From the Watershed to the Ocean: Using NASA Data and Models to Understand and Predict Variations in Central California Salmon

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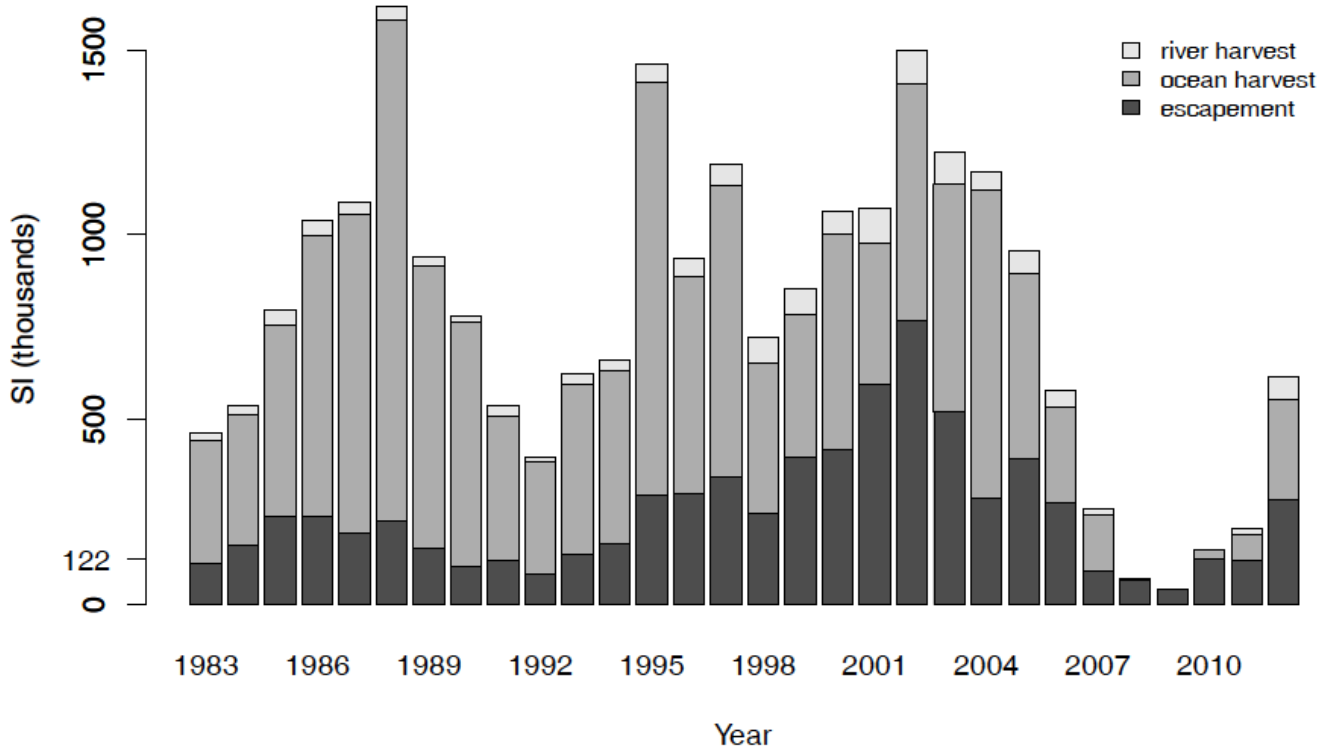
Central Valley Salmon

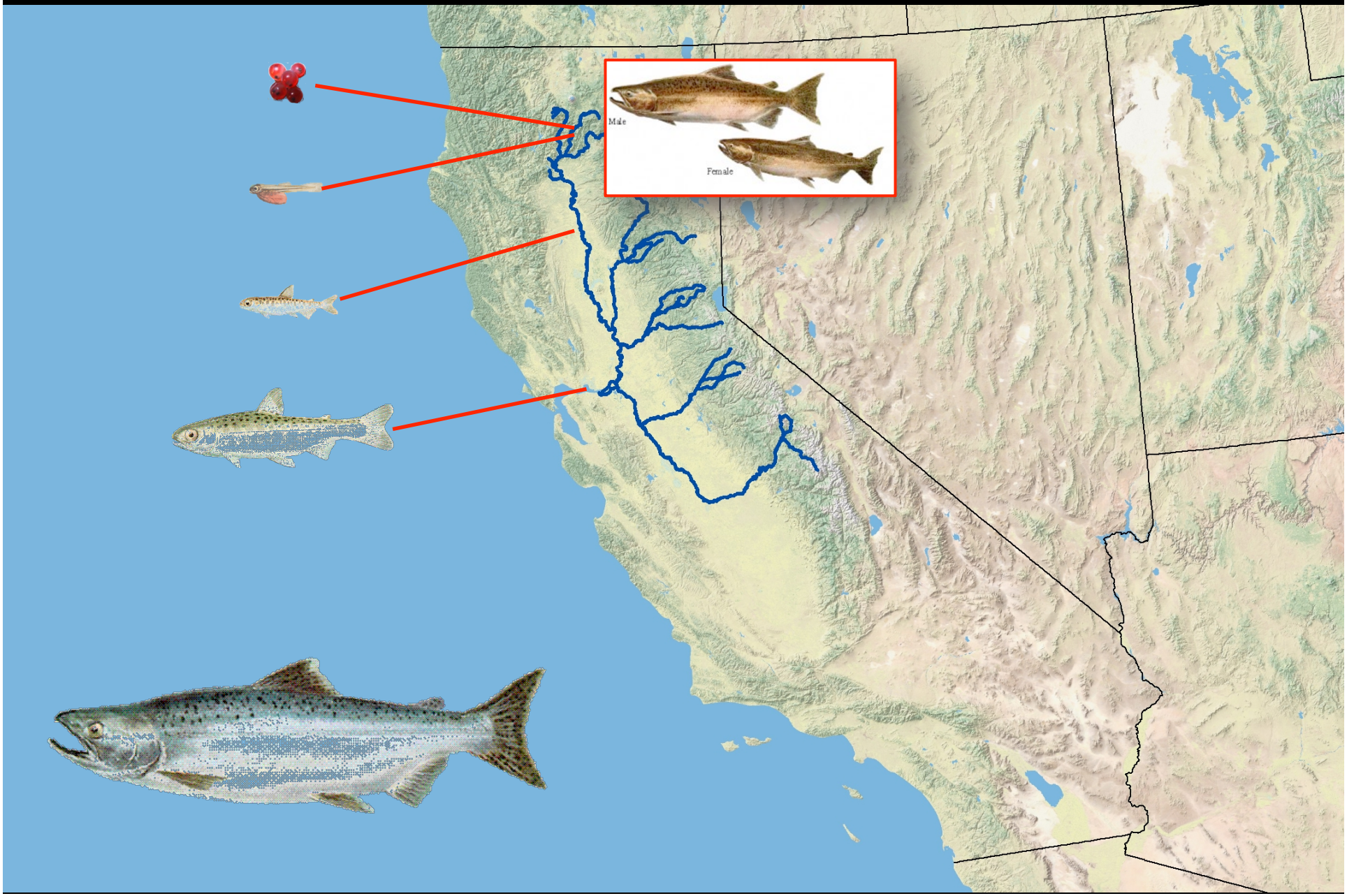


The Sacramento Index (SI) and relative levels of its components.

Pacific Fishery Management Council (2013)

Central Valley Water

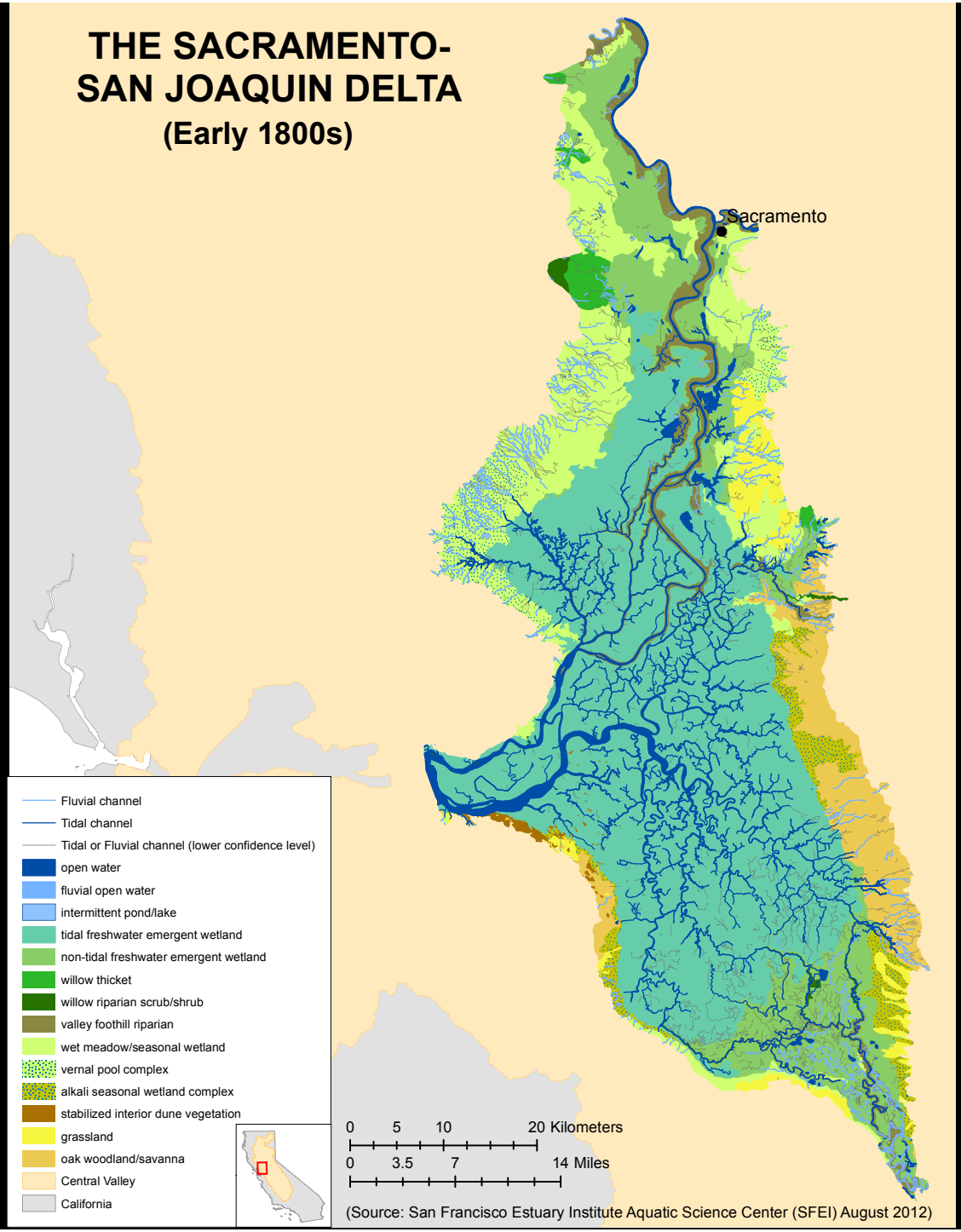
Salmon Life Cycle



Project Habitats

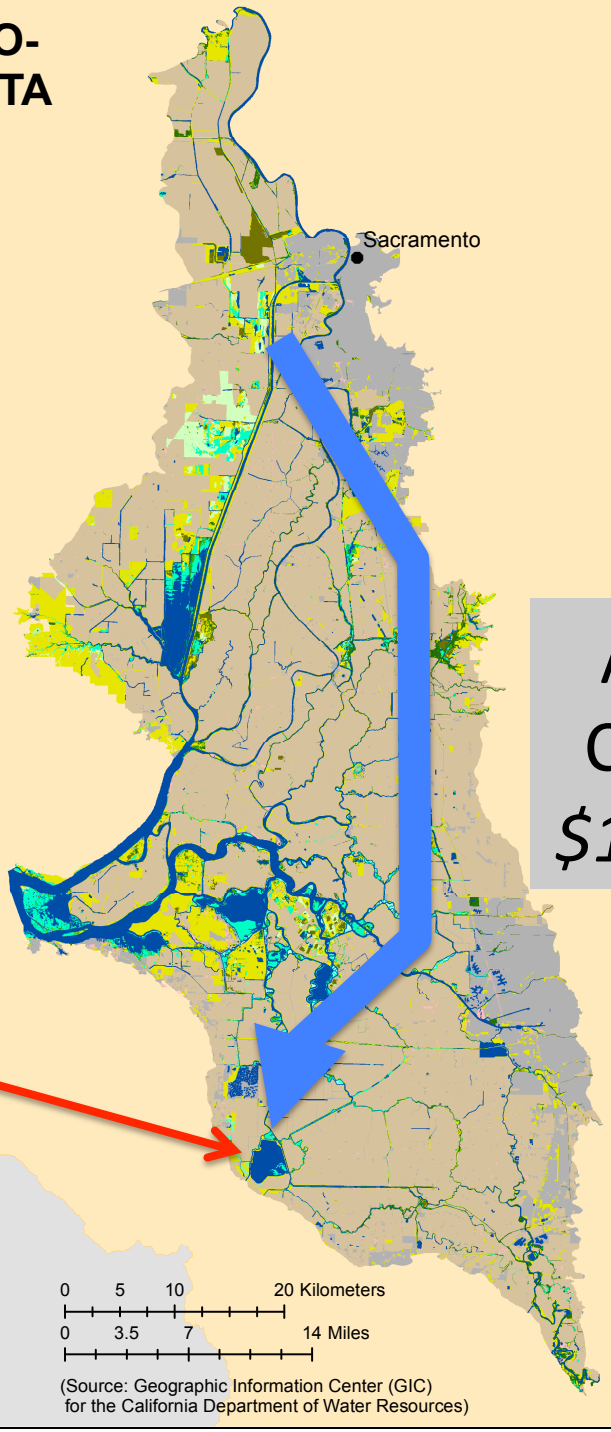
THE SACRAMENTO-SAN JOAQUIN DELTA

(Early 1800s)



(Source: San Francisco Estuary Institute Aquatic Science Center (SFEI) August 2012)

THE SACRAMENTO-SAN JOAQUIN DELTA
(2010-2011)

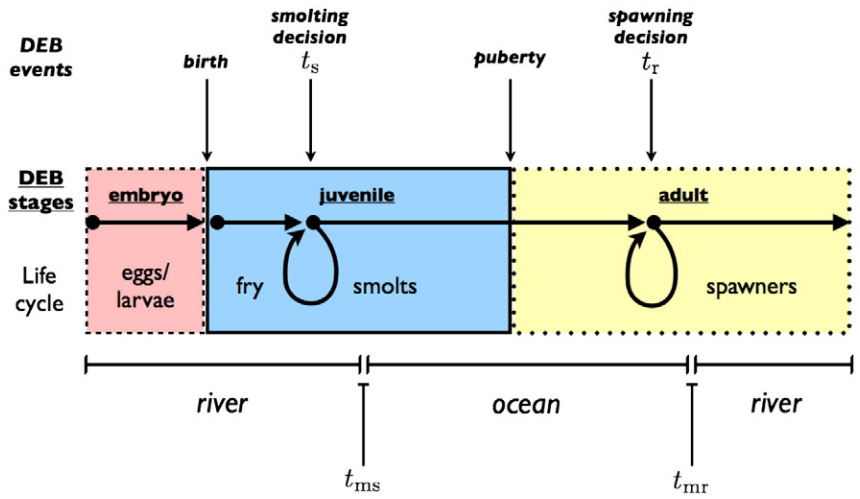


Alternative Conveyance
$15-20 billion

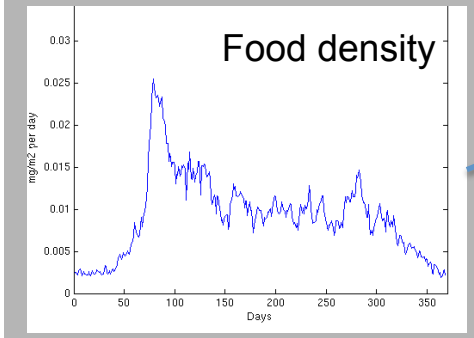
How do we model sublethal effects on individual life stages?

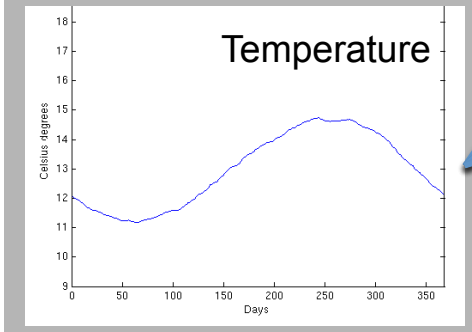
Length, weight, fecundity

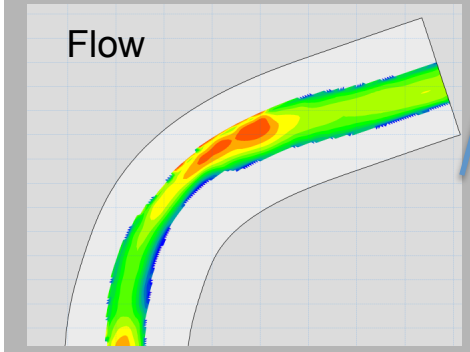
Dynamic Energy Budget (DEB) models

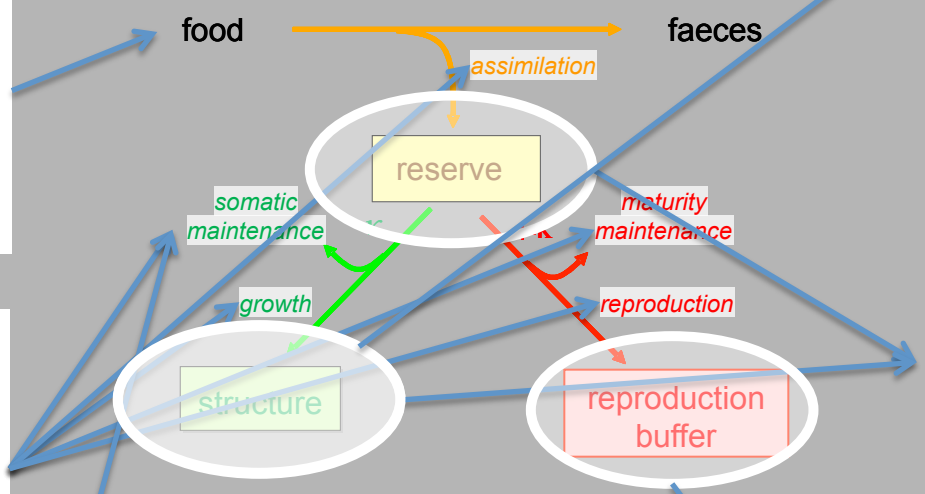


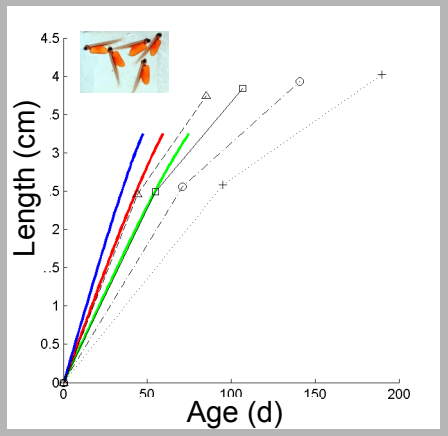
Dynamic Energy Budget (DEB) models

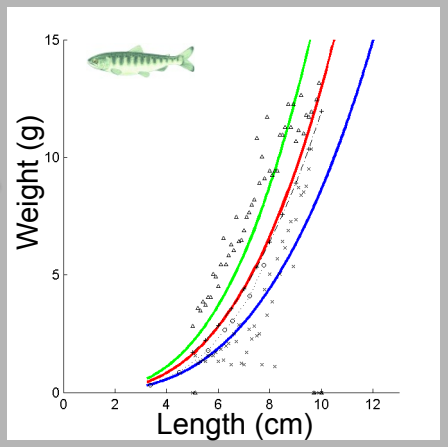


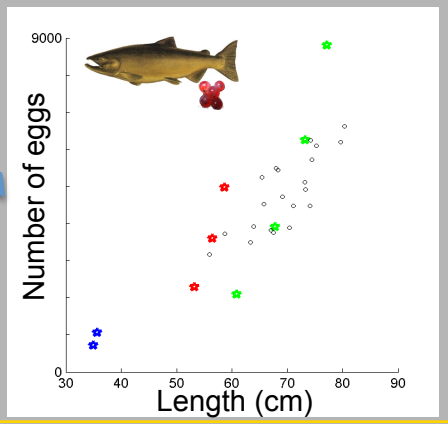








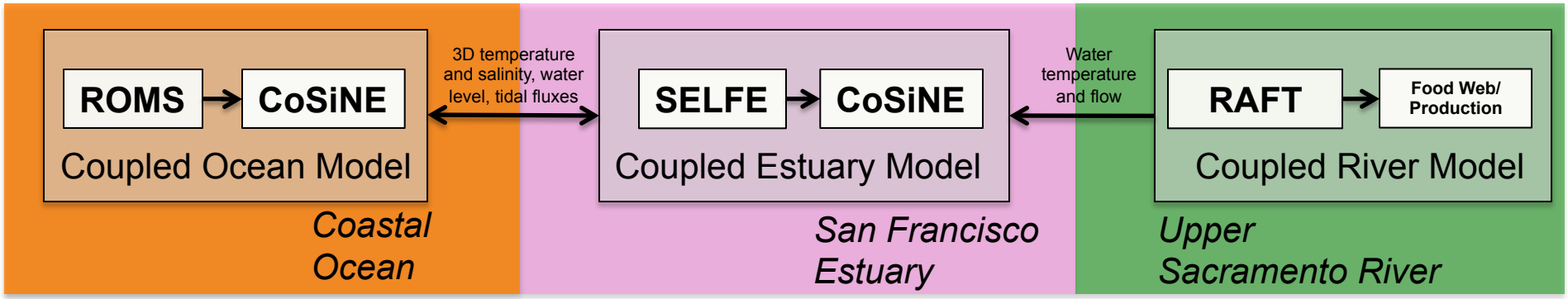


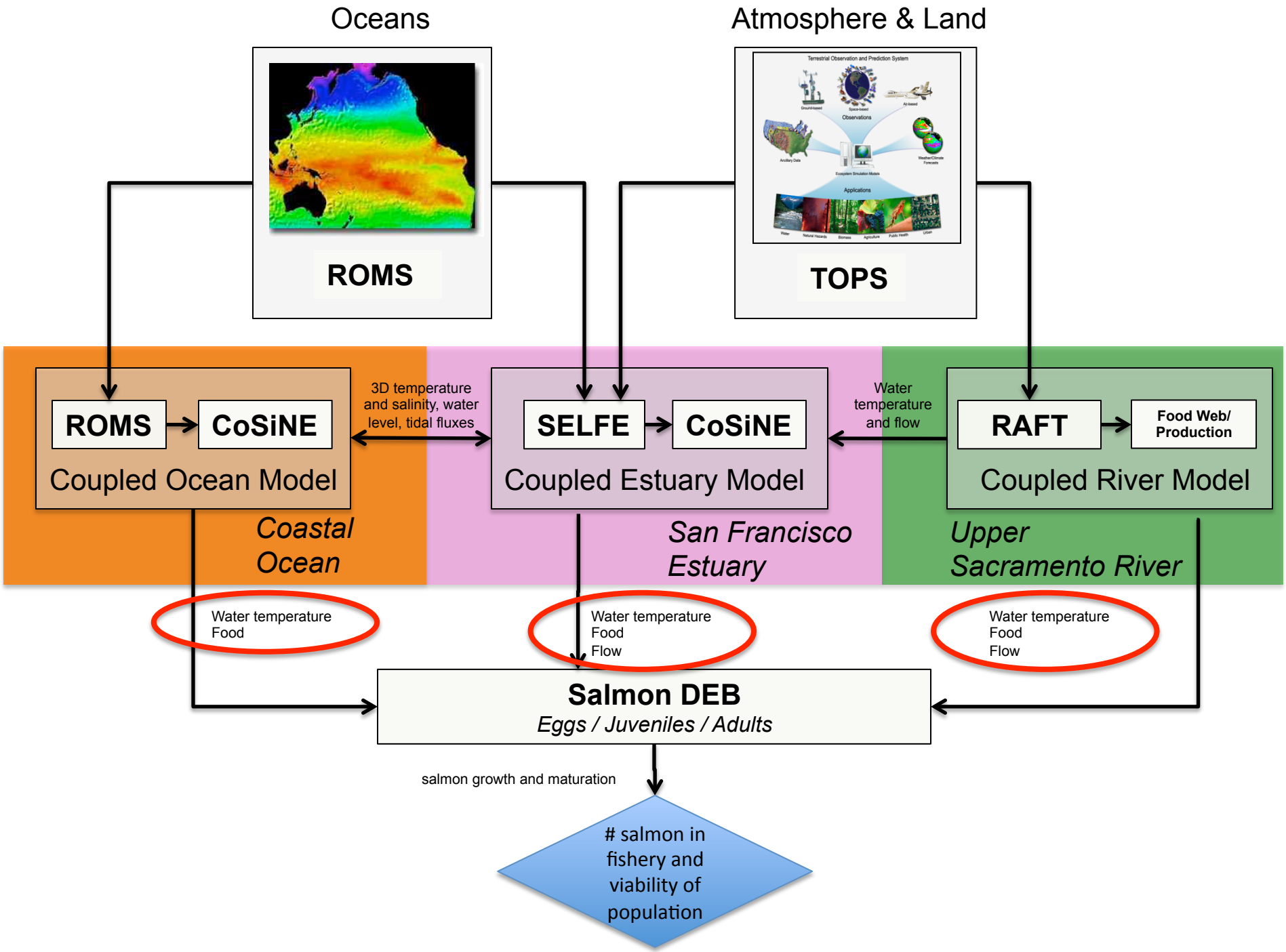


INPUTS DEB MODEL OUTPUTS

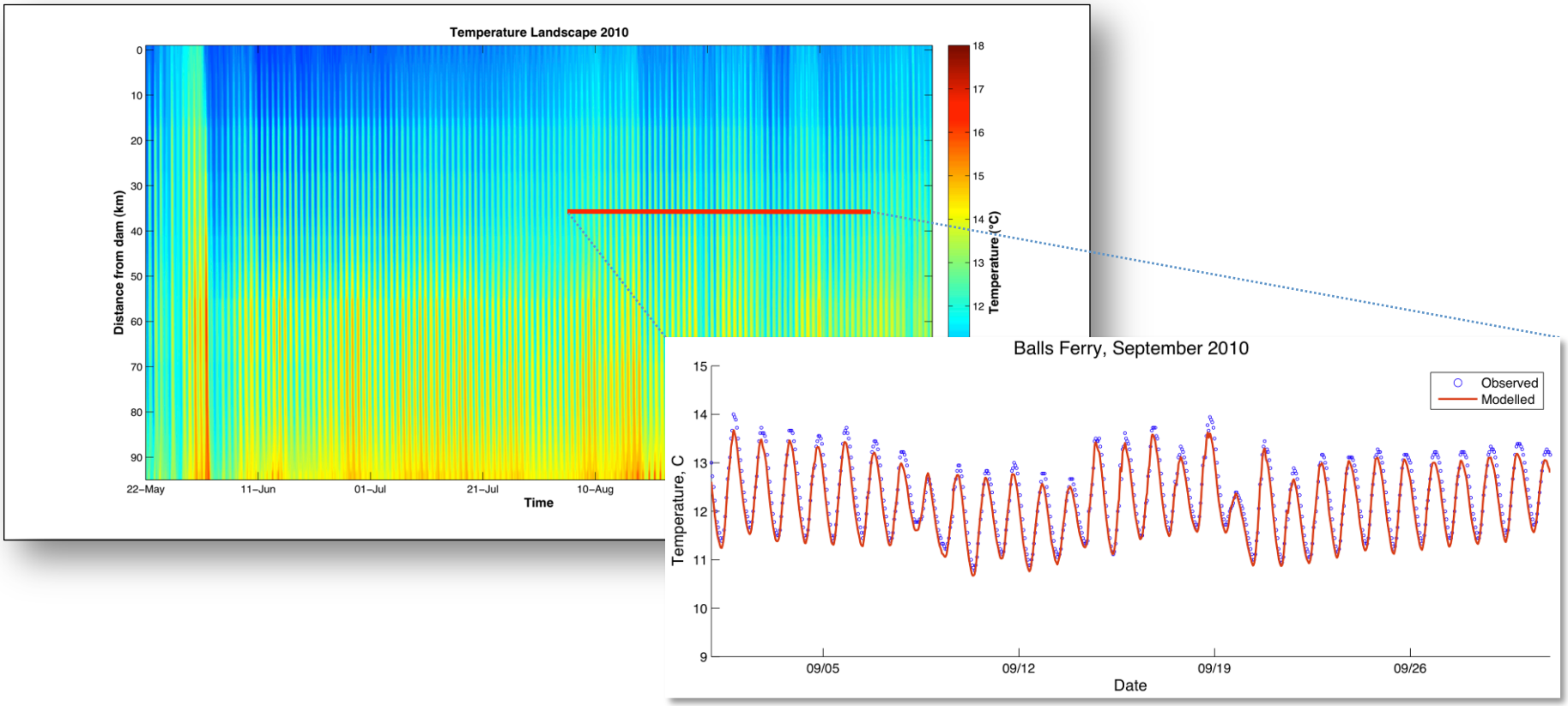
How do we get temperature, food, and flow over the broad and diverse range of habitats?

Coupled physical-biological models for each system

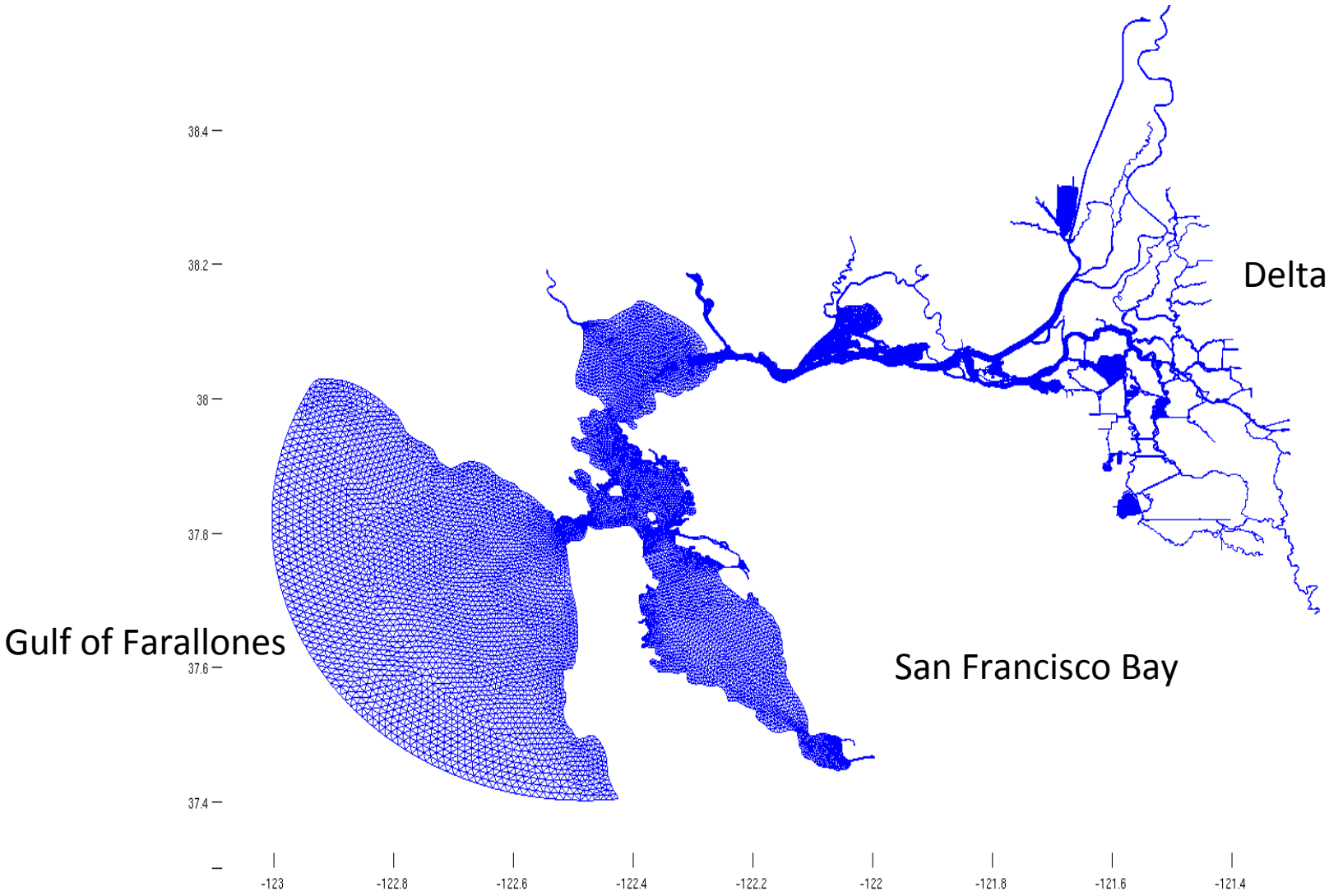



Oceans
Atmosphere & Land
ROMS
TOPS
ROMS
CoSiNE
Coupled Ocean Model
3D temperature and salinity, water level, tidal fluxes
SELFE
CoSiNE
Coupled Estuary Model
Water temperature and flow
RAFT
Food Web/ Production
Coupled River Model
Coastal Ocean
San Francisco Estuary
Upper Sacramento River
Water temperature Food
Water temperature Food Flow
Water temperature Food Flow
Salmon DEB
Eggs / Juveniles / Adults
salmon growth and maturation
salmon in fishery and viability of population

Modeling the river environment (RAFT)

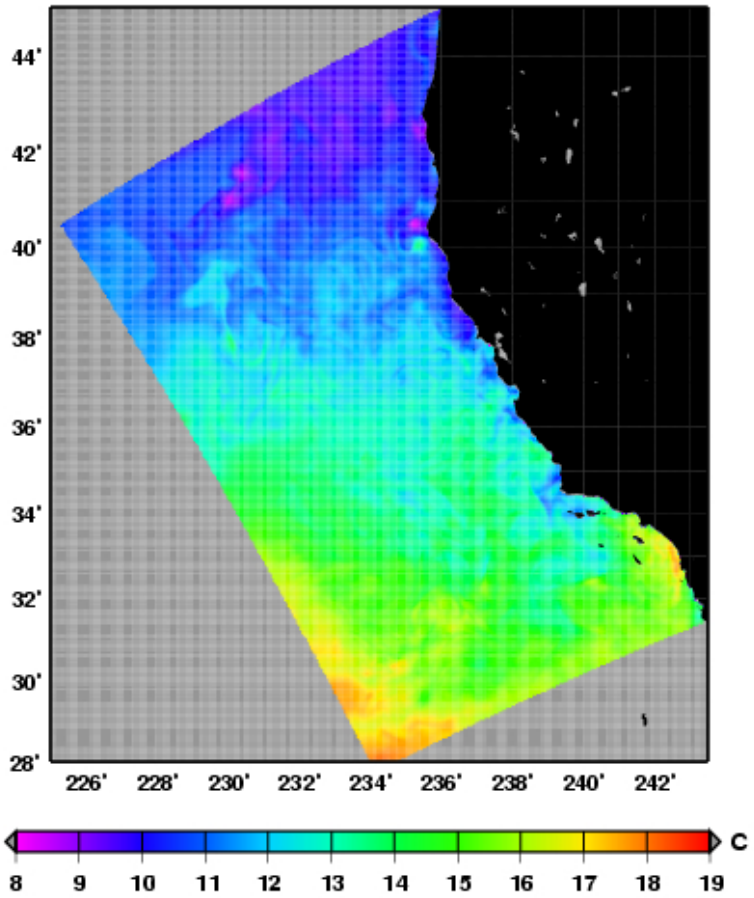


Modeling the estuarine environment (SELFE-CoSiNE)

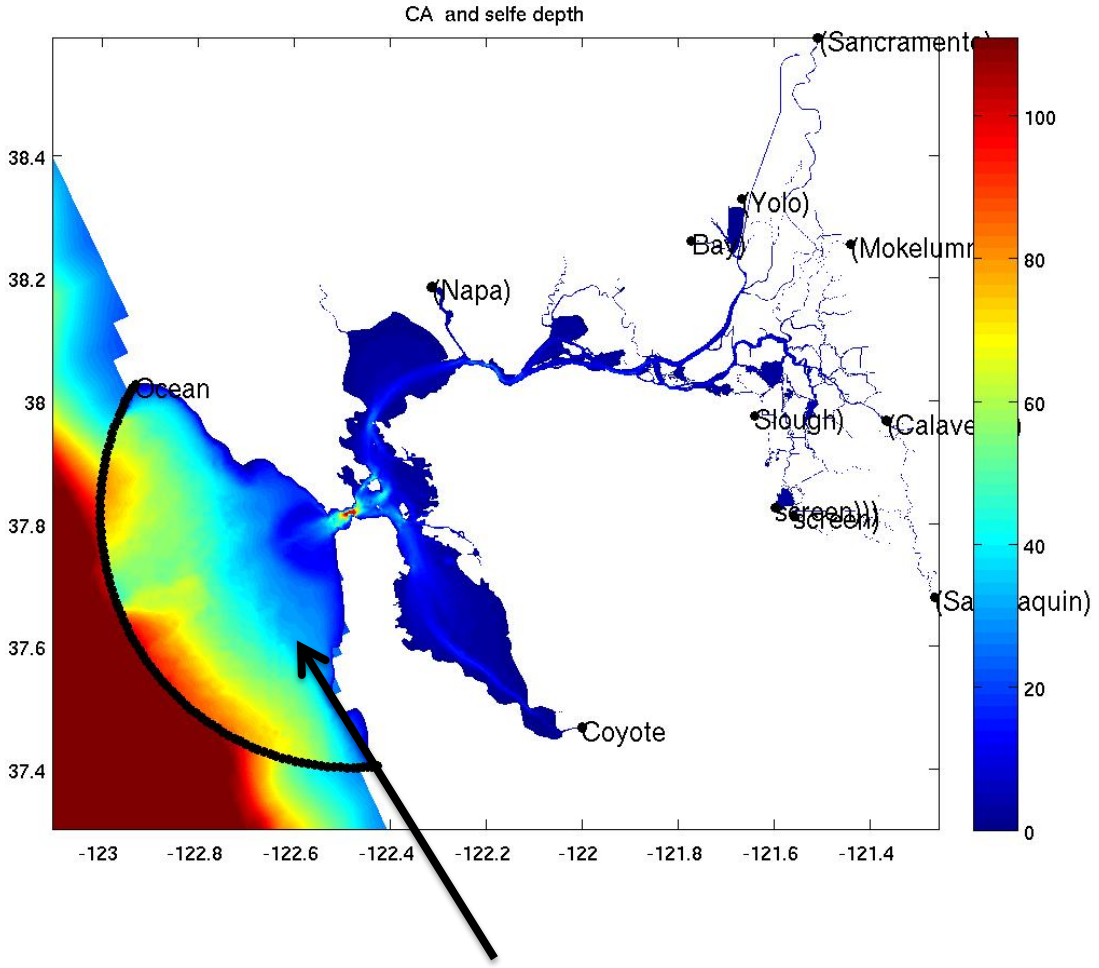


ROMS – SELFE Boundary

12.5 km ROMS is too course

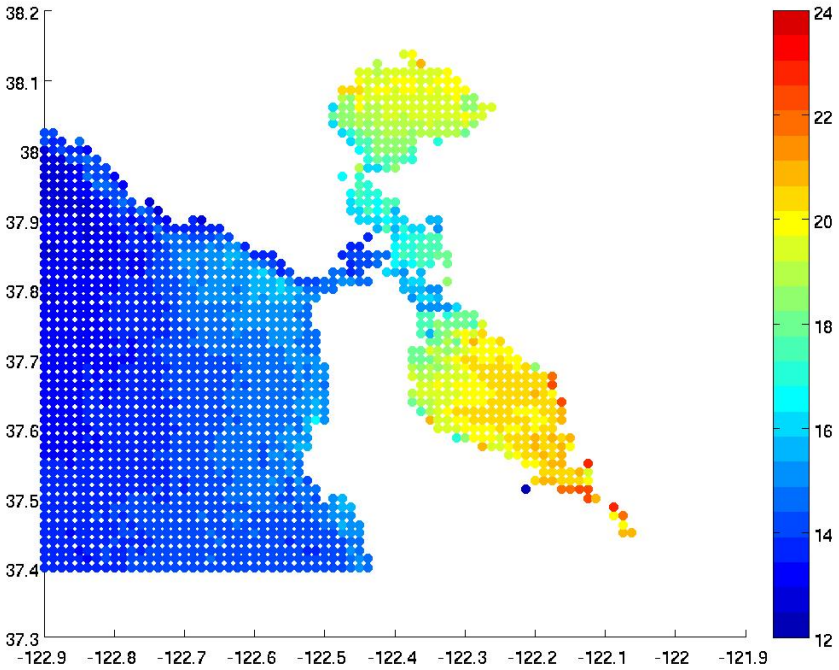


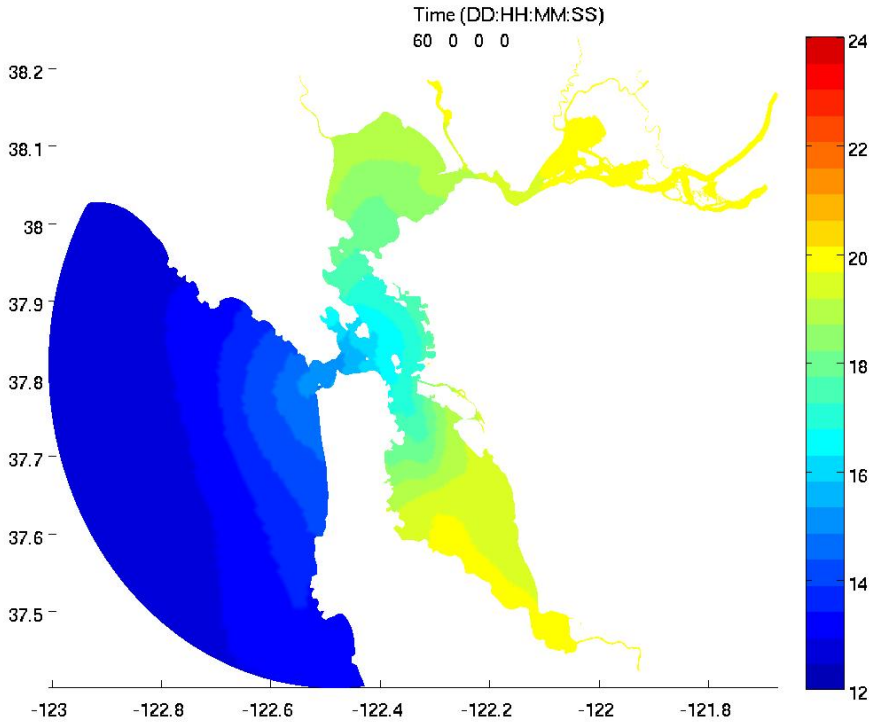
3-km ROMS



ROMS & SELFE boundary

June-July 2009 Mean SST





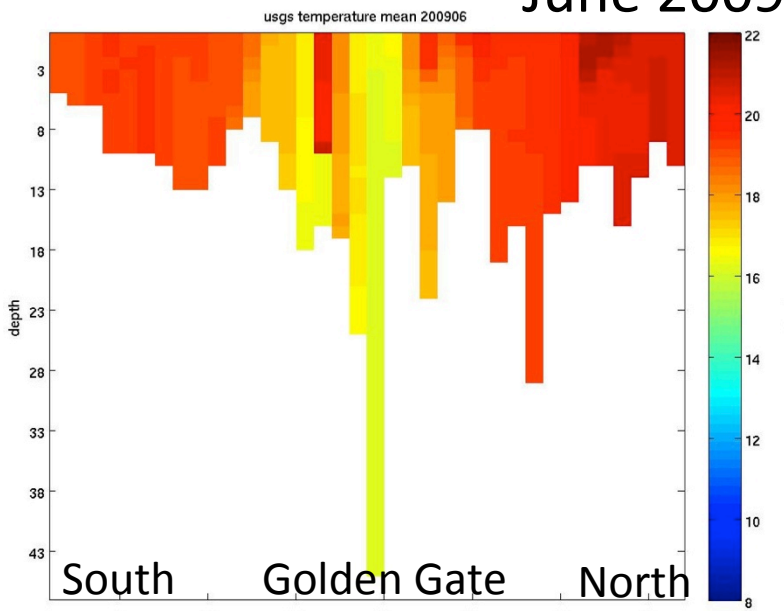
GOES Satellite

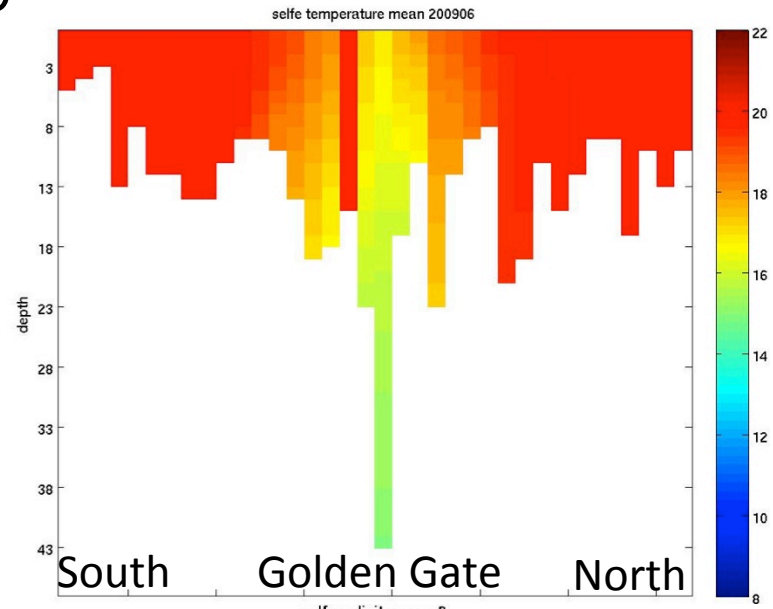
SELFE Model

Vertical Profiles of Temperature & Salinity

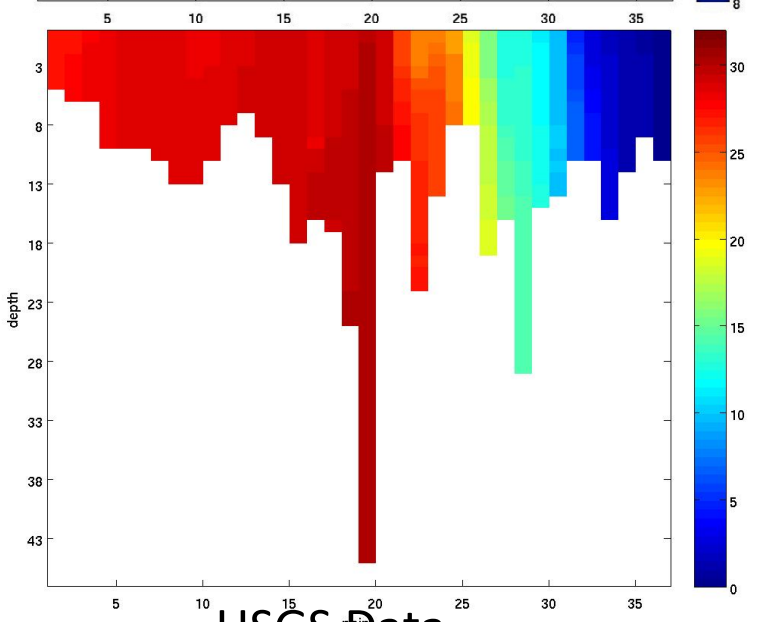
June 2009

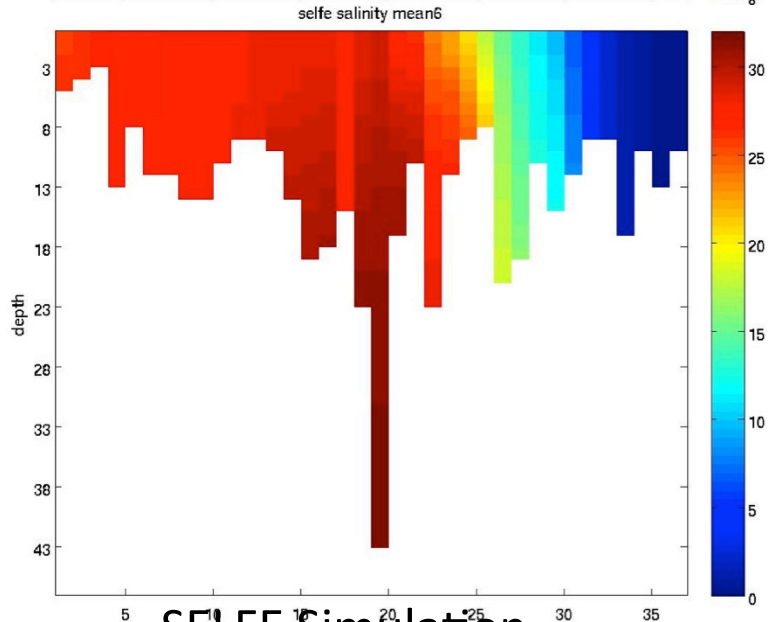
Temperature





Salinity



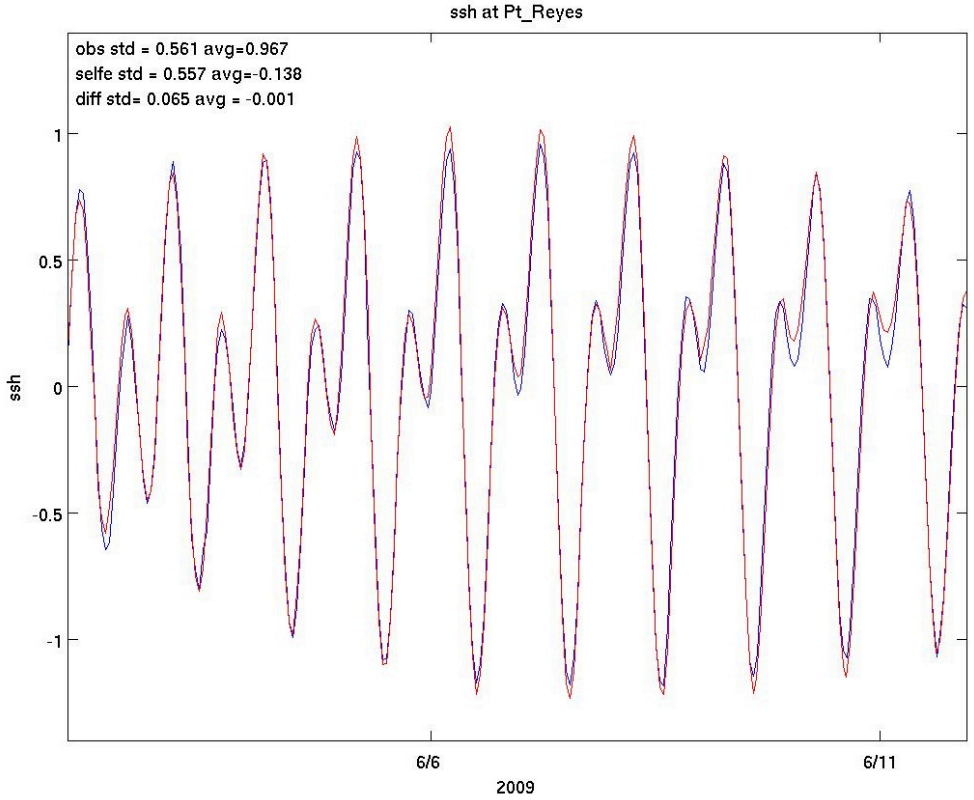


USGS Data

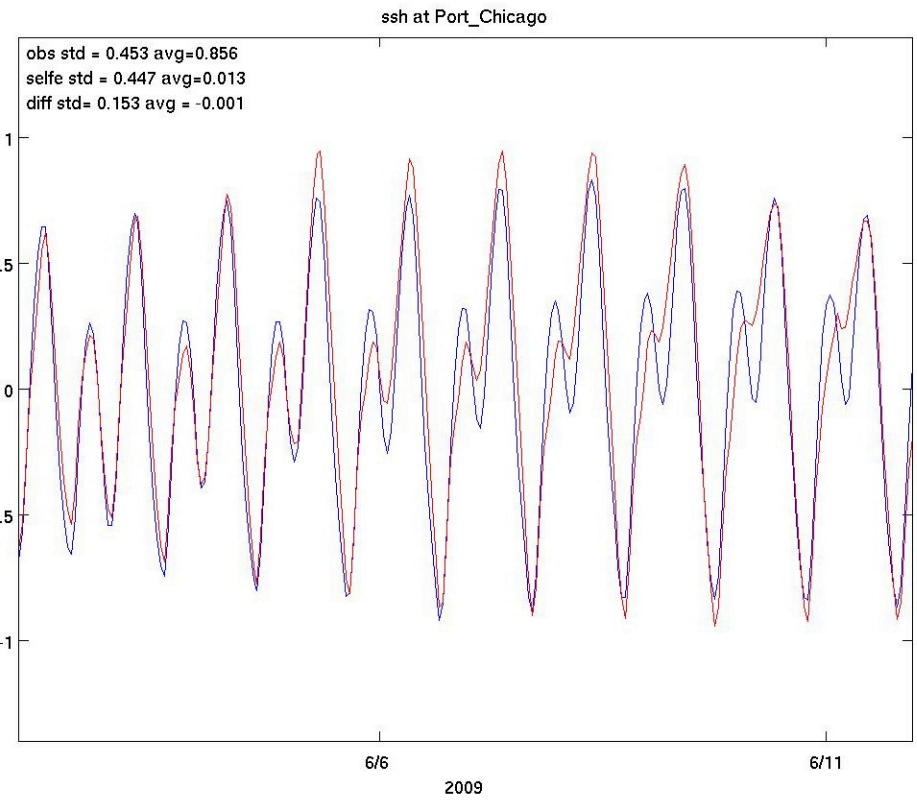
SELFE Simulation

Water Level Inside/Outside Golden Gate

Pt. Reyes: RMS = 6.5 cm



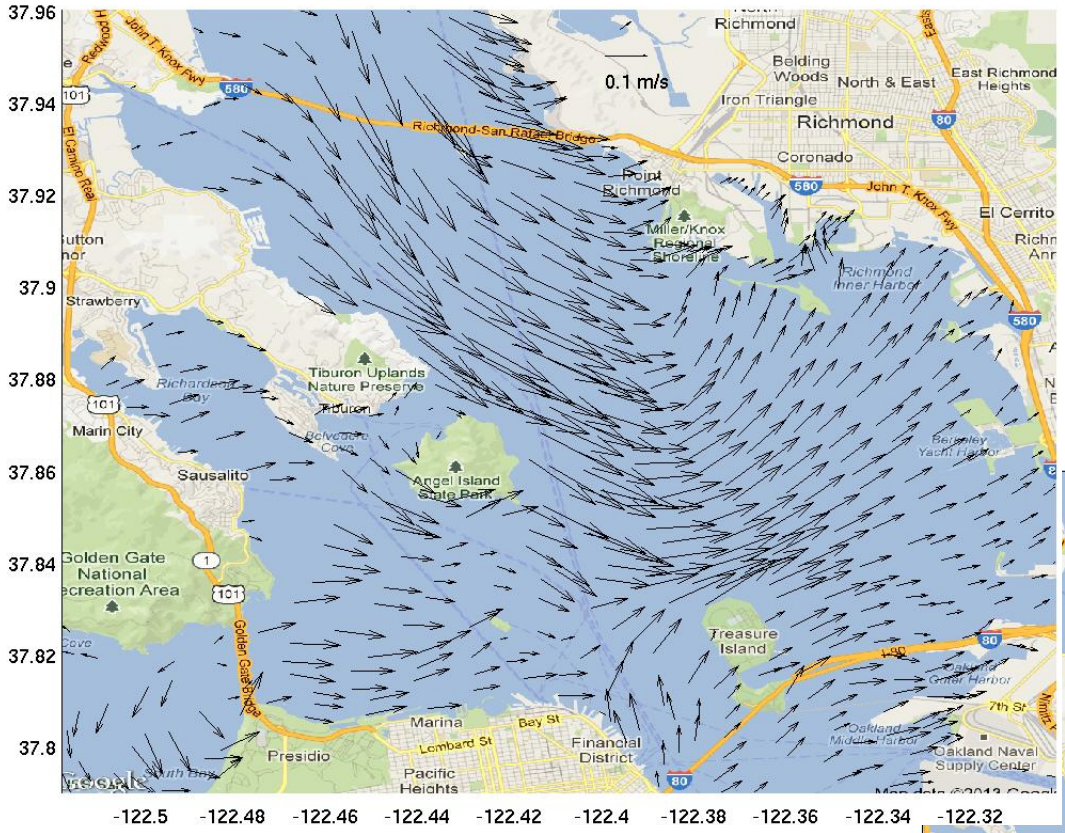
Port Chicago: RMS = 15.3 cm



Tide Gauge measurements

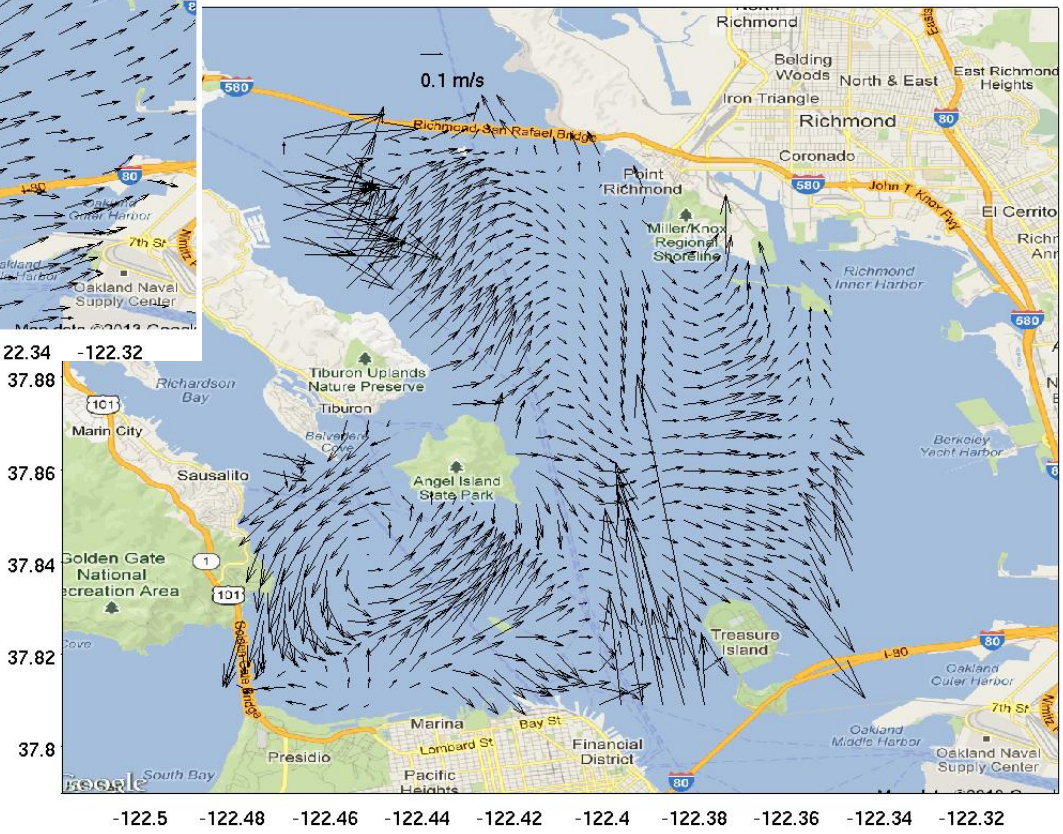
SELFE simulations

June–July Mean Surface Current

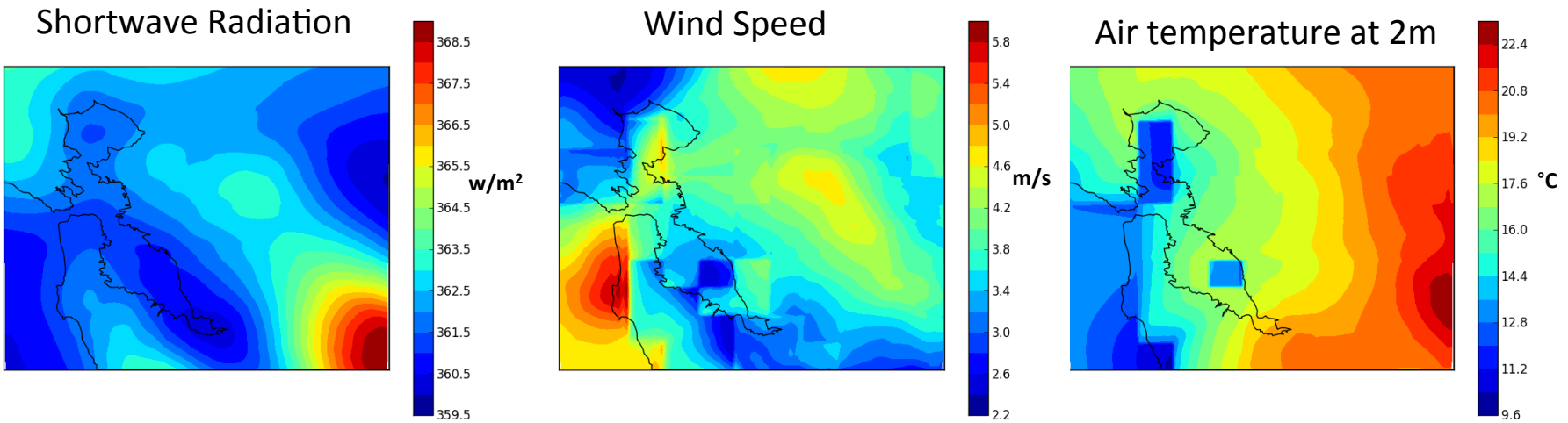


SELFE

HF Radar



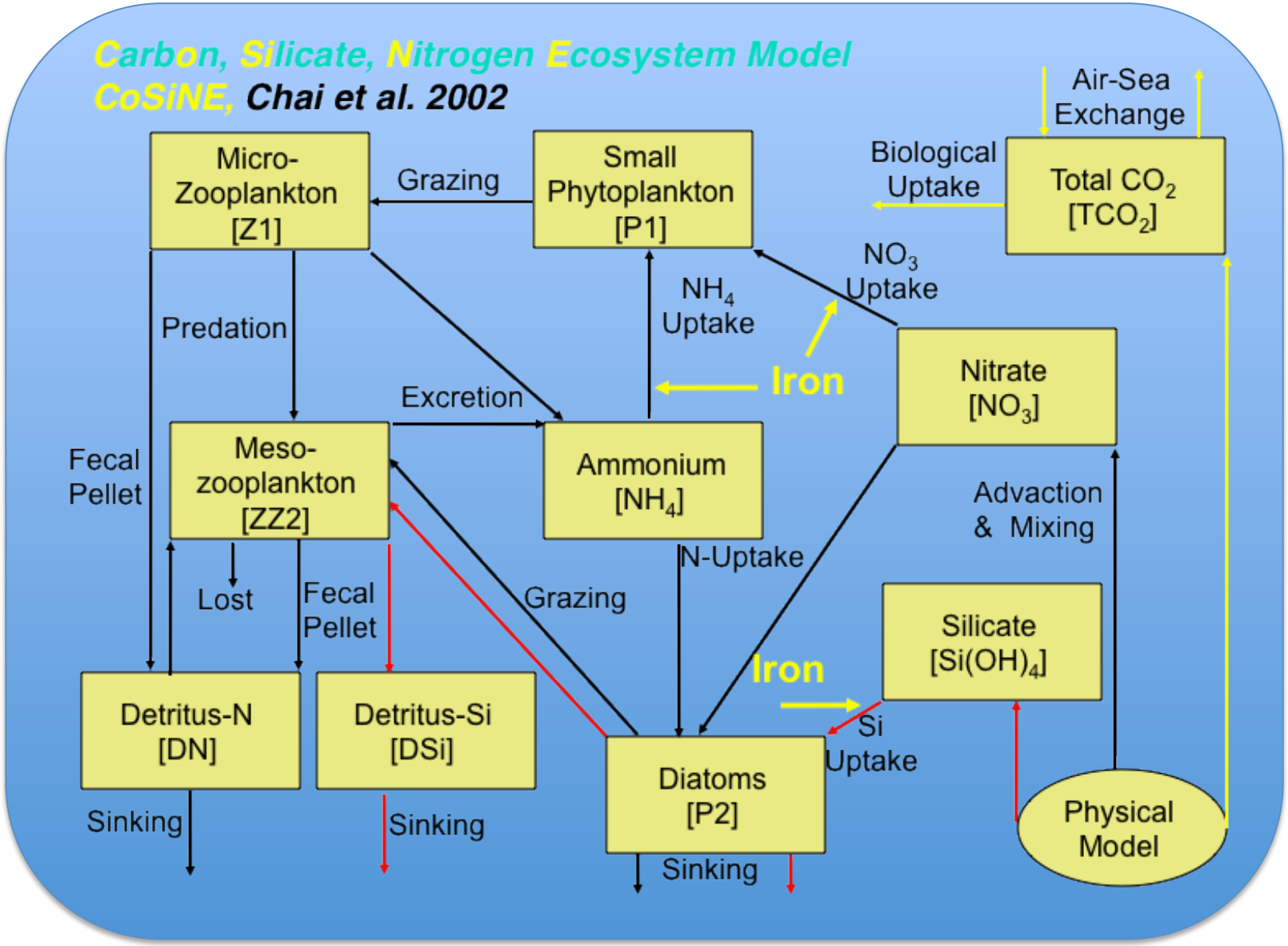
Surface meteorology from TOPS-WRF 1-km model



August 1, 2009

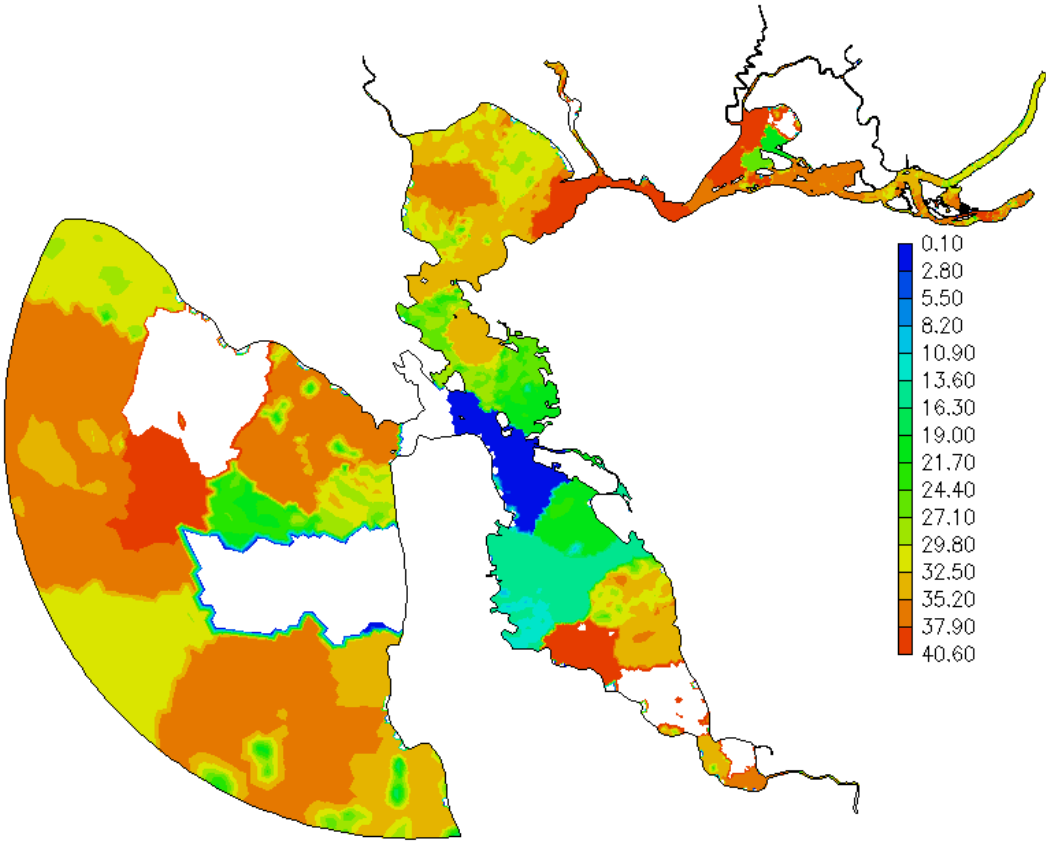
- TOPS-WRF incorporates the WRF mesoscale weather model within the the NASA Terrestrial Observation and Prediction System (TOPS) modeling framework
- TOPS-WRF 1-km surface weather fields (e.g., wind direction, wind speed, air temperature, solar radiation flux, etc.) are being used to drive SELFE
- Computationally intensive – model runs from 2003-2012 require >50,000 CPU hours

Modeling the estuarine environment (SELFE-CoSiNE)



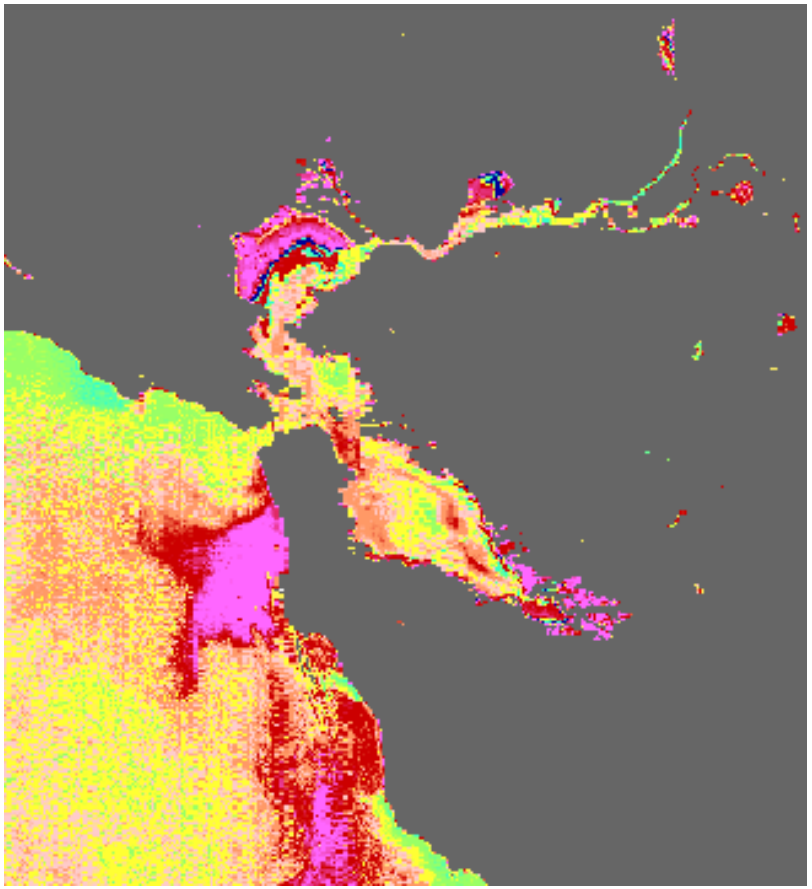
SELFE-CoSiNE

SELFE-CoSiNE Chlorophyll



Chl_a mg/m3

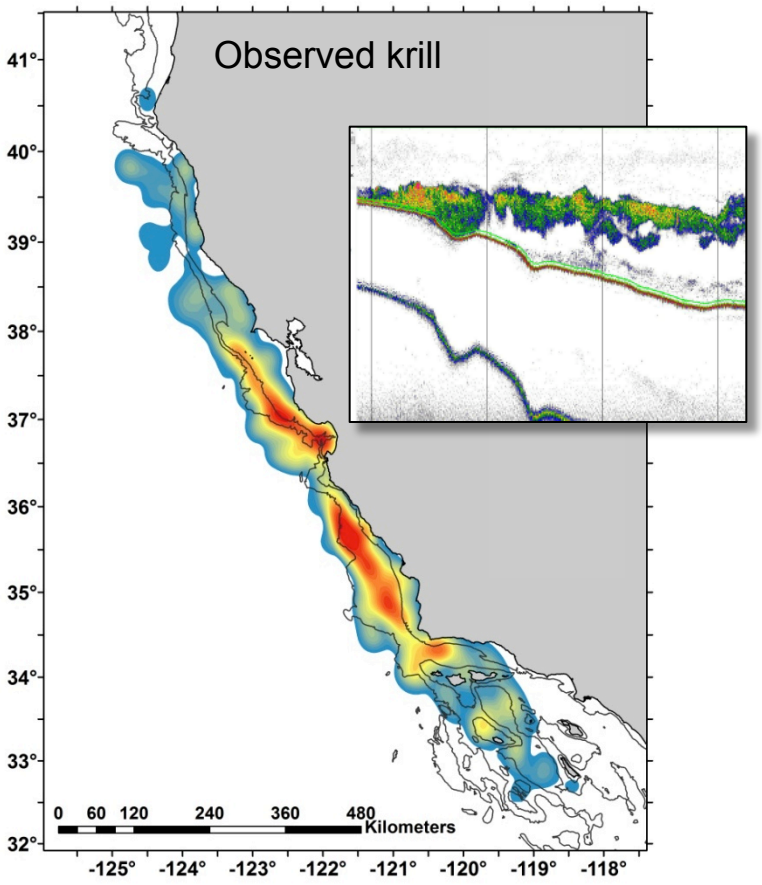
MERIS 300 meter FR

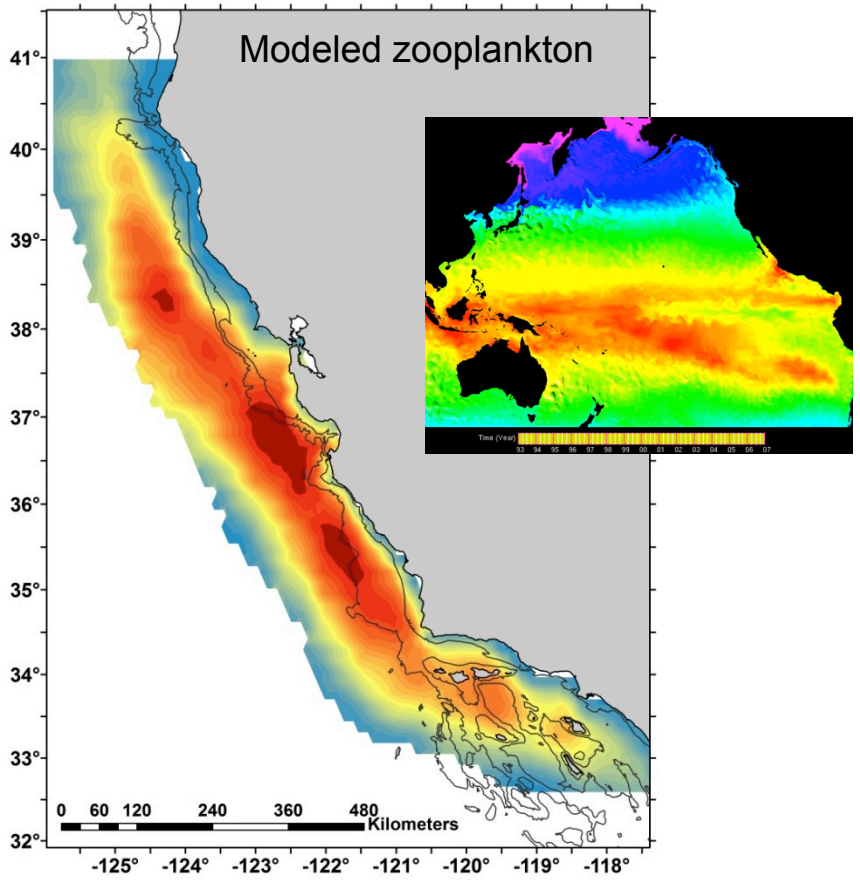


CoSiNE model parameters need to be tuned for the estuarine and coastal regions- currently very sensitive to detritus N and Si

Modeling the ocean environment (ROMS-COSINE)

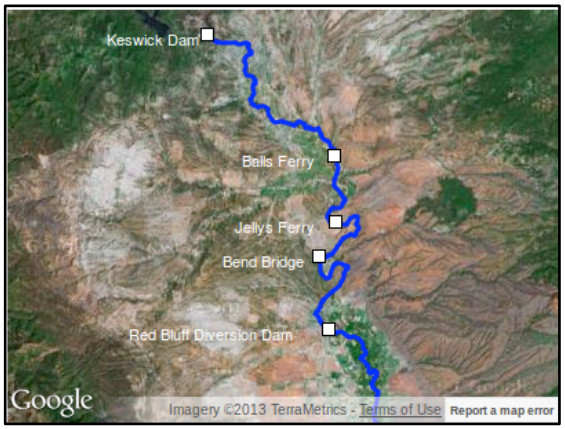
The modeling approach is capable of reproducing the zooplankton climatology demonstrated in empirical studies



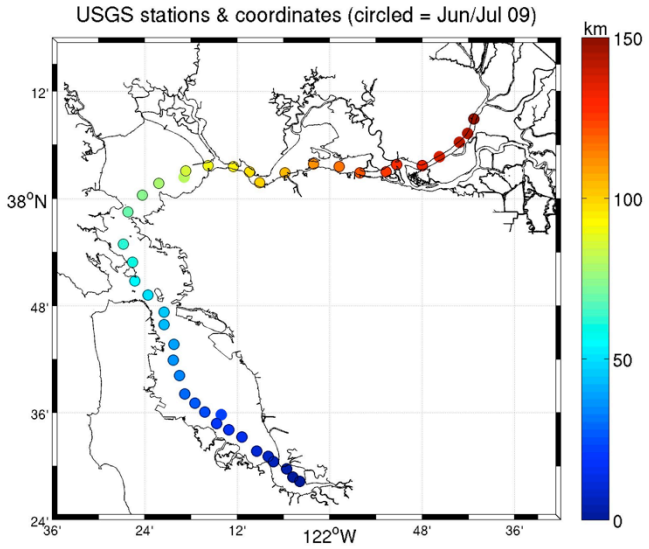


Model Validation and Interdisciplinary Coordination

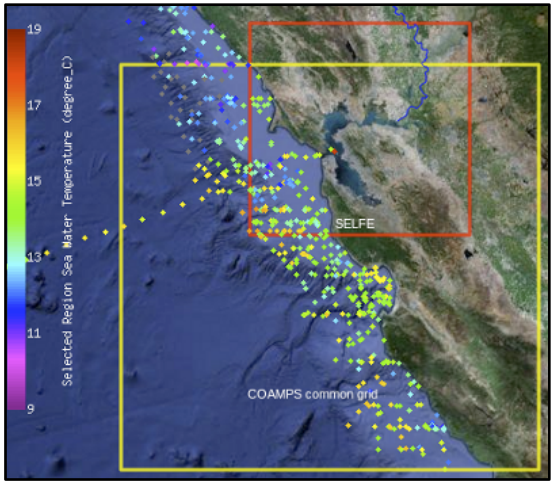
sesame.noaa.gov



River



Estuary



Ocean

Southwest Fisheries Science Center
National Marine Fisheries Service

SALMON ECOSYSTEM SIMULATION AND MANAGEMENT EVALUATION

*open sesame: a very successful means of achieving a result**

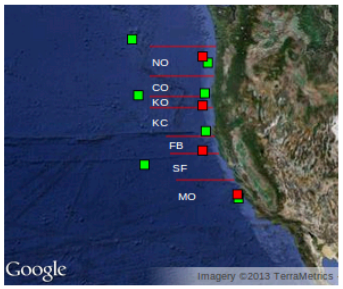
Home | Map | Models | Data | Models vs Data | WorkSpace

SESAME-RELEVANT DATA

Overview | River | Estuary | Ocean | Validation

On this page:

- 10-year time series in several Ocean Management Regions of
  - Upwelling Index and Anomaly
  - Shelf Water Temperature
  - Offshore Water Temperature
- Satellite Data used for SELFE Validation
- NOAA Ship Underway Data June-July 2009
- Rockfish Survey CTD Data June-July 2009
- 6 km HF Radar Currents



10-year Time Series for Ocean Management Regions

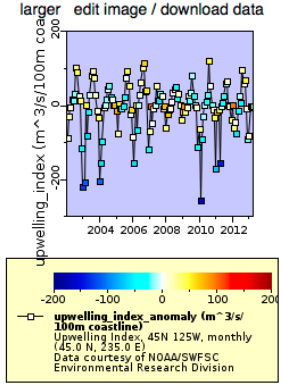
Location of the Upwelling Index time series (■) and Water Temperature time series (■) shown below in relation to the Ocean Management Regions (red lines). More buoy data can be found on the map page under "Real Time Observations -> NDBC Buoys".

Clicking on the download link above each graph will take you to ERDDAP where you can select the time period you need and form a URL for downloading the data in many formats or for use in an application.

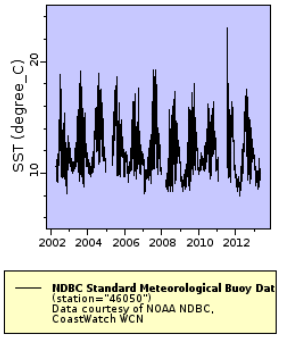
Choose a variable: Water Temperature

Region NO:

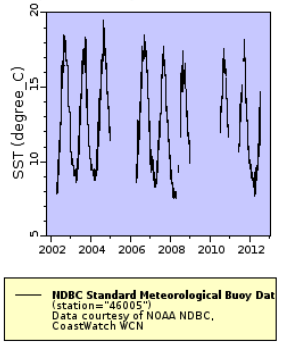
Upwelling Index
45N 125W
larger edit image / download data

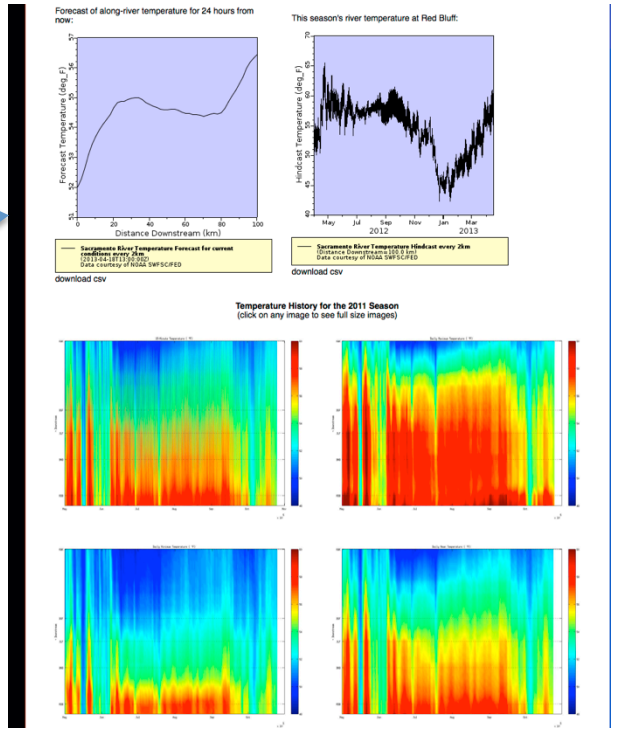


Shelf: Water Temperature
44.639N 124.534W
larger edit image / download data

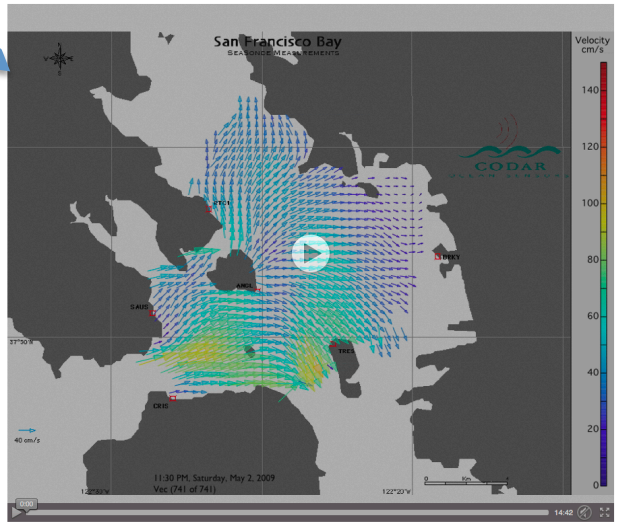


Offshore: Water Temperature
46.1N 131.001W
larger edit image / download data





HF Radar Currents May-June 2009 (Provided by Jim Pettigrew, Romberg Tiburon Center for Environmental Studies)



NASA Earth Exchange

- High resolution modeling of Bay-Delta (SELFE, TOPS-WRF) utilizing NEX resources
- NASA Earth Exchange (NEX), http://nex.nasa.gov

Thank you.

Improving Stream Temperature Predictions for River Water Decision Support Systems

From the watershed to the ocean: Using NASA data and models to understand and predict variations in central California salmon