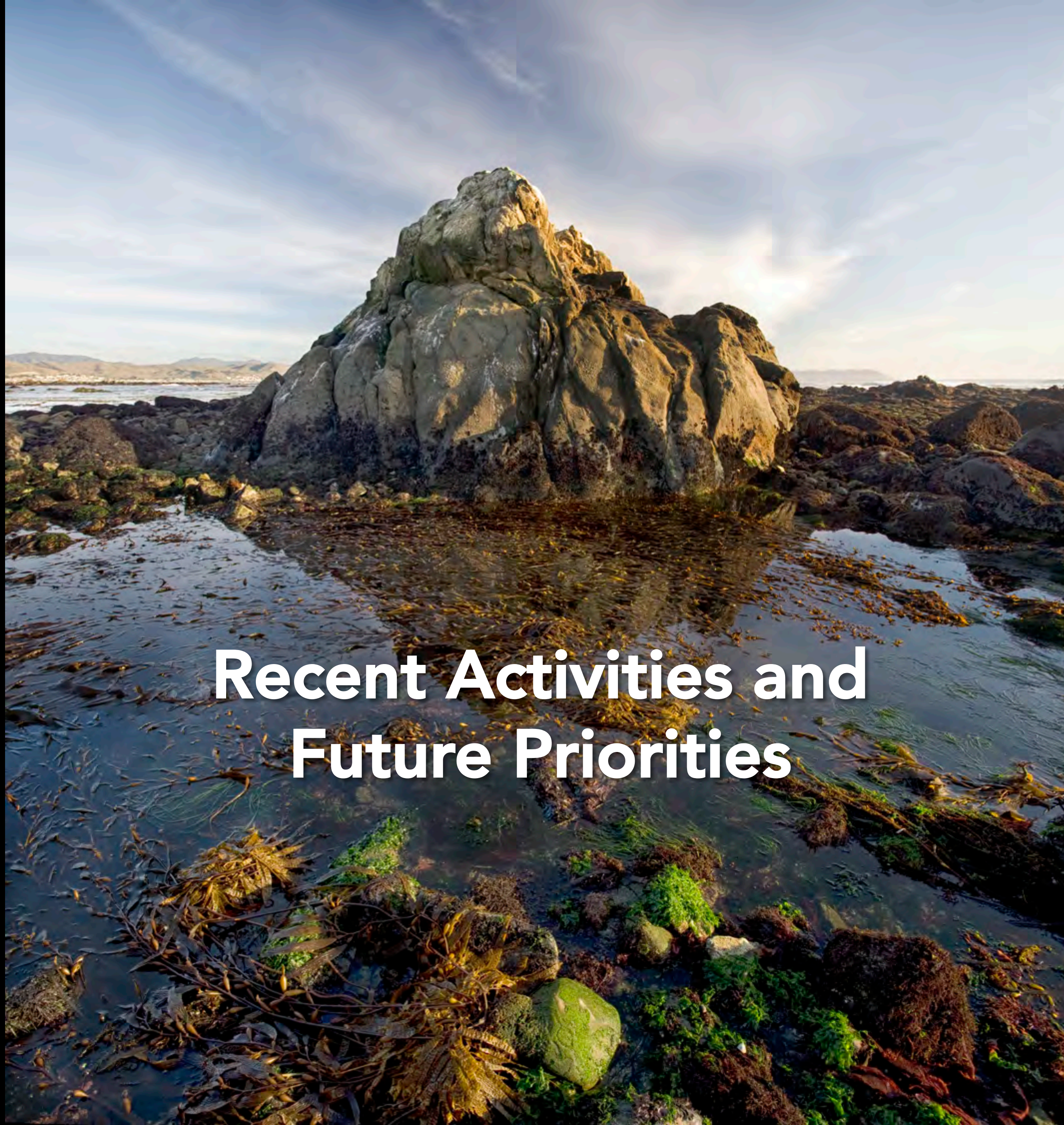
COAST

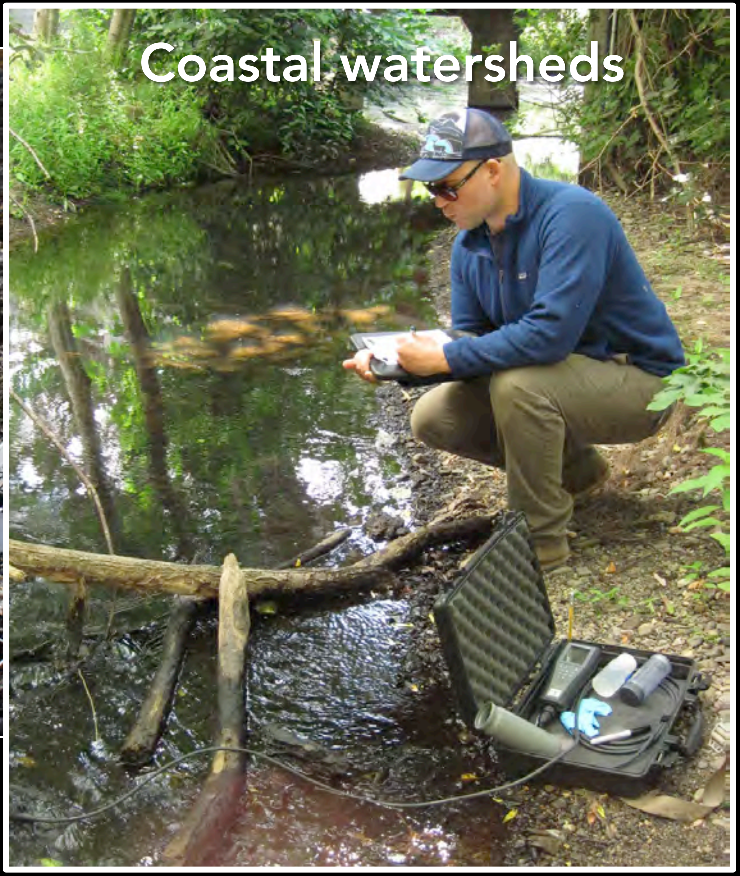
www.calstate.edu/coast/

Annual Meeting
April 19, 2018


Recent Activities and
Future Priorities

COAST Is Broad

Umbrella organization for marine, coastal and coastal watershed related activities within the CSU



NOT Limited to California

Three Main Goals Guide Activities

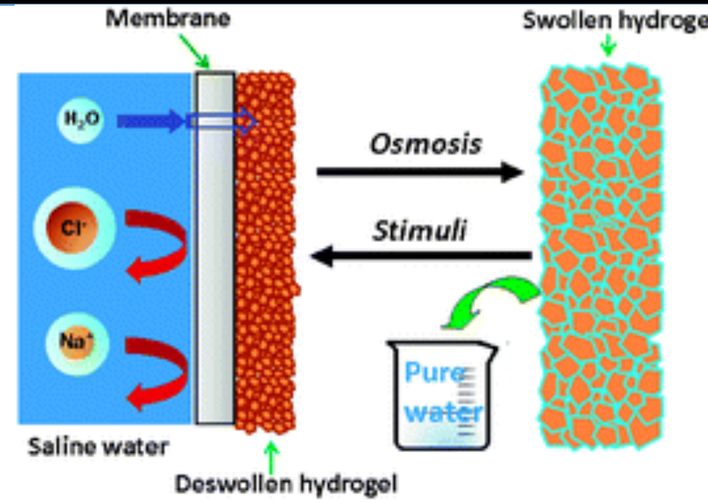
1. Advance our knowledge of marine and coastal resources and the processes that affect them.

2. Inform decision-making and the development of responsible policy.

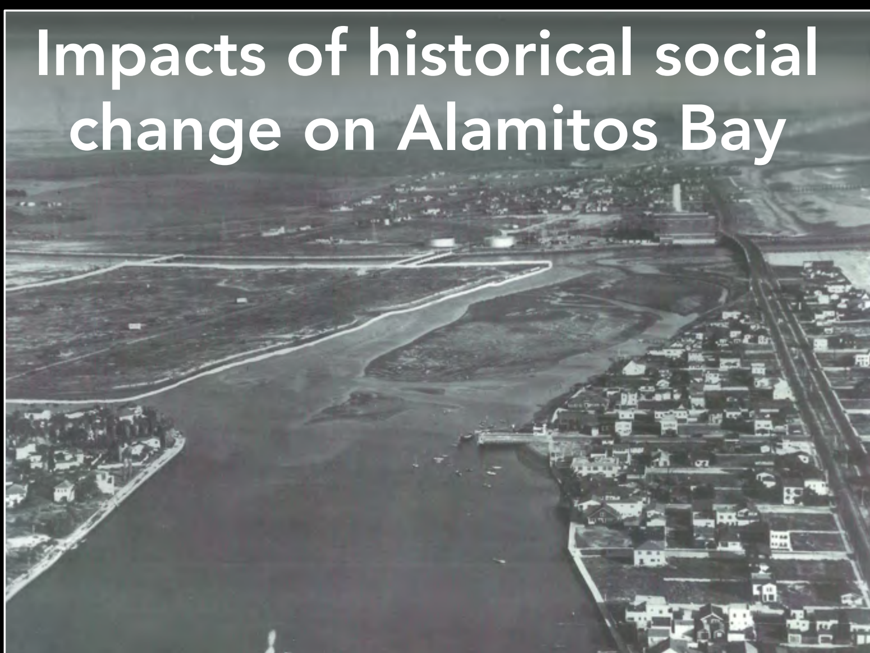
3. Train the future workforce.

~$200,000 to Faculty Research and Professional Development

Program	# of Awards	Award total
Grant Development Program	9	$155,695
Rapid Response Funding	4	$29,601
Seminar Speaker Series	10	$6,500
Short Course, Workshop, Symposia Funding	1	$10,000
Total	**24**	**$201,796**



Stimuli-responsive hydrogels for water separation and energy recovery



Rapid Response Award Led to NSF Funding

- $7,500 RR award in 2016-17
  - Pete Edmunds, Northridge
- Caribbean soft corals, hurricane impacts
- $432,516 from Biological Oceanography
  - $1.44M total
- 30+ years, many students

COAST Member Research and Development Grant and Contract Activity

2015-16		2016-17	
Number of Awards	Award Amount	Number of Awards	Award Amount
255	$21,009,839	281	$26,494,896

CSU external funding 2016-17
$590,227,000

COAST Member Research and Development Grant and Contract Activity

2015-16		2016-17	
Number of Awards	Award Amount	Number of Awards	Award Amount
255	$21,009,839	281	$26,494,896

CSU R&D funding 2016-17

<$300,000,000

Ocean Day 2018

Ocean Day 2018

Ocean Day 2018

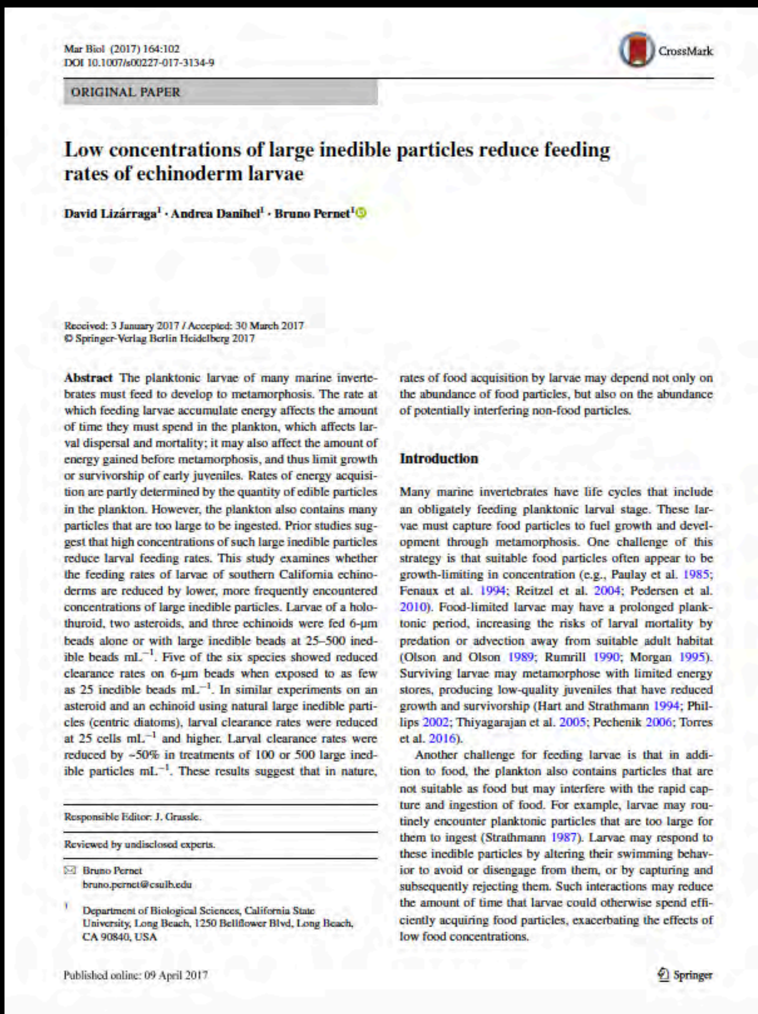
Ocean Day 2018

>$250,000 to >150 Students

Program	# of Awards	Award total
Graduate Student Research Awards	30	$90,000
Undergraduate Student Research Support Program	70*	$57,500
Student Travel Awards	40	$29,494
Summer Internships	16	$85,000§
Total	**156**	**$261,994**

* Estimate based on prior years
§ 50% provided by Hosts

Graduate Student Research Award Led to NSF Funding



Mar Biol (2017) 164:102
DOI 10.1007/s00227-017-3134-9

CrossMark

ORIGINAL PAPER

Low concentrations of large inedible particles reduce feeding rates of echinoderm larvae

David Lizárraga[1] · Andrea Danihel[1] · Bruno Pernet[1]

Received: 3 January 2017 / Accepted: 30 March 2017

Abstract The planktonic larvae of many marine invertebrates must feed to develop to metamorphosis. The rate at which feeding larvae accumulate energy affects the amount of time they must spend in the plankton, which affects larval dispersal and mortality; it may also affect the amount of energy gained before metamorphosis, and thus limit growth or survivorship of early juveniles. Rates of energy acquisition are partly determined by the quantity of edible particles in the plankton. However, the plankton also contains many particles that are too large to be ingested. Prior studies suggest that high concentrations of such large inedible particles reduce larval feeding rates. This study examines whether the feeding rates of larvae of southern California echinoderms are reduced by lower, more frequently encountered concentrations of large inedible particles. Larvae of a holothuroid, two asteroids, and three echinoids were fed 6-μm beads alone or with large inedible beads at 25–500 inedible beads mL^{-1}. Five of the six species showed reduced clearance rates on 6-μm beads when exposed to as few as 25 inedible beads mL^{-1}. In similar experiments on an asteroid and an echinoid using natural large inedible particles (centric diatoms), larval clearance rates were reduced at 25 cells mL^{-1} and higher. Larval clearance rates were reduced by ~50% in treatments of 100 or 500 large inedible particles mL^{-1}. These results suggest that in nature, rates of food acquisition by larvae may depend not only on the abundance of food particles, but also on the abundance of potentially interfering non-food particles.

Introduction

Many marine invertebrates have life cycles that include an obligately feeding planktonic larval stage. These larvae must capture food particles to fuel growth and development through metamorphosis. One challenge of this strategy is that suitable food particles often appear to be growth-limiting in concentration (e.g., Paulay et al. 1985; Fenaux et al. 1994; Reitzel et al. 2004; Pedersen et al. 2010). Food-limited larvae may have a prolonged planktonic period, increasing the risks of larval mortality by predation or advection away from suitable adult habitat (Olson and Olson 1989; Rumrill 1990; Morgan 1995). Surviving larvae may metamorphose with limited energy stores, producing low-quality juveniles that have reduced growth and survivorship (Hart and Strathmann 1994; Phillips 2002; Thiyagarajan et al. 2005; Pechenik 2006; Torres et al. 2016).

Another challenge for feeding larvae is that in addition to food, the plankton also contains particles that are not suitable as food but may interfere with the rapid capture and ingestion of food. For example, larvae may routinely encounter planktonic particles that are too large for them to ingest (Strathmann 1987). Larvae may respond to these inedible particles by altering their swimming behavior to avoid or disengage from them, or by capturing and subsequently rejecting them. Such interactions may reduce the amount of time that larvae could otherwise spend efficiently acquiring food particles, exacerbating the effects of low food concentrations.

Responsible Editor: J. Grassle.

Reviewed by undisclosed experts.

Bruno Pernet
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Published online: 09 April 2017

- $3,000 award to David Lizarraga in 2016 in Bruno Pernet's lab at Long Beach
- Paper in Marine Biology (2017)
- $347,639 from Biological Oceanography (2018)

Three Publications from One Undergraduate Research Support Project

- Fall 2014-Spring 2016
- *Crustaceana* (2017)
- *Journal of Parasitology (2018)*
- *Journal of Crustacean Biology (2018)*

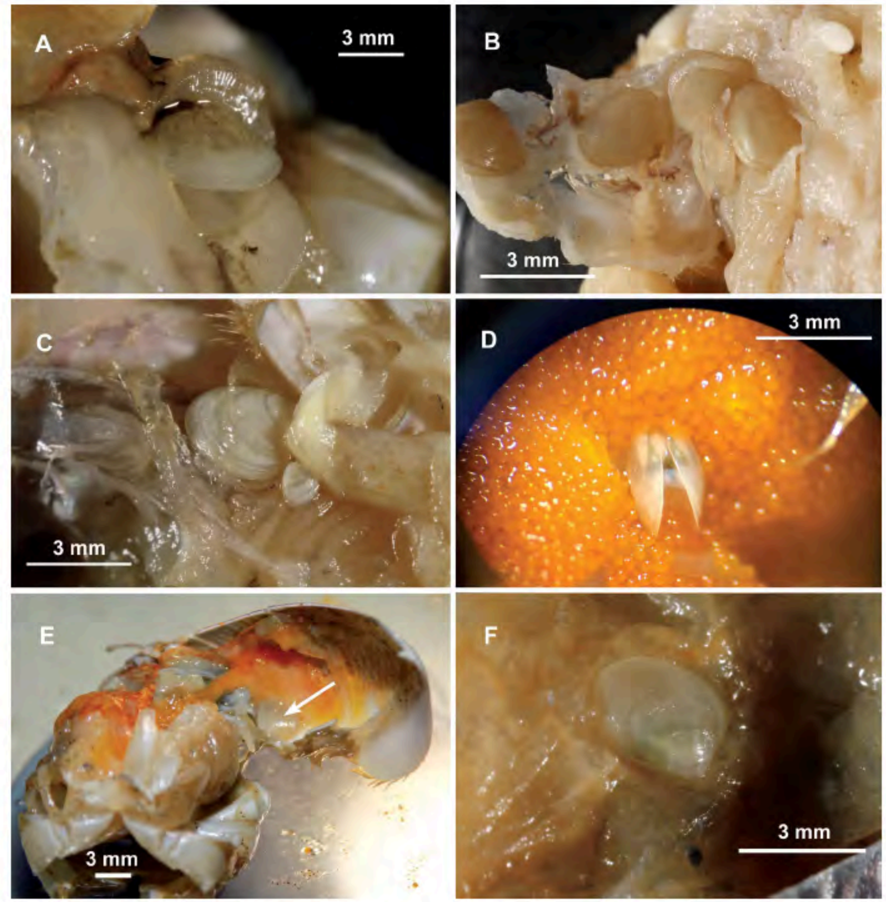


Figure 2. *Kurtiella pedroana* associated with the mole crab *Emerita analoga* (scale bar = 3 mm): (**A**) A clam on the mole crab, attached with byssal threads; (**B**) 5 clams inside the gill chamber of a mole crab; (**C**) 2 clams inside the gill chamber; (**D**) 1 clam attached to the ventral surface of a female mole crab, amidst egg mass; (**E**) clam inside the mole crab's hemocoel (see arrow); (**F**) a close-up of a clam inside the hemocoel. Color version available online.

Ritin Bhaduri, Stanislaus

COAST Undergraduate Researcher in SFSU MS Program

- Dulce Cortez
  - Started at community college
  - Transferred to Fullerton
    - Undergraduate Student Research Support Program
    - BS in Geology
  - Pursuing MS at SFSU
  - Plans to get PhD


John Green, San Jose Mercury News
COAST Climate Change
Smorgasbord

Negative and Synergistic Effects of Multiple Stressors

- Porcelain crab (*Petrolisthes cinctipes*), a model intertidal organism
- Increased temperature and decreased pH
  - Metabolic physiology
  - Interspecies interactions
- Overall decline in ecological performance

Jonathon Stillman, SFSU

Multiple Stressors Exert Large Energetic Debts

Fish, urchins and mussels

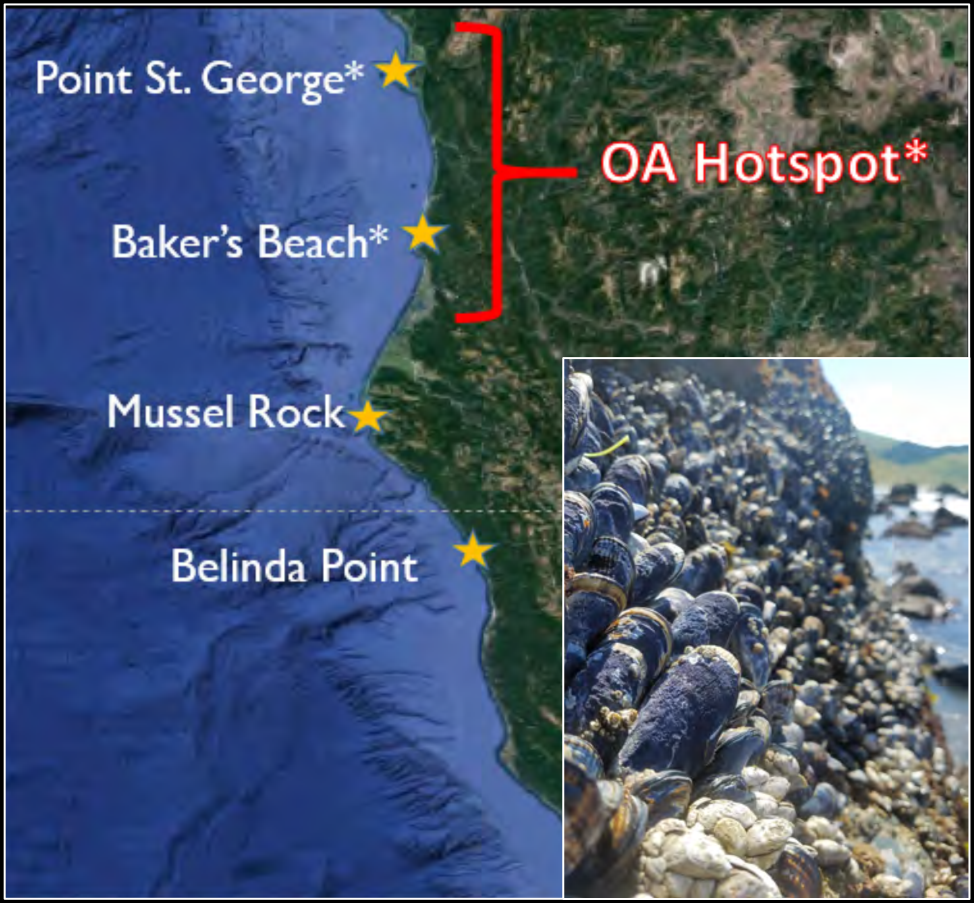
- OA x hypoxia
- OA x temperature

- Increased metabolic rates
- Increased DNA & protein damage
- Reduced rates of cell division
- Reduced growth
- Reduced hypoxia tolerance

Sean Place, Sonoma

Extra food or pre-conditioning?

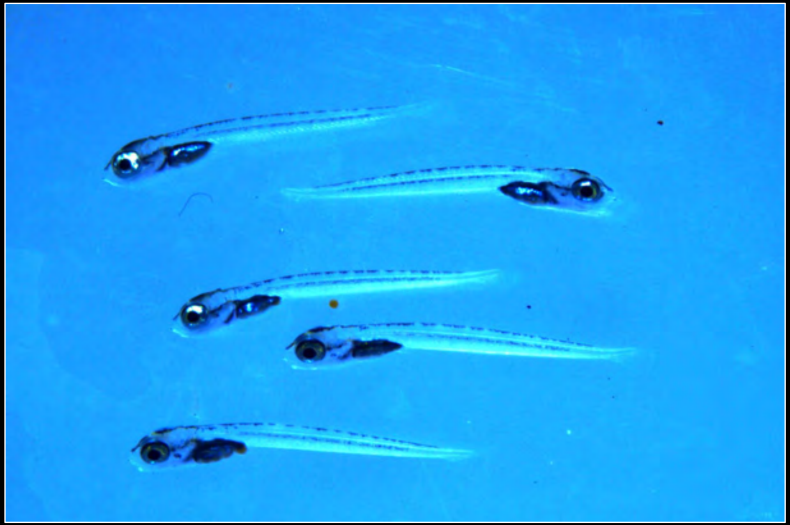
- Upwelling brings rich, acidic water
- Mussels north of Cape Mendocino grow well
  - Food availability?
  - Frequent previous exposure?



Paul Bourdeau, Humboldt and Bengt Allen, Long Beach

Larval Fish Tolerance to OA

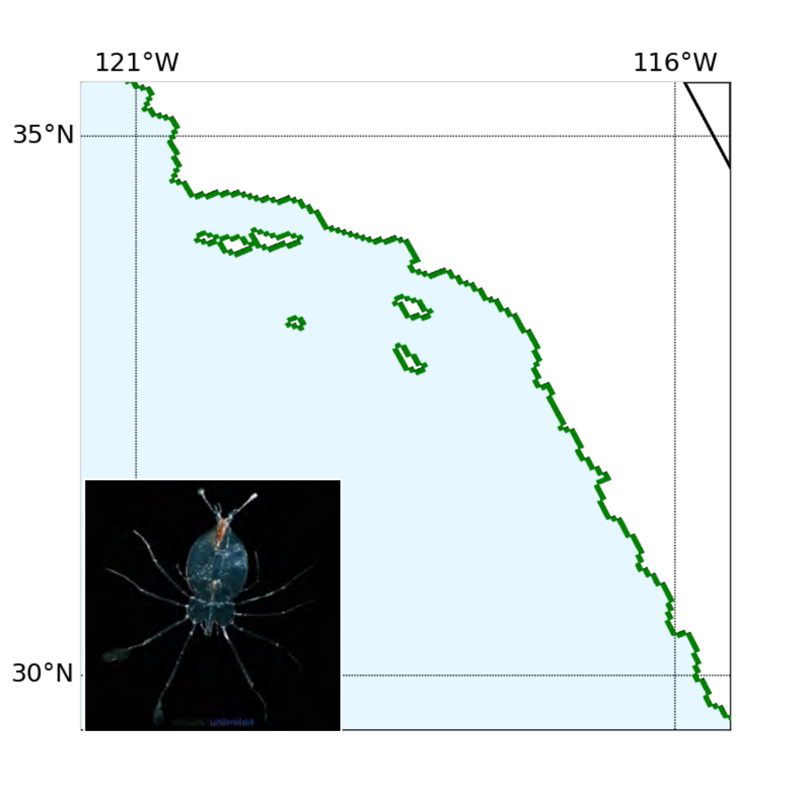
- Sensitive to high CO_2/ low pH levels
  - Mortality increases and recruitment decreases
  - Some intra-population variability in response
- Is there a genetic basis and could populations evolve to tolerate OA?
  - Full vs. half siblings



Darren Johnson, Long Beach

Future Ocean Conditions and Spiny Lobsters

- Fishery > $10M/yr
- Planktonic larvae
  - How will climate change affect circulation patterns and larval distribution?
- Warmer waters may reduce seagrass and kelp forest habitats



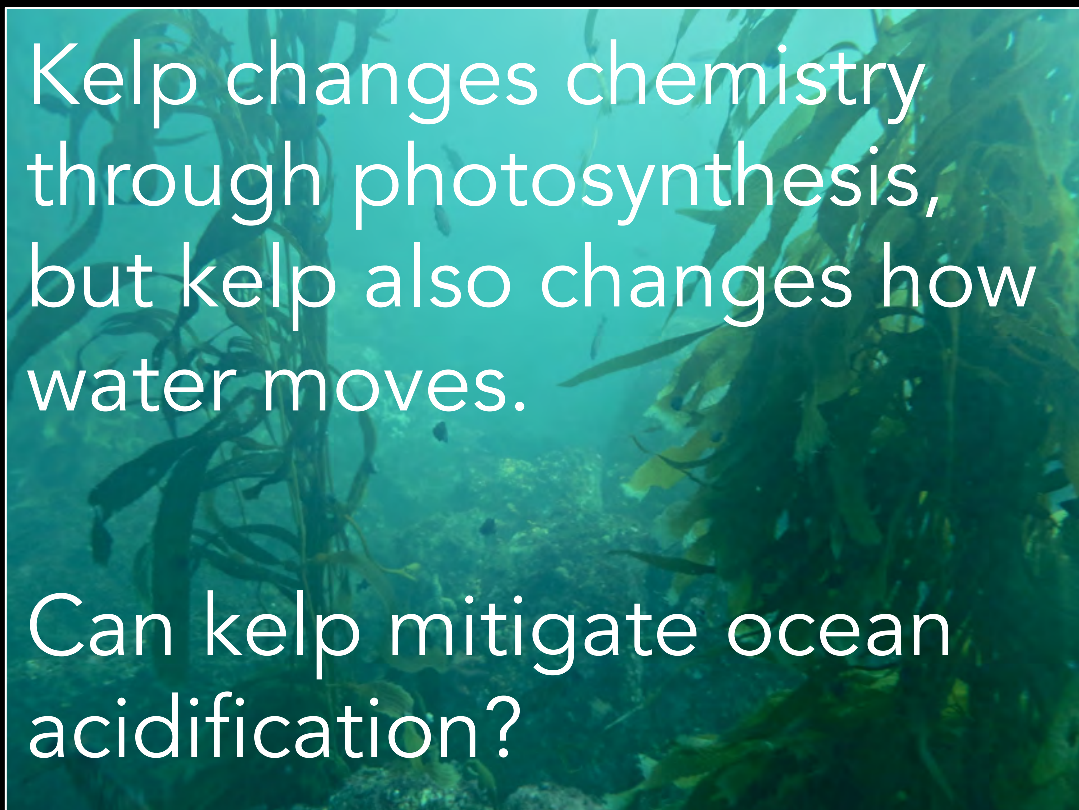
Kevin Hovel, SDSU

Seagrass Ecology and Climate Change

- More carbon available
  - May enhance seagrass growth but also the growth of competing algae
- How will invertebrate herbivores respond to changes in temperature, pH and sea level?
- To what extent can seagrass and other aquatic plants buffer/counteract decreases in pH?

Kevin Hovel, SDSU and Kathy Boyer, SFSU

Kelp Forests Alter Water Column Chemistry



Kelp changes chemistry through photosynthesis, but kelp also changes how water moves.

Can kelp mitigate ocean acidification?

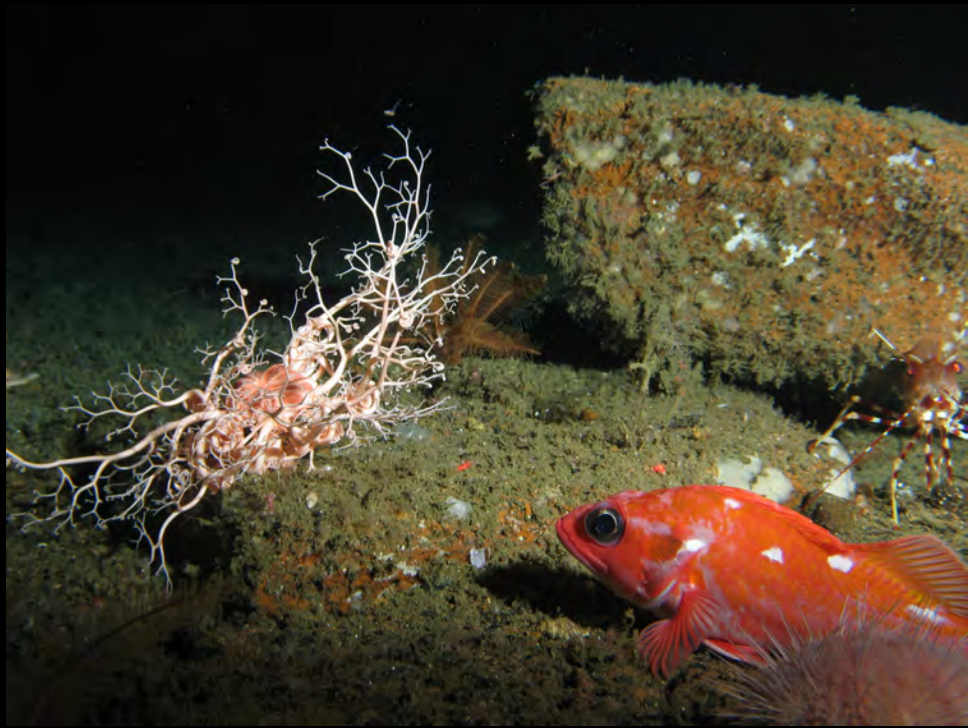
Differences in pCO_2

- In and out of kelp forests
- Vertically and horizontally within a site
- Seasonally

Kerry Nickols, Northridge

Baseline Characterization for Assessing Future Change

- Rocky and soft-bottom
  - Intertidal
  - Shallow
  - Mid-depth
  - Deep
- Sandy beaches
- Estuaries and wetlands



- Critical in assessing MPA performance

James Lindholm, Monterey Bay

Greenhouse Gas Exchange in Coastal Wetlands

- Measuring and modeling CO_2 and CH_4 exchanges
- Blue carbon
  – Inform carbon markets, which can fund restoration

Patty Oikawa, East Bay

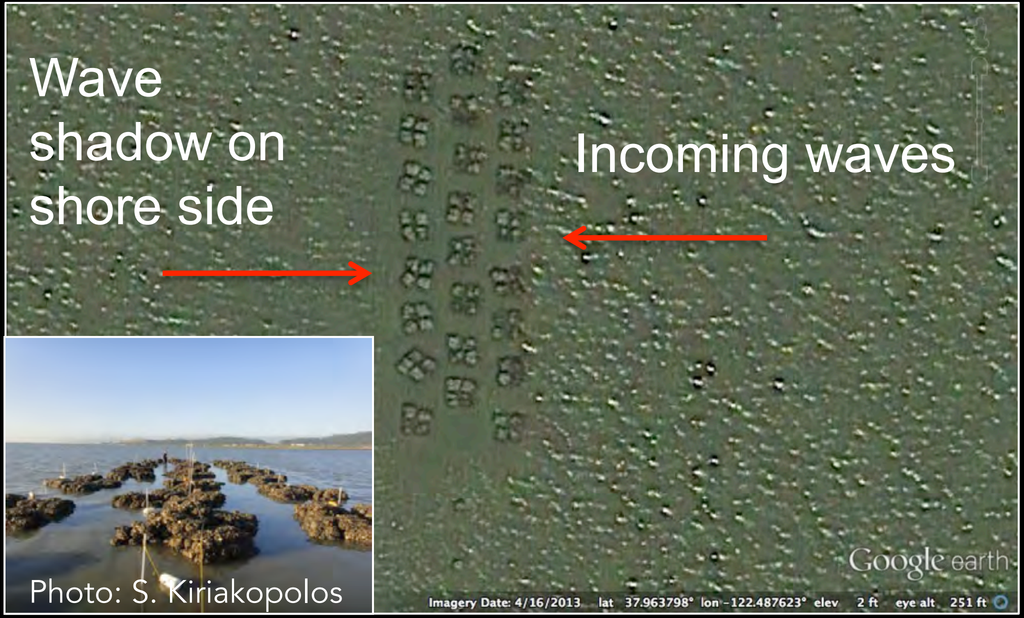
Planning for Future Salt Marsh Restoration

- Changes in inundation and temperature
- Sediment augmentation to raise elevation to keep pace with SLR

Christine Whitcraft, Long Beach

Living Shorelines
Native Oysters and Native Eelgrass

- Tool for SLR adaptation
- Reduce wave energy and increase sedimentation
- Increase species diversity
- Oysters protect eelgrass; eelgrass may protect oysters from OA



Kathy Boyer, SFSU

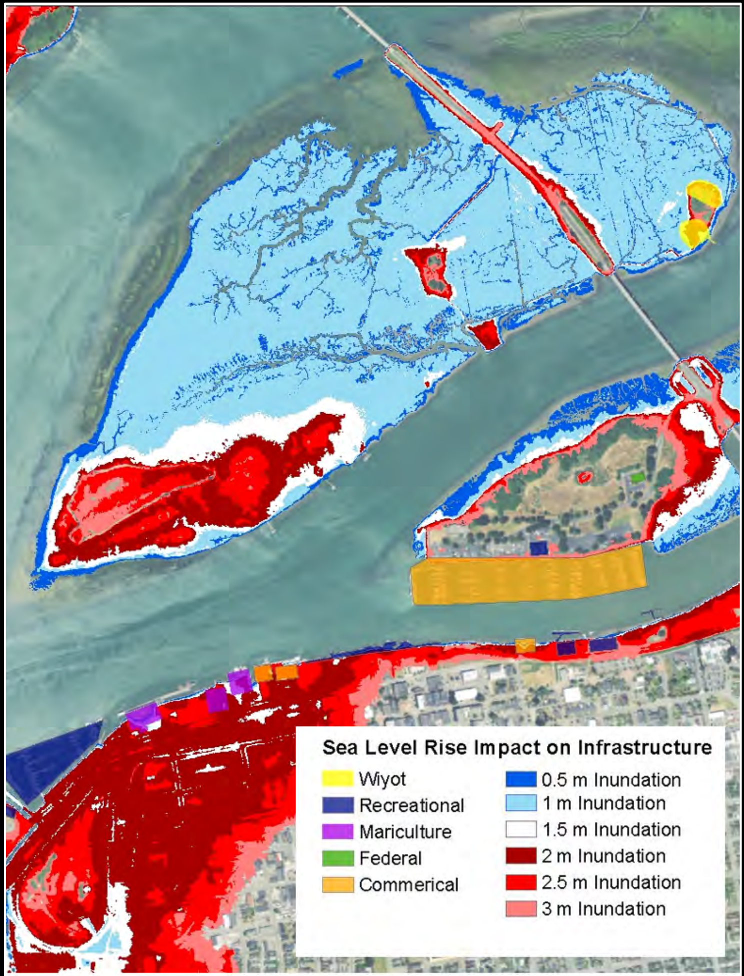
Sea Level Rise Threatens Critical Seal Habitat

Harbor seal haul-out, Russian River estuary.
Photo credit: Karen Backe

- Pinnipeds require haul-outs for resting, pupping and molting
- Threats
  - Storm surge
  - Near-term SLR (50 years)

Ellen Hines, SFSU

Sea Level Rise Initiative at HSU



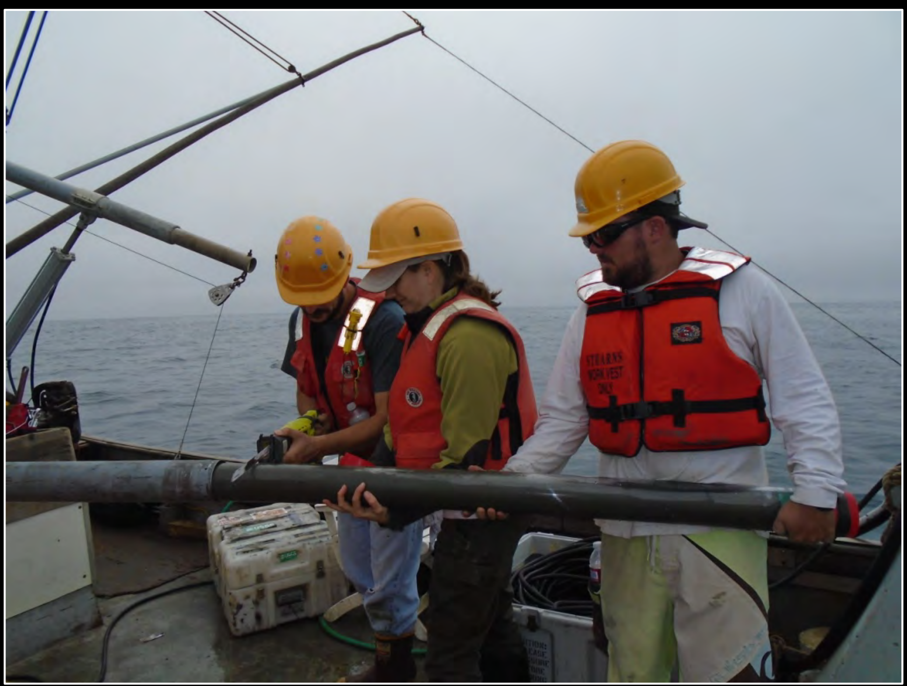
Humboldt Bay Sea Level Rise Vulnerability Map
Alyssa Suarez 2017

- Humboldt Bay - fastest rate of SLR in CA
- Researchers, students, community members, agencies, and planners
- Adaption strategies under different scenarios
  – Current regulations make it difficult to adapt

Laurie Richmond, HSU

Using the Past to Predict the Future

- Reconstructing environmental change over last 200-10,000 years



  - How did previous rapid climate change impact upwelling?
  - Terrestrial sediment supply
    - Coupled human activities and modern climate changes

Joe Carlin, Fullerton and Amy Wagner, Sacramento

Extreme Weather

- Five atmospheric river (AR) events occurred from January-February 2017
  - Flooding, destruction of property, contamination of water supplies
- Do AR events result from long-range transport of aerosols and greenhouse gases from Asia to the Northern Pacific Ocean?

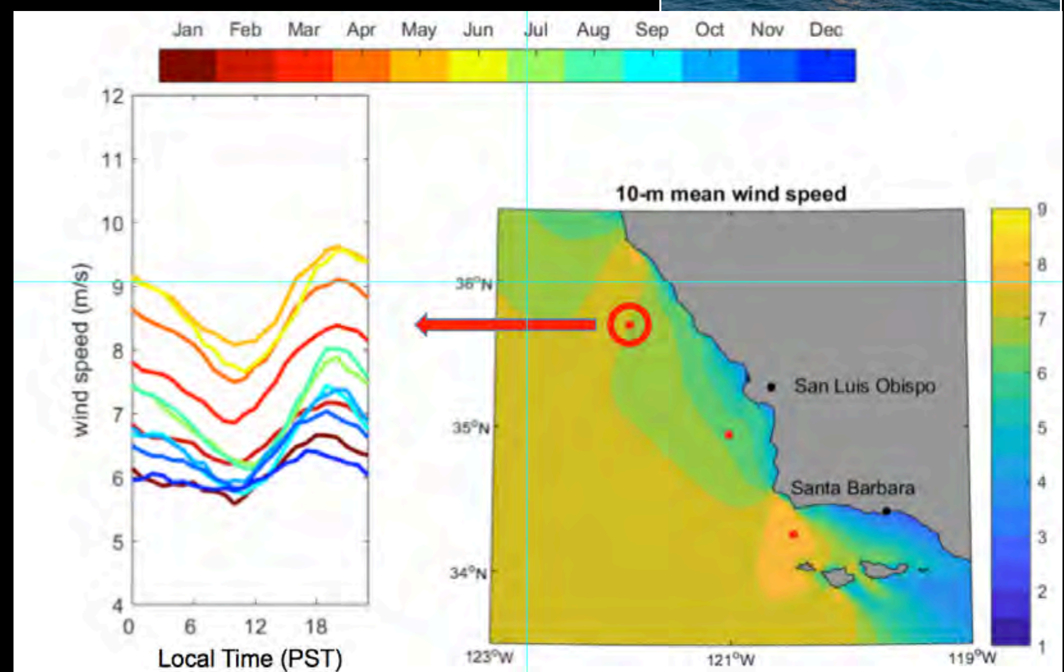
Sen Chiao, SJSU

Fog Catching to Conserve Water

Dan Fernandez, Monterey Bay

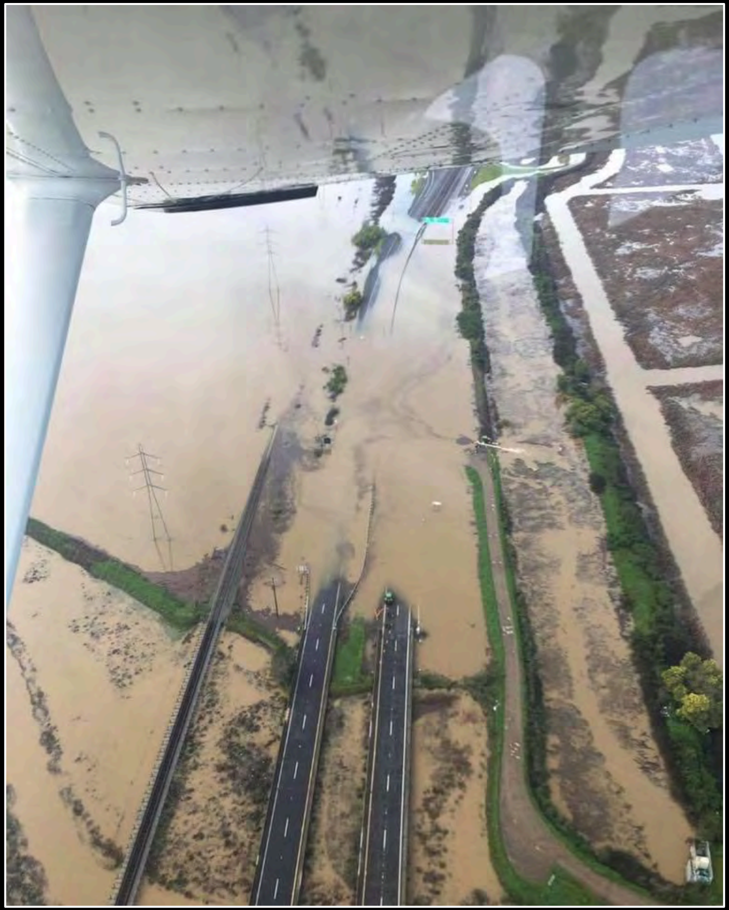
Potential for Offshore Wind Energy Production

- High resolution data to estimate power available
- Market value of unit of power
- Environmental impacts
- Socioeconomics
- Menu of options



Ben Ruttenberg, San Luis Obispo

Modeling Climate Change Impacts on Flooding and Community Vulnerability



- Larger, more intense storms
  - Stream flow, SLR and storm surge
- Disproportionate effects on low-income families
- Incorporating climate science into flood hazard assessment

Suzanne Goldstein; Advisor: Jason Gurdak, SFSU

Where Do We Go Next?

- Continue to advocate for funding for CSU faculty
  - Knowledge of new and developing opportunities
  - Connecting PIs with stakeholders
  - Connecting PIs with each other

Dean Wendt, Cal Poly SLO

COAST Executive Committee
2010-2017


HAPPY EARTH DAY!
Questions?


15-minute break
Please return at 10:30 am


State Perspectives on
Climate Change


Connecting Science and Policy in the CSU: Faculty Engagement


Lunch Break
Please return at 1:00 pm