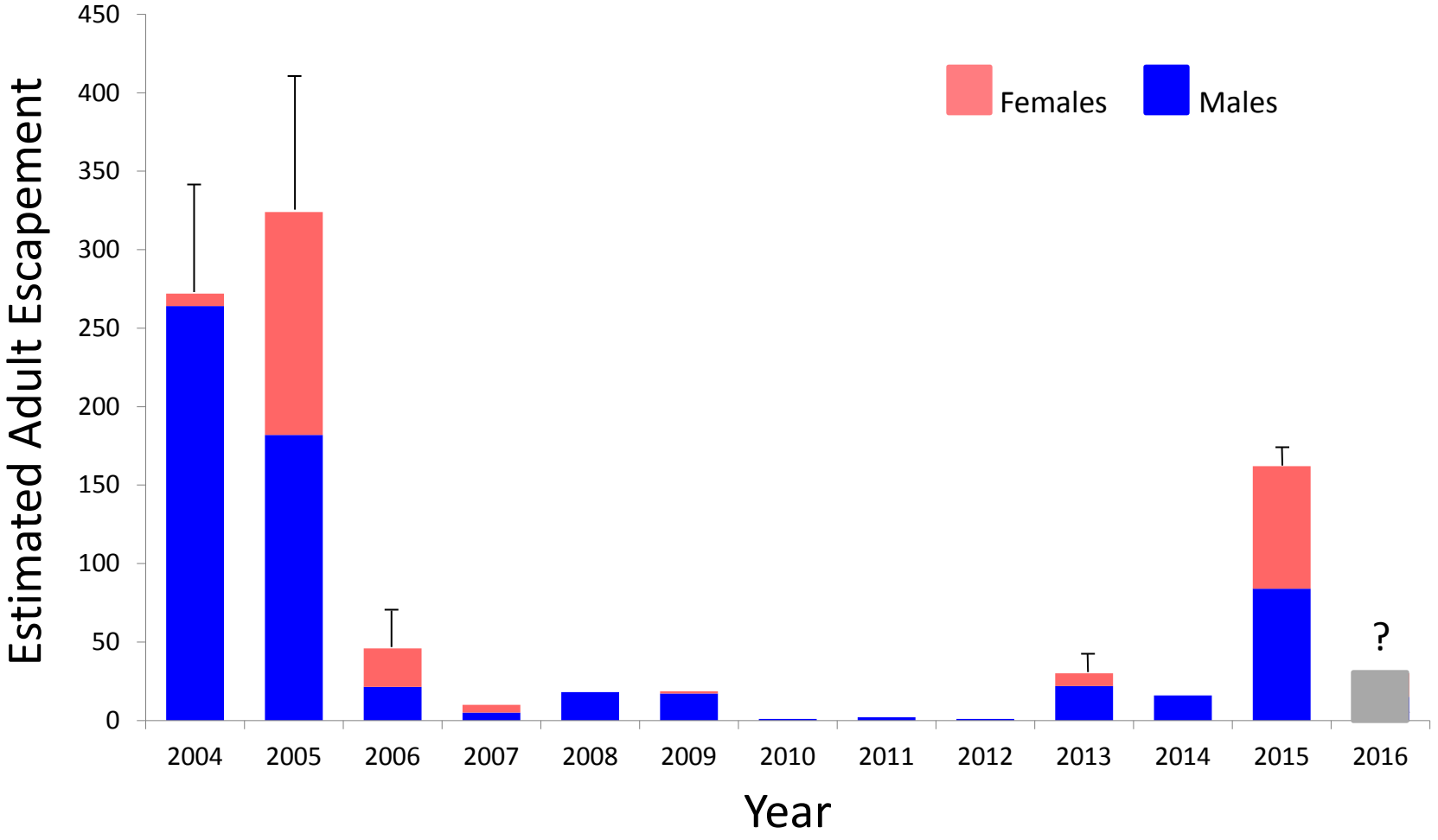



Coho presence detected:
2014-2015 spawning season
Coho present
Coho not detected
Tunitas
San Gregorio
Pescadero
Gazos
?
Waddell
Scott
San Vicente
Laguna
San Lorenzo
Soquel
Aptos

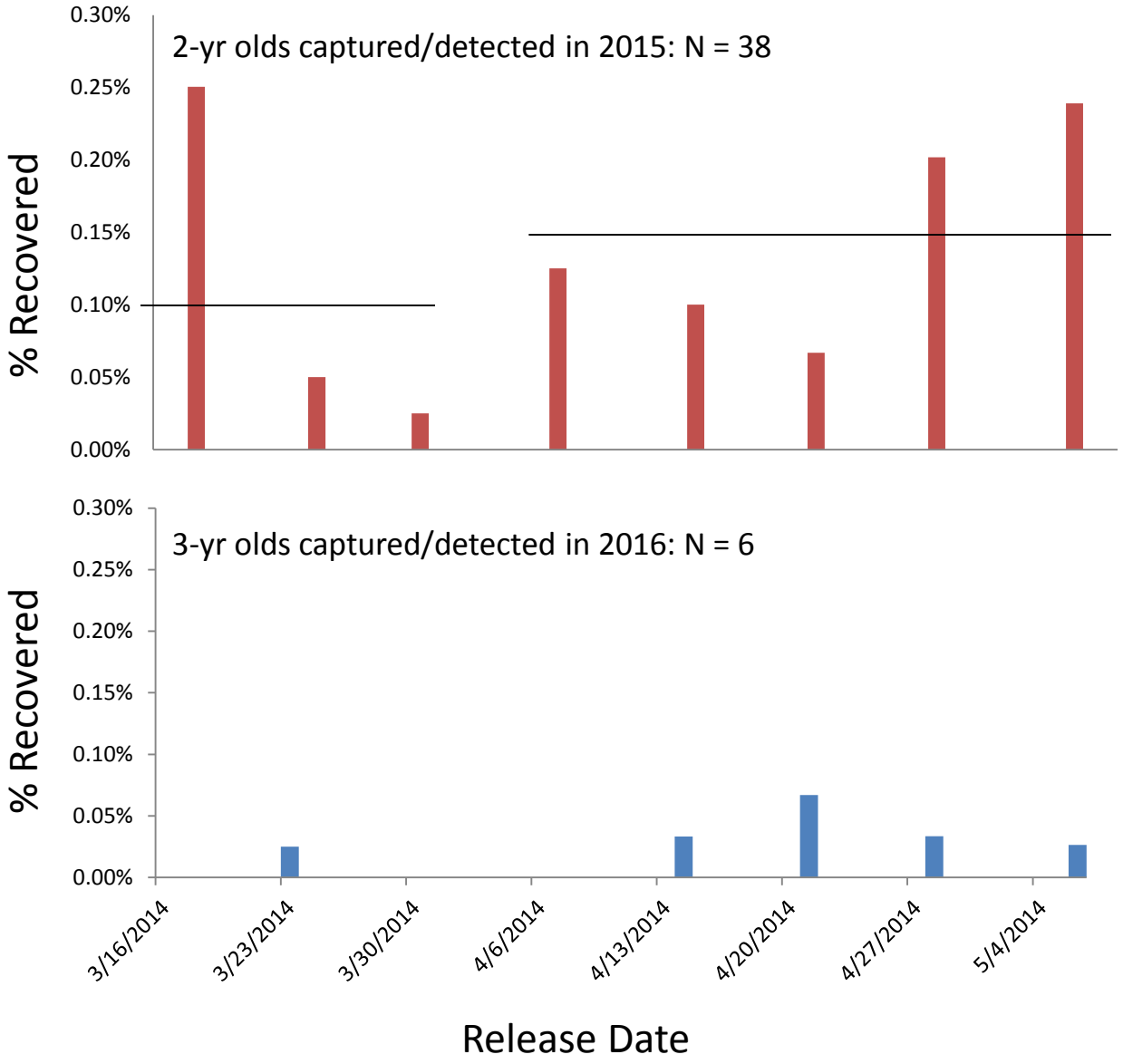
2013 Release Year



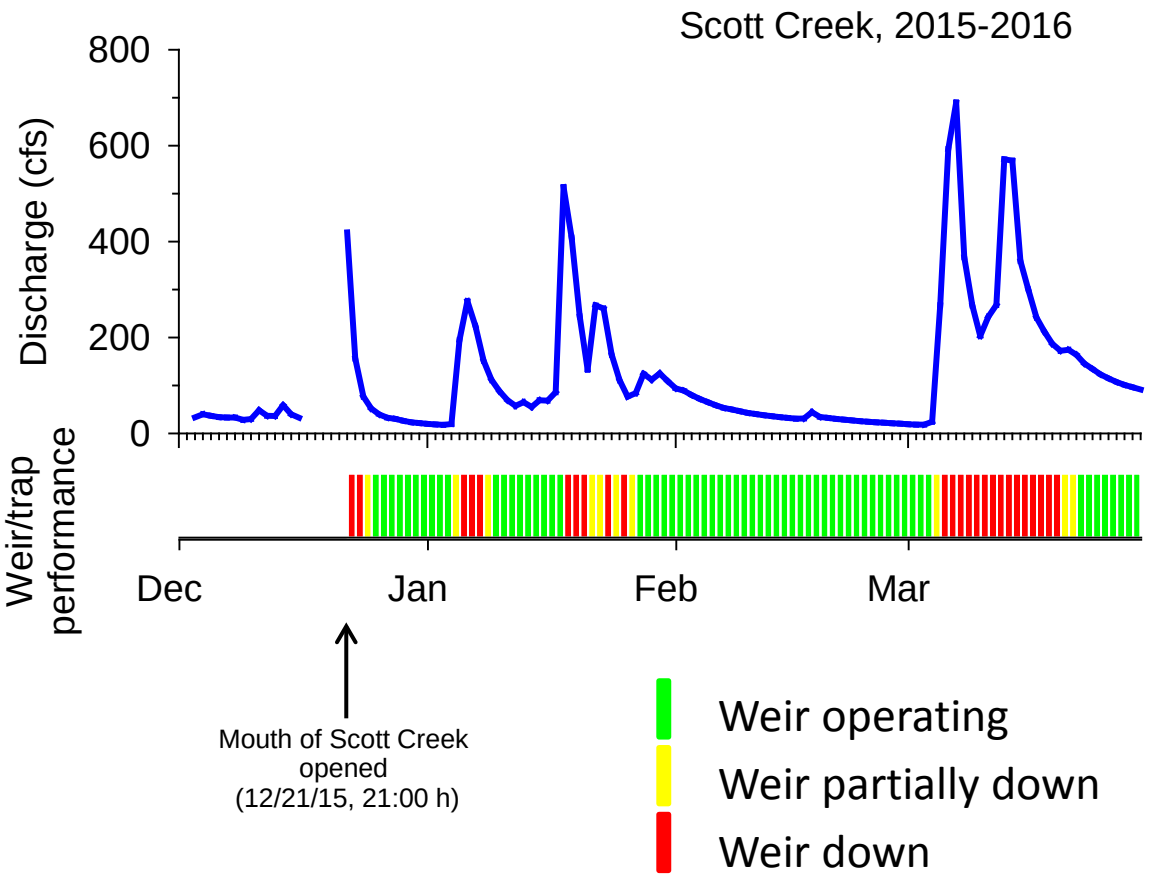
2004-2016 Adult returns to Scott Creek



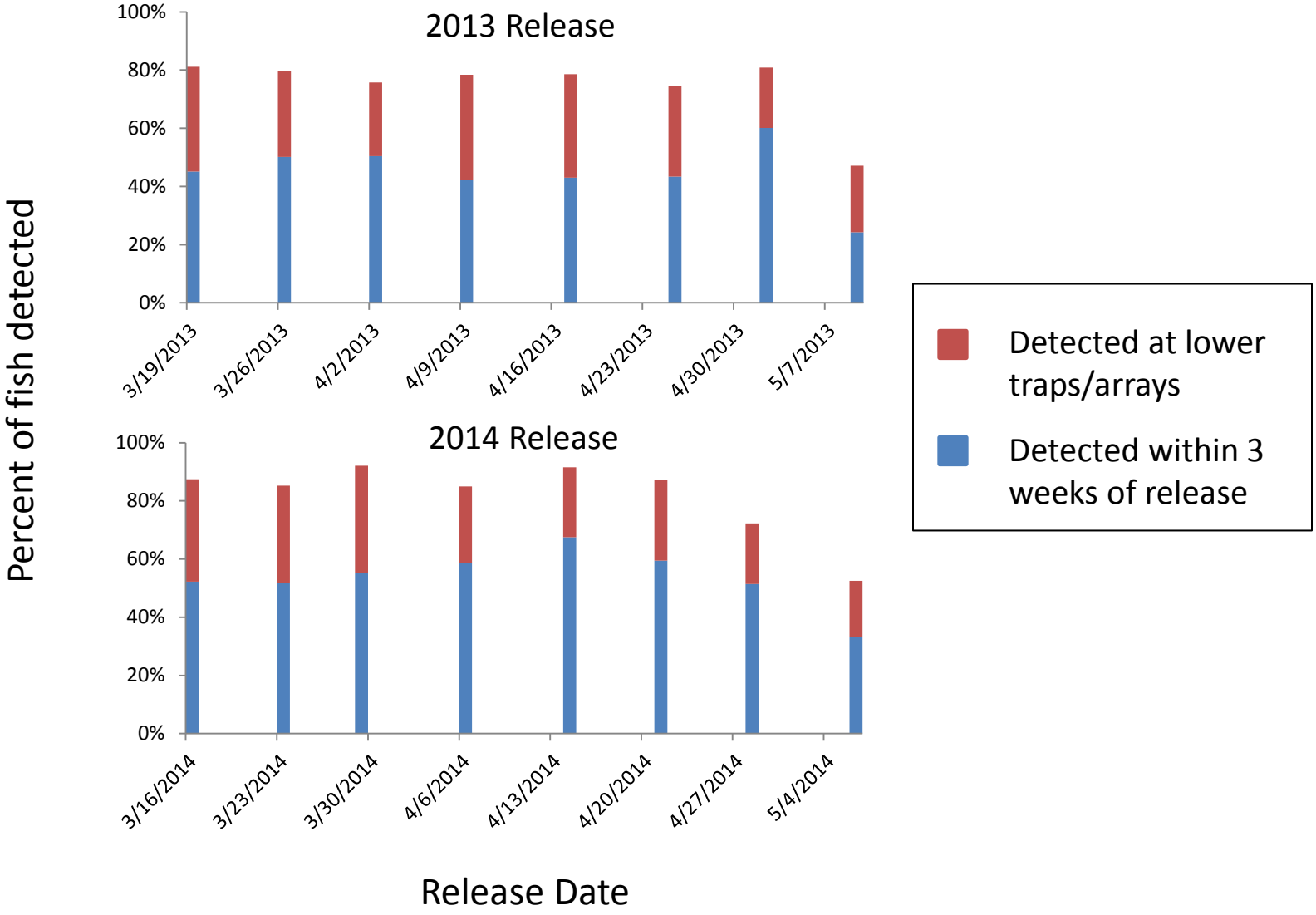
2014 Release Year

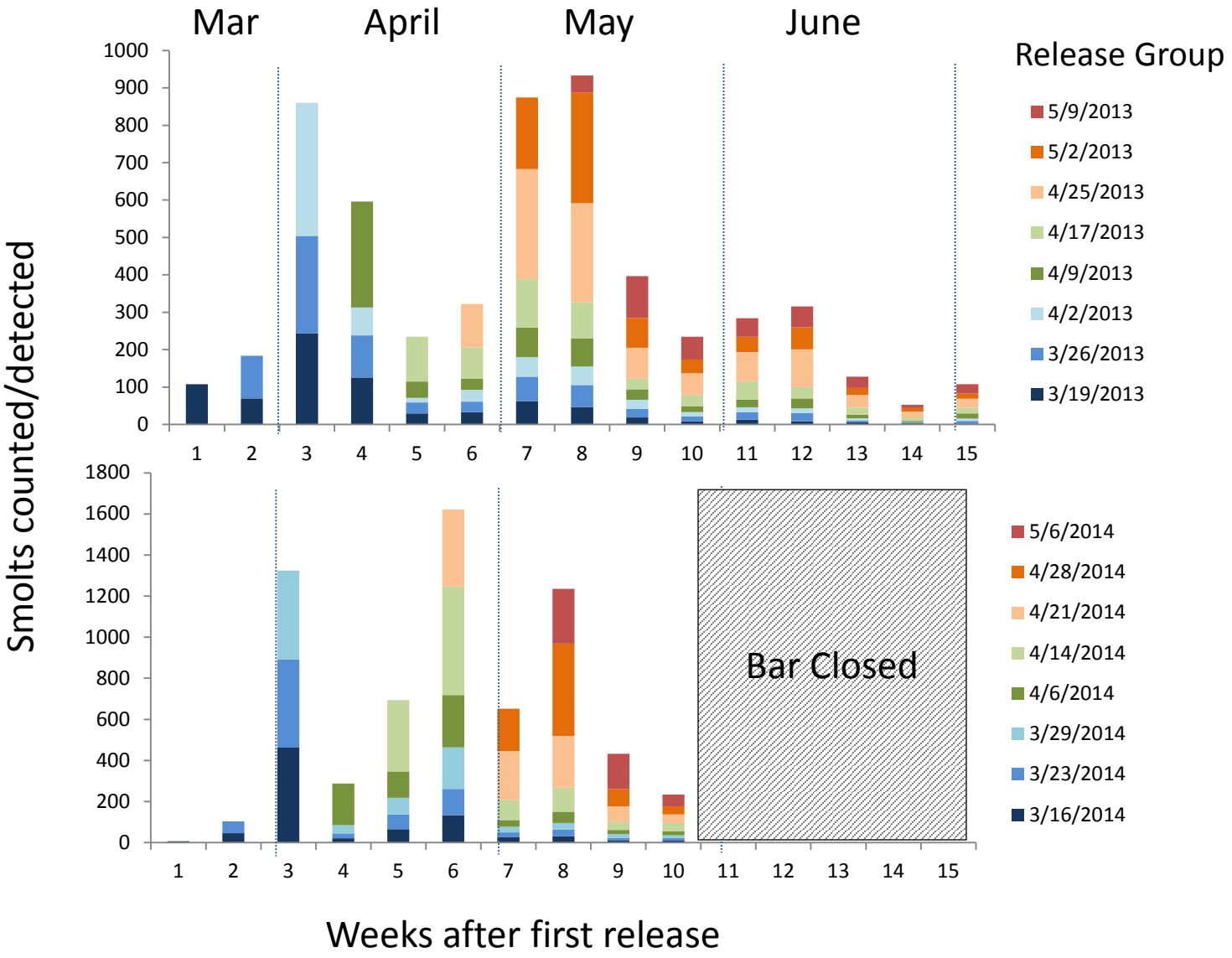


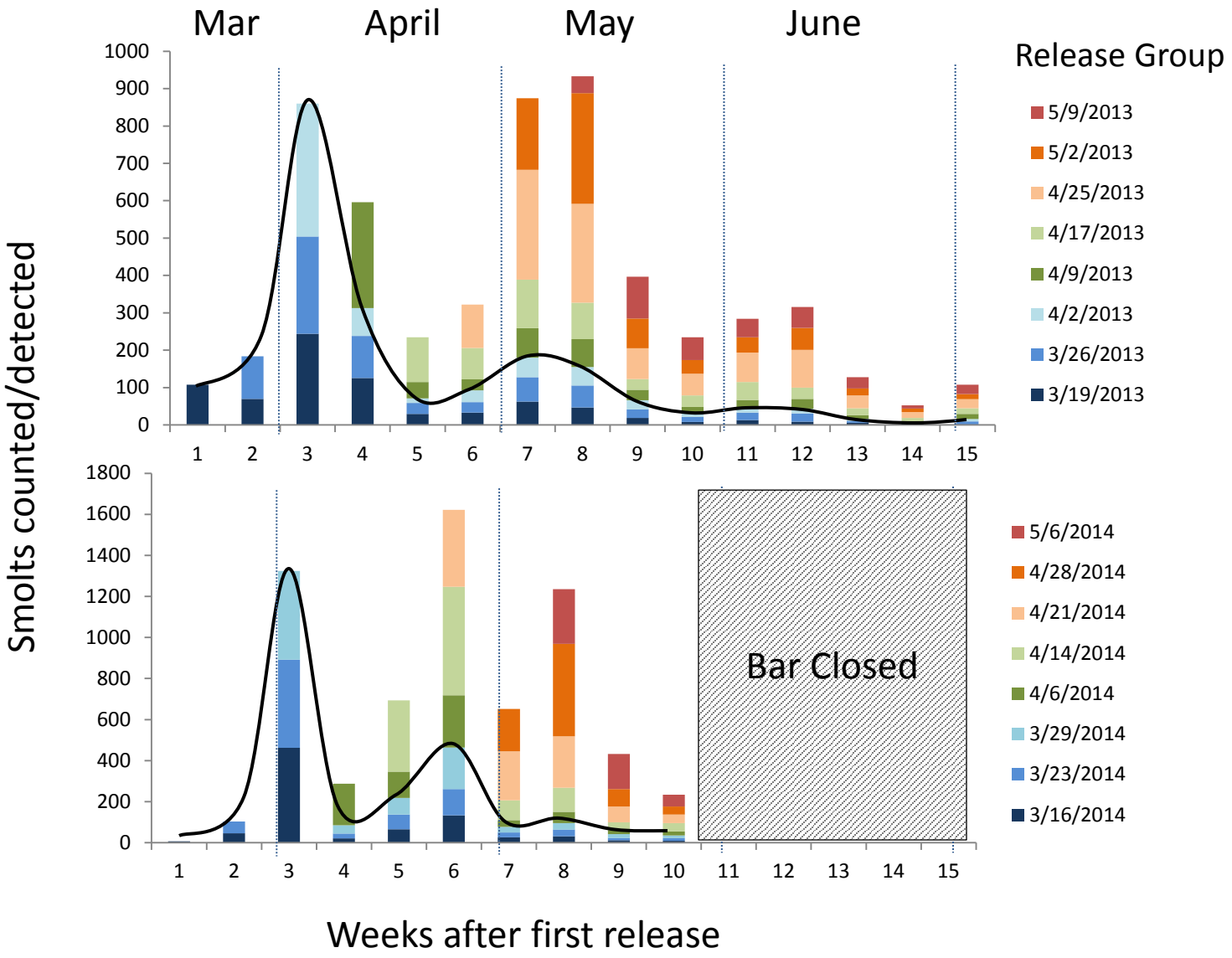
Hydrography and weir performance



Percent of Fish Detected Downstream




Mar
April
May
June
Release Group
5/9/2013
5/2/2013
4/25/2013
4/17/2013
4/9/2013
4/2/2013
3/26/2013
3/19/2013
5/6/2014
4/28/2014
4/21/2014
4/14/2014
4/6/2014
3/29/2014
3/23/2014
3/16/2014
Bar Closed
Smolts counted/detected
Weeks after first release


Mar
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May
June
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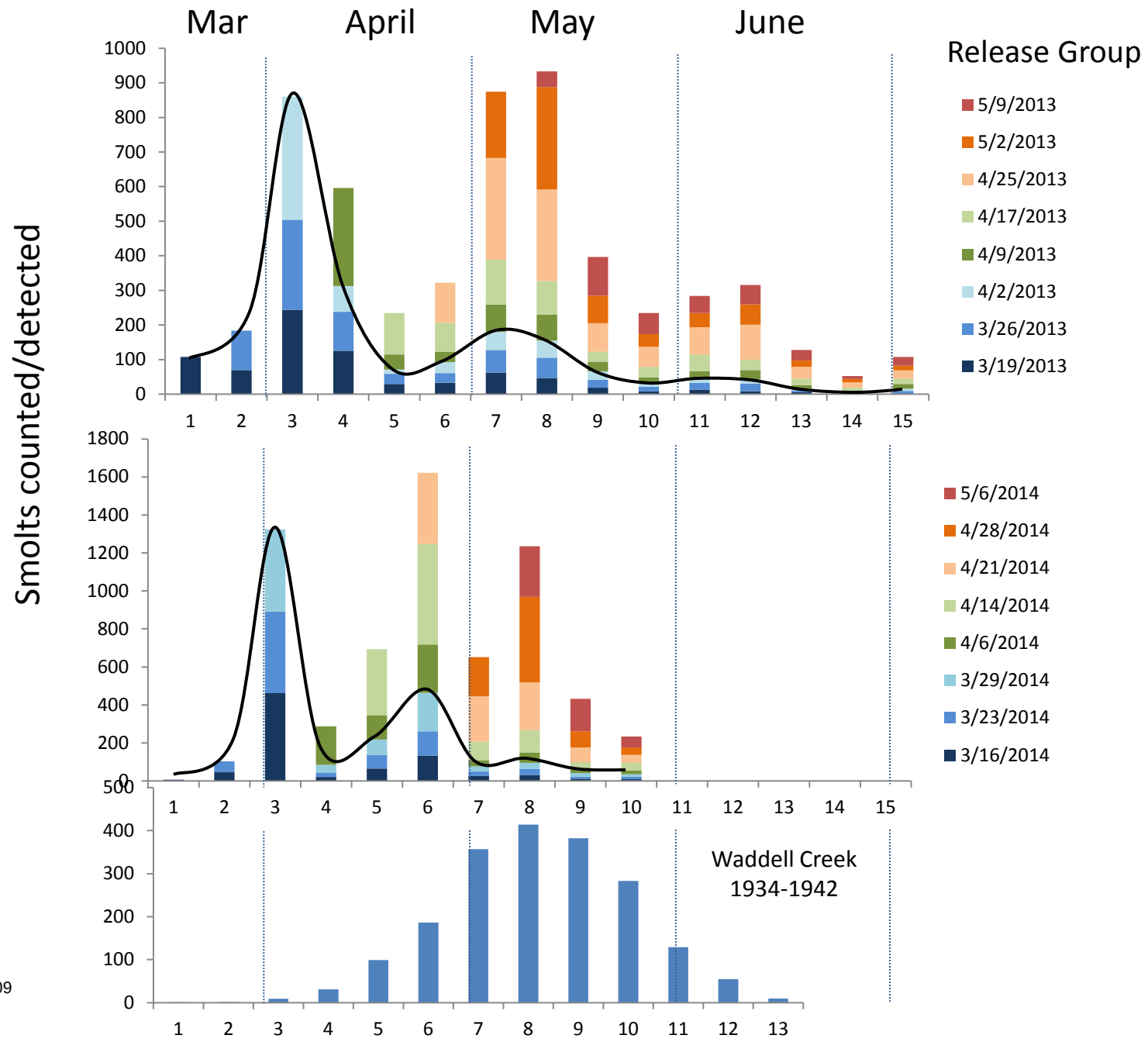
Weeks after first release
Release Group
5/9/2013
5/2/2013
4/25/2013
4/17/2013
4/9/2013
4/2/2013
3/26/2013
3/19/2013
5/6/2014
4/28/2014
4/21/2014
4/14/2014
4/6/2014
3/29/2014
3/23/2014
3/16/2014
Bar Closed


Mar
April
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Smolts counted/detected
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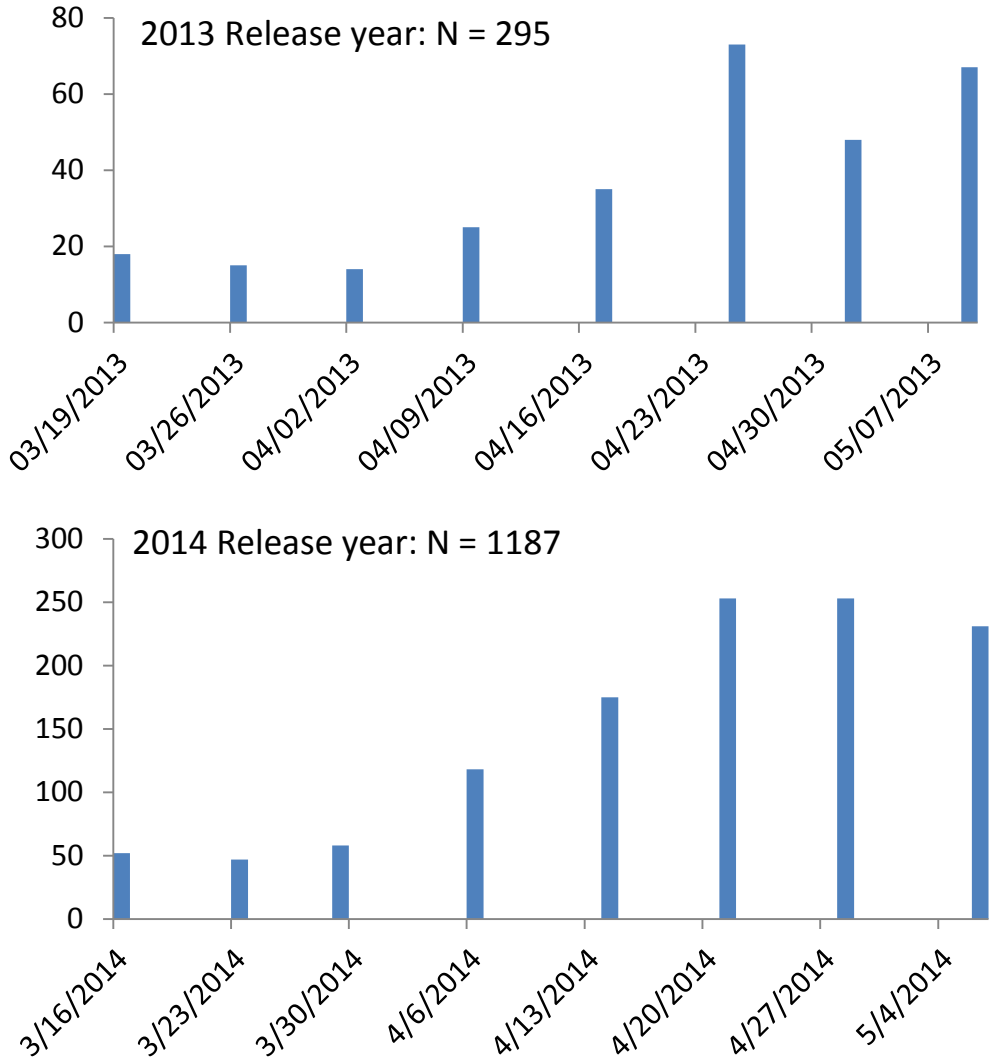
5/9/2013
5/2/2013
4/25/2013
4/17/2013
4/9/2013
4/2/2013
3/26/2013
3/19/2013
5/6/2014
4/28/2014
4/21/2014
4/14/2014
4/6/2014
3/29/2014
3/23/2014
3/16/2014
Waddell Creek
1934-1942

Complicating factors

- Drought
  - “Holdover” smolts
  - Instream mortality

Fish detected after bar closure in lower Scott Creek



Environmental Timeline

Environment	2013	2014	2015	2016
Freshwater	Year 2 CA drought; low spring flows and early bar closure (June 27)	Year 3 CA drought; delayed bar opening (Feb 9) and low spring flows; very early bar closure (May 28)	Year 4 CA drought; extremely early bar closure (May 16)	> Normal PPT and streamflow, but intermittent access early in season
Marine	Cold productive NE Pacific	NE Pacific in transition from good to bad ocean conditions	Record warm temps in NE Pacific; many signs of stress on "subarctic" species off the West Coast	A still warm and unproductive NE Pacific??

Coho response				
2013 Release Coho	Smolts	2-yr fish	3-yr fish	
2014 Release Coho		Smolts	2-yr fish	3-yr fish

Environment	2013	2014	2015	2016
Freshwater	Year 2 CA drought; low spring flows and early bar closure (June 27)	Year 3 CA drought; delayed bar opening (Feb 9) and low spring flows; very early bar closure (May 28)	Year 4 CA drought; extremely early bar closure (May 16)	> Normal PPT and streamflow, but intermittent access early in season
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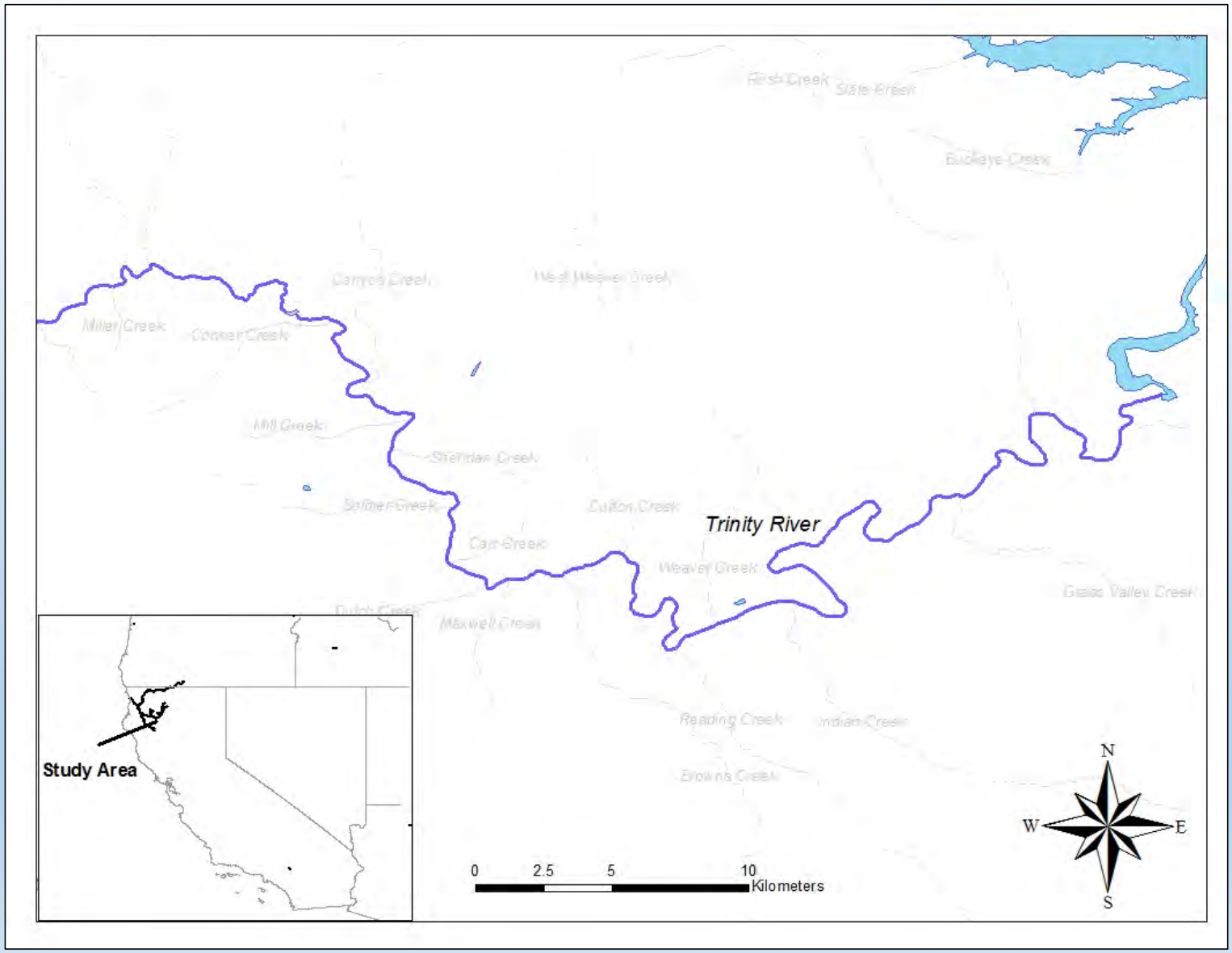
2014 Release Coho		Smolts	2-yr fish	3-yr fish
2015 Release Coho			Smolts	2-yr fish
2016 Release Coho				Smolts??

Acknowledgments

- SWFSC
  Ann-Marie Osterback,
  Nic Retford, Jeff Perez,
  Cynthia Kern, Emerson Kanawi,
  Colin Nicol, Lea Bond
  Vanessa Lo, Sue Sogard
  Dave Stafford, Katie Kobayashi,
  Candice Young, Alina Montgomery,
  Heidi Fish
- Watershed Stewards Program
  Rachelle Tallman, Tim Ryan
  Chris Attias, Patrick Doughty
- Monterey Bay Salmon & Trout Proj.
  Mark Galloway, Seth Bowman
- Pacific States Marine Fish Comm.
  Mark Goin
- Landowner support
  Big Creek Lumber Co.
  CalPoly Swanton Pacific Ranch
- Funding
  NOAA SWFSC
  NOAA SWRO
  CDFW FRGP, Manfred Kittel
  Northwest Marine Technology

Evaluating the Impact of Brown Trout on the Native Fishes of the Trinity River in Northern California

Justin Alvarez


Trinity River
Study Area
0 2.5 5 10
Kilometers
N
W
E
S


ScouHarmelssExotic??River

Invasive Species

February 1894
20,000 brown trout eggs brought into California

An **invasive species** is a plant or animal that is not native to a specific location (an Introduced **species**); and has a tendency to spread, which is believed to cause damage to the environment, human economy and/or human health.

New Trout Sent to Trinity Co.

Scottish Variety to Eventually Supplant the Famous Rainbow Species

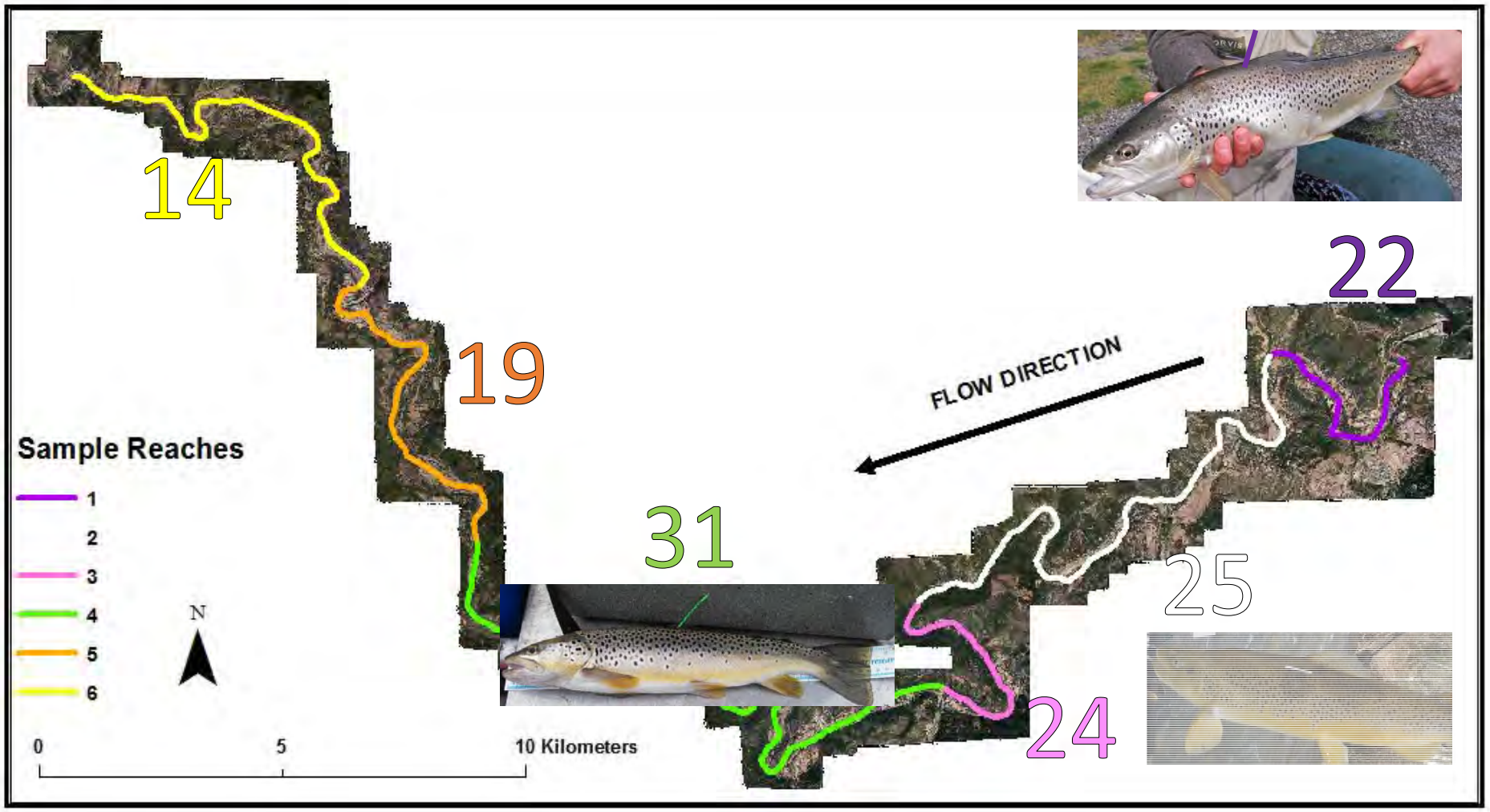
July 29, 1911 ——Trin. Journal

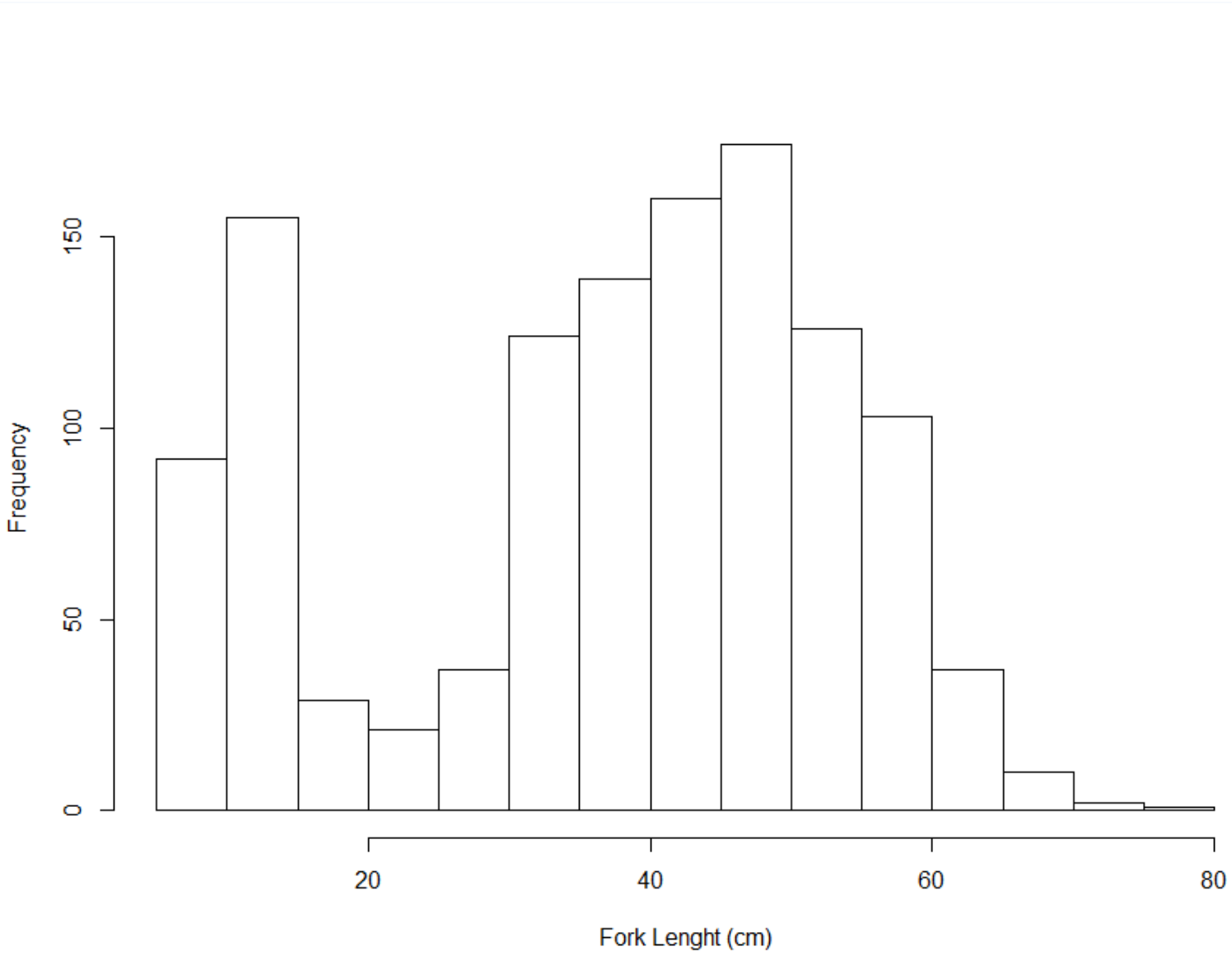
Trinity county is to be the first in the state that will be stocked with Scottish trout, known to fish experts as the Loche II variety, and said to be the the largest, gamest and best flavored trout in the world. The species being entirely new to the Pacific coast says the Redding Searchlight of July 21st.

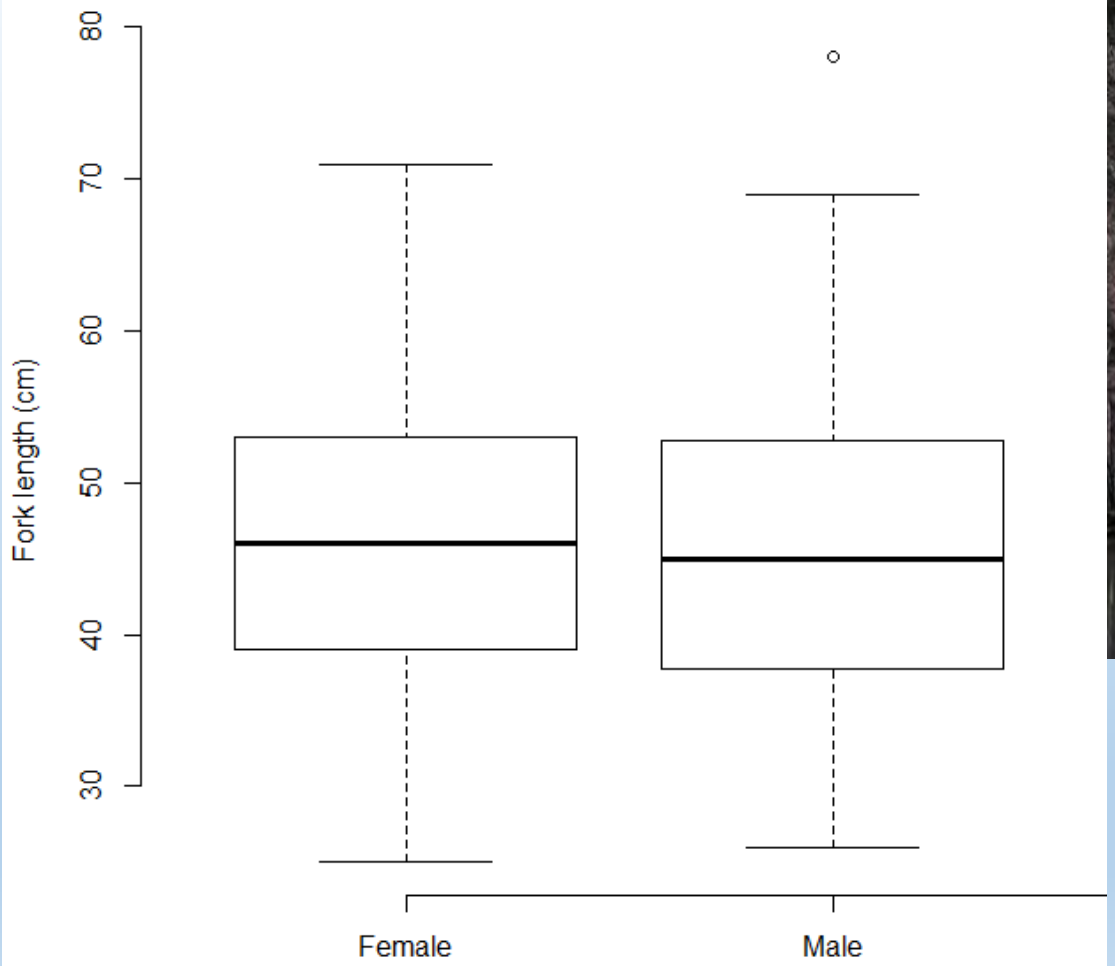
The fish are to be distributed first in Stewart's fork and they arrived here in the fish car from Sisson hatchery Wednesday night. Ten thousand of the Loche II were loaded on a large wagon drawn by four horses and 10,000 of the familiar Rainbow species. A. H. Wolf, the driver, at once started for Trinity county, where he will superintend the planting.

A mishap overtook Wolf when he got a few miles from town. Two cans, each containing a thousand rainbow trout, were lost off the wagon without his knowlege and may not be recovered. He is glad they were the now less prized rainbow variety.

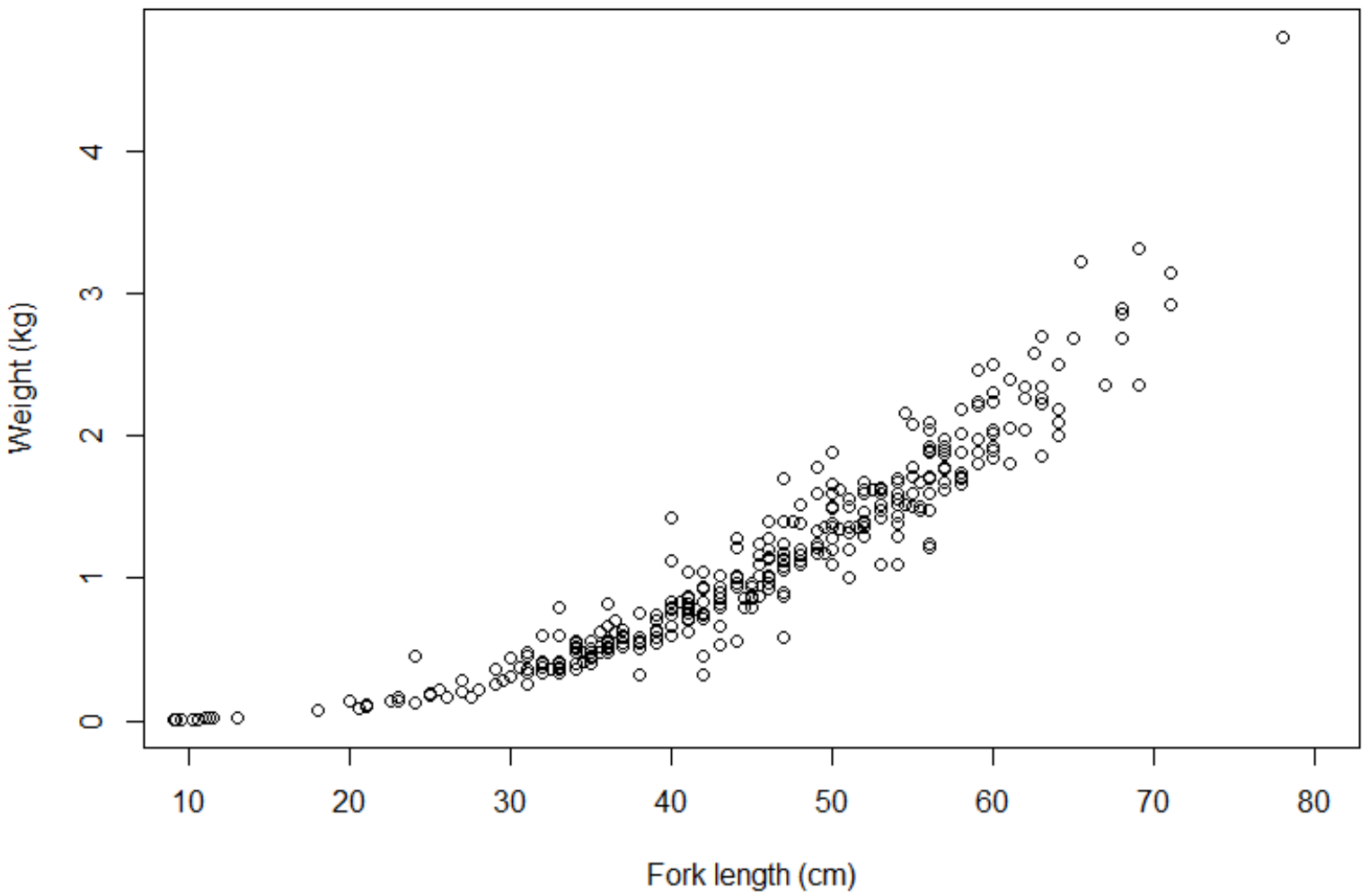
The fish hatchery at Sisson had been experimenting for five years on the trout which flourishes in Scottish waters and it is believed they have the type that will flourish here. The next planting will be done in Yosemite valley, 124,000 of the Loche II to be placed in its various streams. If the fish prove all that is expected of them they will be planted all over the state to gradual displacement of the rainbow variety.

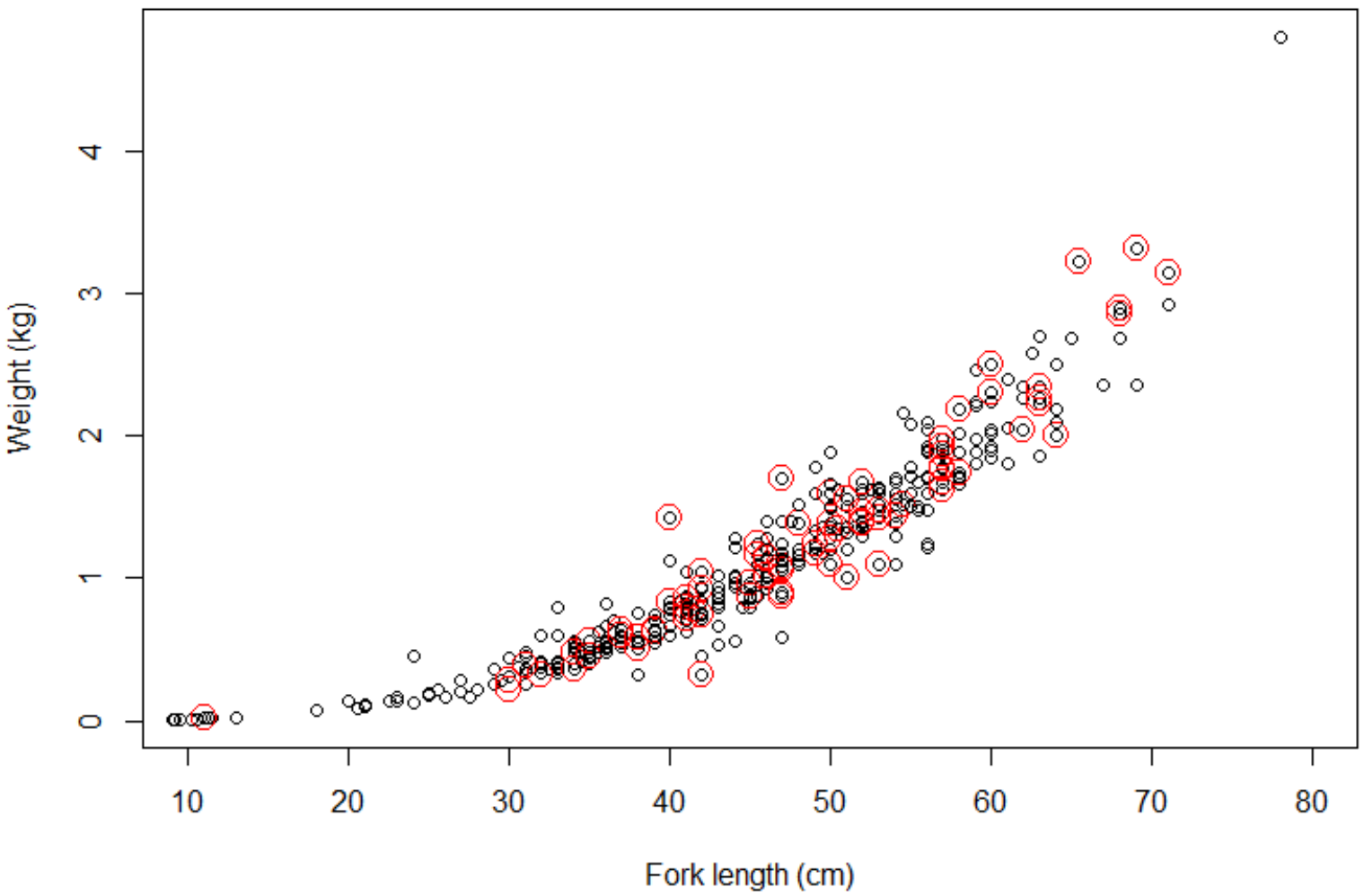

14
19
31
22
25
24
FLOW DIRECTION
Sample Reaches
1
2
3
4
5
6
N
0
5
10 Kilometers


Frequency
0
50
100
150
20
40
60
80
Fork Lenght (cm)



10.5 lb Male

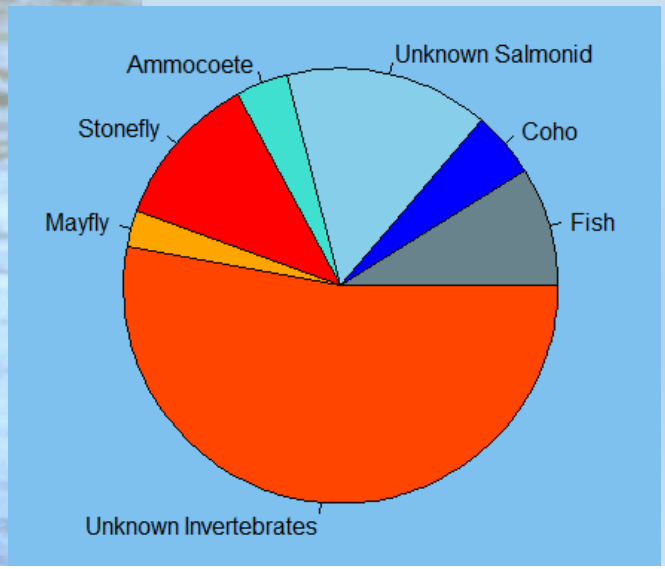

Weight (kg)
0
1
2
3
4
10
20
30
40
50
60
70
80
Fork length (cm)


Weight (kg)
0
1
2
3
4
10
20
30
40
50
60
70
80
Fork length (cm)

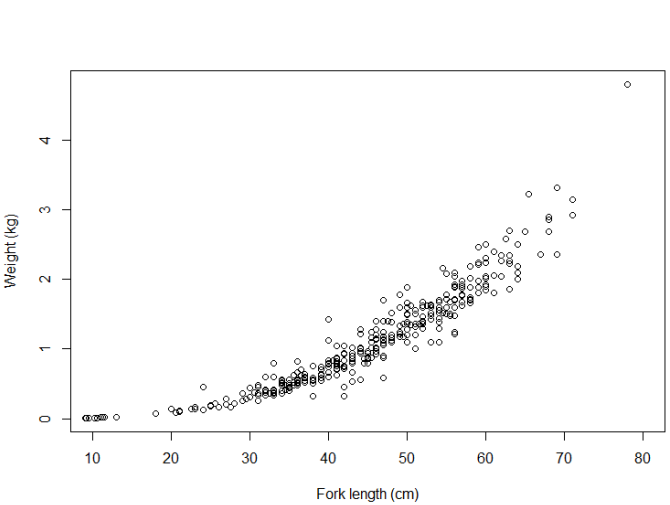
- Lamprey
- Pacific Giant Salamanders
- Yellow Legged Frogs
- Three-spine stickleback
- Speckled Dace

Diet Proportions

- 715 sampled
- 189 empty 26%
- 298 had fish in their stomach 42%
- 33 had identifiable Coho salmon 5%
- 26 had ammocetes 4%
  - but in 2016 right after rain 19 of 116 ~ 16%



Theoretical caloric need



2015 population estimate N=1500

Size range from 20-80 cm in 5 cm bins

Number per bin based on frequency histogram

Assumptions

- Temperature at Douglas City
- No change in mass from January 1 to December 31
- Fish weight in each bin is predicted from the middle FL value
- The mass consumed is of similar energy density to the brown trout that ate it

Theoretical caloric need

Brown Trout Biomass – 1611 kg
Amount Consumed – 9678 kg

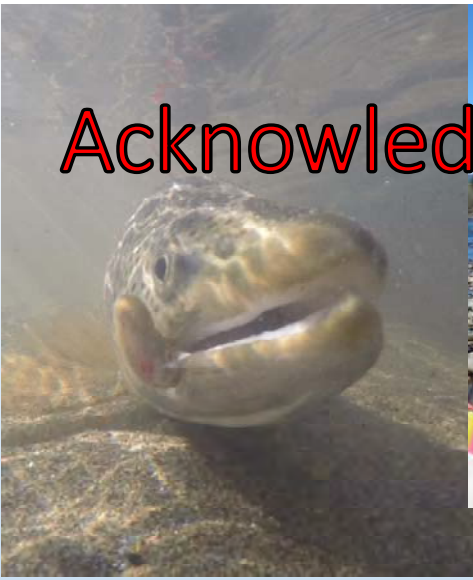
If eating only 120mm fish ~20grams = 483,900 fish
If broken out by the proportion that ate fish = 203,238 fish
If only inverts= 13,385 kg of mayflies/stoneflies
~9,000,000,000 individual inverts

300k hatchery coho
4.6 mil hatchery chinook
800k hatchery steelhead

Management Considerations

- Coho are disproportionately impacted
- Brown trout can be managed through fishing regulations and active suppression if political will is there
- Given over $150 million dollar investment in recovery of native fishes and a small but active recreational fishery, how do you balance restoration goals and recreational fishing interests?
- Would resident rainbow trout populations fill the ecological niche currently filled by brown trout if suppression was implemented?

Acknowledgements



- Hoopa Tribe
- Darren Ward
- My grad lab Molly, Michelle, Gabe, (Jon too)

National Marine Fisheries Service
Bureau of Reclamation

CA Department of Fish and Wildlife
Amnis Opes Institute

Questions?