



# The National Estuarine Research Reserve Concept

- State/Federal partnerships
  - Community Council
- Relevant Research and Communication of Science
- Sectors
  - Research
    - Graduate Research Fellowship
  - Education
  - Stewardship
  - Coastal Training Program





## The KBNERR Mission



To enhance understanding and appreciation of the Kachemak Bay estuary and adjacent waters to ensure that these ecosystems remain healthy and productive.

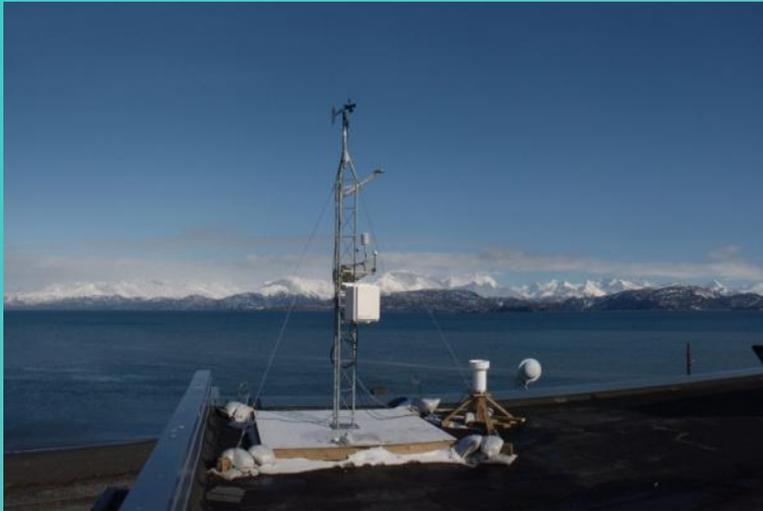


# KBNERR Research and Monitoring: current areas of emphasis

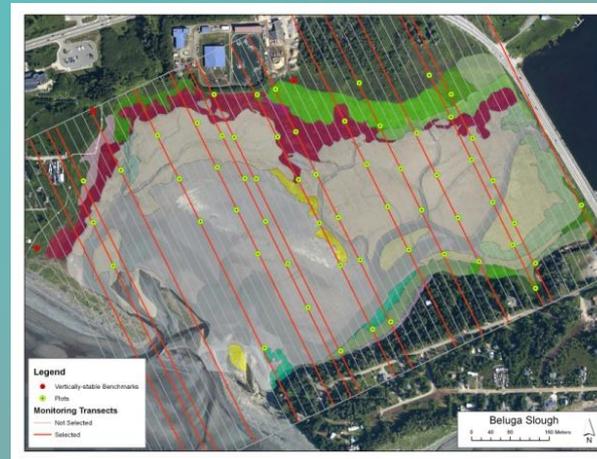
- Long-term monitoring
  - NERR System-wide Monitoring Program
    - Water quality, nutrients, weather, salt marsh vegetation (species, elevation, & mapping)
  - EVOSTC environmental drivers
    - Water quality (conductivity & temp), zooplankton, sea otter diet
  - Citizen Science (marine invasive species & HABs)
- Directed studies
  - SWG/AKSSF juvenile salmon studies
    - Overwintering habitat, estuary outmigration, headwater rearing
  - Coastal Uplift, Sea Level Rise, and Habitat Change



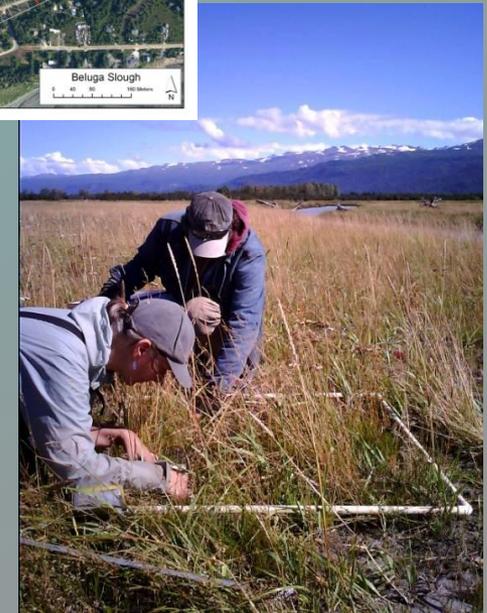
# System-wide Monitoring Program: national program standards for 28 Reserves



Meteorological Station at Lands End  
Water quality monitoring stations in  
Homer and Seldovia Harbors



Long-term monitoring  
of salt marsh  
vegetation, sediment  
elevation, and  
vertical control  
networks



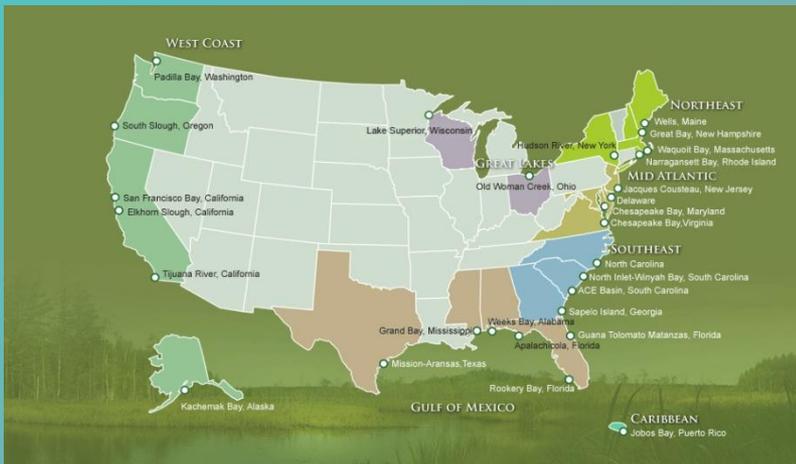


# System-wide Monitoring Program (SWMP)

## KBNERR WQ Goals

NERR Goal: To identify short-term variability track long-term changes in estuarine ecosystems for effective coastal zone management.

- 1) improved understanding of circulation patterns in Kachemak Bay;
- 2) examine freshwater inputs into the Bay and how they change over season and time;
- 3) provide mariculture growers and HAB monitors with almost real-time information to help protect against pathogens
- 4) examine the short term variability and track long term trends in water quality parameters (ocean acidification).



## Legend

### Monitoring Locations

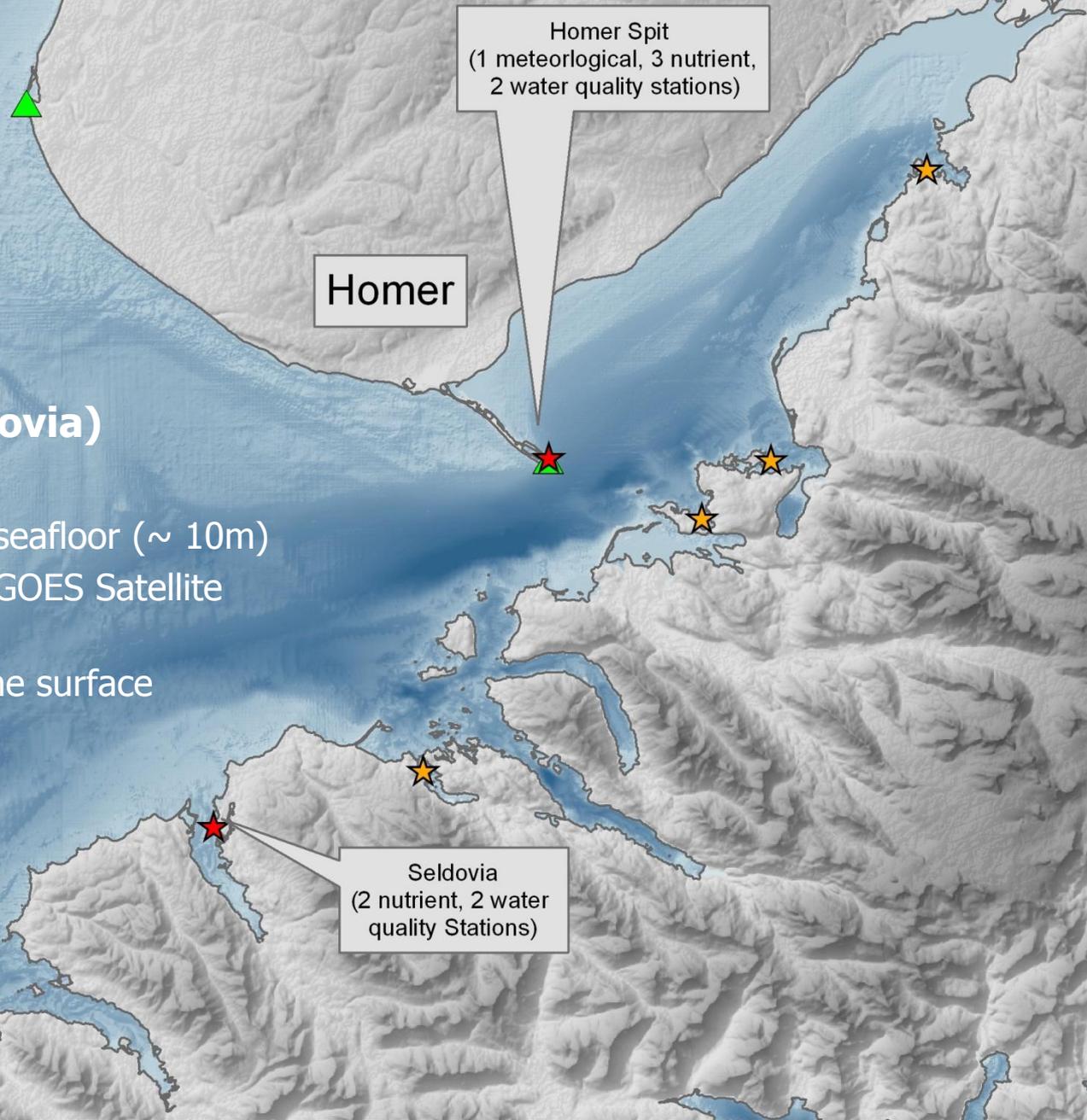
-  Meteorological Site
-  Water Quality and Nutrient Site
-  Water Temperature only (Tidbit)

## 2 Sites (Homer and Seldovia)

- 2 Stations per site
  - **Deep** 1m above the seafloor (~ 10m)
    - Telemetered to GOES Satellite System
  - **Surface** 1m below the surface

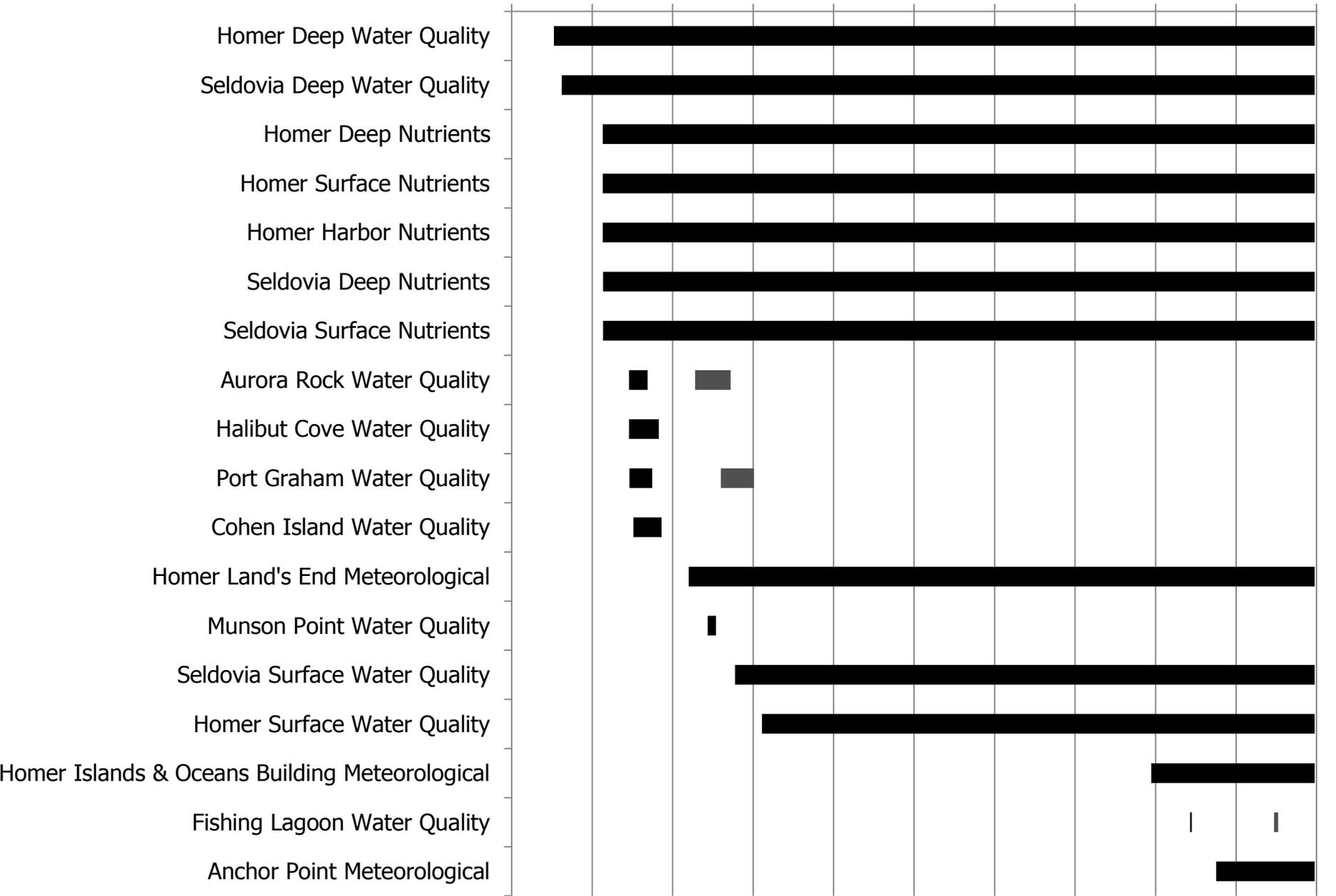


0 3 6 12 Kilometers



# Kachemak Bay Research Reserve Monitoring Program Timeline

2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011





## Nutrients

### 3 Sites (Homer, Homer Harbor, & Seldovia)

- **Deep** 1m above the seafloor (~ 10m)
- **Surface** 1m below the surface
- 1 24hr Diel Station in Homer Harbor (2hr/sample)

### Chemistry:

- Analysis of PO<sub>4</sub>, NO<sub>2</sub>, NH<sub>4</sub>, SiO<sub>2</sub>, Chl-a



## Weather

- 2 Sites (Homer and Anchor Point)

Sample at 5 sec intervals averaged 15 min, hourly, and daily

Temp, RH, BP, WS, WD, Precip, PAR, & TSR

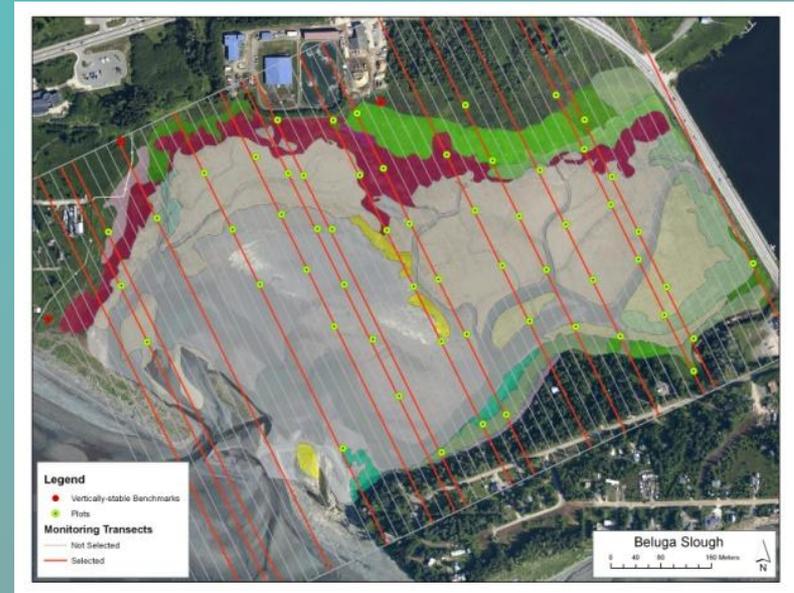
Telemetered to GOES Satellite System



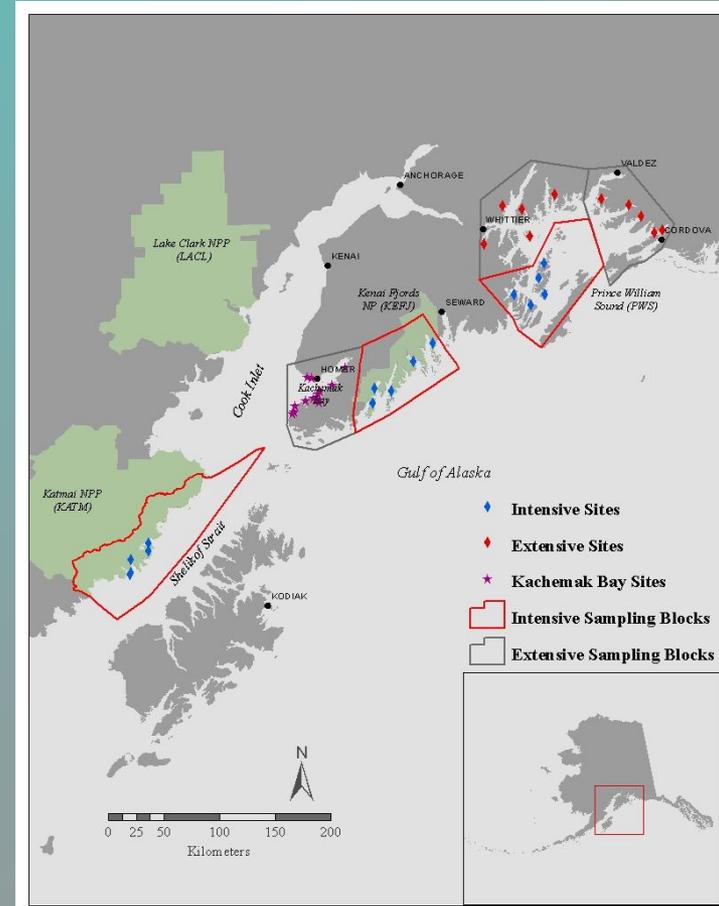
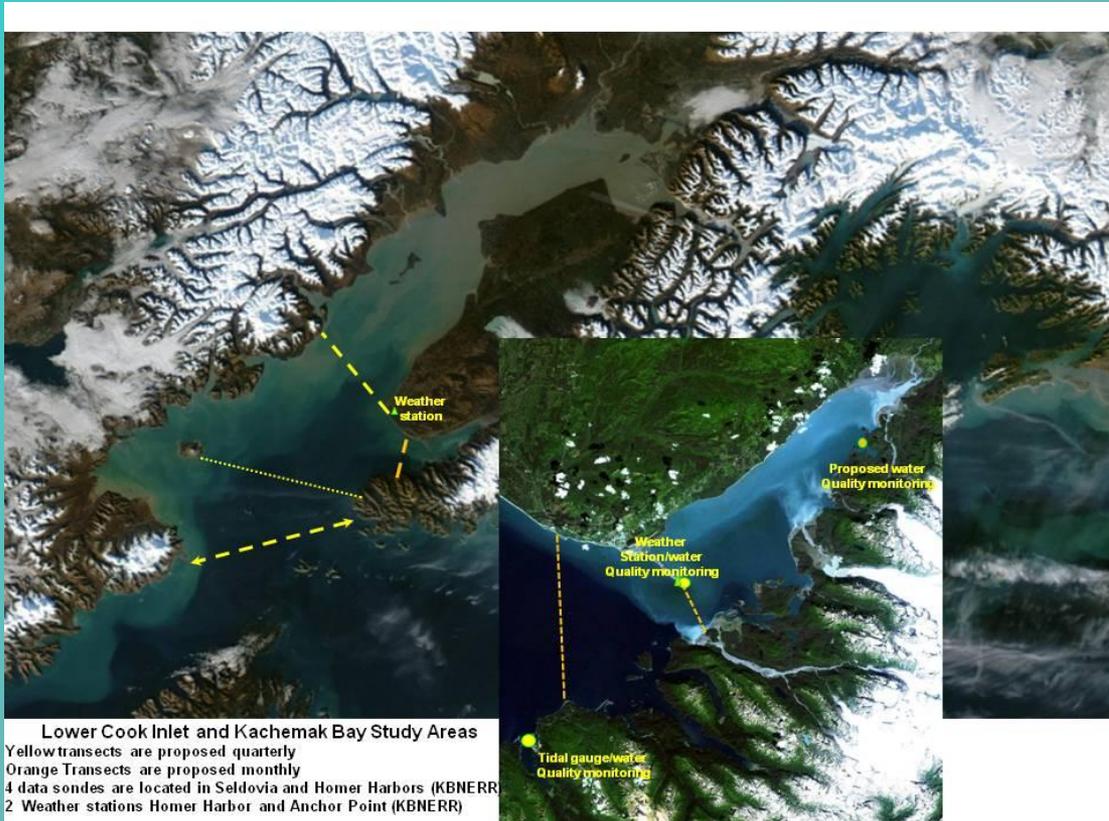
# SWMP Emergent Vegetation Monitoring

## Primary Goals

1. Establish permanent plots and transects for long-term monitoring of salt-marsh vegetation in Kachemak Bay marshes
2. Establish vertical control (precise elevation information) at these sites, and obtain fine-scale measurements of the elevation of the monitoring plots
3. Assess plant species composition within the plots, and use this information to fine-tune salt marsh plant community maps produced by KBRR in 2004



# EVOSTC Environmental Drivers: Long-Term Monitoring of Marine Conditions and Injured Resources and Services





# Citizen Science: monitoring for harmful species

## Marine Invasive Species

### Primary Goals

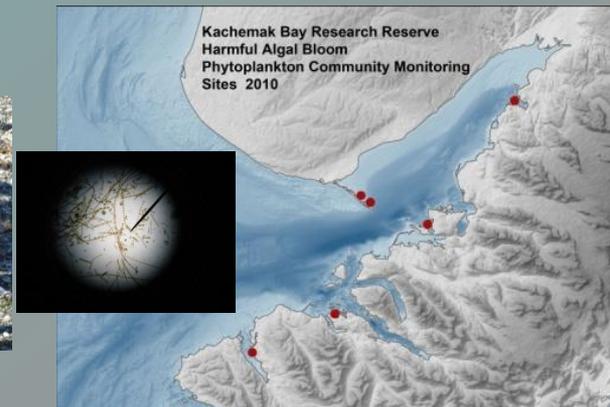
- Regularly check for invasive tunicates
- Keep an eye out for this invasive crab that has proved to be a problem in other areas.
- Get more people who live and work on the water aware of what this invasive crab looks like and how to tell it from our native crab.
- Be prepared to respond quickly if crab are found. The earlier the eradication starts, the easier it will be to get rid of them.



## Harmful Algal Blooms

### Primary Goals

- Early warning system for DEC and local mariculture sites for harmful algal blooms in Kachemak Bay.
- Volunteers gather water samples from different bays throughout the summer. Looking under microscopes, they identify and record abundance and species of phytoplankton.



# Directed Studies

## Juvenile Salmon

- Overwintering habitat,
- Estuary outmigration,
- Headwater rearing



## Coastal Uplift, Sea Level Rise, and Habitat Change

- Resources to integrate science and management
- Engagement of intended users throughout the process





# KBRR Watershed Research



**OVERWINTERING HABITAT**  
Anchor River



**ESTUARY  
OUTMIGRATION**  
Fox River



**HEADWATER REARING**  
Anchor R, Stariski  
Creek,  
Ninilchik, Deep

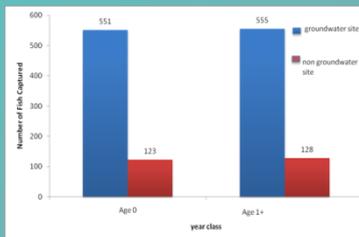
- ▣ *How landscapes support juvenile salmon habitats*



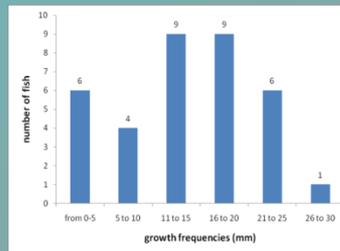
# Overwintering Habitat



Sampling Methods: 20 each ground water/non groundwater sites; Fall and spring habitat and fish sampling; Recapture during outmigration



groundwater  
support



growth

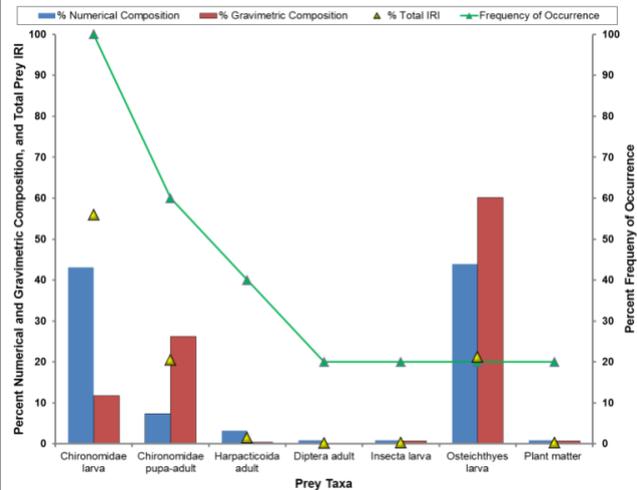


Oxygen  
+ Microhabitat  
variability  
Temperature

# Estuary Outmigration-Fox River: diet, growth, and residency

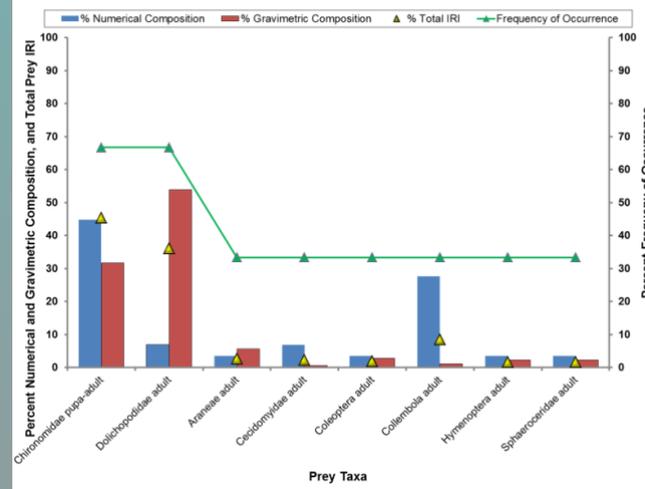


**Fox River Delta Juvenile Salmon Diet IRI Spectrum**  
TS01 *Oncorhynchus nerka* 37-68 mm FL; 21 June 2010; n=5 (0 empty)



Sockeye  
Diets

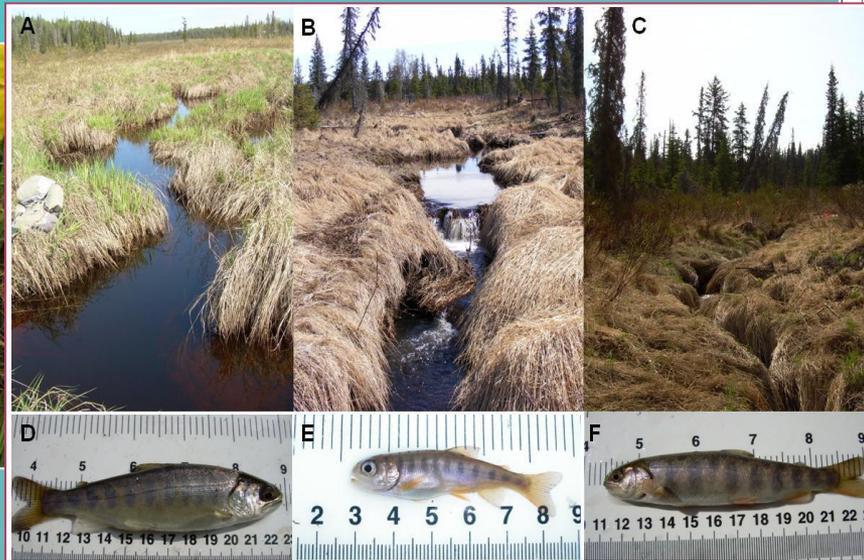
**Fox River Delta Juvenile Salmon Diet IRI Spectrum**  
TS01 *Oncorhynchus kisutch* 45-89 mm FL; 24 May 2010; n=3 (0 empty)



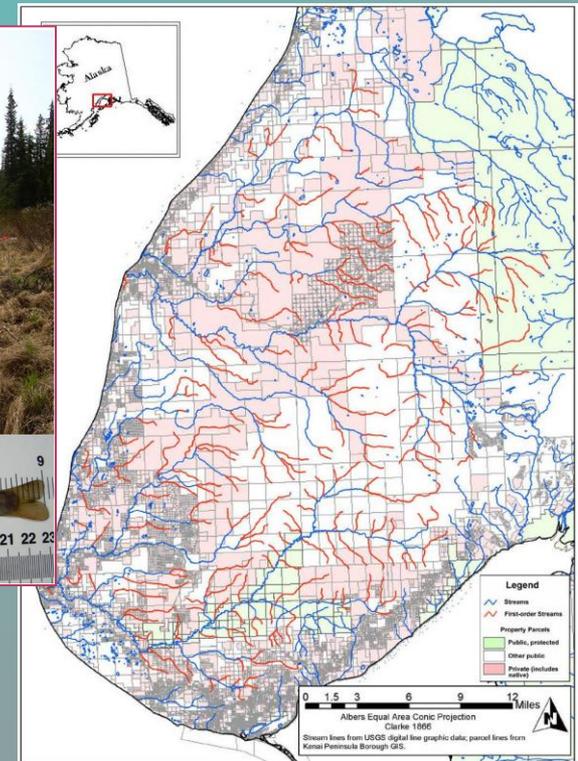
Coho  
Diets

# Headwater Rearing Habitats (2006-2011)

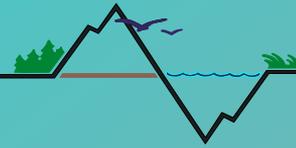
Partners: Baylor, Smithsonian, USF  
Funding: EPA, AKSSF



Salmon in small streams

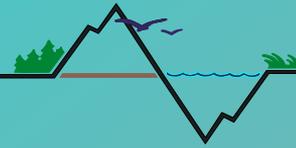


Small streams are a large % of  
watersheds (340 miles)



# Coastal Uplift, Sea Level Rise, and Habitat Change

- **Research Project:** Assessing Coastal Uplift & Habitat Changes in a Glacially Influenced Estuary System
- **Research Team:** Angela Doroff –Principal Investigator (KBRR), Megan Murphy Integration Lead (KBRR), Steve Baird Co-Principal Investigator (KBRR), Jeff Freymueller Co-Principal investigator (UAF)
- **Core Intended Users:** City of Homer's Office of the Mayor, Port and Harbor, and Planning and Zoning Office, Kenai Peninsula Borough's Office of the Mayor, Seldovia Village Tribe, Kachemak Bay NERR Community Council, Kenai Peninsula Coastal Management Program, NOAA Kasitsna Bay Laboratory, Alaska Department of Natural Resources Division of Mining, Land and Water
- **Project Timeline:** 9/2010 to 9/2013
- **For more information:** [www.kbayrr.org](http://www.kbayrr.org)

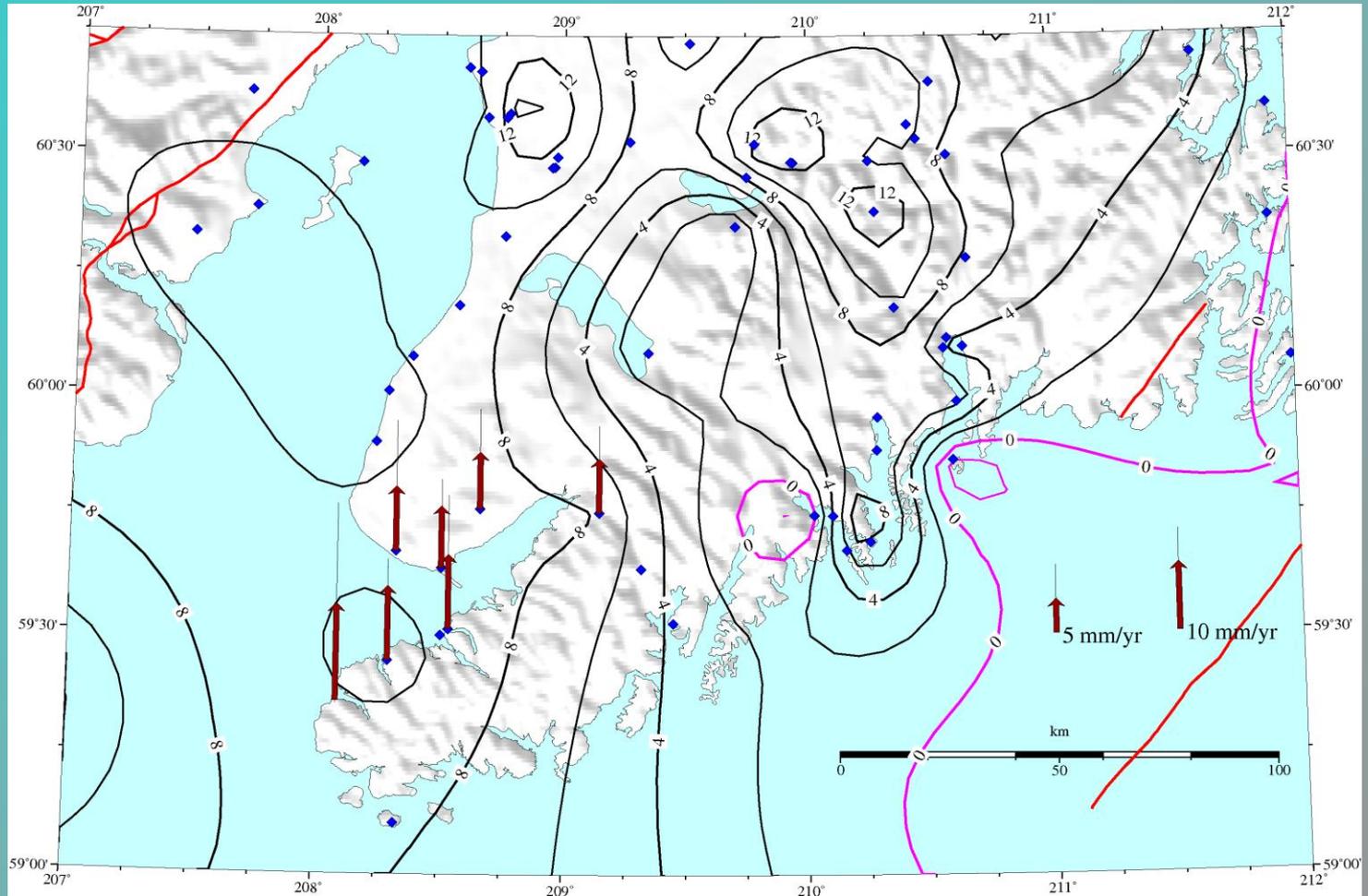


## Project Elements

- Land-Level Changes
  - Earthquakes
  - Since 1964, models have projected uplift of up to 60cm in the Bay area.
  - The models were based on a limited number of sites near Kachemak Bay.
  - Glaciers are melting at a fairly rapid rate
  - The weight released from the earth's surface as glaciers retreat has caused rebound or uplift.
- Relative Sea Level Rise
  - Important to understand sea level rise projections in the context of land level change
- The waters in Kachemak Bay are fed by 15 glaciers
  - The increased melt water is rich in nutrients and sediments which influence the community ecology in the Bay.

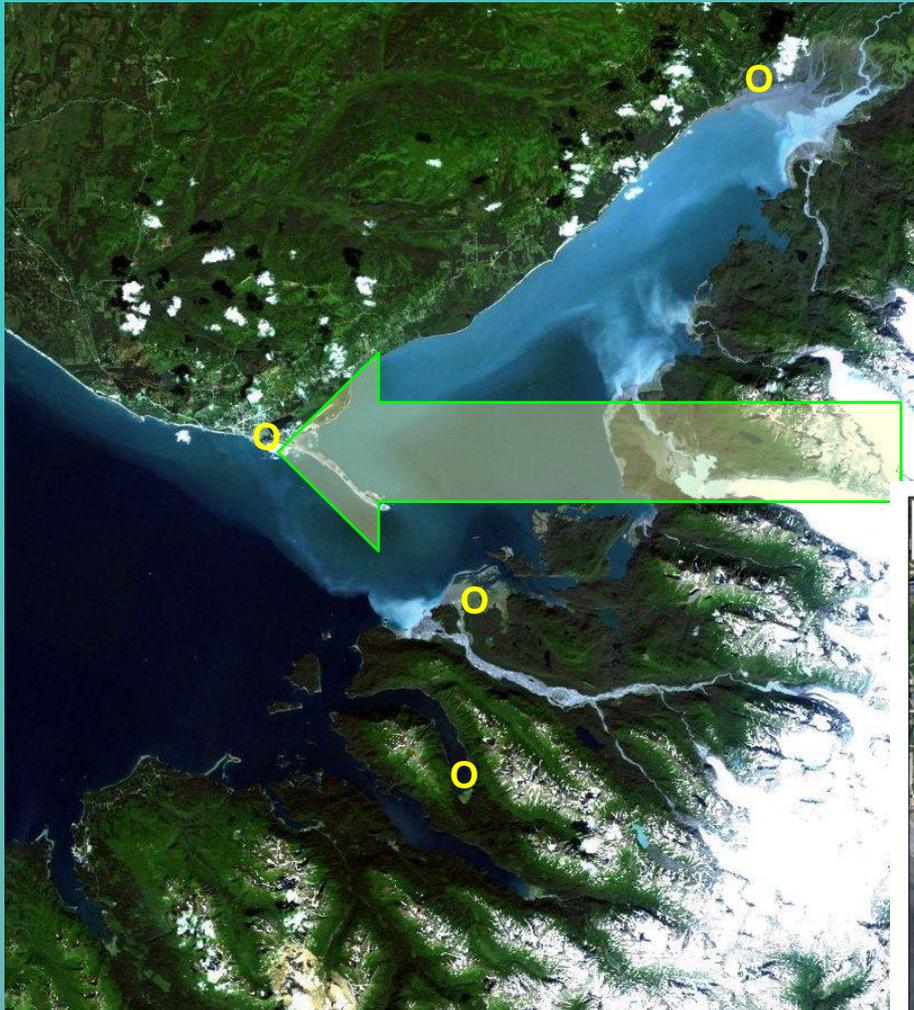


# Updating a Land-level Change Model





## NERR Long-term Monitoring Salt Marshes



### Four Salt Marsh Sites

Vegetation plots

Soil temperature (upper & lower)

Water level loggers (upper & lower)

3 Vertically stable benchmarks

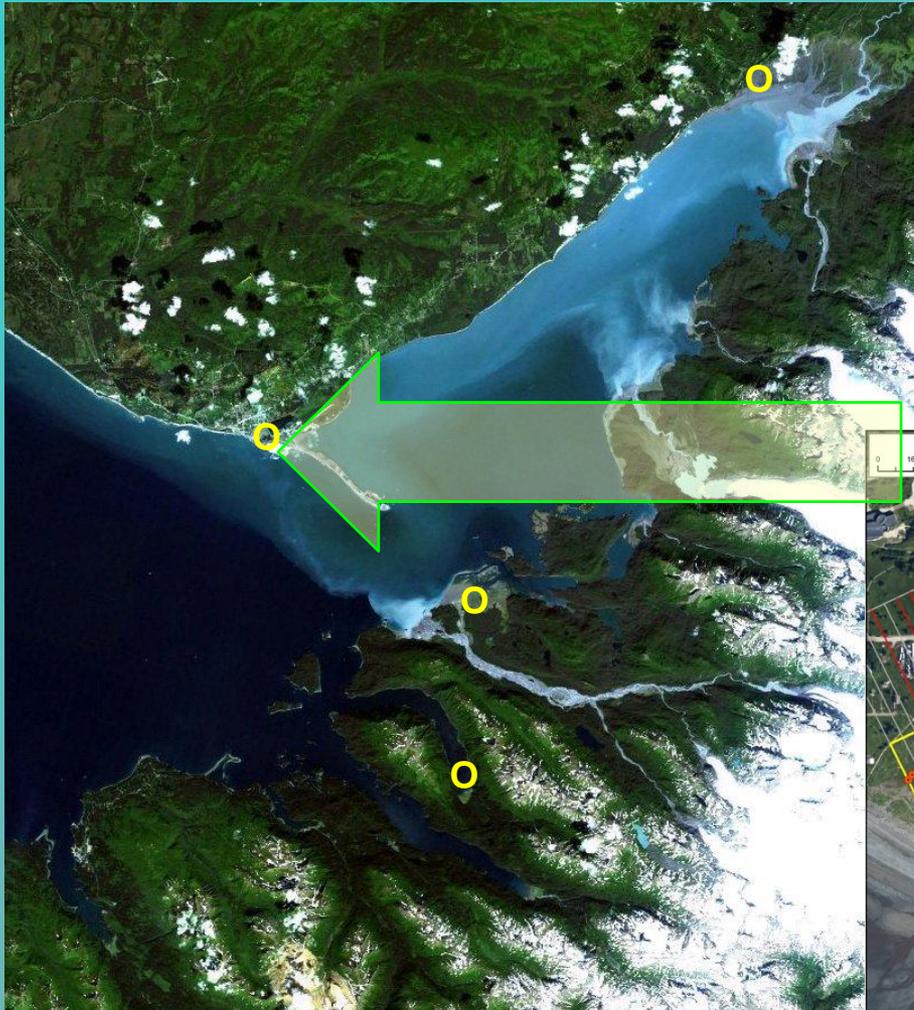
1 Bedrock bench mark (where feasible)

5 CORS sites





# Biological Monitoring



## Community Monitoring

- 144 additional vegetation plots
- 12 Insect Fallout Traps
- 12 Insect Sweeps
- 12 Samples for Infaunal Invertebrates
- Fish Sampling (tidal & fresh water)
- Bird and Mammal Species Lists





## Research Staff

- Coowe Walker: watershed specialist
- Steve Baird: mapping and GIS specialist
- Joel Markis: water quality and meteorological monitoring
- Ori Badajos: marine mammals and program assistance on all levels





# Questions?

