

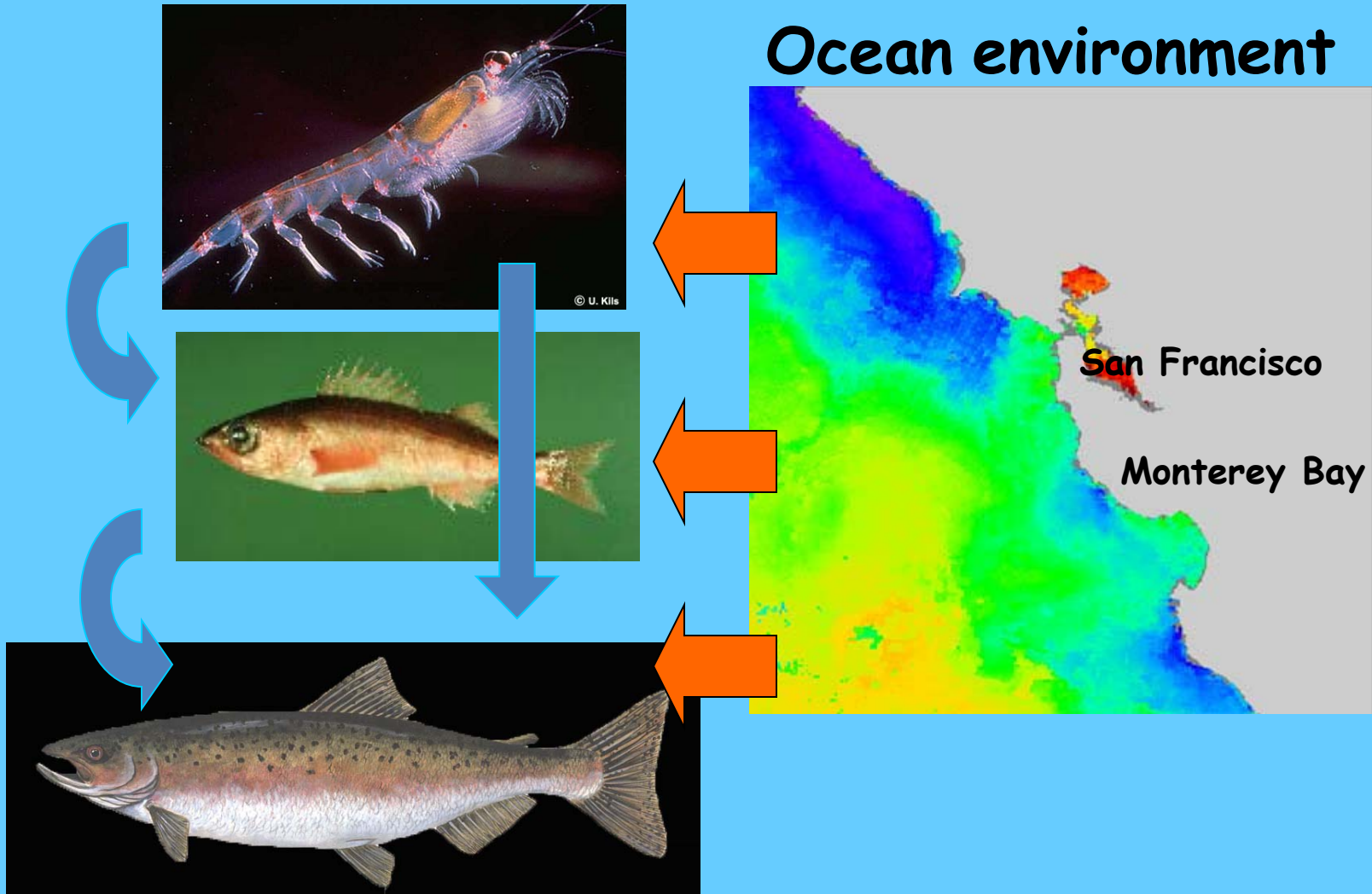


NMFS salmon management support projects

presented by Steve Lindley and Pete Lawson

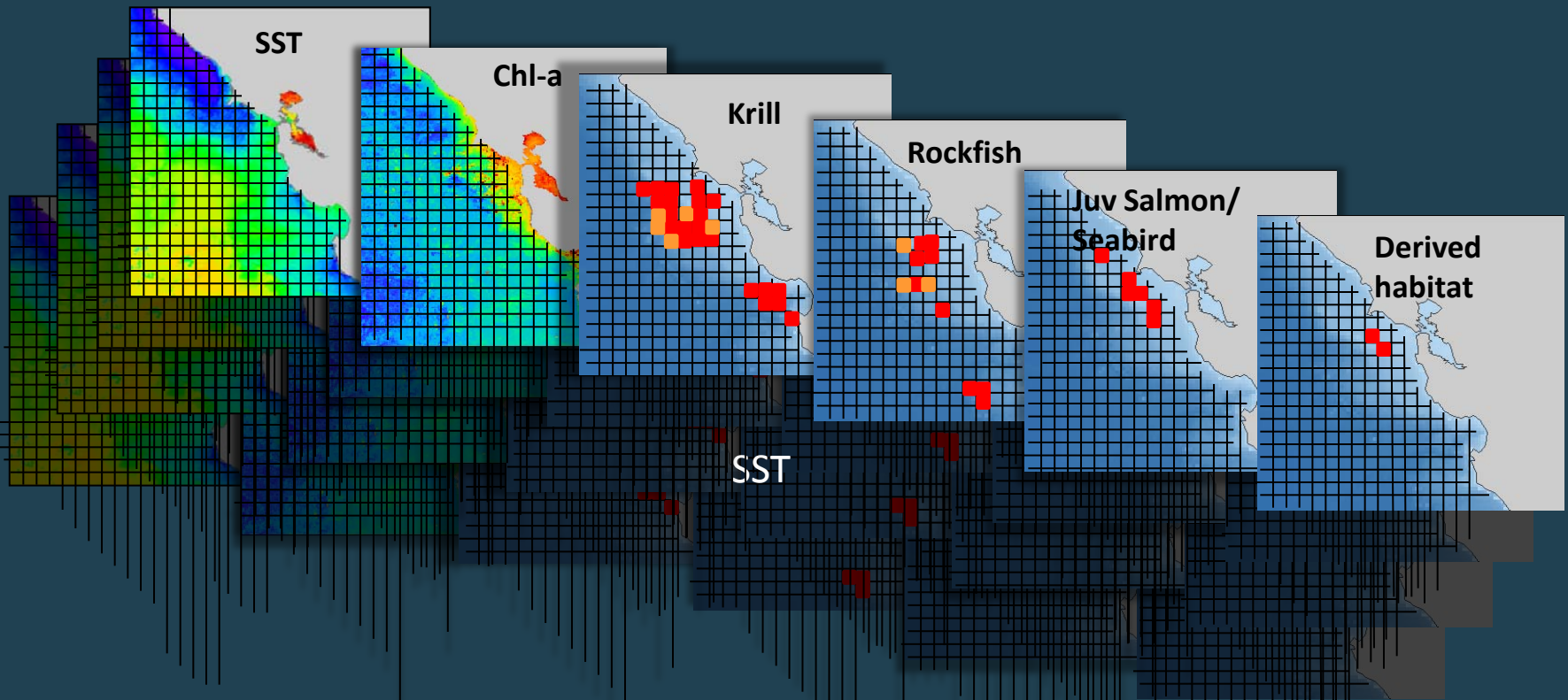
- **California Current System ecological modeling**
- **Sacramento, Klamath, and Columbia River life-cycle modeling**
 - Stream temperature modeling
 - Klamath disease modeling
- **California Mass Marking Working Group**
 - Evaluation of mass marking and mark-selective fisheries
- **Ocean sampling**
 - Juvenile salmon rope trawl survey
- **Use of GSI data in salmon management**

Modeling in the California Current System



To date, we have focused on adult reactions to REGIONAL and COASTWIDE conditions.

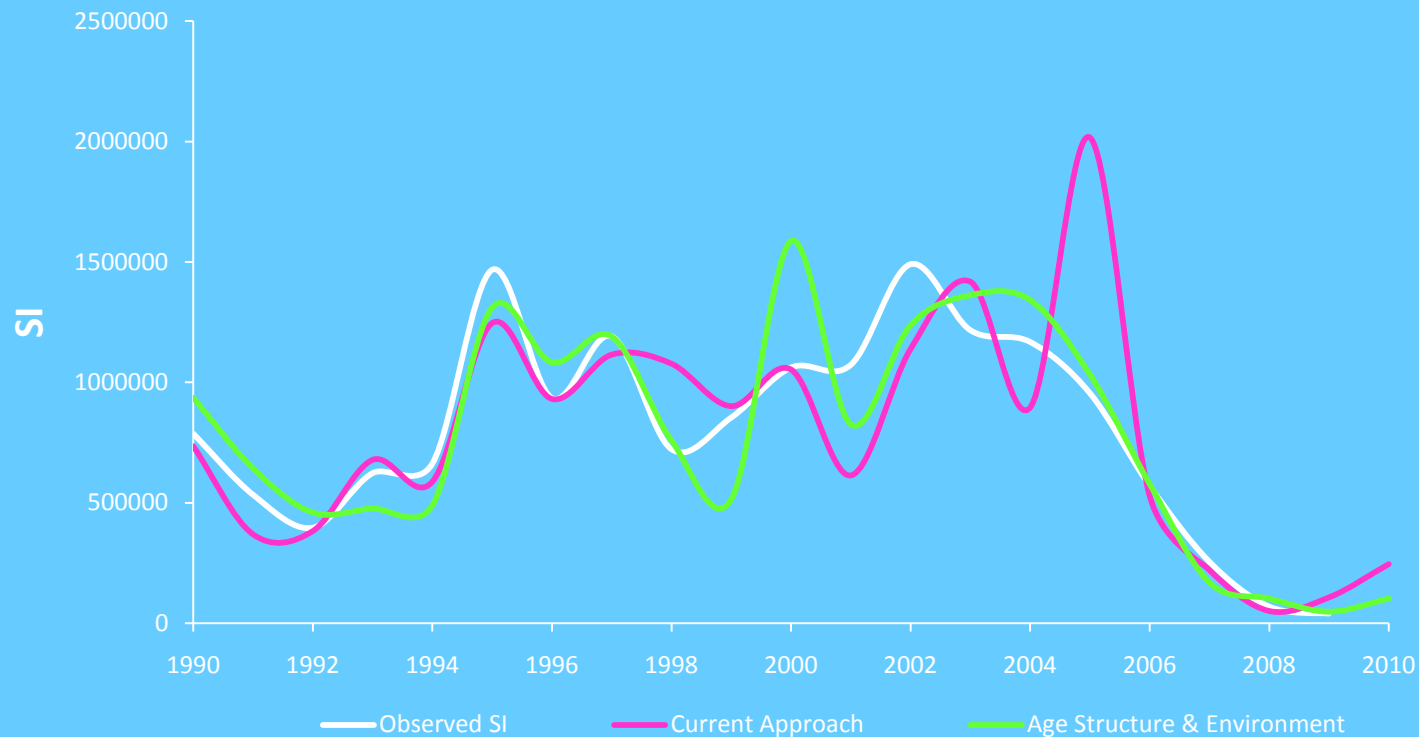
Meso-scale Ocean environment



We are expanding and improving on previous models by examining the role of mesoscale variability (the scale relevant to juveniles) on the productivity of Central Valley Fall run salmon.

Incorporation of environmental data and age structure variability into the assessment models

For Sacramento River fall Chinook, preliminary analyses shows an improvement in estimates of productivity. This is especially true when abundance is drastically reduced.



The future of the California Chinook salmon fishery: roles of climate variation, habitat restoration, hatchery practices, and biocomplexity: A management strategy evaluation

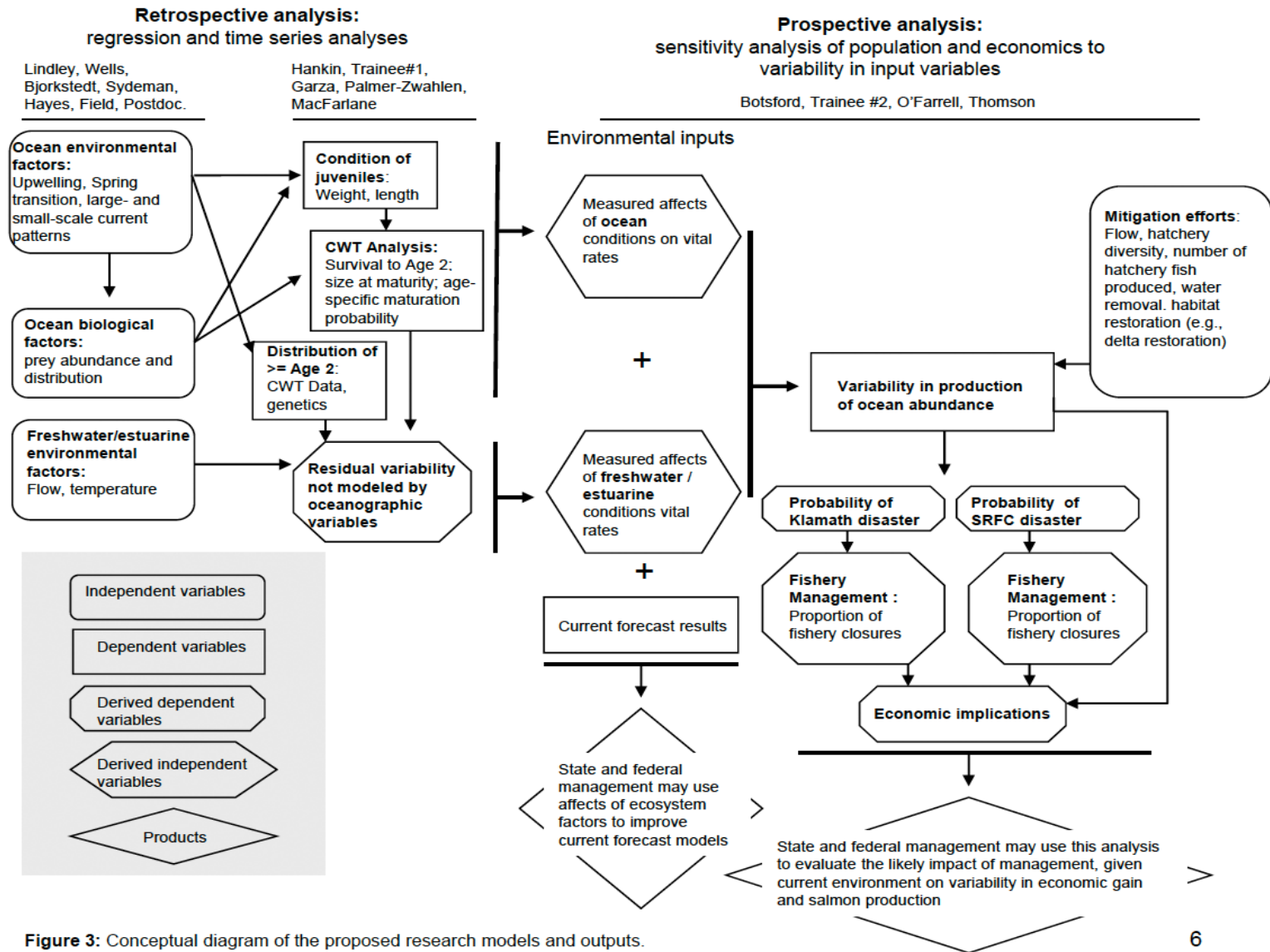


Figure 3: Conceptual diagram of the proposed research models and outputs.

Population dynamics model for evaluating the effects of removing four dams from the mainstem Klamath River on Klamath River fall Chinook.

Iron Gate



Photo: Gary Thain

Copco 1

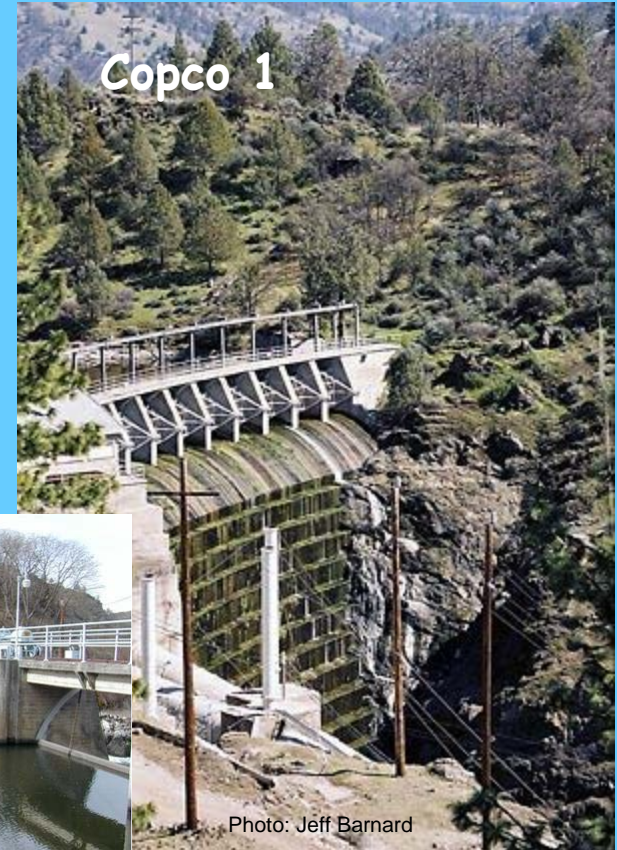


Photo: Jeff Barnard

J C Boyle

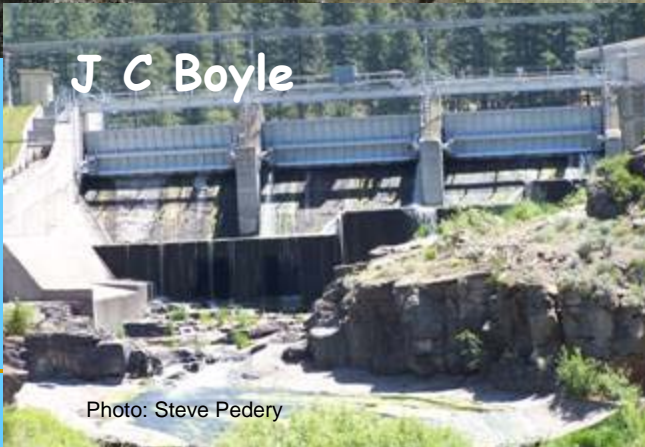


Photo: Steve Pedery

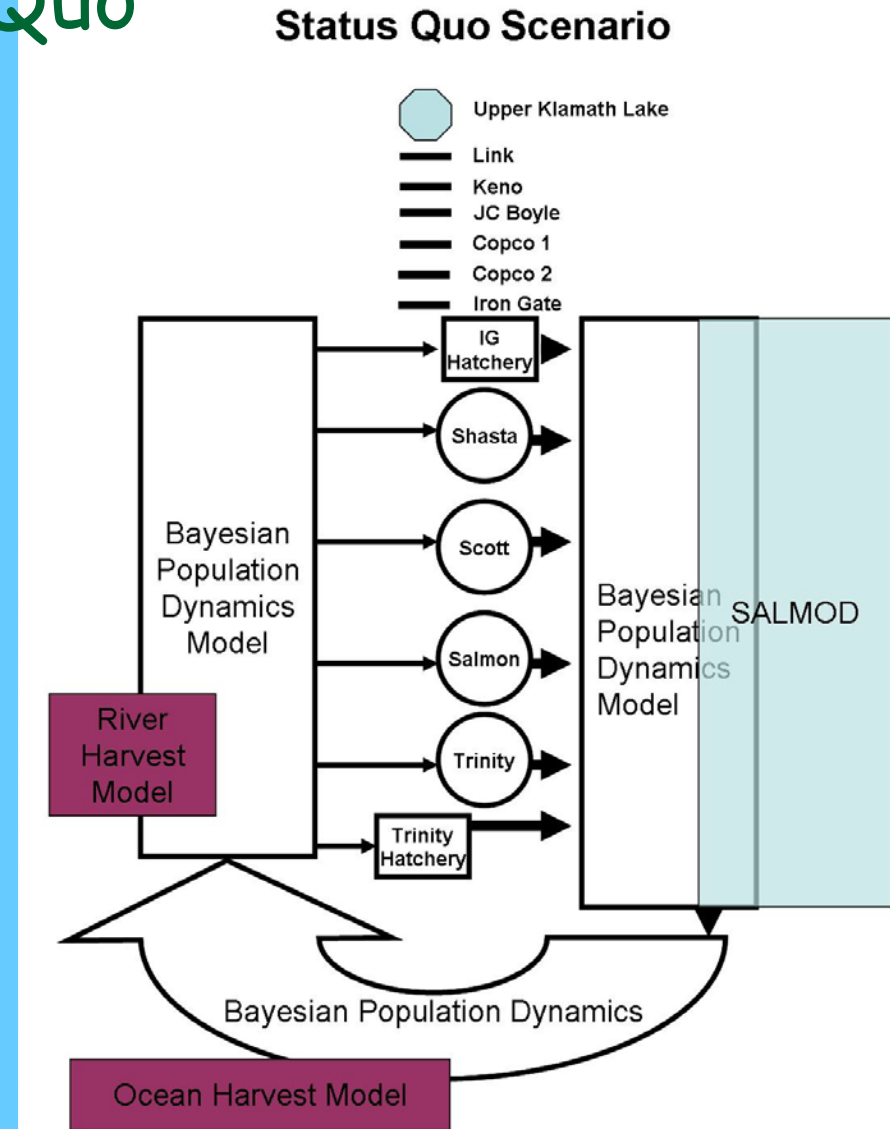
Copco 2



Photo: USFWS

Alternative: Status Quo

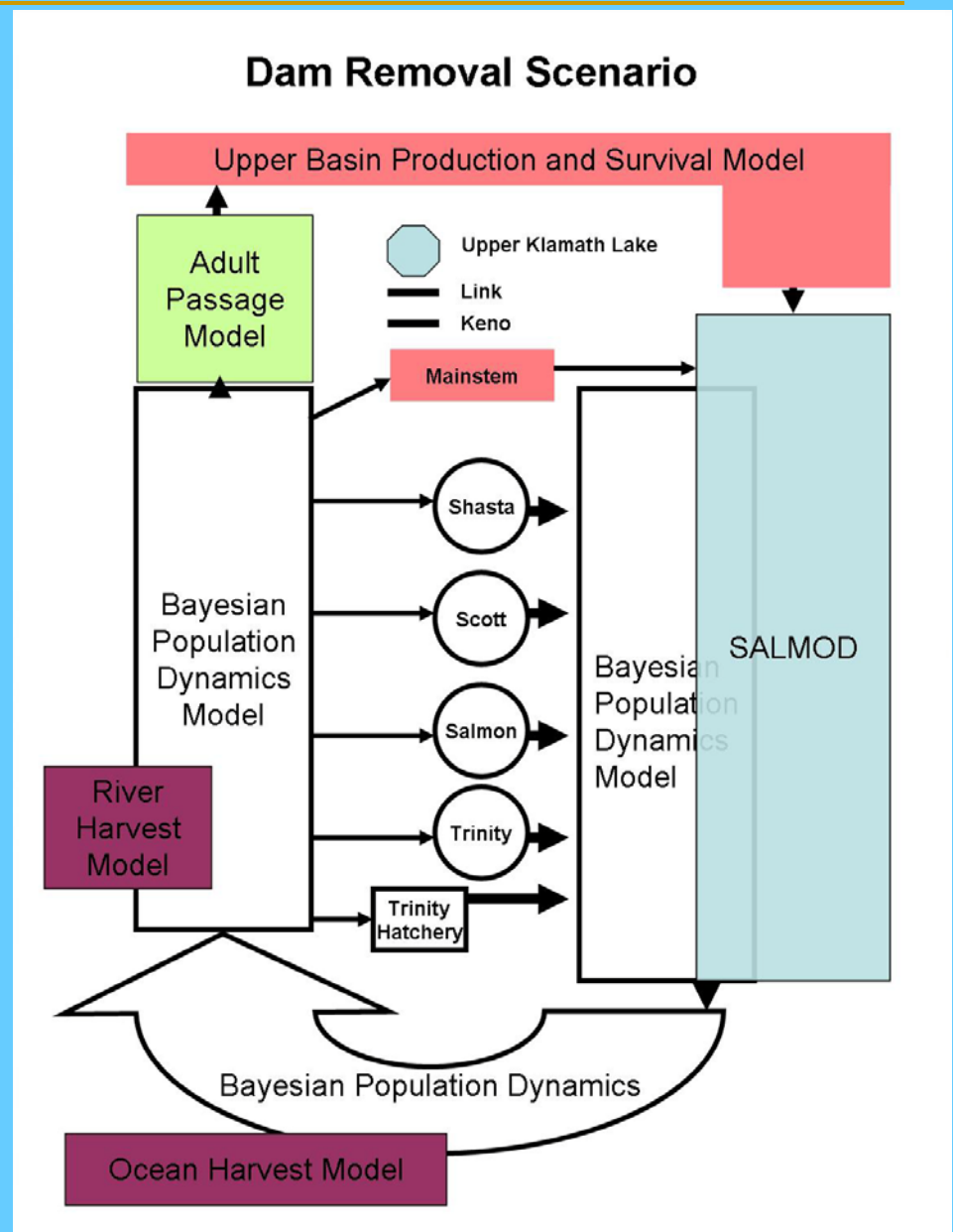
- Bayesian Population Dynamics
 - Lifecycle model for tributaries and IG Hatchery
- SALMOD
 - IG to Ocean survival
- Harvest Model



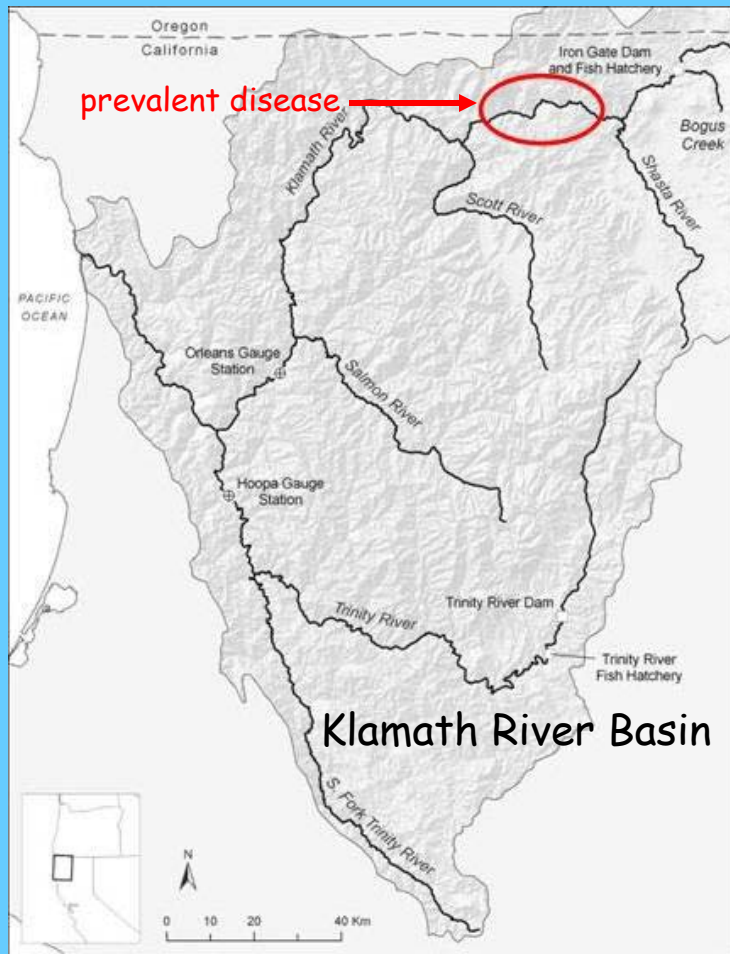
Alternative: Dam Removal

in addition...

- Adult Passage
 - Timing
 - Water quality
- Upper basin and mainstem production
 - Carrying Capacity
 - UKL conditions
- SALMOD
 - Disease
 - Water quality



Population level effects of disease on KRFC salmon

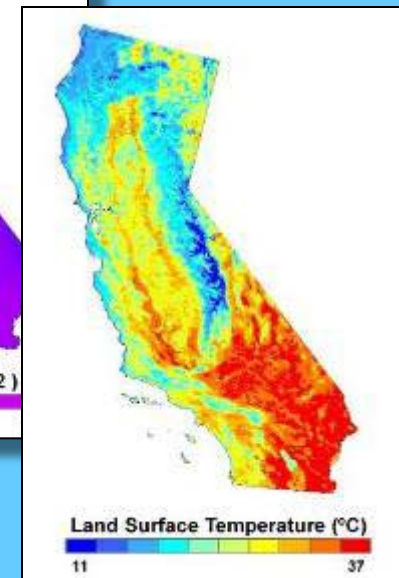
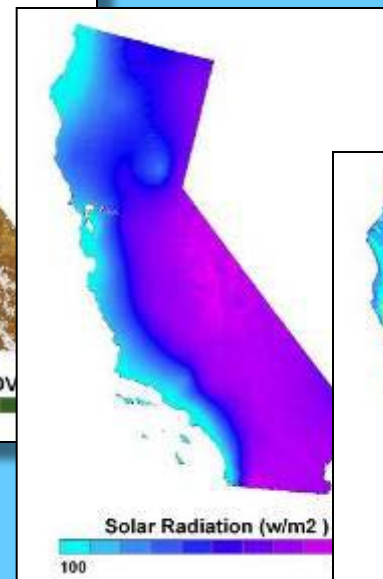
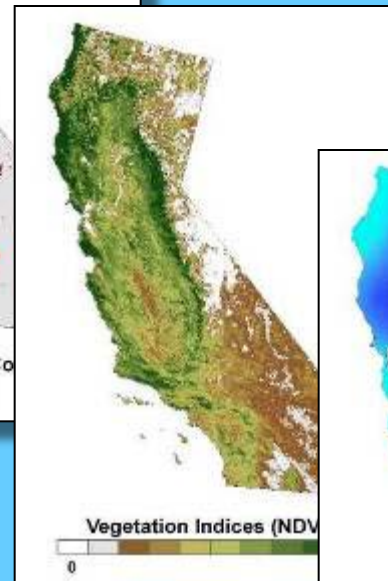
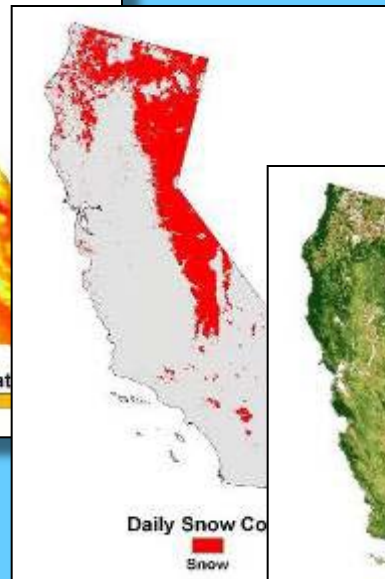
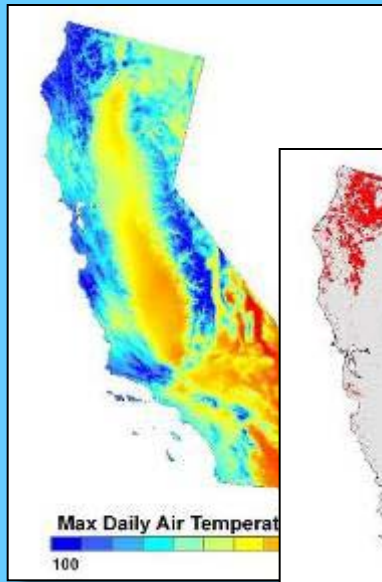


- Evaluate how disease affects KRFC population dynamics, abundance, and harvest
- Construct KRFC life-cycle models with disease incorporated
- Collaboration with fish pathologists

Improving stream temperature predictions for Sacramento River water decision support systems



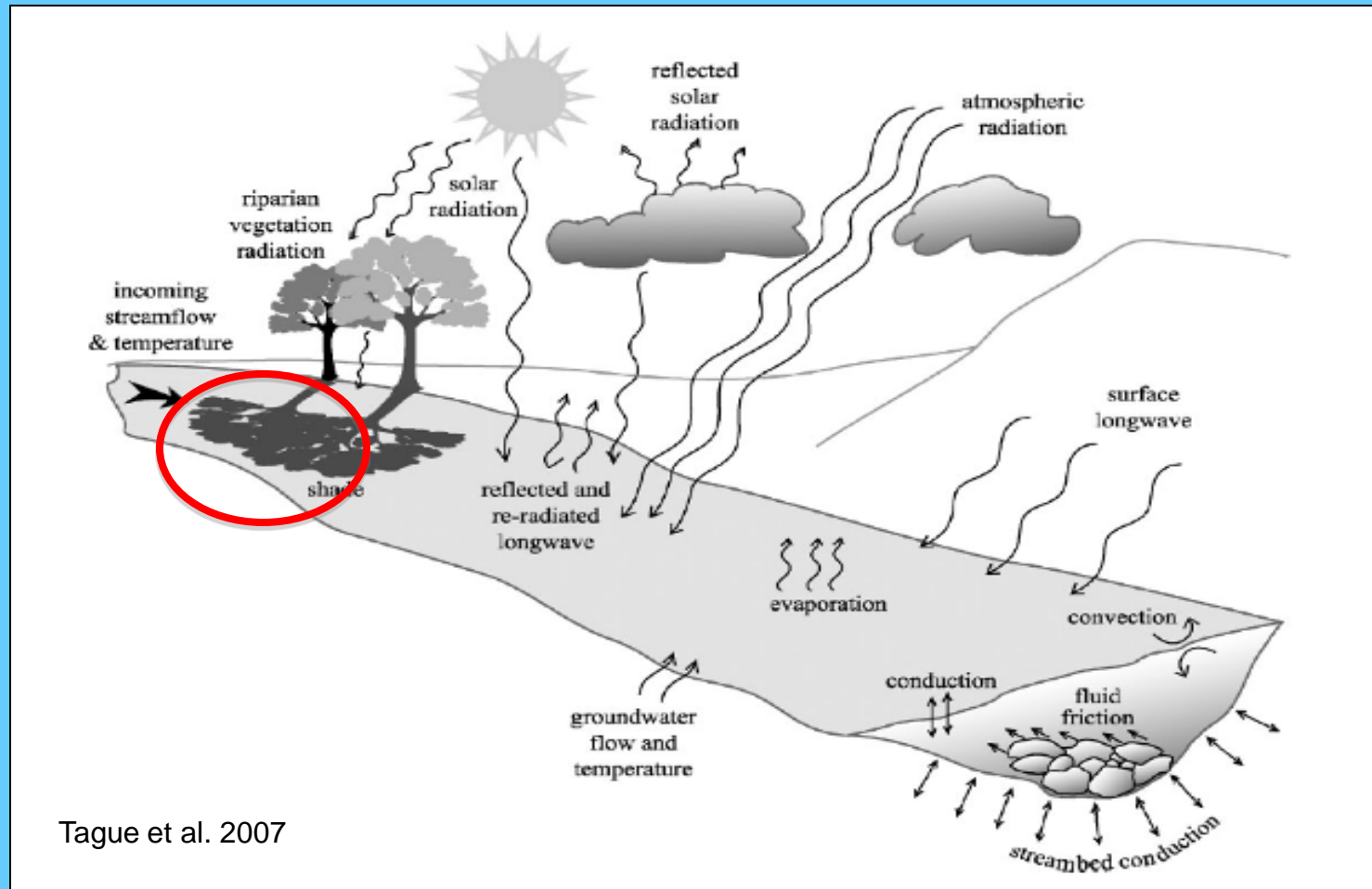
Integrate weather research and forecasting (WRF) model into Terrestrial Observation and Prediction System (TOPS)



Coupled TOPS-WRF system to generate hindcasts and forecasts of weather conditions every 15 minutes at a spatial resolution of 1km²

Heat Budget

Based on both atmospheric inputs and water temperature

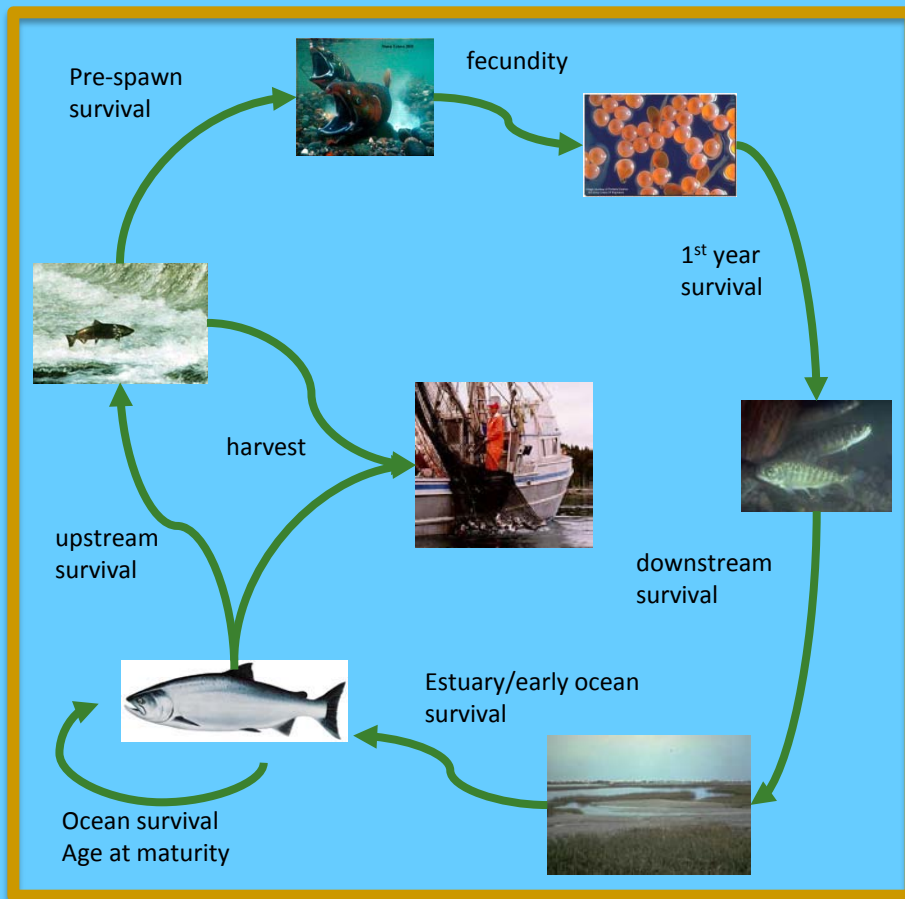


Tague et al. 2007

NWFSC Actions under FCRPS BiOP and AMIP

- Updated status and trends analysis
 - Life cycle modeling (see Rich's slides)
 - Developing early warning indicators
 - Evaluating reintroductions above barriers
 - Assessing impacts of non-native species
 - Assisting development of rapid response actions if stocks decline
-

FCRPS BiOP Life-Cycle Model



Data

- Spawner counts and ages
- Smolt-to-Adult survival
- PIT-tag survival
- Chinook and steelhead

Model Output

- Future trajectories of abundance
- Annual population increase (I)

Questions

- How will populations respond to future environmental conditions in the ocean and freshwater?
- How will alternative hydrosystem conditions affect long-term viability?

Continued Development by NWFSC and
the Interior Columbia Technical Recovery Team

Mass Marking Workgroup

Workgroup Charge

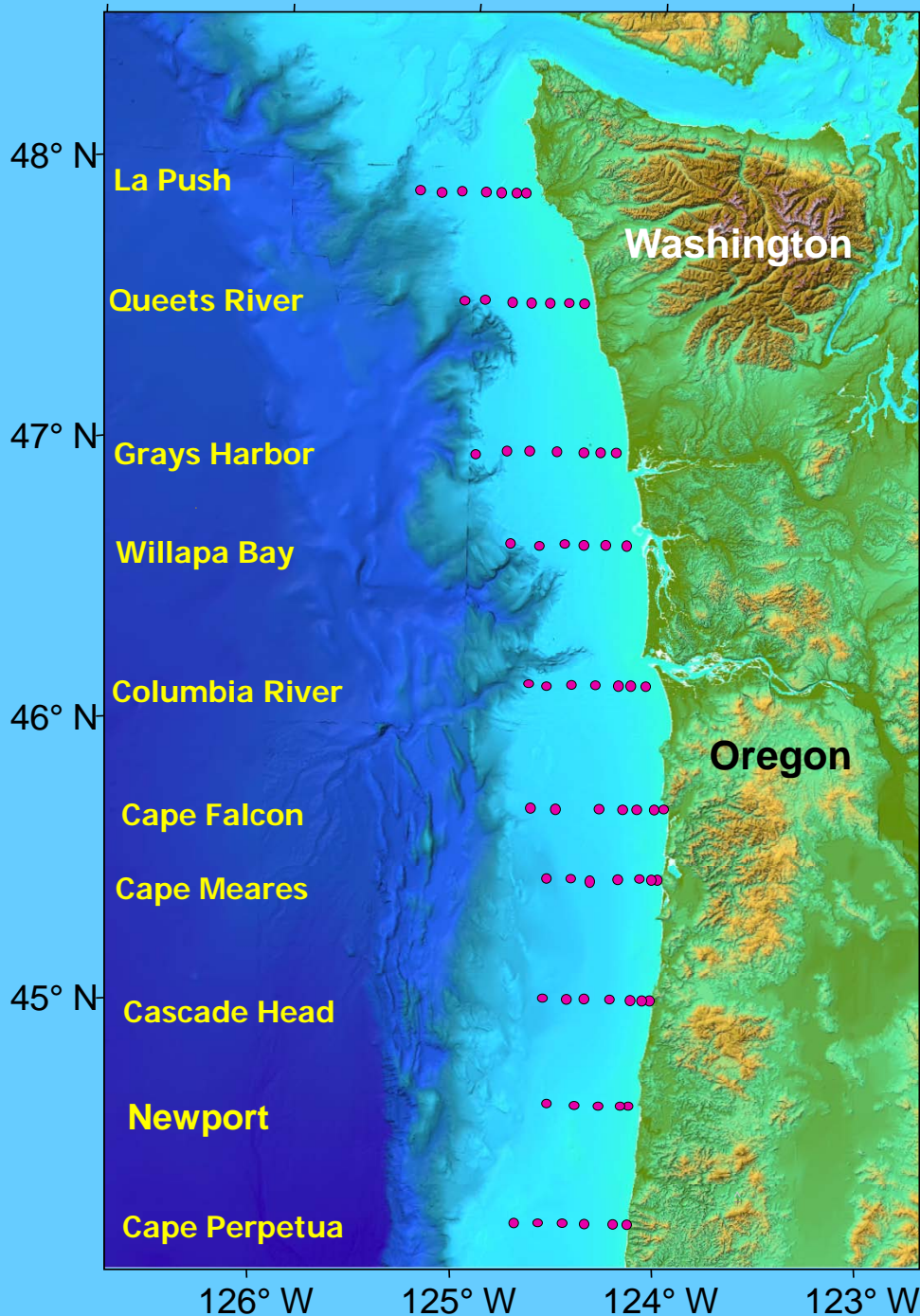
Provide a technical evaluation of the attributes of various alternative marking/tagging systems and their value for conservation of Central Valley (CV) and Klamath River (KR) fall Chinook salmon, conservation of other salmon stocks, management of salmon fisheries, management of hatcheries, and other operations.

The Workgroup charge does not include recommending that one or another of these systems be adopted nor will this effort include a "Hatchery Reform" review.

Background

- Mass marking and mark-selective fisheries have recently been proposed as a basis for an alternative management system for fall Chinook salmon in California.
- Possible benefits that would accrue from the proposal include:
 - improved genetic fitness of hatchery broodstock and natural spawning populations.
 - significantly increased overall harvest and fishing opportunity with decreased fishing mortality on ESA-listed and unmarked stocks.
- However, many questions and concerns have been raised about this proposal regarding the certainty of these benefits accruing, the unintended consequences that could occur with implementation, and the costs of such a program.
- Other marking/tagging system proposals have also been put forward that promise certain benefits over the current system.
- Report target: October 2010

Ocean Sampling of juvenile salmon

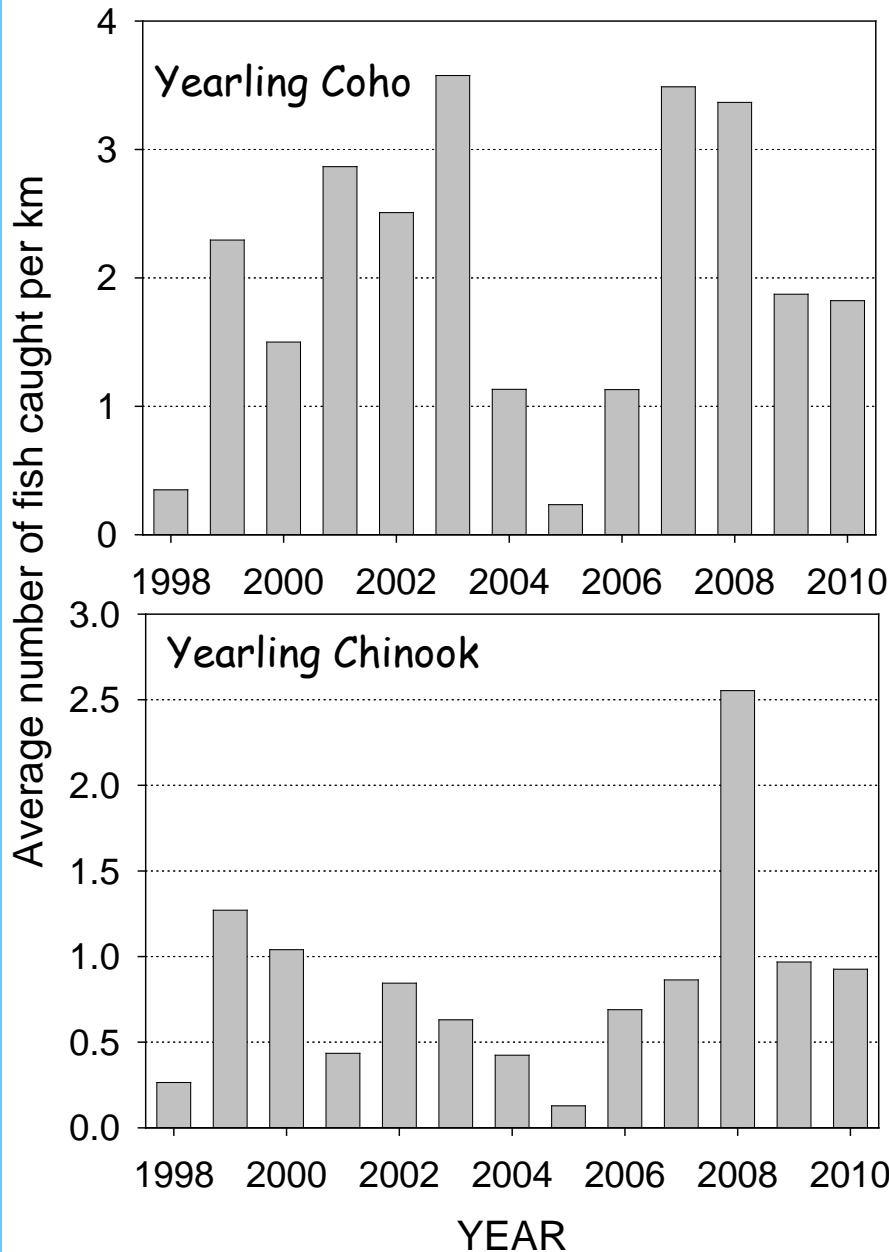


- Juvenile salmon sampled in May, June and September since 1998 (13th year) with NORDIC 264 rope trawl, from La Push south to Newport.

- Ocean conditions sampled biweekly off Newport on oceanographic cruises (temperature, salinity, nutrients, phytoplankton, zooplankton, krill, fish larvae)

- Historical data:
 - hydrography, 1960s;
 - plankton, 1969-1973;
 - 1983, 1990-1992
 - juvenile salmon, 1981-1985

Catches of juvenile salmon during June surveys



Inter-annual variations in catches of juvenile salmon in rope trawl surveys

- High catches of coho in 1999-2003 and again in 2007 and 2008, but average in 2009 and 2010
- Highest catches of spring Chinook in 2008, but average in 2009 and 2010.
- For other details see salmon forecasting website: <http://www.nwfsc.noaa.gov> and click on "Ocean Conditions and Salmon Forecasting"

Stoplight Chart showing ocean conditions among years: 1998-2009

1998, 2003-2005 = warm & unproductive; poor salmon returns

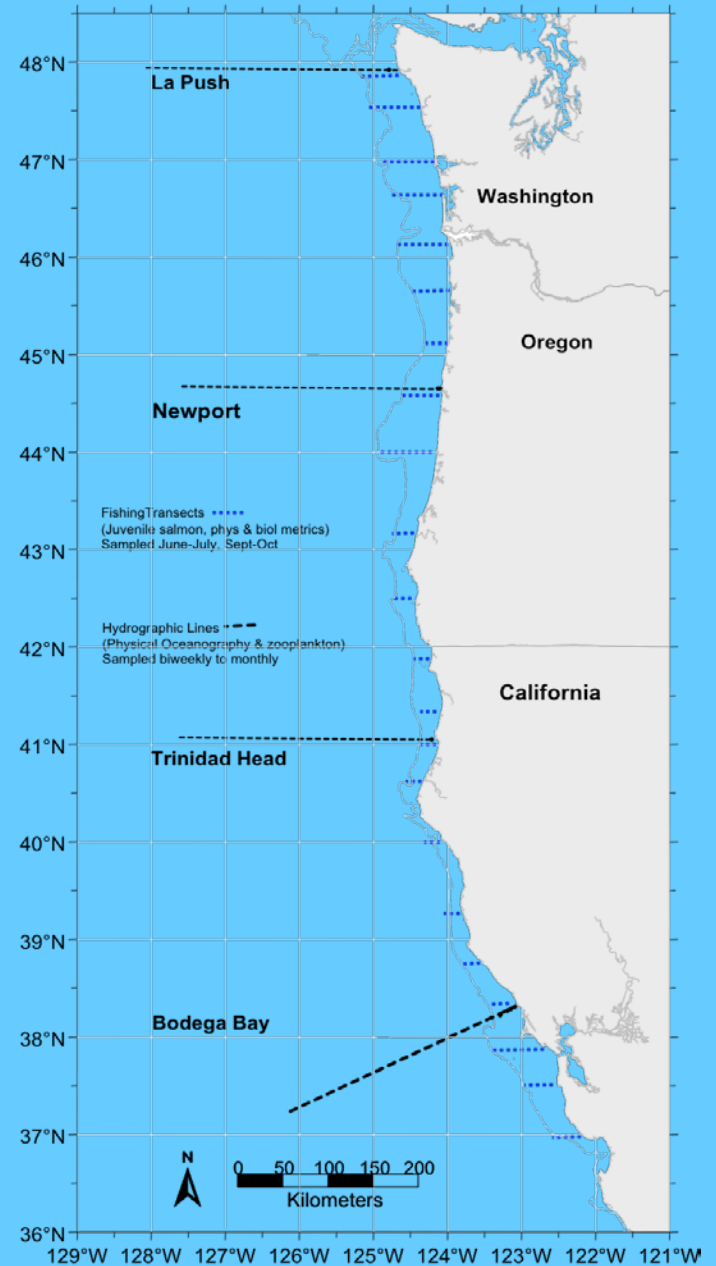
1999-2002 and 2008 = cold & productive; very high returns

<i>Environmental Variables</i>	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
PDO (December-March)	11	5	2	8	4	12	7	10	9	6	3	1
PDO (May-September)	9	2	3	4	6	11	10	12	8	7	1	5
MEI Annual	12	1	3	5	11	10	8	9	6	4	2	7
MEI Jan-June	12	2	3	5	8	10	7	11	4	9	1	6
SST at 46050 (May-Sept)	10	8	4	5	1	6	12	9	2	11	3	7
SST at NH 05 (May-Sept)	8	2	1	4	6	7	12	11	5	9	3	10
SST winter before going to sea	12	7	5	6	4	8	11	10	9	3	1	2
Physical Spring Trans (Logerwell)	8	7	2	1	4	10	9	12	10	3	6	5
Upwelling (Apr-May)	7	1	11	3	6	10	9	12	7	2	4	5
Deep Temperature at NH 05	12	4	5	3	1	7	9	10	11	6	2	8
Deep Salinity at NH05	12	3	6	2	5	9	11	8	7	1	4	10
Length of upwelling season	7	3	2	10	1	11	9	12	6	5	8	4
Copepod richness	12	2	1	5	3	9	8	11	10	6	4	7
N.Copepod Anomaly	12	9	3	6	2	10	7	11	8	5	1	4
Biological Transition	11	5	4	7	6	10	8	12	9	2	1	3
Copepod Community structure	12	3	4	6	1	8	9	11	10	7	2	5
Catches of salmon in surveys												
June-Chinook Catches	11	2	3	9	6	8	10	12	7	5	1	4
Sept-Coho Catches	9	2	1	4	3	5	10	11	7	8	6	12
Mean of Ranks of Environmental Data	10.4	3.8	3.5	5.2	4.3	8.9	9.2	10.8	7.5	5.5	2.9	5.8
RANK of the mean rank	11	3	2	5	4	9	10	12	8	6	1	7

See the NW Center's website: <http://www.nwfsc.noaa.gov> and click on "Ocean conditions..."

NWFSC and SWFSC coast-wide juvenile salmon survey proposal

- Comprehensive survey of abundance, distribution, condition of juvenile salmon by stream of origin
- Data for annual predictive models of ocean productivity and recruitment
- Intensively monitored hydrographic lines expanded to determine state of ocean productivity and monitor changes due to ocean conditions
- Annual assessment of juvenile salmon in relation to ocean conditions



Use of GSI data in salmon assessment: West Coast Salmon GSI Collaboration

- Closely examine how GSI data can be used in salmon fishery management
- Incorporate GSI data into existing CWT-based models, and construct new models that accommodate GSI
- Develop new statistical methods to estimate stock-specific ocean distributions based on GSI and CWT information
- Sample all fishery times and areas South of Cape Falcon in 2010

West Coast GSI Collaboration

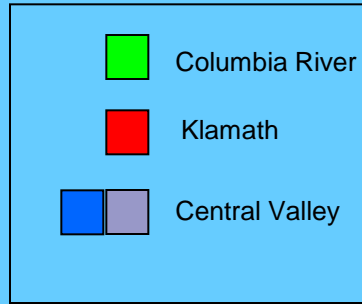
Commercial troll fishermen collect GSI and distribution information at sea.

Sampling in 2010
 open seasons
 non-retention fishing
 NMFS SRP
 Scientific Research
 Vessels

Samples through August 2010

8834	Total
4502	Oregon
4332	California

* Washington trollers also collected samples



Newport	N = 617
Coos Bay	N = 267
Brookings	N = 38
Crescent City	N = 15
Eureka	N = 52
Fort Bragg	N = 166
Bodega Bay	N = 107
San Francisco	N = 121
Half Moon Bay	N = 156
Santa Cruz	N = 26
June Total N = 1555	

