

Potential Impacts of Brine on Local Fisheries

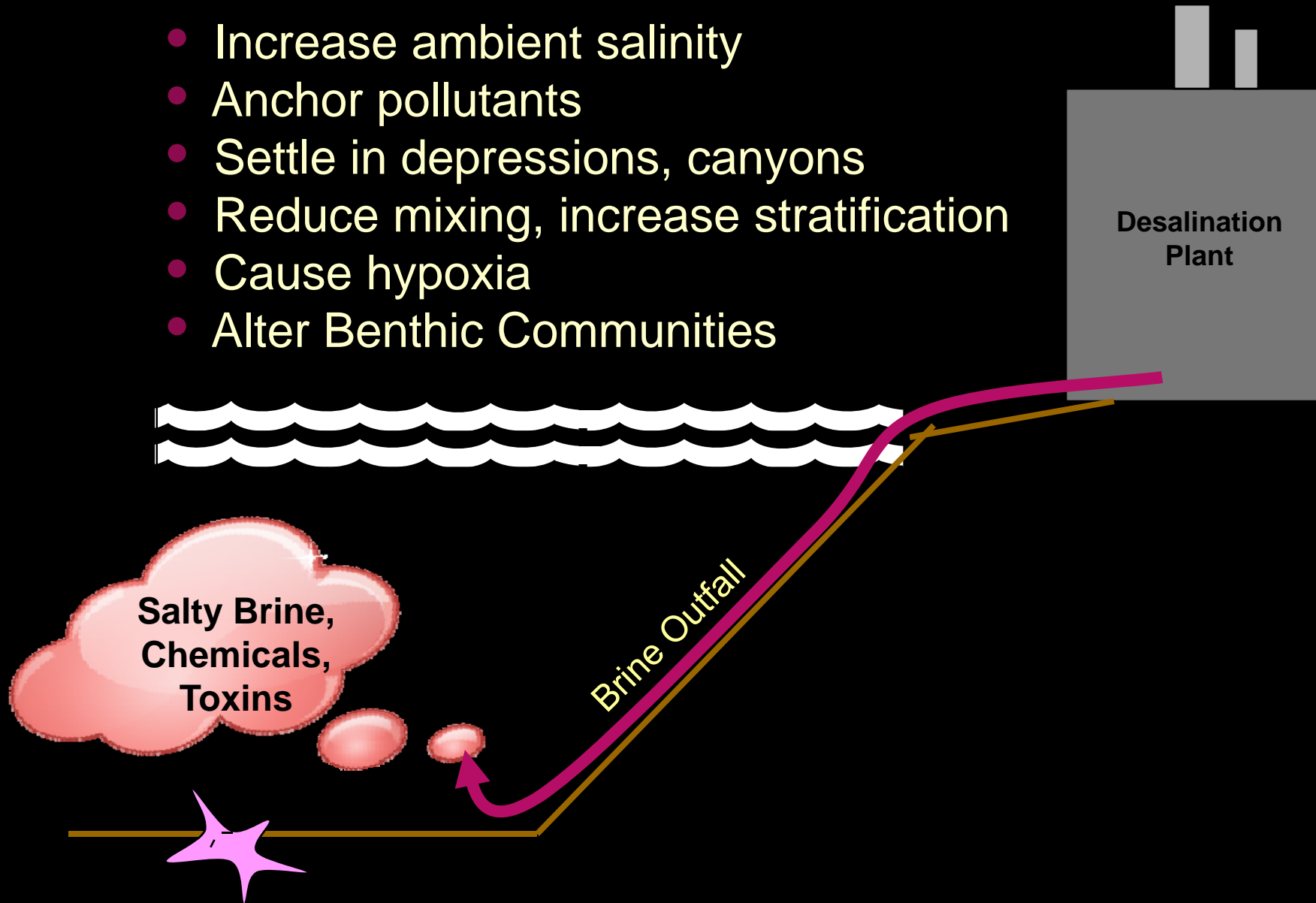
Carol A. Reeb, PhD
Hopkins Marine Station
Stanford University

8 December 2011



Hypersaline Brine Discharge Can:

- Increase ambient salinity
- Anchor pollutants
- Settle in depressions, canyons
- Reduce mixing, increase stratification
- Cause hypoxia
- Alter Benthic Communities

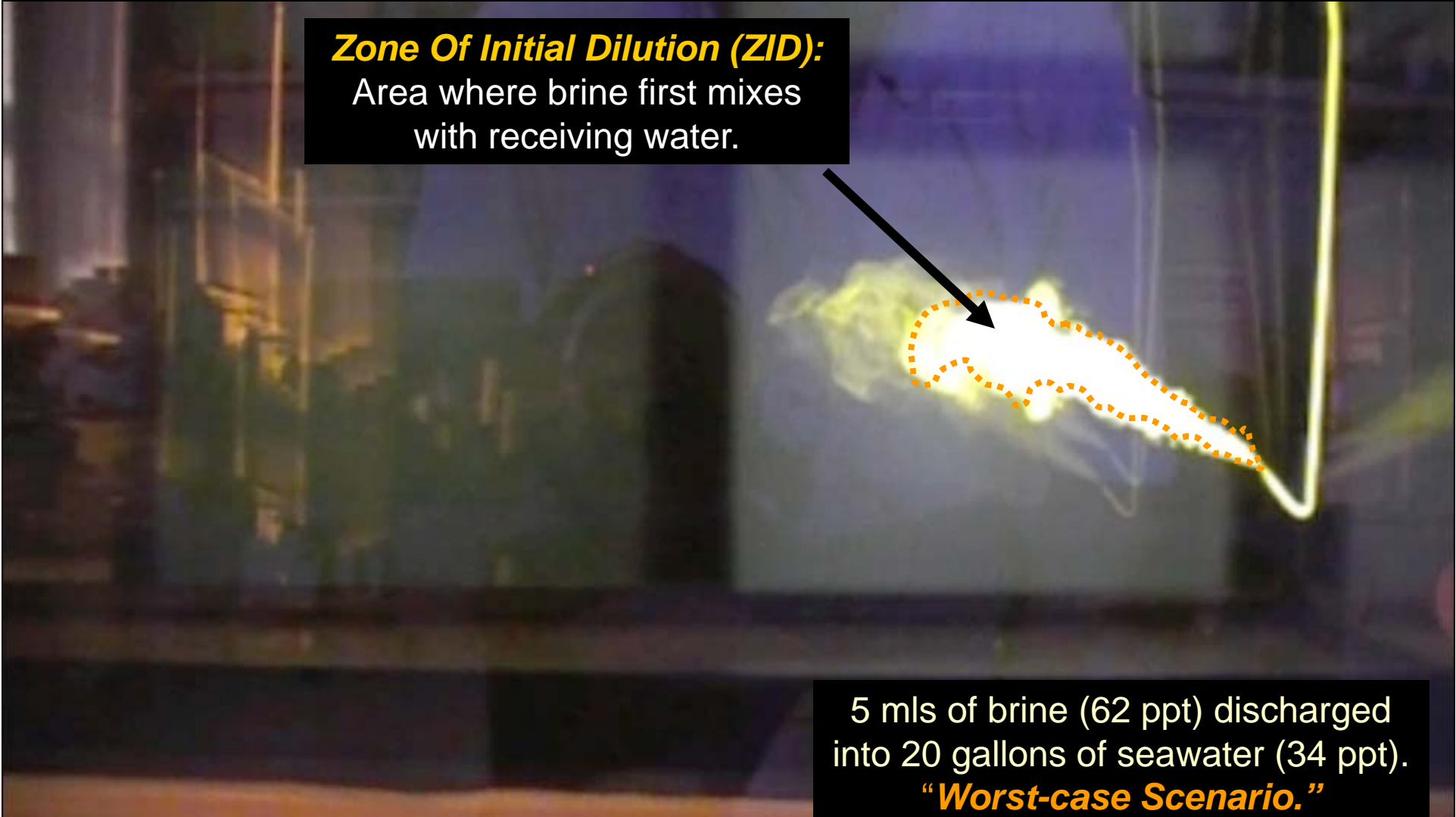


Brine Plume

(released as “high velocity” jet)

Zone Of Initial Dilution (ZID):

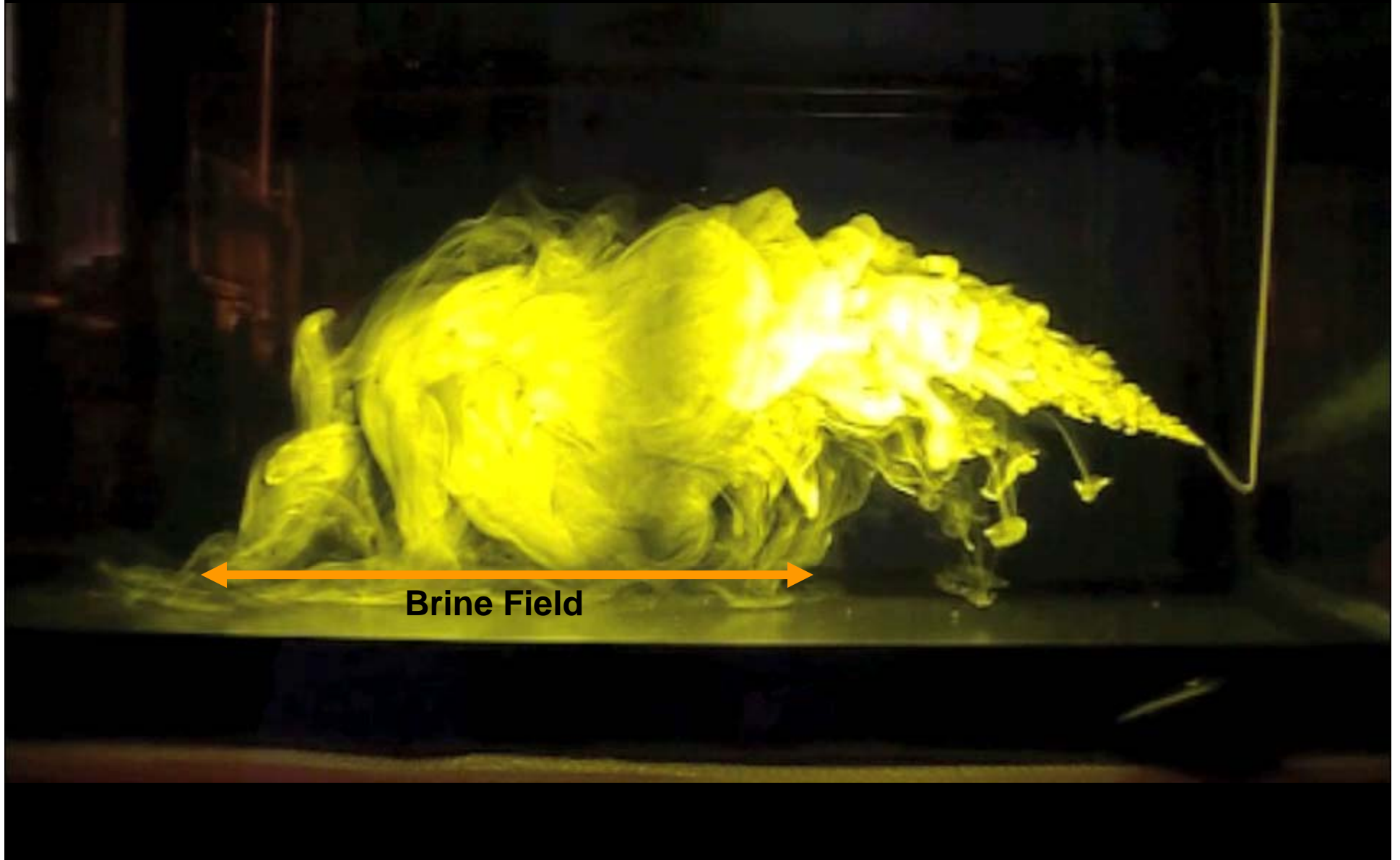
Area where brine first mixes
with receiving water.



5 mls of brine (62 ppt) discharged
into 20 gallons of seawater (34 ppt).
“Worst-case Scenario.”

Brine Plume

(released as “high velocity” jet)



Monitoring Brine Plumes In Spain



Photo: Albert Kok, Wikimedia commons

Salinity Tolerance of *Posidonia Oceanica*:
Sánchez-Lizaso et al. 2008. Desalination 221:602–607

Concludes:
< 5% above
ambient ok

Monitoring Brine Plumes In Spain

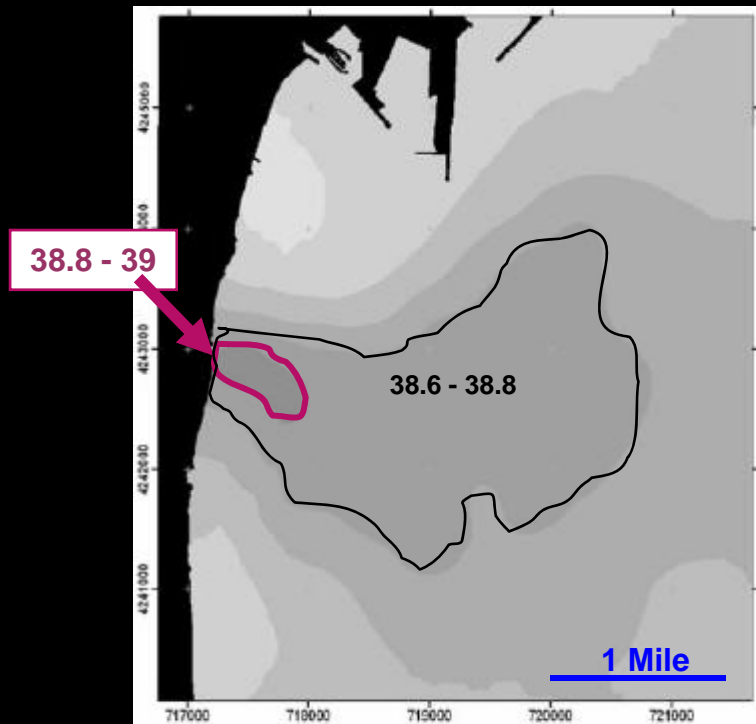
Ambient salinity: 37 ppt

Brine Salinity: 68 ppt

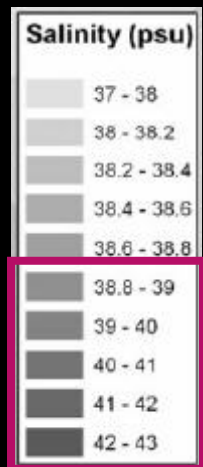
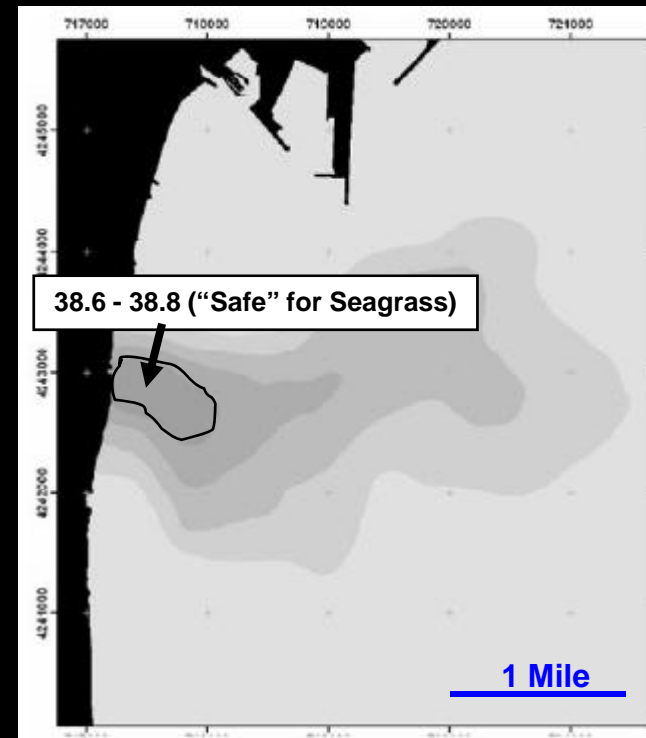
Brine Flow: 66,000 m³/day (~17 mgd)

Mitigation: discharged from shore

April 2004



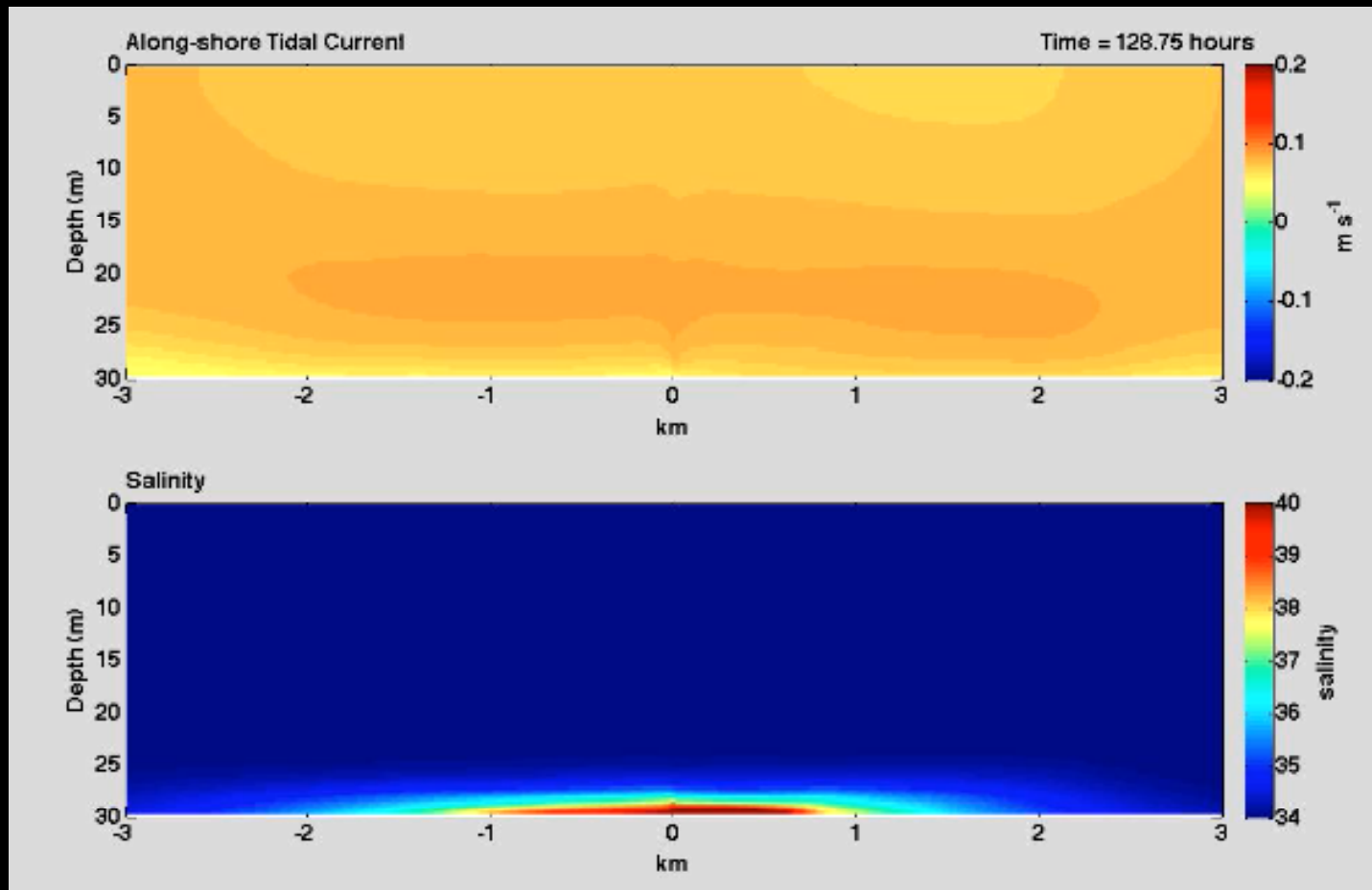
January 2005



> 5%

Figure 5A & C.

Fernández-Torquemada et al. 2009. *Desalination and Water Treatment* 5:137–145



Movie: Brine Model, Brock Woodson, Ph.D.
Research Scientist, Environmental Fluid Mechanics Lab
Stanford University
<http://www.stanford.edu/~bwoodson/>

Salinity Tolerance of California Market Squid, *Doryteuthis opalescens*

Carol Reeb¹ and Lou Zeidberg²

¹Hopkins Marine Station, Stanford University

²University of California, Los Angeles

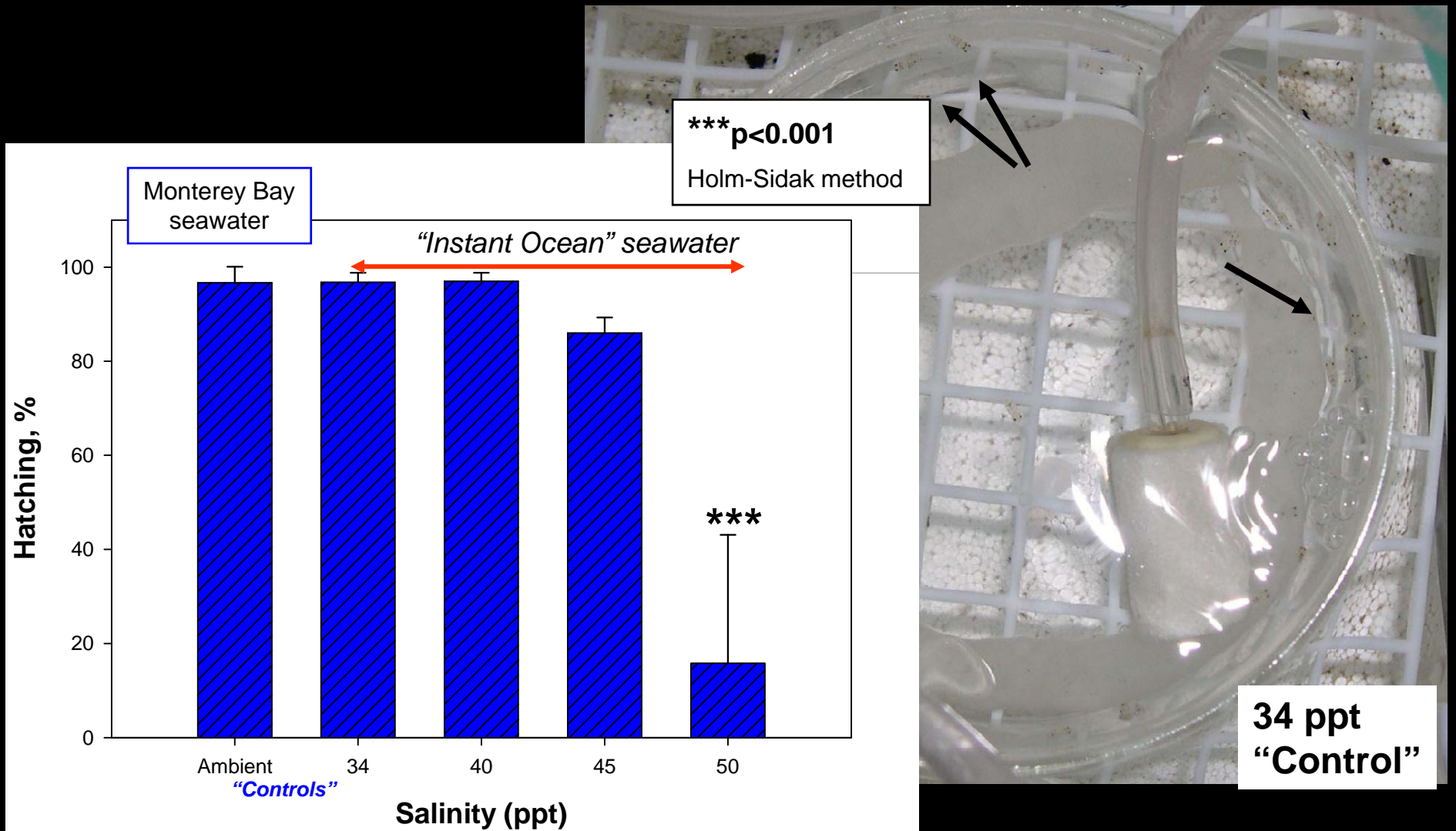
California's Fishery: **\$73.8 Million in 2010**

Essential habitat: **Sandy seafloor**

<http://www.dfg.ca.gov/marine/landings10.asp>

Photo: L. Zeidberg

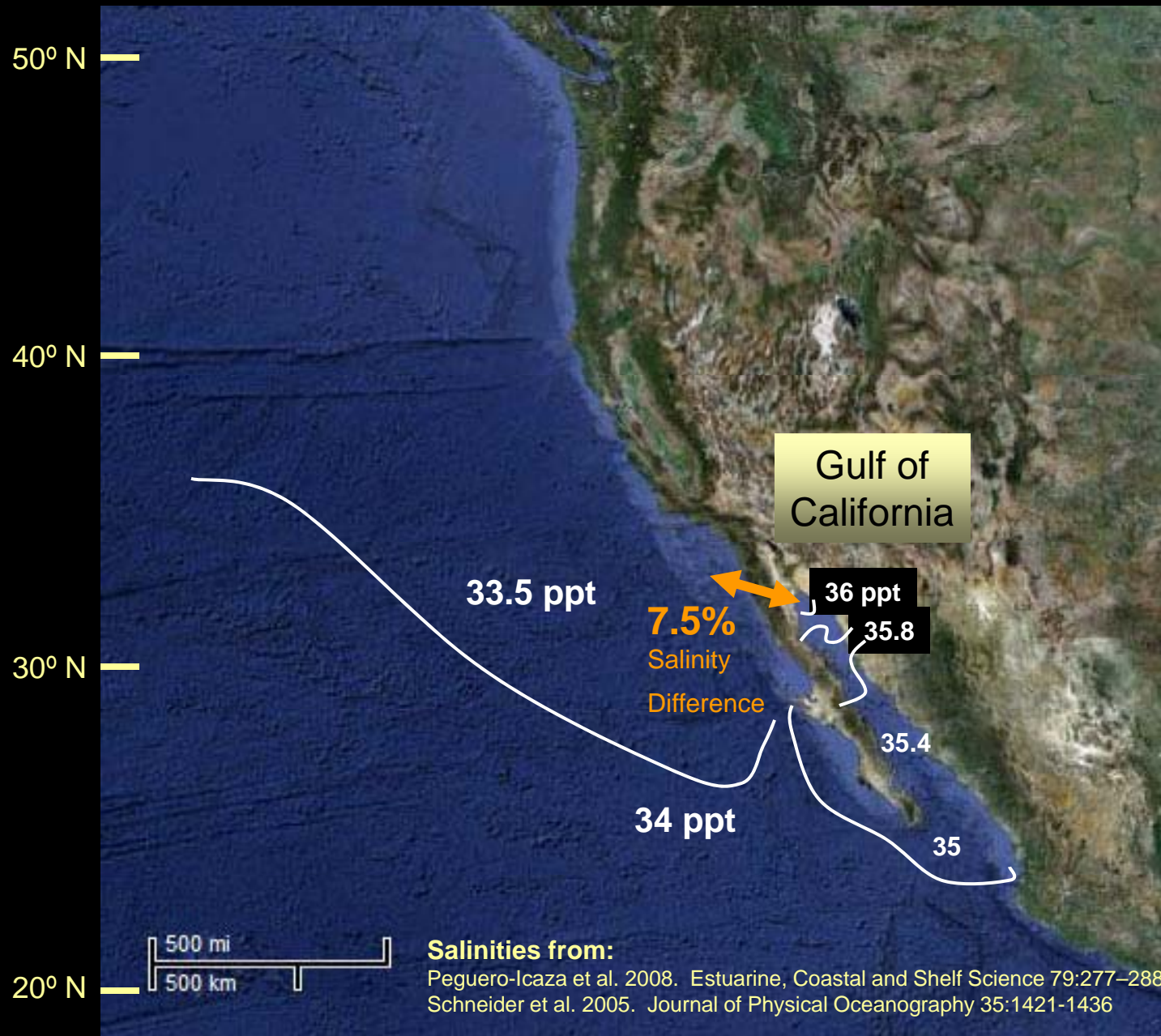
Hatching Rate In Brine



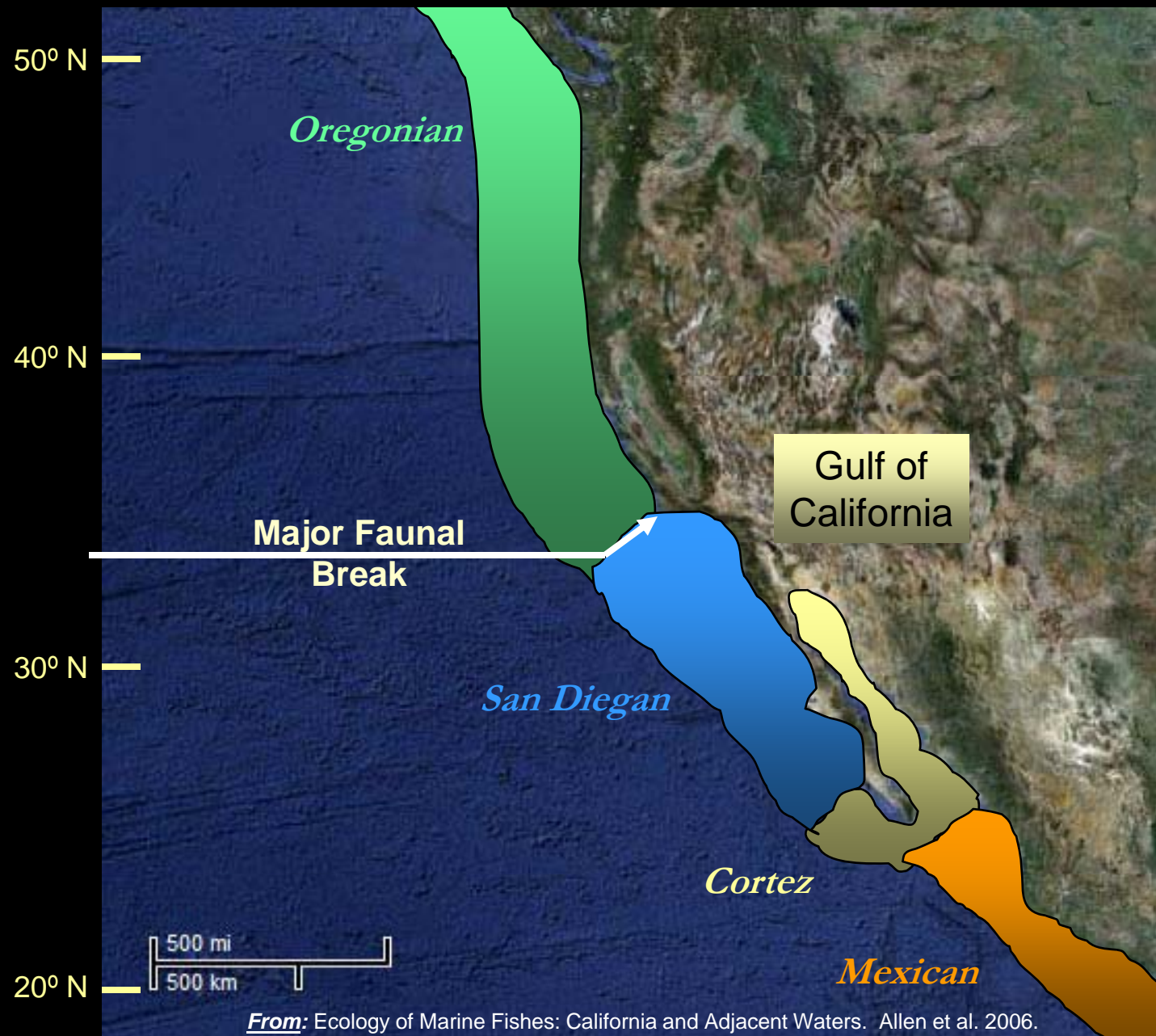


Movie: *D. opalescens* paralarvae in Brine, Carol Reeb, Ph.D.
Research Associate, Hopkins Marine Station
Stanford University
<http://hopkins.stanford.edu/postdocs.html>
<http://www.tunaresearch.org/>

Will Species Adapt to High Salinity?



Biogeographic Provinces, N. East Pacific



Desalination in California

(3 “Hotspots”)



From: Cooley et al. 2006 Pacific Institute (updated 2007); Lattemann, 2010 (Ph.D. Dissertation).

We Have a Great Stake In Our Coastal Ocean...and Gaps in Our Science

Cumulative Impacts

- How much brine can a basin tolerate over time?

Identify Risks

- List of vulnerable species
 - *Developing embryos, young most at risk*
- Map of essential habitats

Monitoring

- Bio-indicators, instruments on seafloor
- Electronically-tagged marine life

