# Building a Marine Life Observing System:

## Lessons from the Tagging of Pacific Predators


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and TOPP Scientific Teams

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TAGGING OF PACIFIC PREDATORS

CENSUS OF MARINE LIFE

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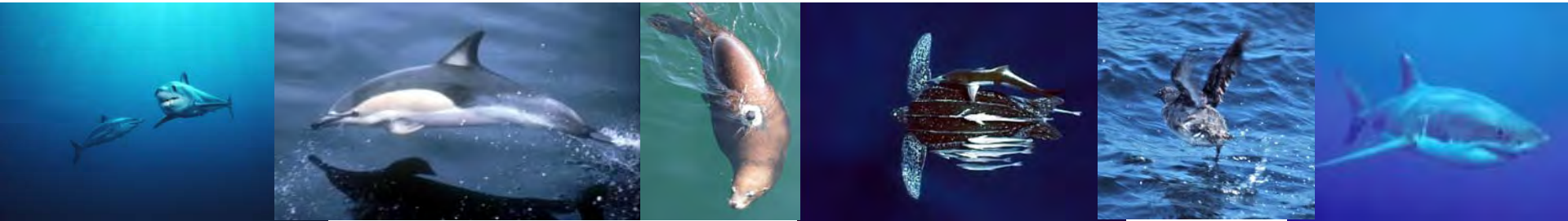
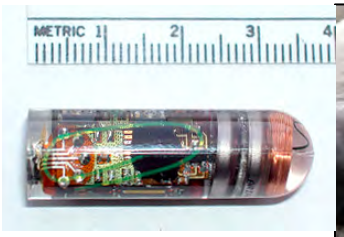
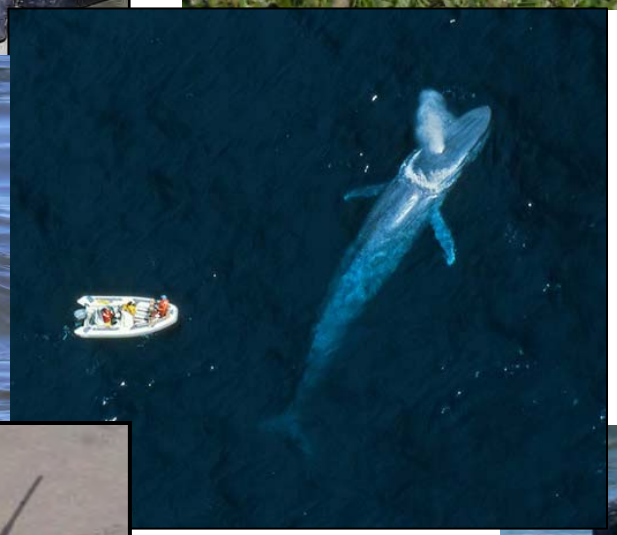
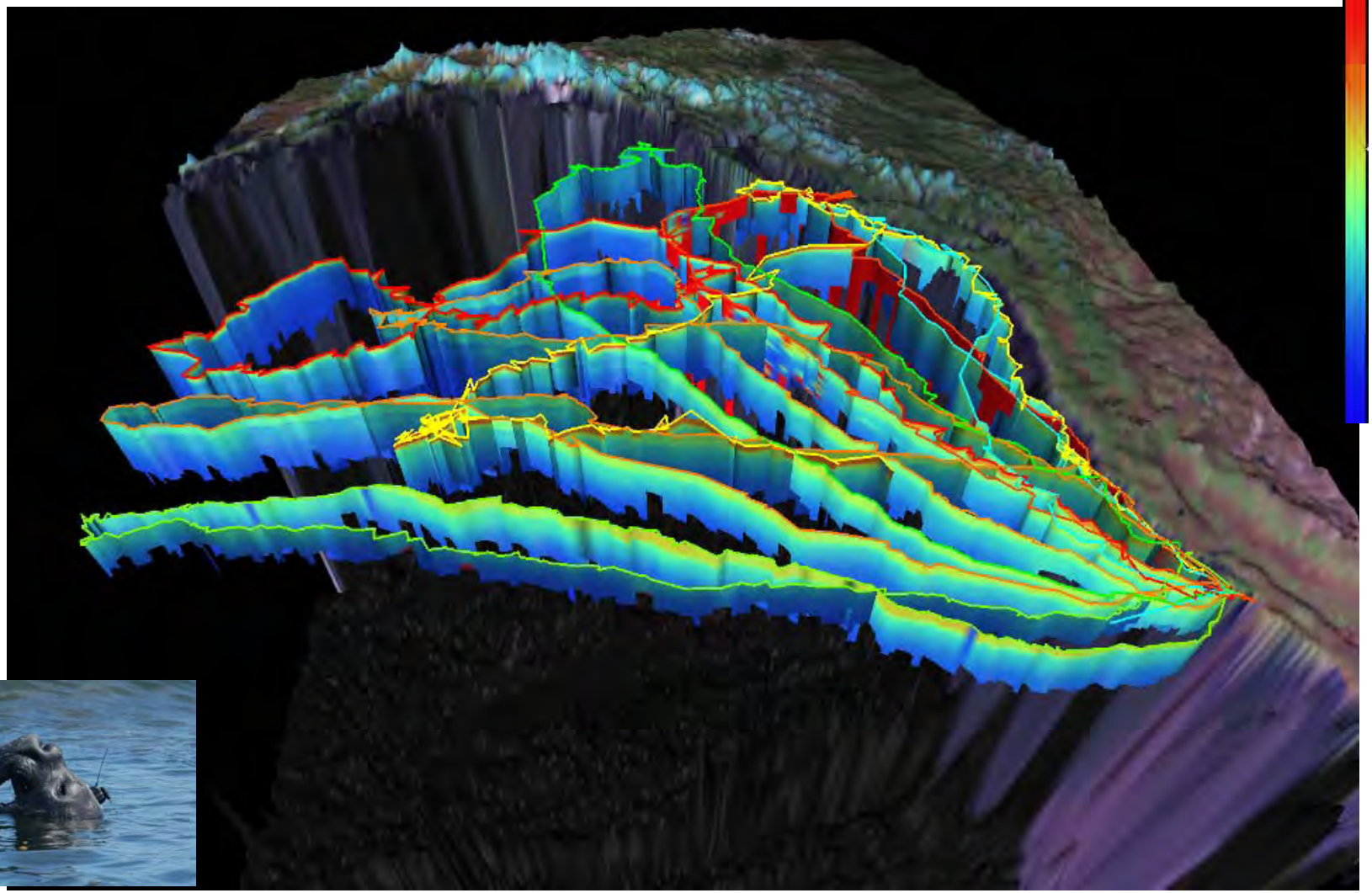


# Technical Approach: Use Multiple Tag Platforms



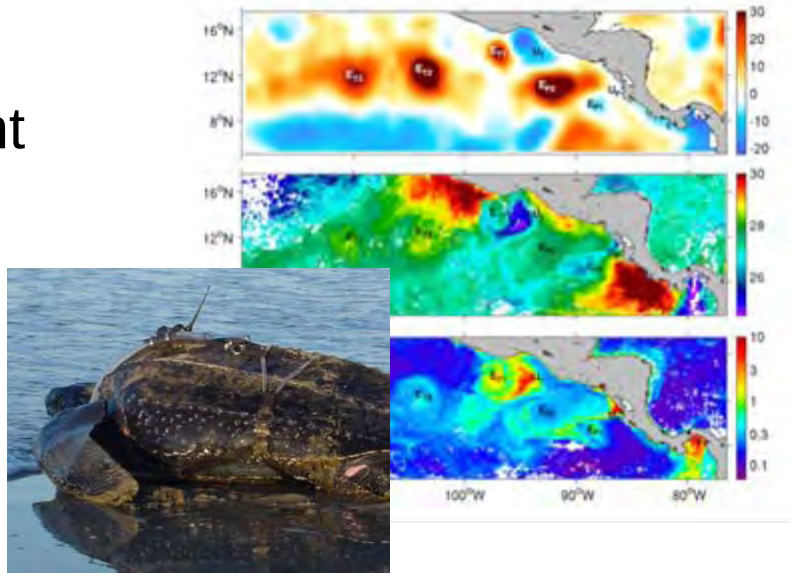


# Ocean Observation & Marine Ecology

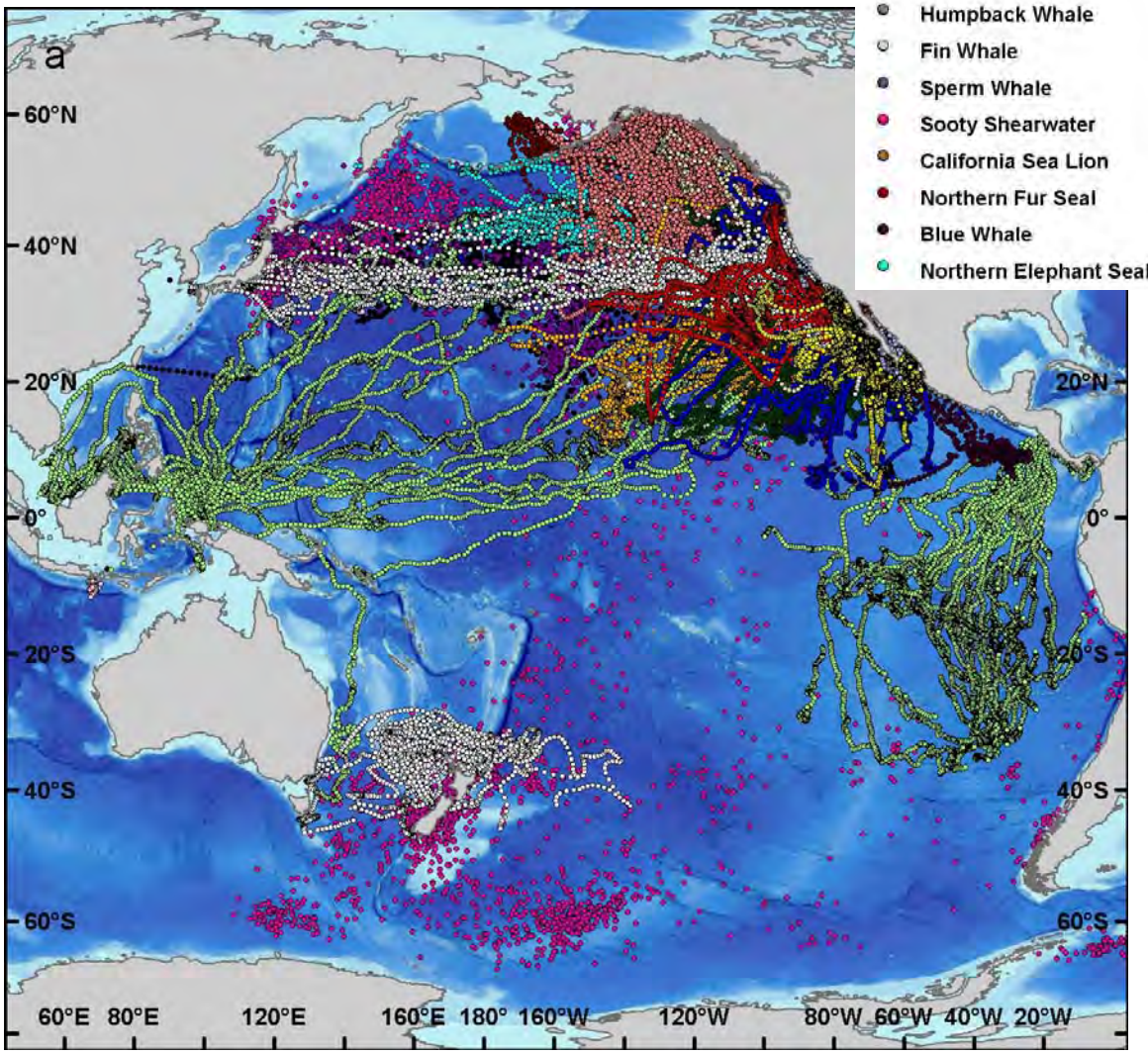


# TOPP Objectives

- Technology Development
  *Tag miniaturization; advance biologging science*
- Interdisciplinary Science
  *Marine ecology, physical oceanography, engineering, ...*
- Elucidate Behavior at Scale of Environment
  *Relate animal behavior to physical processes & features*
- Ocean Observation
  *Animals as ocean sensors*
- Conservation and Management
  *Understand habitat utilization*



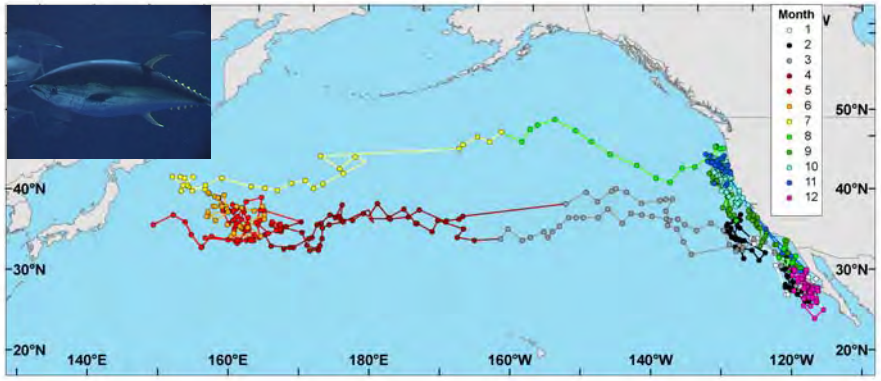
# Top Predator Exploration of the Pacific Ocean

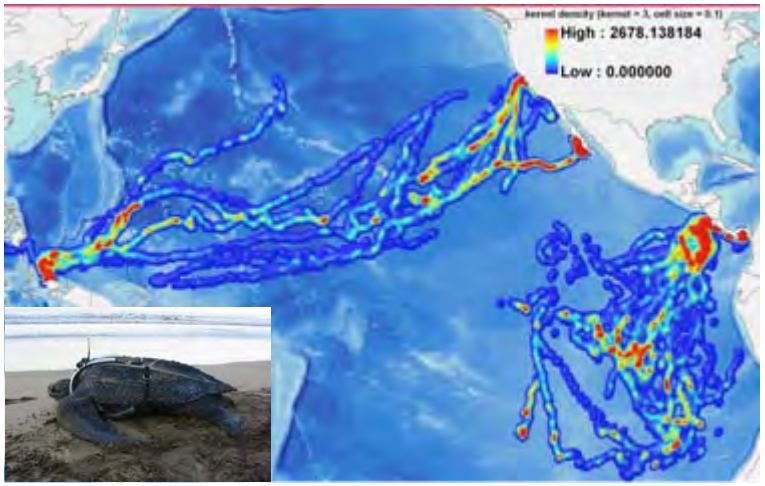


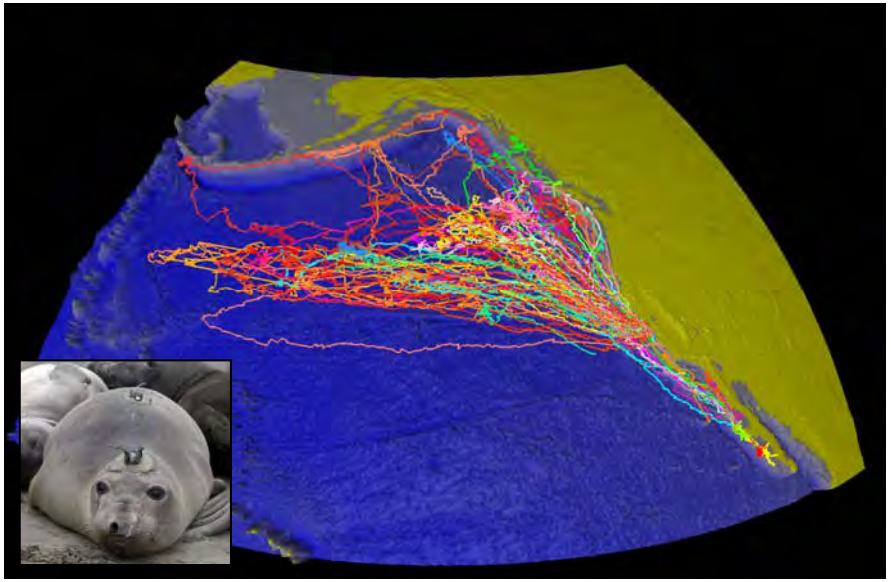
TAGGING OF PACIFIC PREDATORS

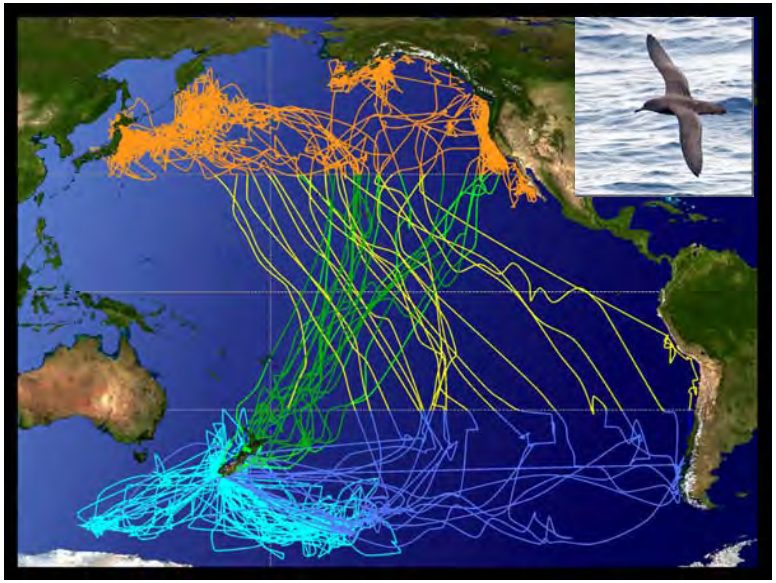
- 23 species
- 4,300 tags
- 350,000 tracking days

# Basin-Scale Migrations of Top Predators

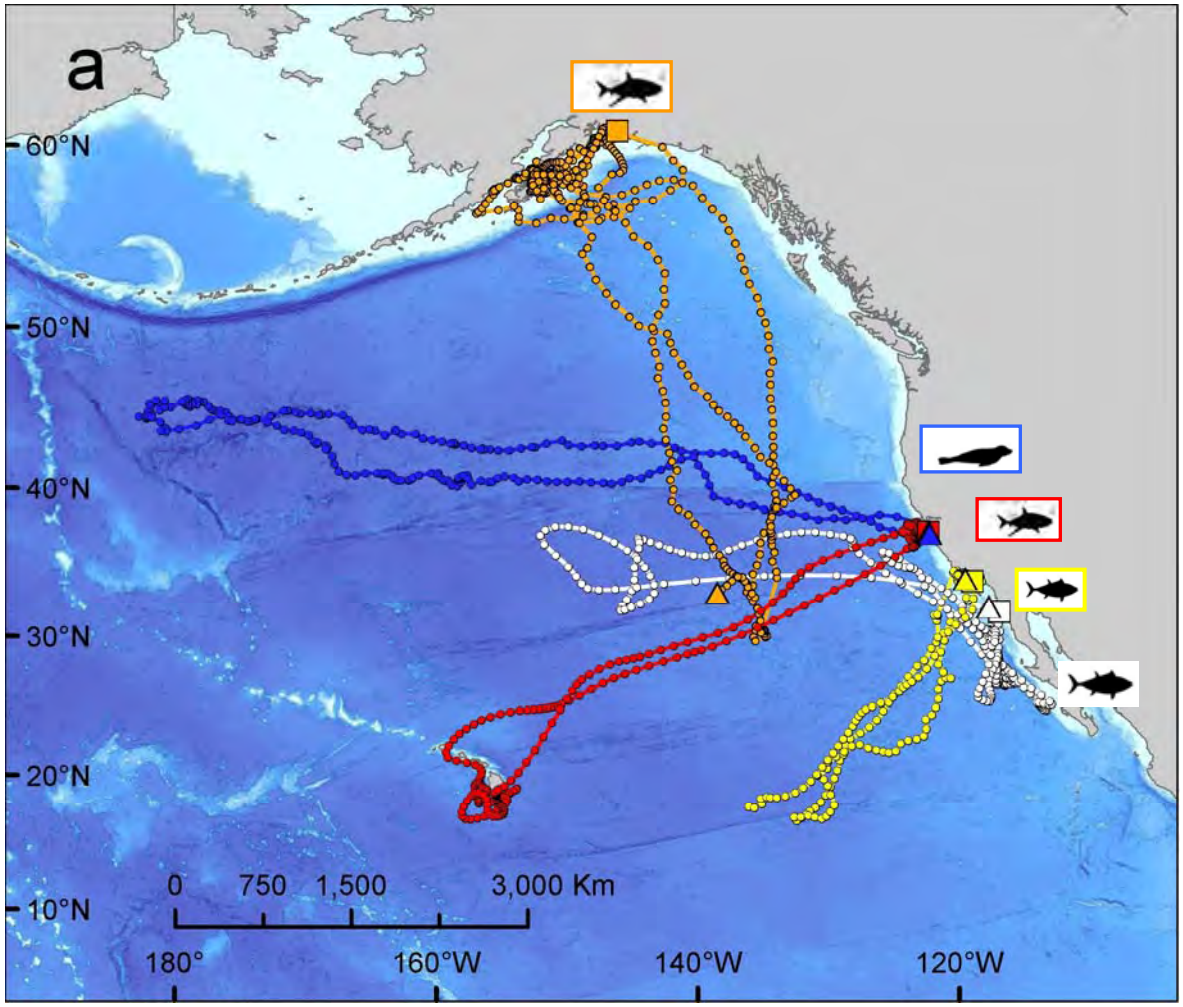


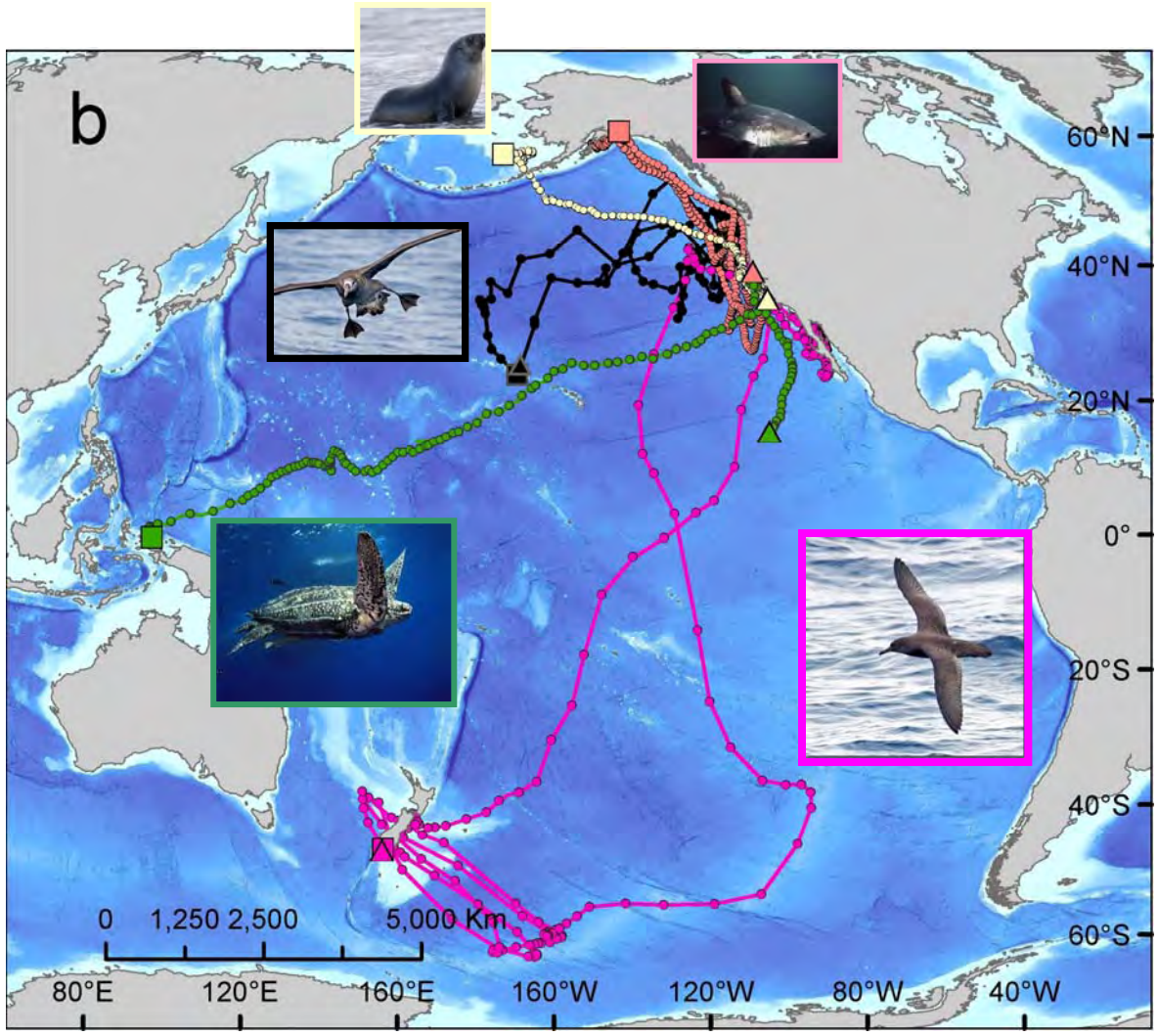





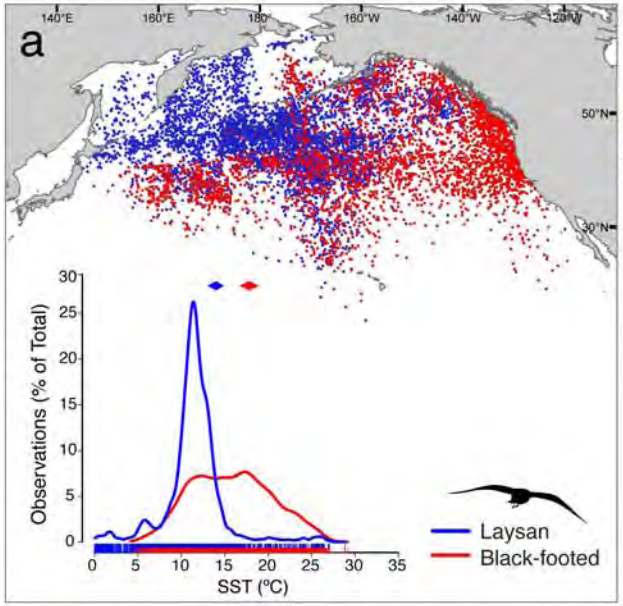
# Fidelity to Migration Pathways

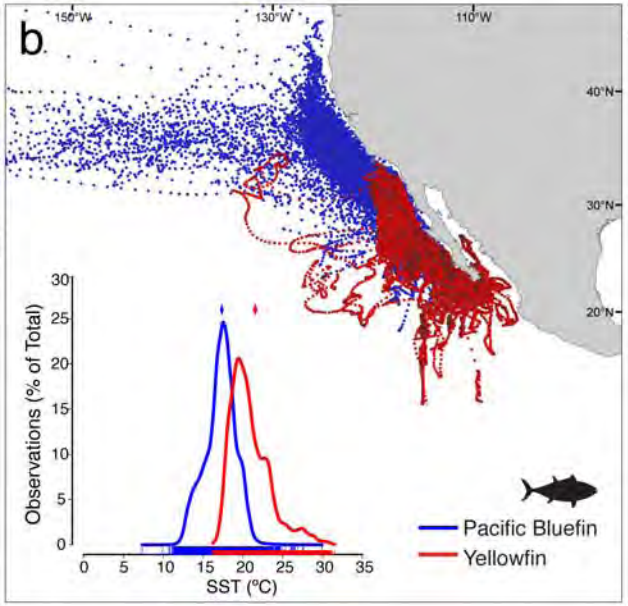


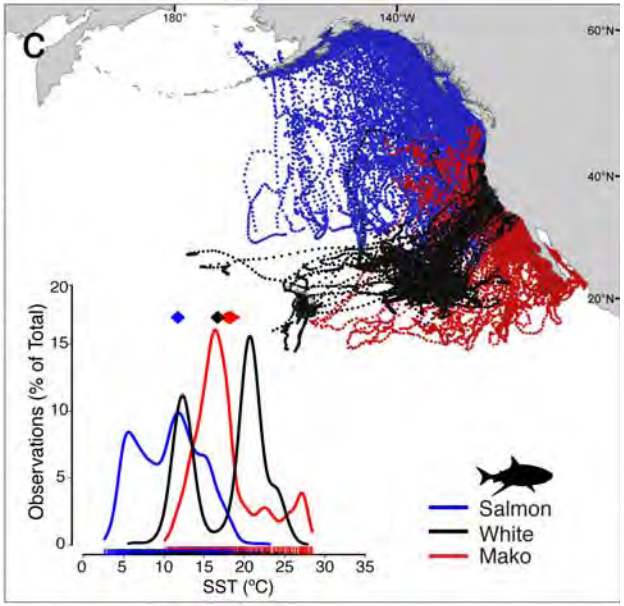
# Fidelity to the California Current Ecosystem



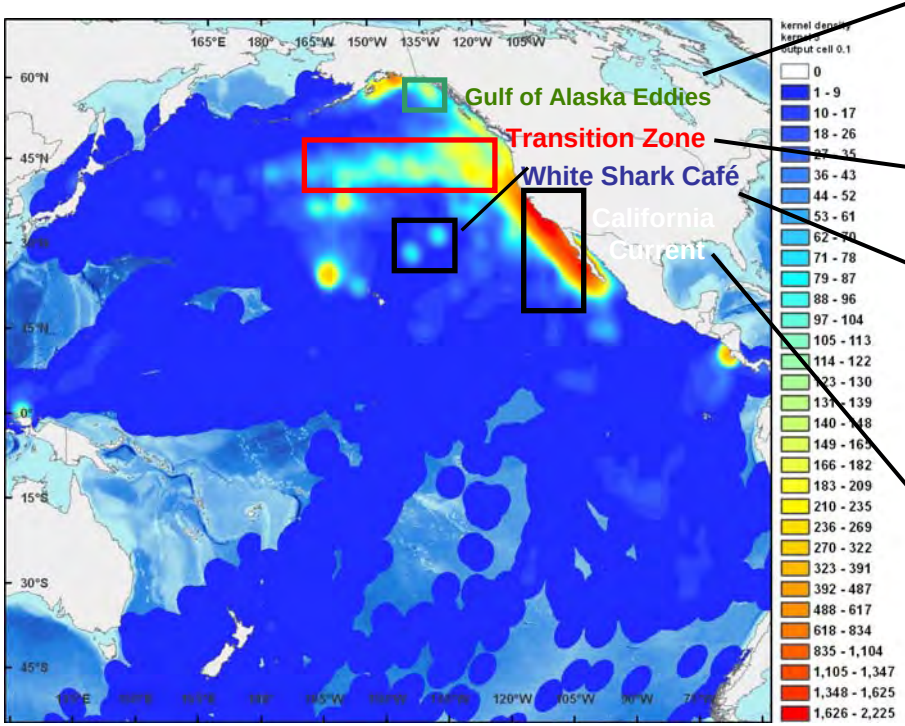
# Habitat Overlap and Niche Partitioning

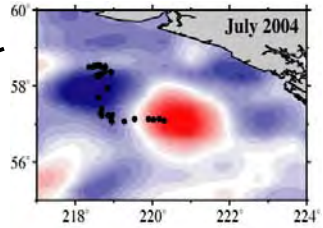


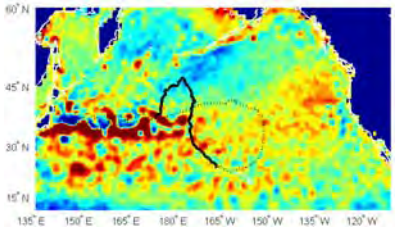



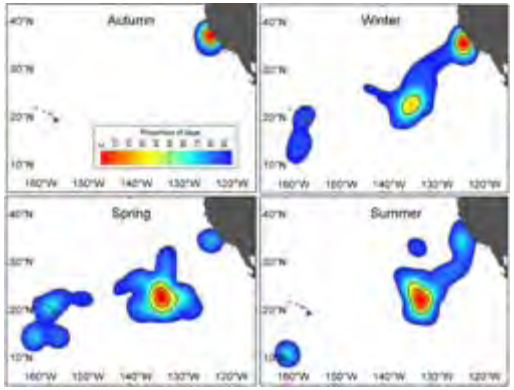



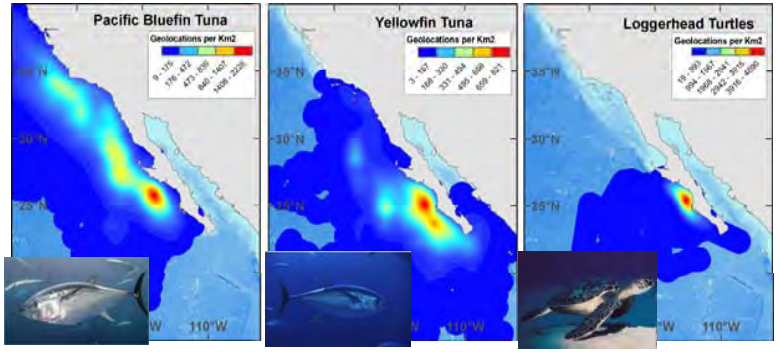
# Hot Spots for Foraging, Migration, Reproduction



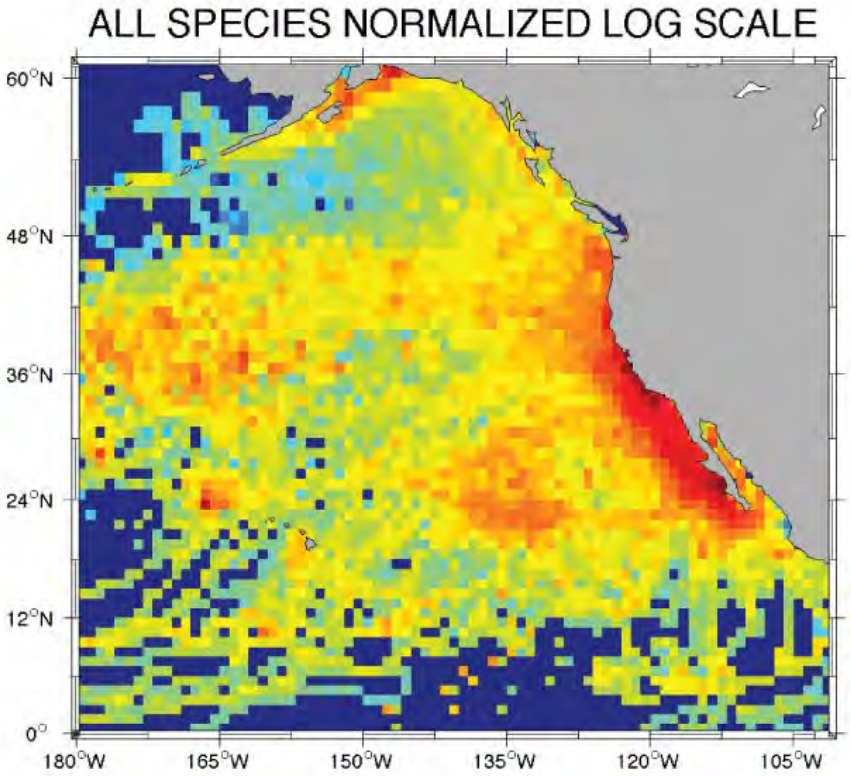



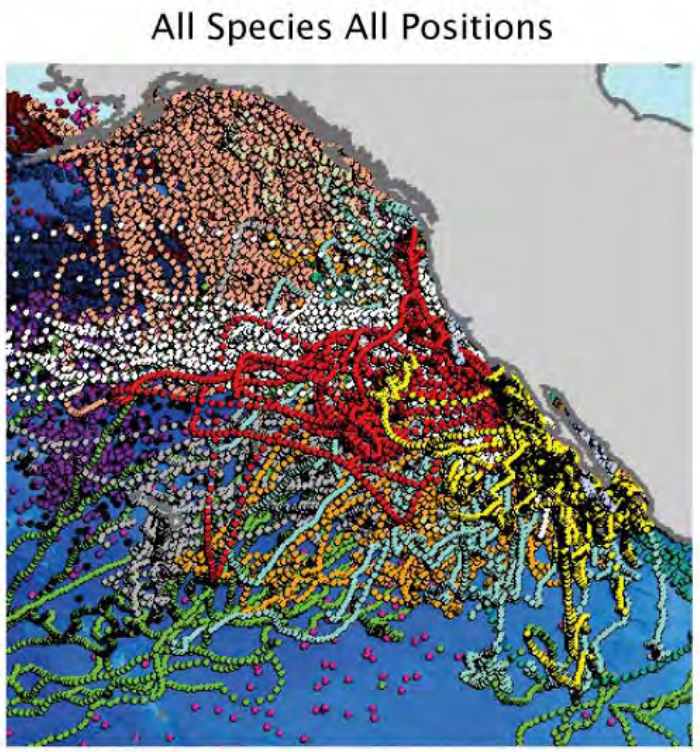



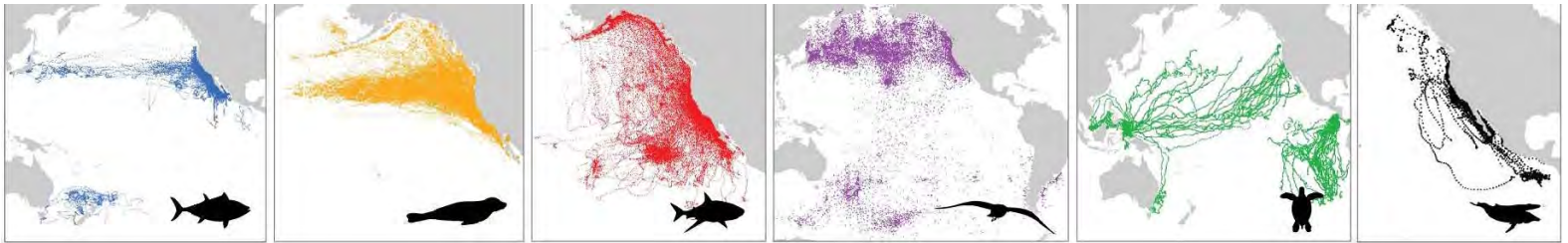


# TOPP Synthesis: Marine Predator Hot Spots



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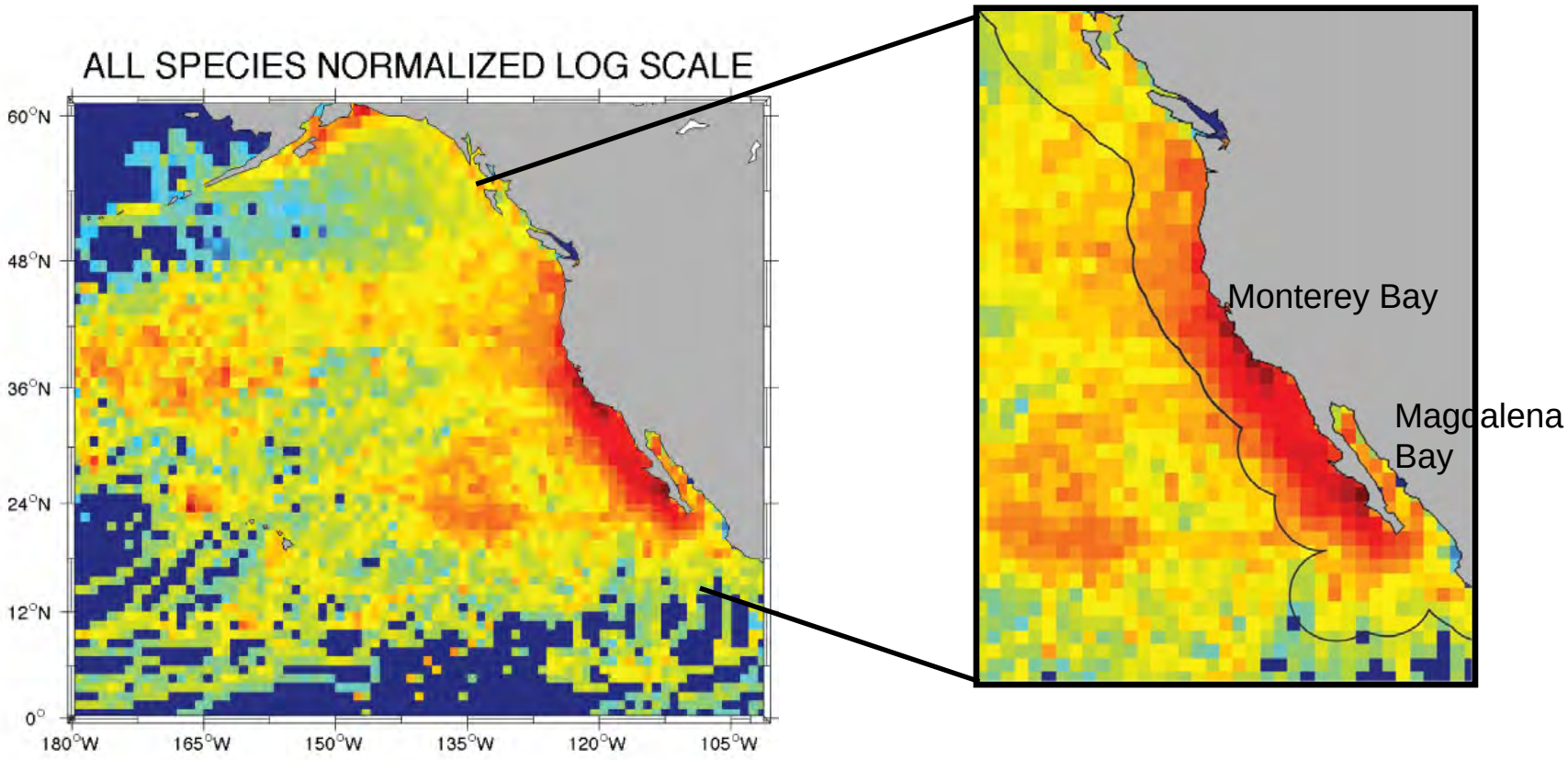


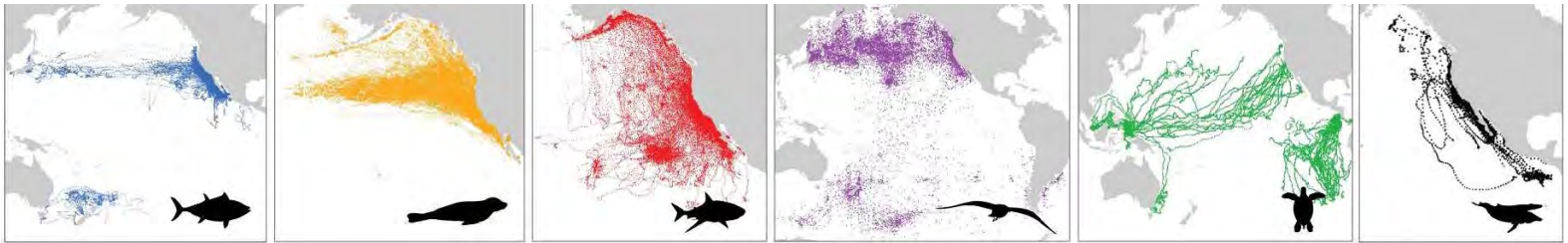

# Marine Predator Hot Spots

- What is the physical forcing?  How persistent/recurrent?
- Can we classify by ecological function?
  - Foraging
  - Reproduction
  - Migratory pathway
- Single-species vs. multi-species
- What are conservation/management options?
  - Time-area closures?
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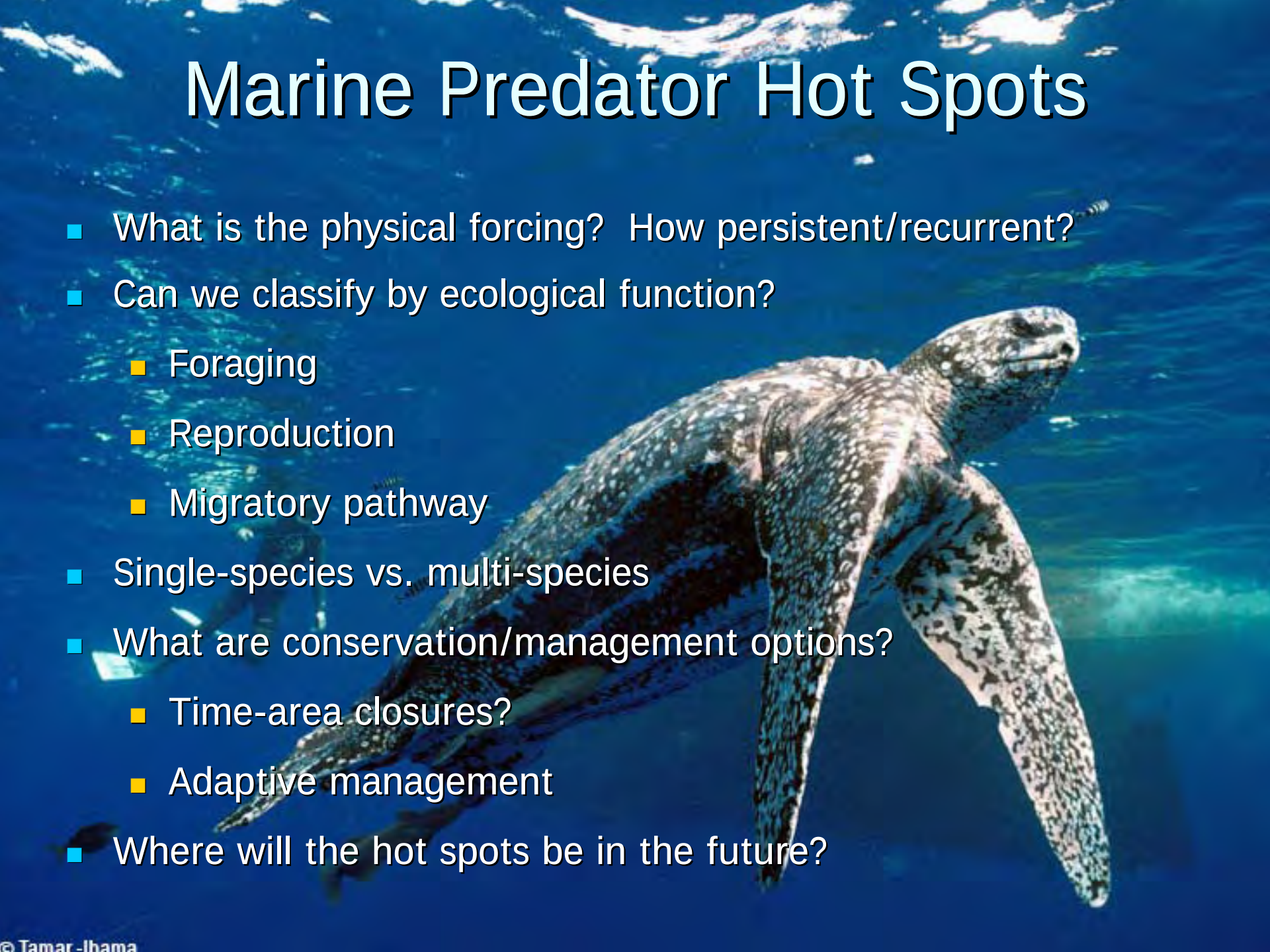
- Where will the hot spots be in the future?



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Next talk …

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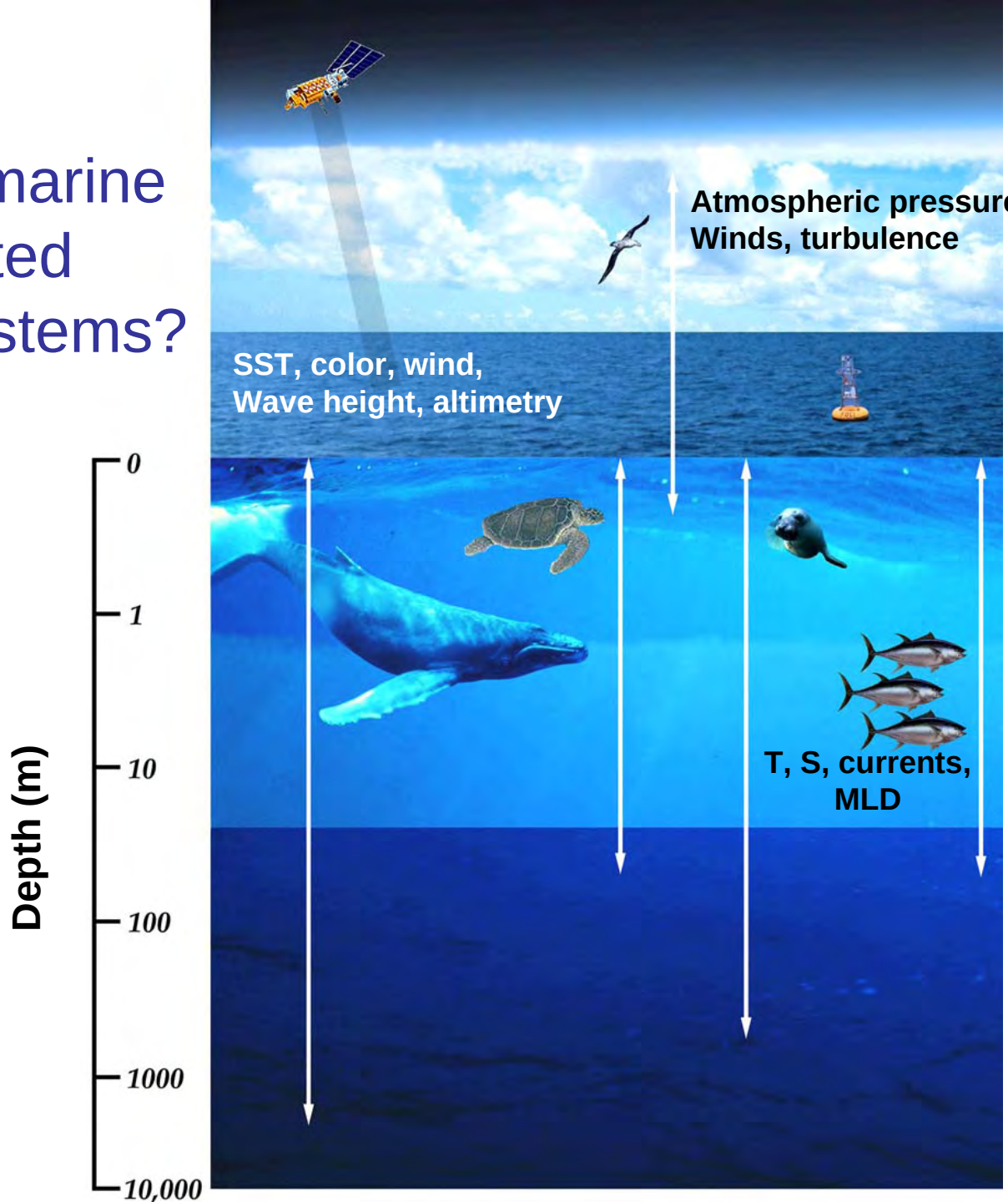
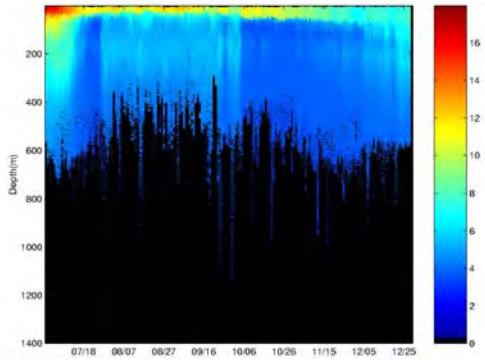
# What role for apex marine predators in integrated ocean observing systems?



# Biologging Contributions to Ocean Observations

- 3-D Ocean Structure
  - mixed layer, thermocline depth
  - event-scale variability



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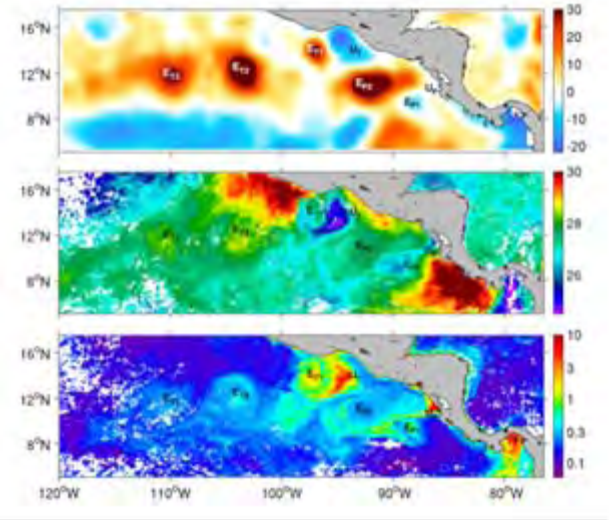

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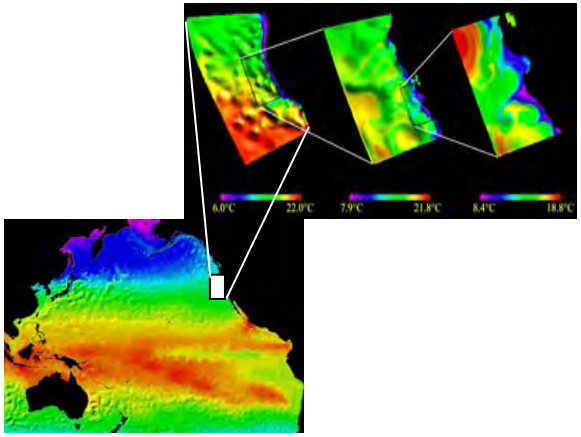
- Modeling
  - validation
  - data assimilation (NASA, NRL)
  - habitat models, prediction?



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CENSUS OF MARINE LIFE 2010

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# Global Tagging of Pelagic Predators

GTOPP

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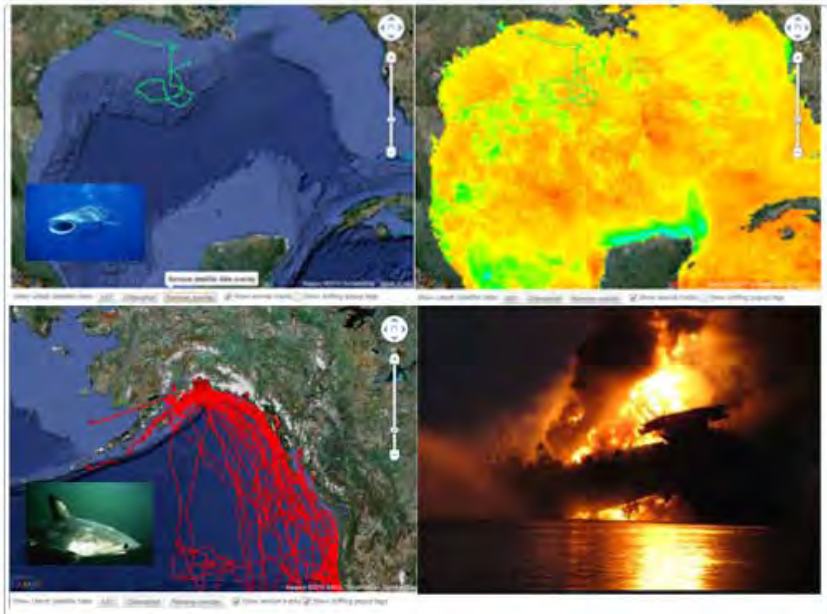
**Welcome to GTOPP!**

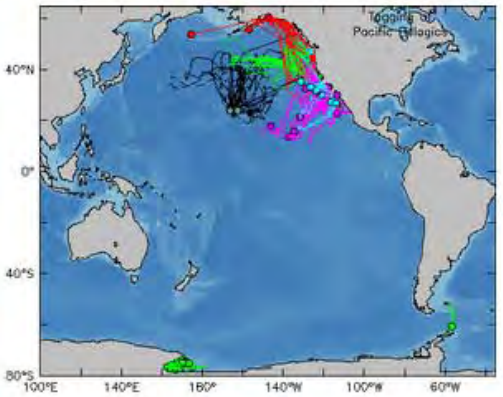
The Global Tagging of Pelagic Predators (GTOPP) program is an international, multidisciplinary collaboration among biologists, engineers, computer scientists and educators, which will allow users to view and interact with animal tracking data, as well as oceanographic datasets, to marine life observation. Read more about GTOPP...



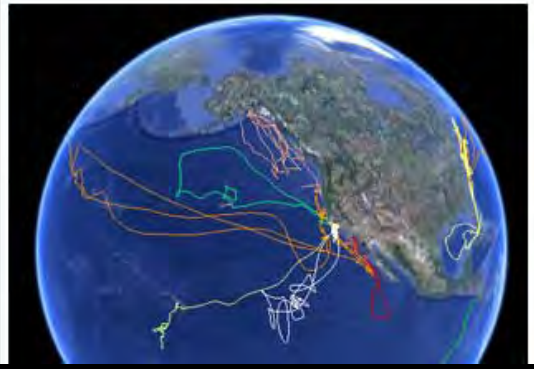
**Tracking Whale Sharks in the Gulf of Mexico**

**Real Time Data Server**

**Click Map To Access TOPP Real-Time Data**




**Interactive Map**



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Remote sensing data:

- Aviso/CNES (altimetry)
- NASA/GSFC (SeaWiFS ocean color )
- NOAA/NODC & JPL (SST)
- UCSD/SIO (Bathymetry)

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# Thank You