"Reconnecting with your Sanctuary"

Cetaceans

presented by
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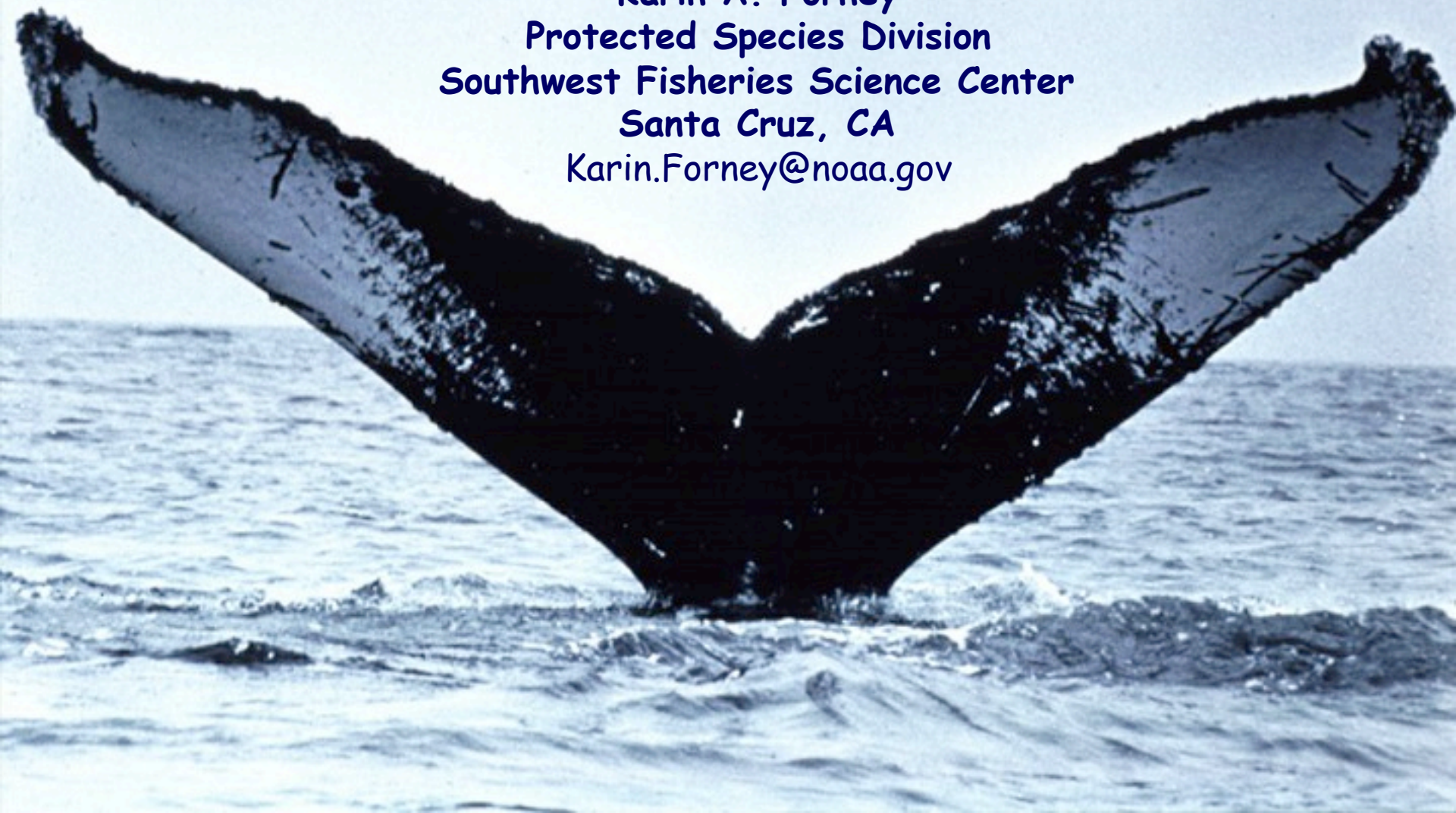
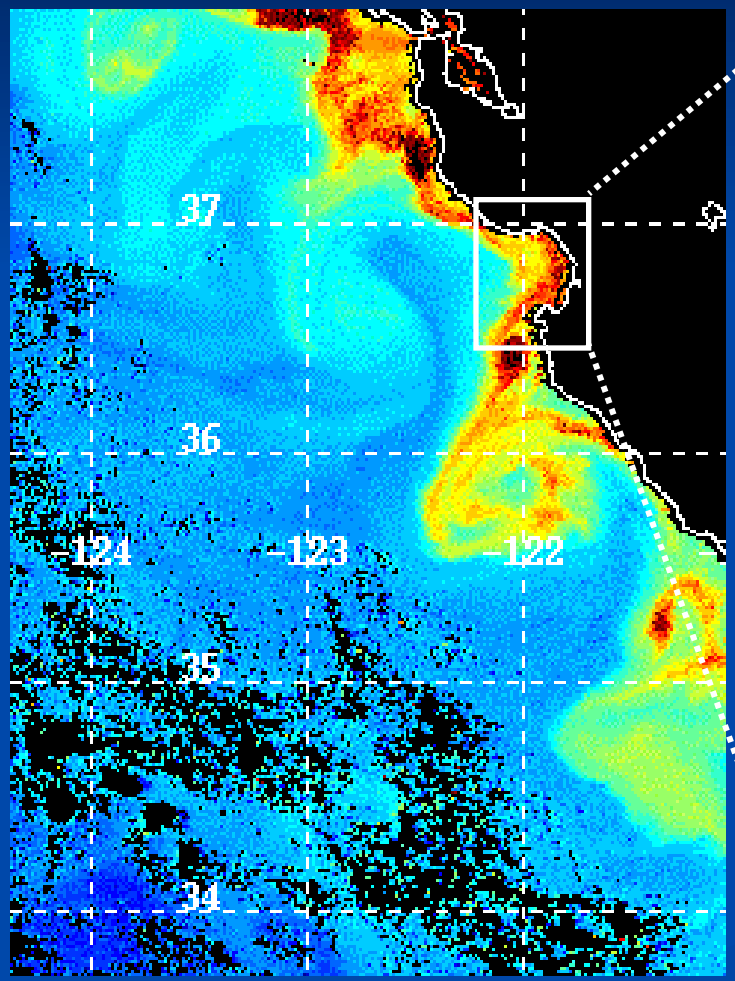


Dynamic Habitats

Local scale - Monterey Bay



Cetaceans in the MBNMS

- Who are they?
  - Migratory whales
  - Cold-temperate, wide-ranging
  - Warm-temperate, wide-ranging
  - Coastal populations
  - Deep ocean species
- How are they doing?
  - Past exploitation
  - Current population trends
  - Emerging issues
- What do we still need to learn?
  - Some ongoing studies in MBNMS

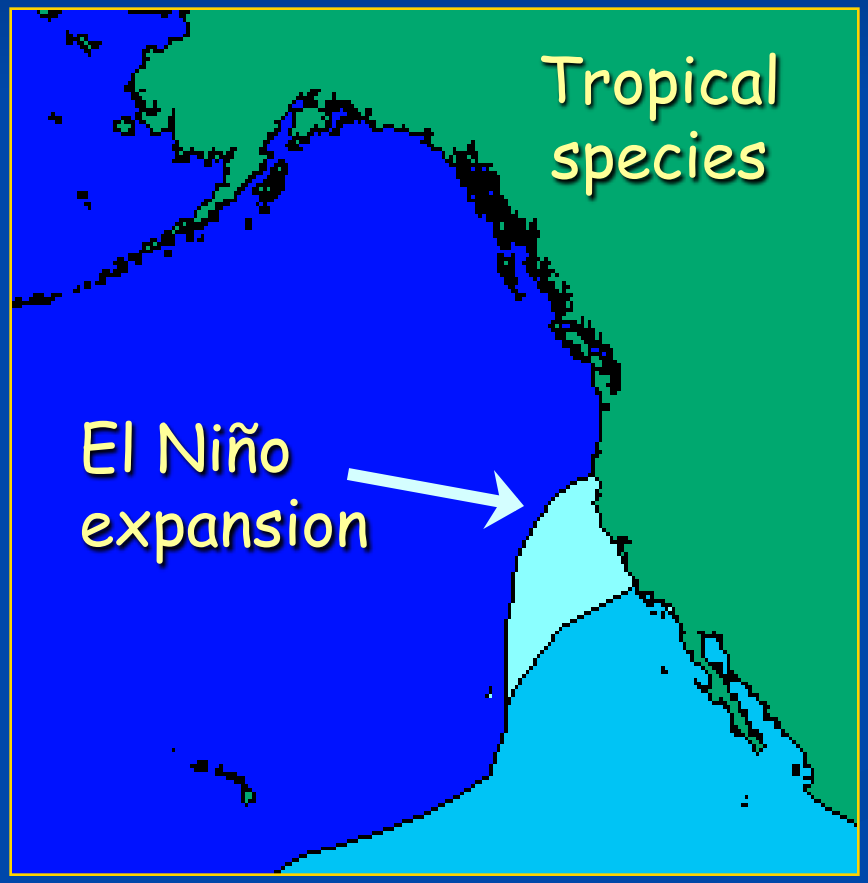
Great diversity of Cetaceans within the MBNMS

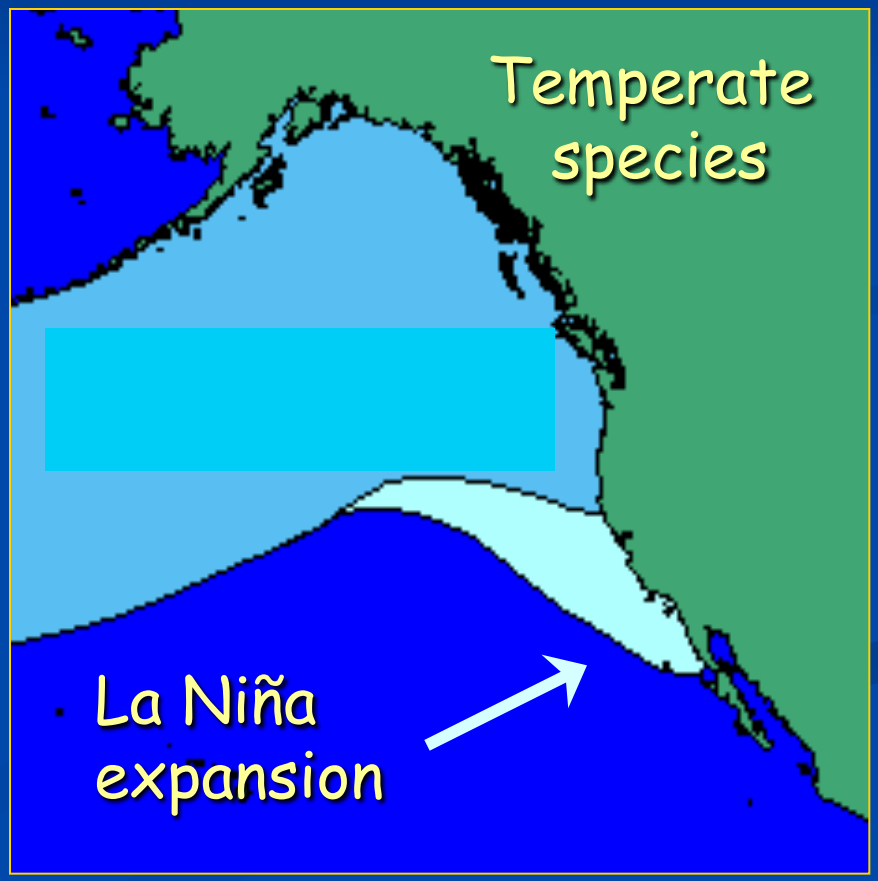
Taxonomic Group	# Species
Mysticetes (baleen whales)	6
Delphinids (dolphins)	8
Phocoenids (porpoises)	2
Ziphiids (beaked whales)	8
Physeterids (sperm whales)	3
TOTAL	**27**

Nearly 1/3 of all cetacean species worldwide

Common dolphins

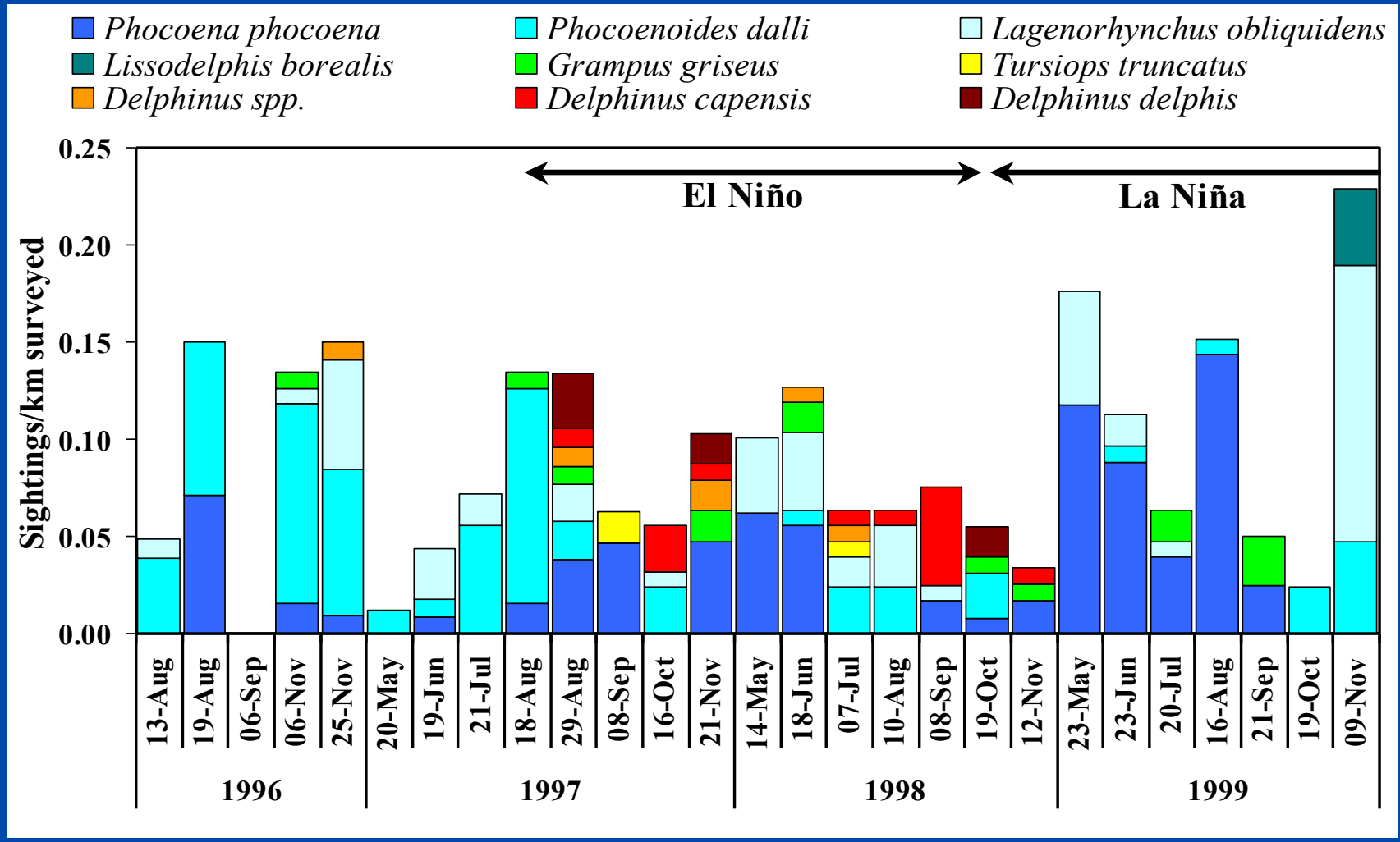
Dall's porpoise





Odontocete Assemblage in Monterey Bay

Benson et al. 2002 (Progress in Oceanography)



Life history traits

- Long-lived species (10 - 100+ yrs)
  - Low population growth rates
  - High adult survival
  - Late age at sexual maturity
  - Single offspring every 1-5 years
  - Long recovery times following impacts (e.g. hunting, bycatch)

- Highly social

- Adapted to dynamic environment
  - Highly mobile to exploit ephemeral prey resources

- Many species widely distributed, but often with discrete populations

Risks vary by species and region…

Incidental fishery bycatch

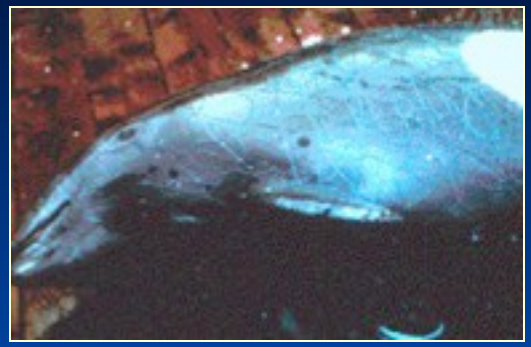
Ship strikes

Pollution and HABs

Illegal shooting

Naval/seismic exercises

Other…



How do we study and monitor cetacean populations?

Common methods of monitoring marine mammal populations

Shipboard line-transect surveys

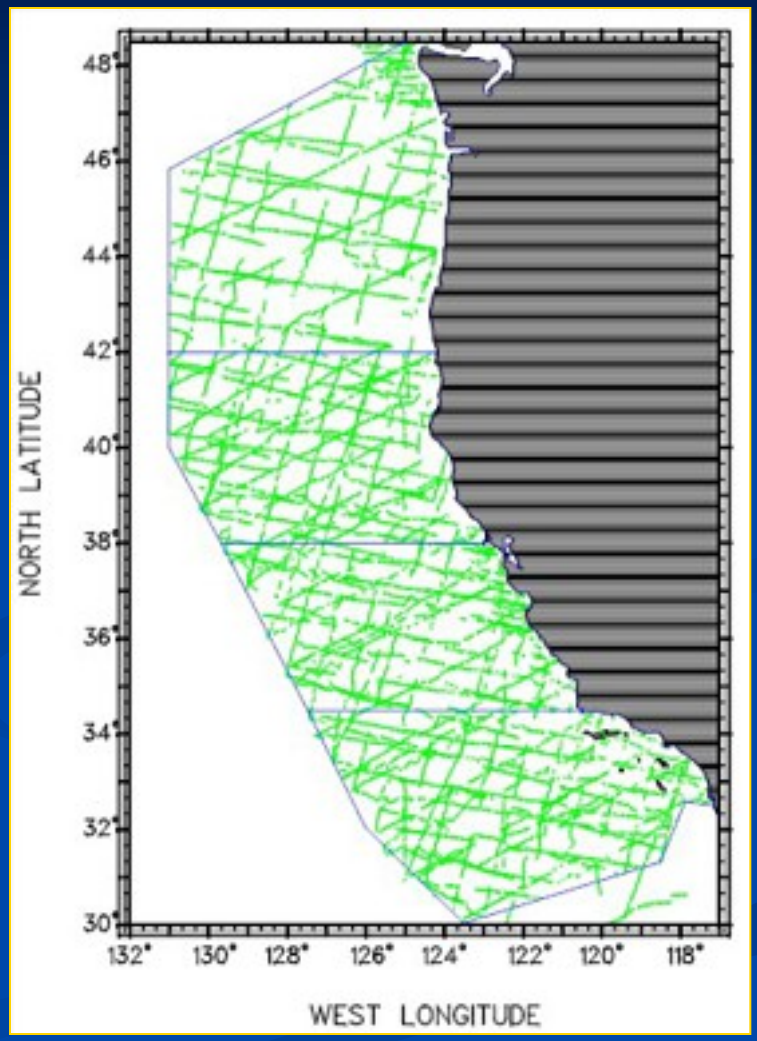
Partenavia

Aerial line-transect surveys and photography

Small boat based photo-identification studies

SWFSC West Coast Shipboard Surveys

Cetacean surveys,
summer & fall
1991, 1993, 1996,
2001, 2005, 2008

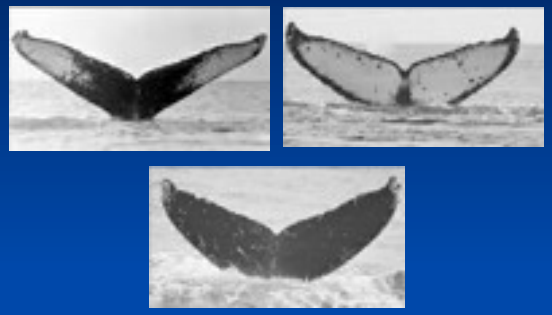


Systematic line-transect methods were used on all surveys.

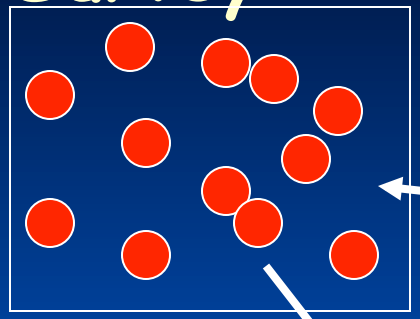
Use line-transect analyses to estimate abundance of all cetacean species

Completed transect lines 1991-2005

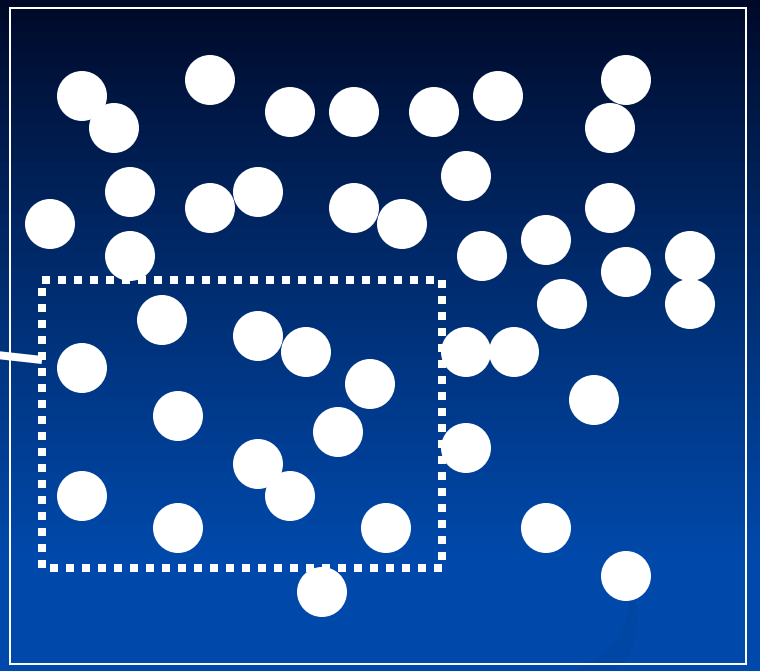
Mark Recapture



Survey 1:

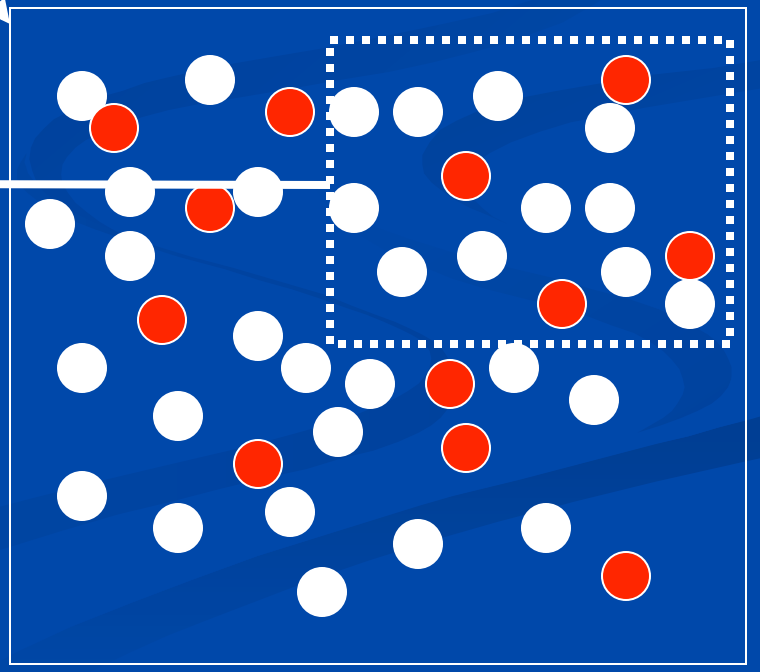


M = marked



$$N = \frac{M*C}{R}$$

Survey 2:



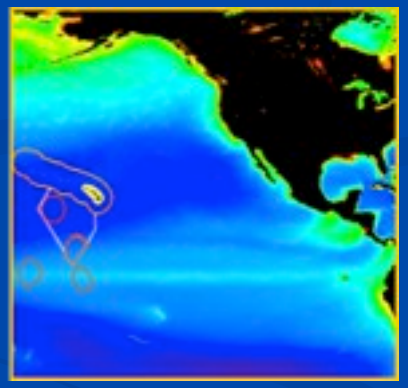
$$45 = \frac{12*15}{4}$$

C = captured

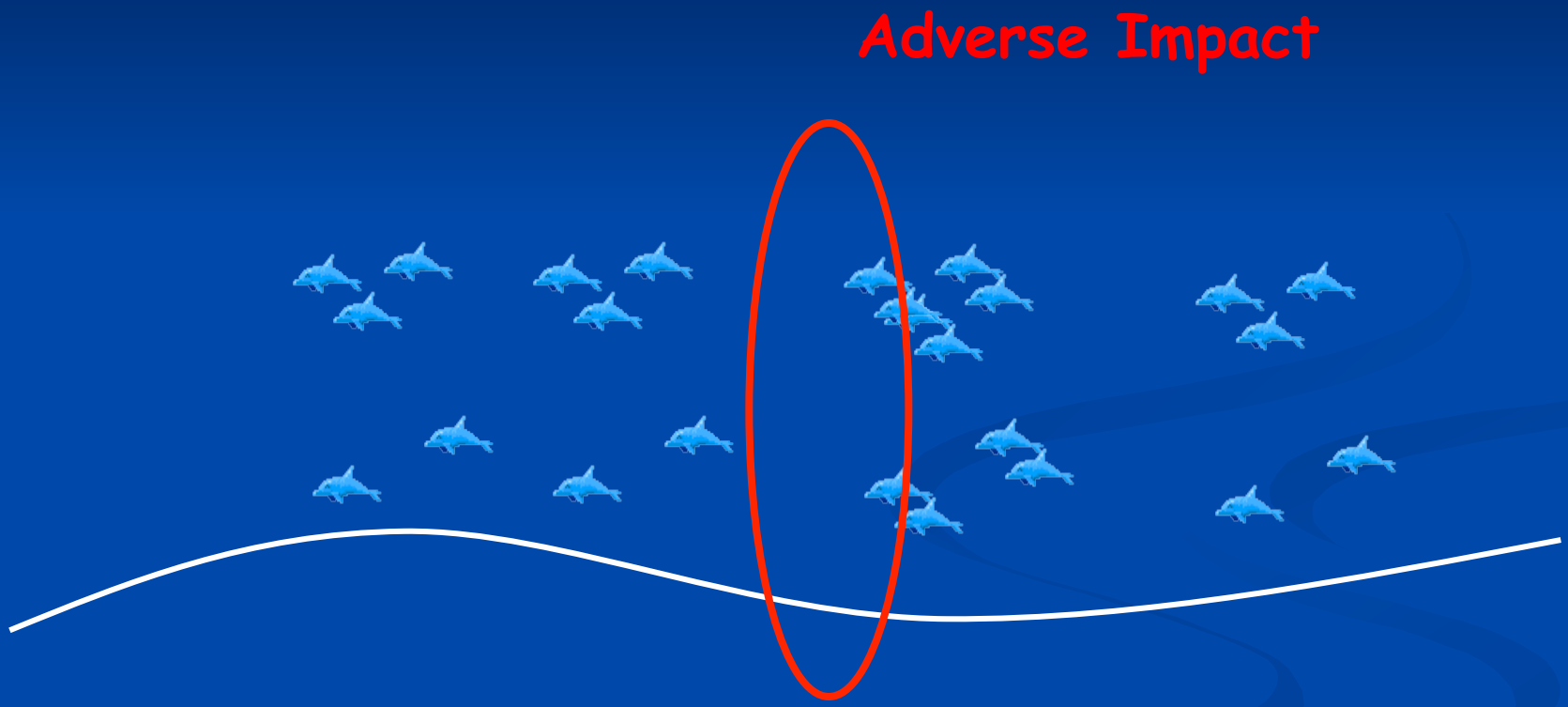
R = recaptured

Stock identification tools

- Distribution
- Movements (photo, tagging)
- Population trends
- Genetic differences
- Morphological differences
- Life history
- Contaminant loads
- Natural isotope ratios
- Parasite differences
- Habitat differences



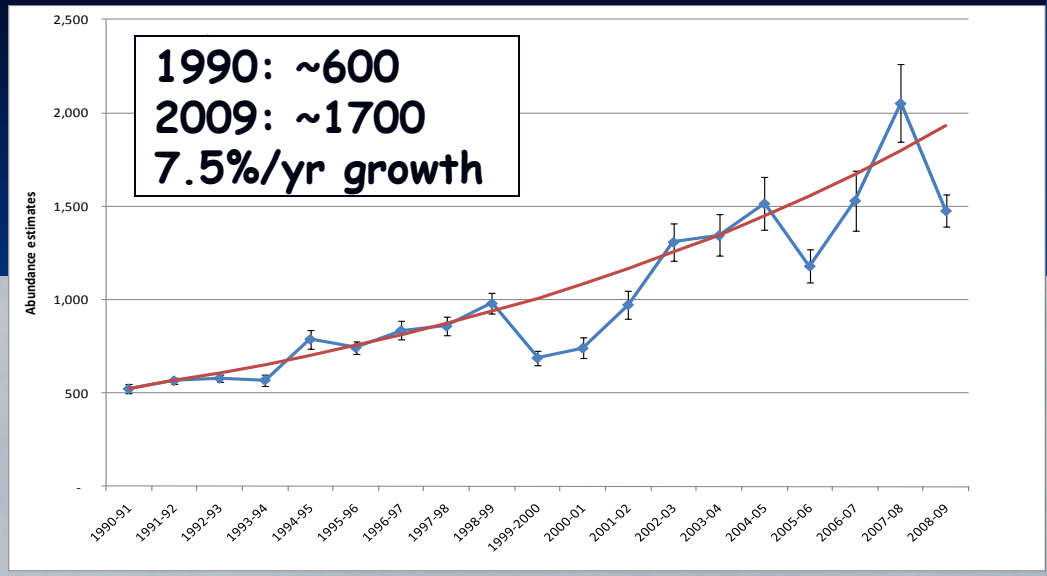
Importance of recognizing local populations



How are they doing?

Humpback Whale

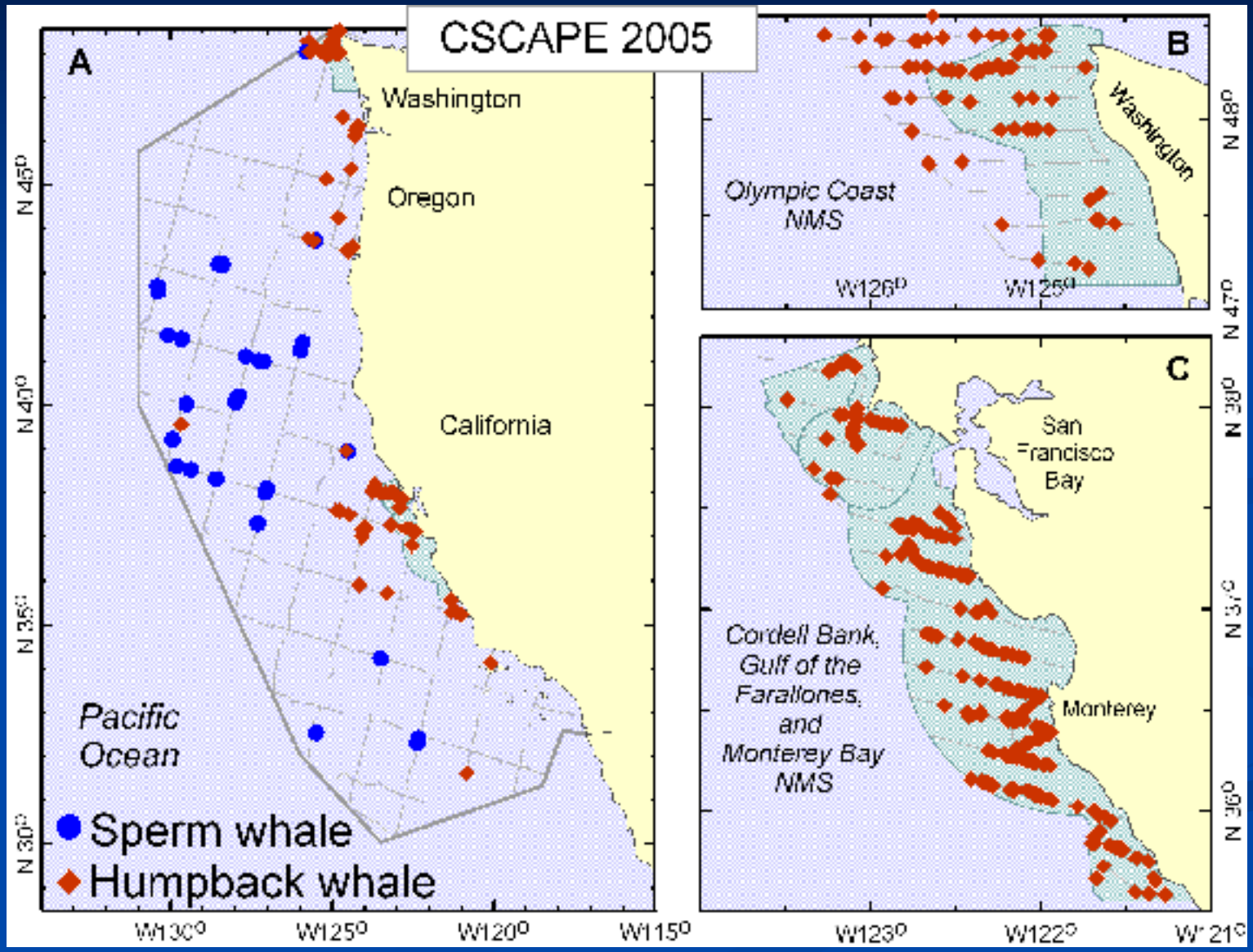
Calambokidis et al.



http://swfsc.nmfs.noaa.gov/PRD/

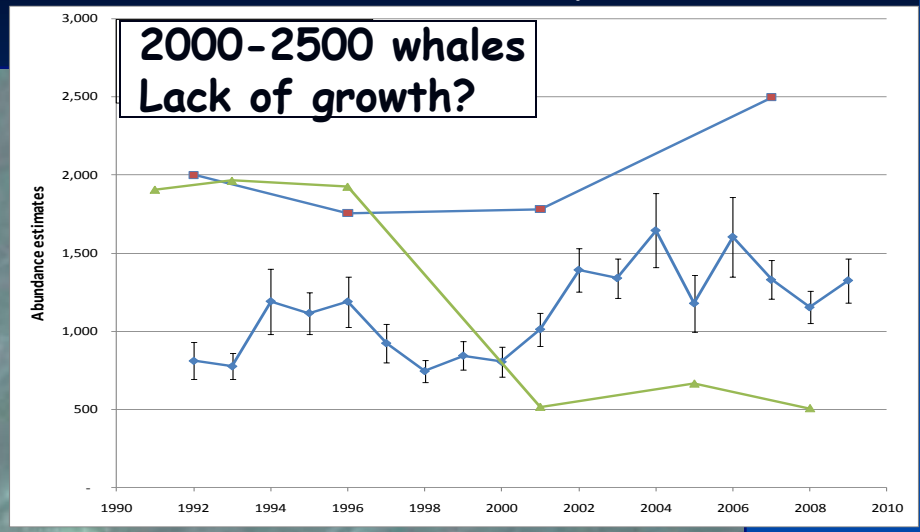
Cornelia Oedekoven

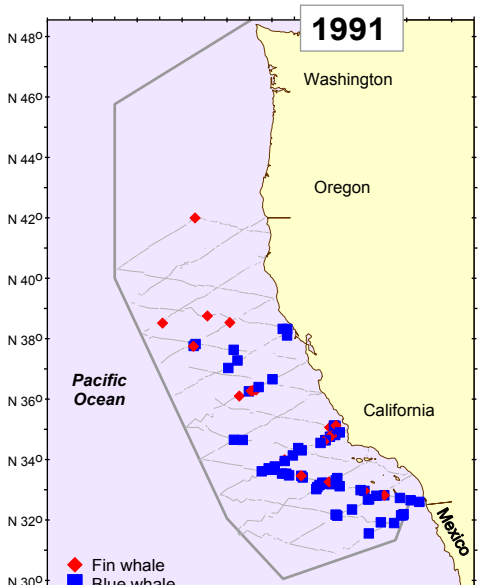
Humpback whales

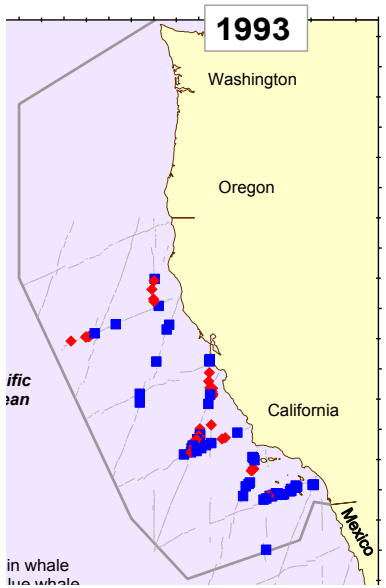


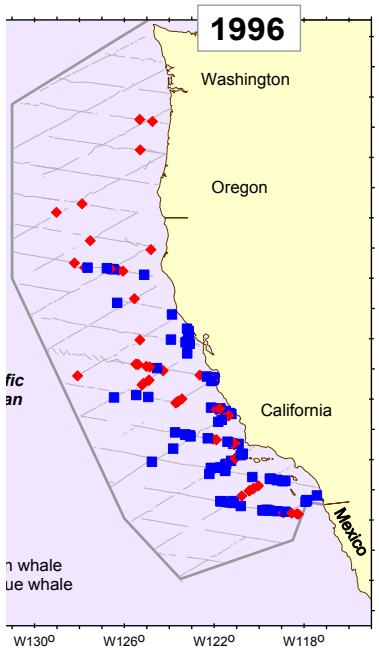
Blue Whale

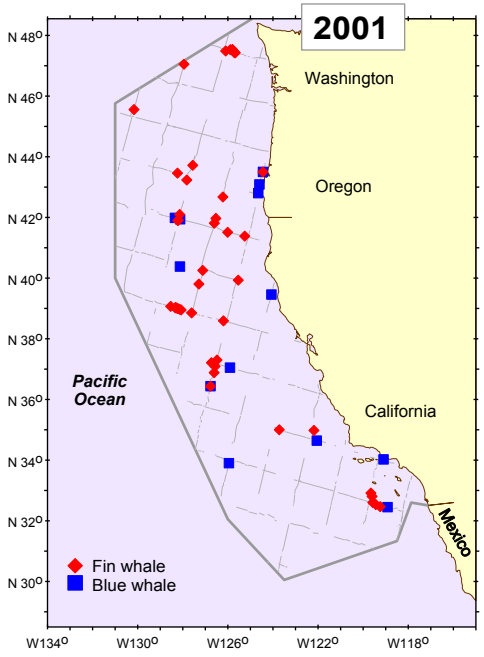
Calambokidis et al.

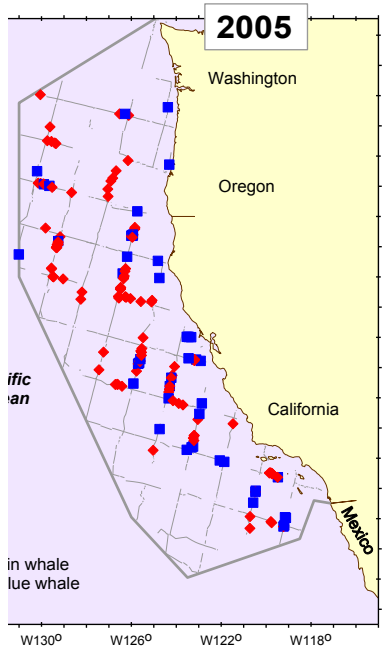












Blue and fin whales

Blue Whale

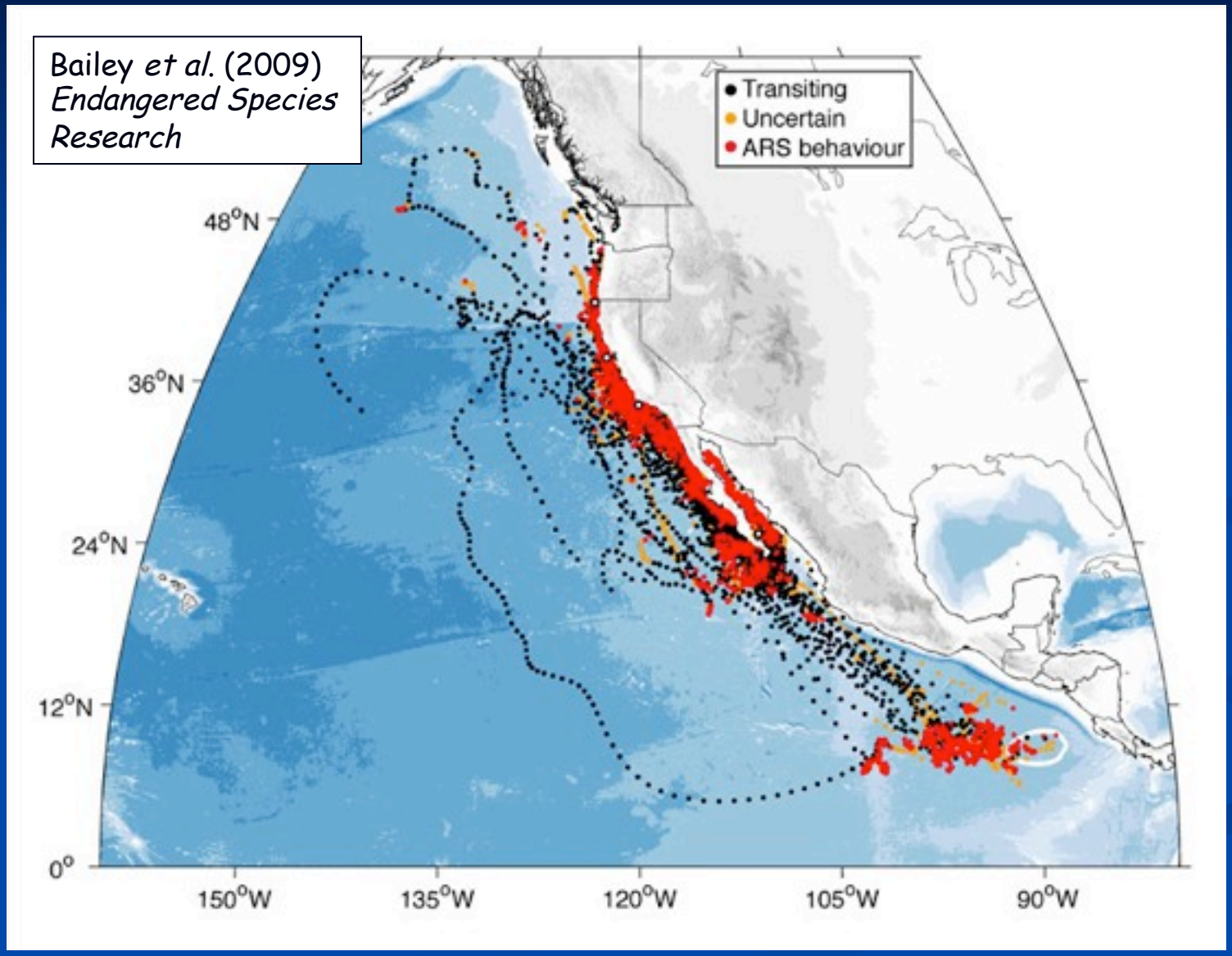
'From wind to whales'

Croll et al. 2005

1993-2007 Oregon State University tagging study: 92 tracks ≥ 7 days

Mate et al. 1999, Mate et al. 2007, Bailey et al. 2009

Blue whale behavior in the NE Pacific



Gray Whale

- Migrate through area each winter/spring en route between Alaska (feeding) and Baja California (breeding)
- ~18,000 whales; recovered from past whaling (delisted)

- 'Transient' killer whales prey on females with calves during northbound migration (Mar-May)

Killer Whale

Three distinct ecotypes off California:

'Transient' killer whales:

- Mammal-eaters
- Roam widely but most common in MBNMS when gray whales are here

'Resident' killer whales

- Salmon-eaters
- Summer in inland waterways of WA/ BC, move along outer coast during winter

'Offshore' killer whales

- Feed on squid and pelagic fishes
- Roam widely

Distinct based on

- Diet
- Vocal dialects
- Genetics
- Dorsal fin shape
- Lack of association

Dall's porpoise

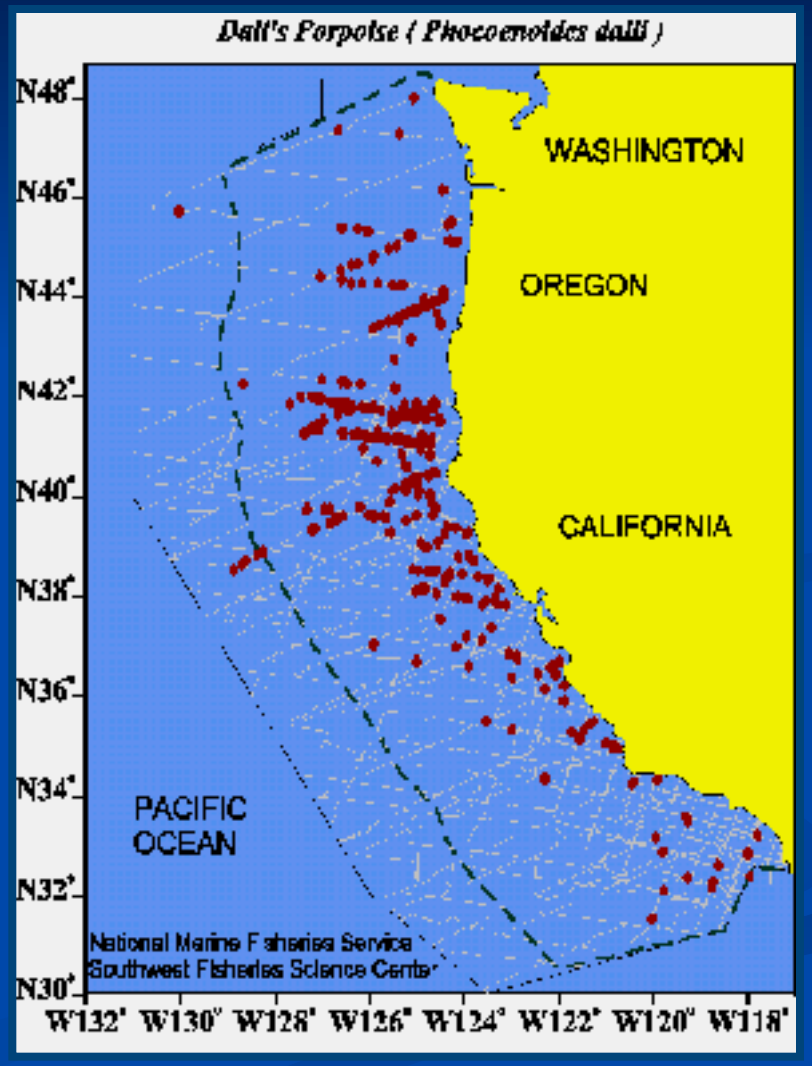
Pacific white-sided dolphin

Risso's dolphin

Northern right whale dolphin

Dall's porpoise, *Phocoenoides dalli*

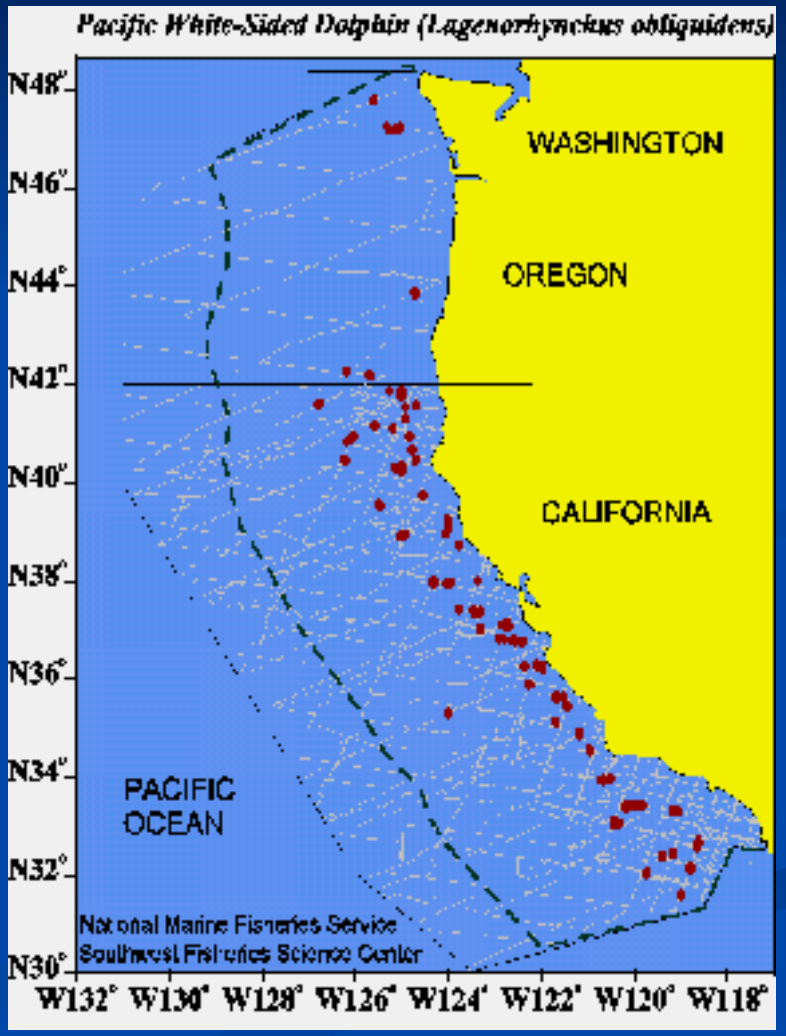
- Shelf, slope and sometimes) beyond
- Cooler water <17°C
- Upwelling-modified
- Seasonal movements
- Interannual variability
- Prey: mesopelagic fish, squid (varied)



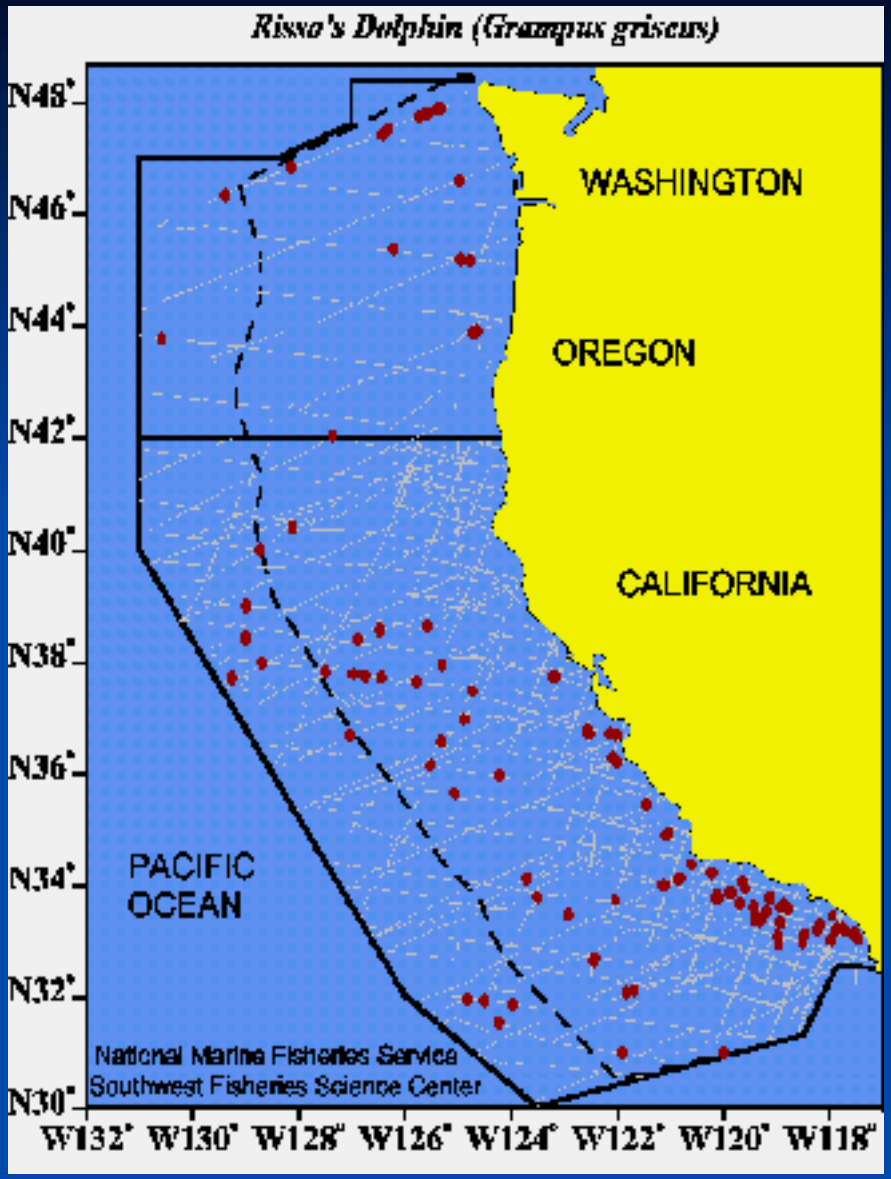
Source: NMFS, Southwest Fisheries Science Center

Pacific White-sided Dolphins, *Lagenorhynchus obliquidens*

- Shelf and slope
- Cooler water
- Seasonal movements
- Interannual variability
- Prey: squid, fish (varied)



Source: NMFS, Southwest Fisheries Science Center



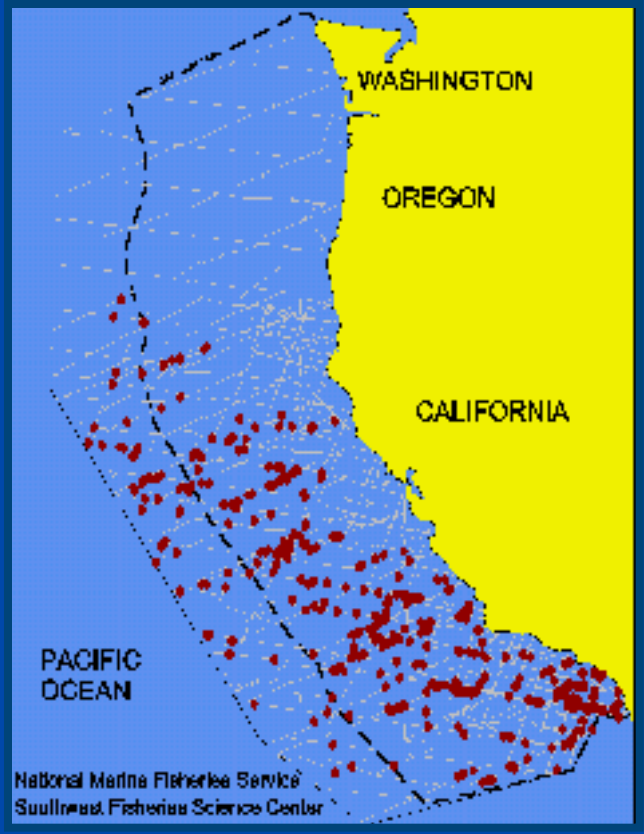
Source: NMFS, Southwest Fisheries Science Center

Risso's Dolphins
Grampus griseus

- Shelf, complex bathymetry, deep, *not slope?*
- Warmer waters
- Seasonal movements
- Interannual variability
- Prey: squid

Short-beaked common dolphin

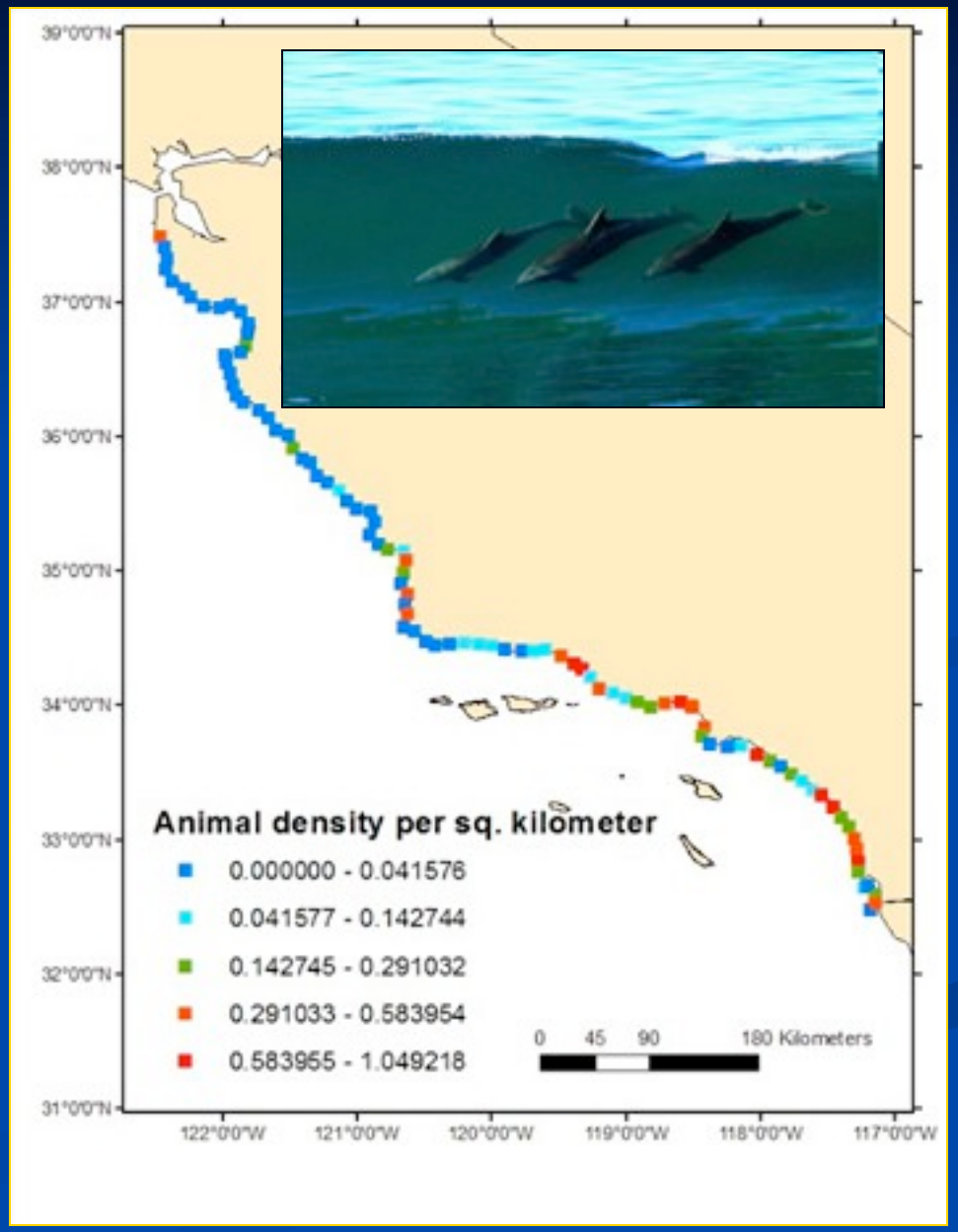
Long-beaked common dolphin



- Very abundant
- Seasonal movements
- Interannual distribution shifts
- Prey: fish, squid (varied)

Bottlenose dolphin

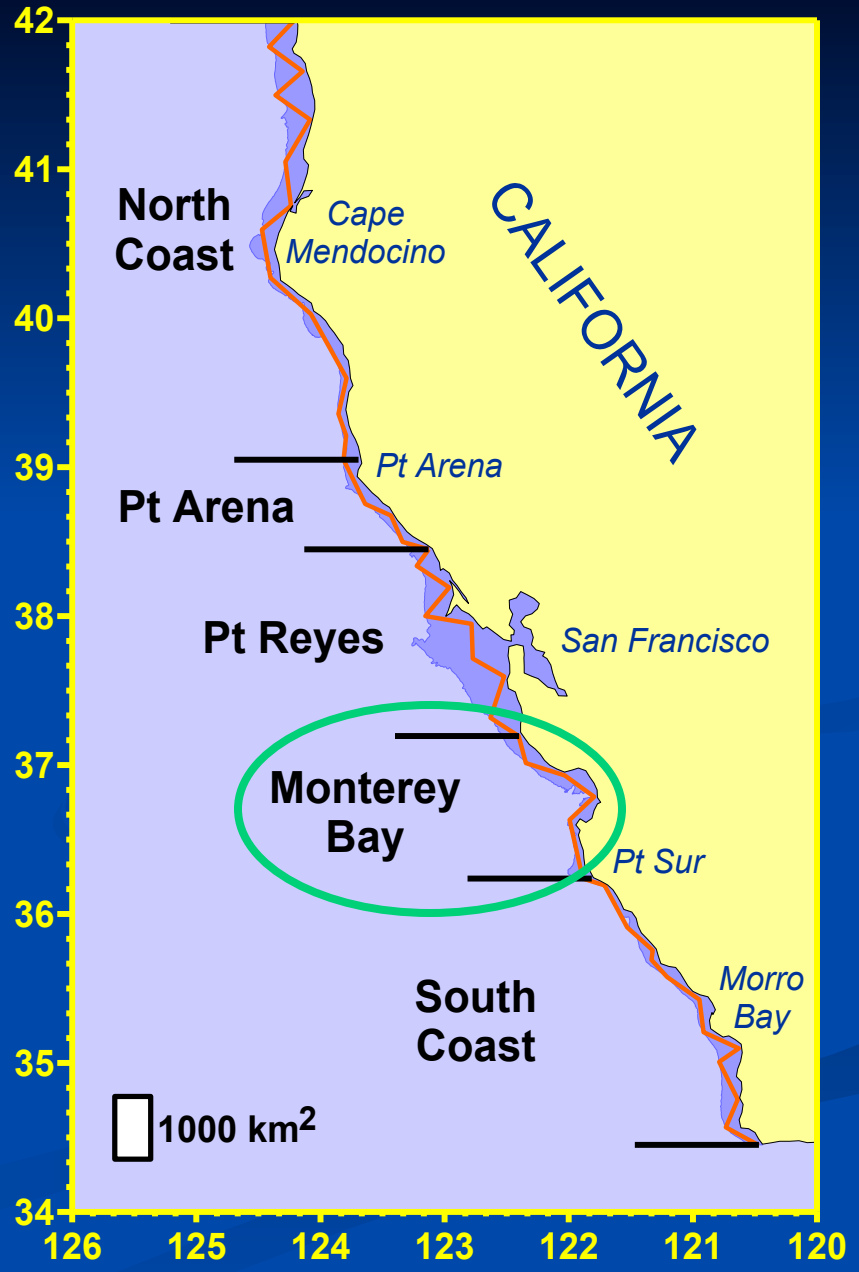
- Live within ~1km of shore
- Range from San Francisco to Ensenada, Mexico
- 1982 El Niño range expansion
- Recently involved in 'porpicide' in Monterey Bay



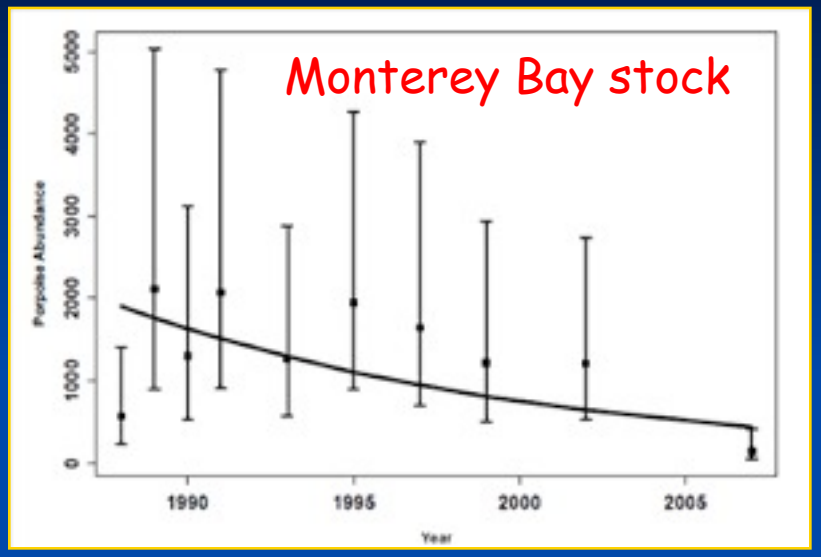
Harbor porpoise

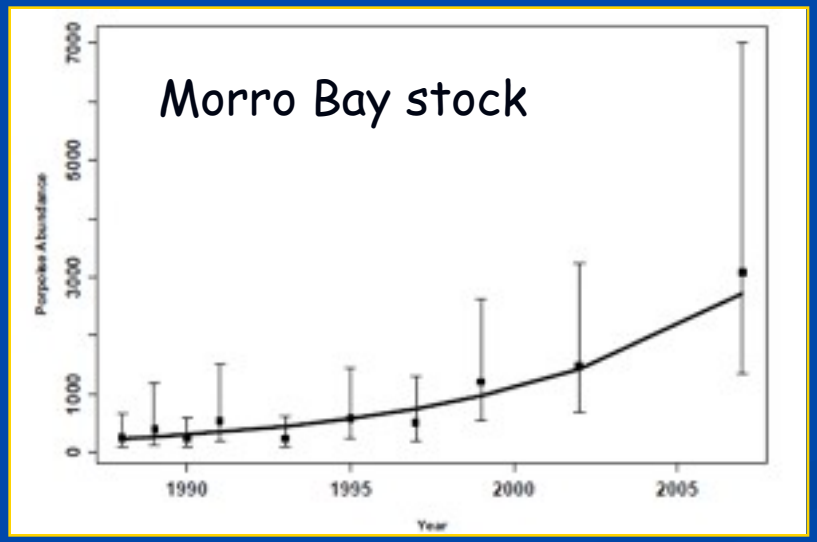
- Nearshore waters only
- Continuous range N of Pt Conception, but distinct, localized populations
- Prey: anchovy, herring, cusk eels, squid, misc.

→ Significant past impacts from gillnet bycatch



Harbor porpoise trends





Fine-scale surveys in Monterey Bay

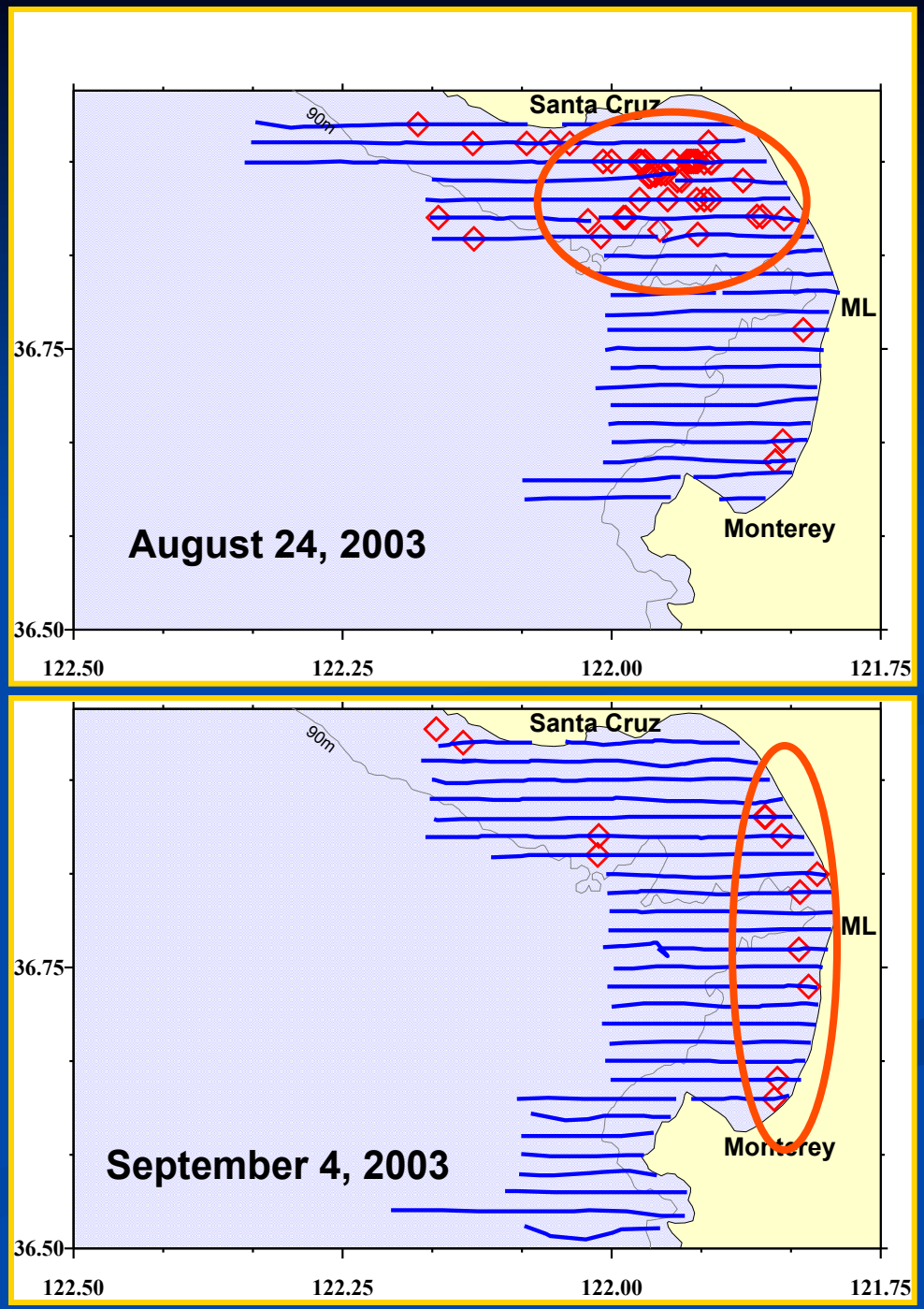
Shifts in porpoise distribution and patchiness…

…affect monitoring efforts

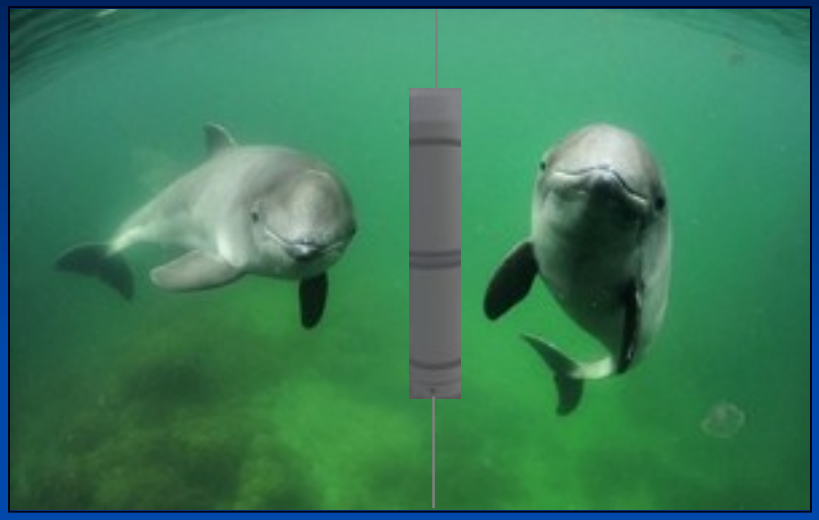
…relate to oceanography

Can we understand their movement patterns?

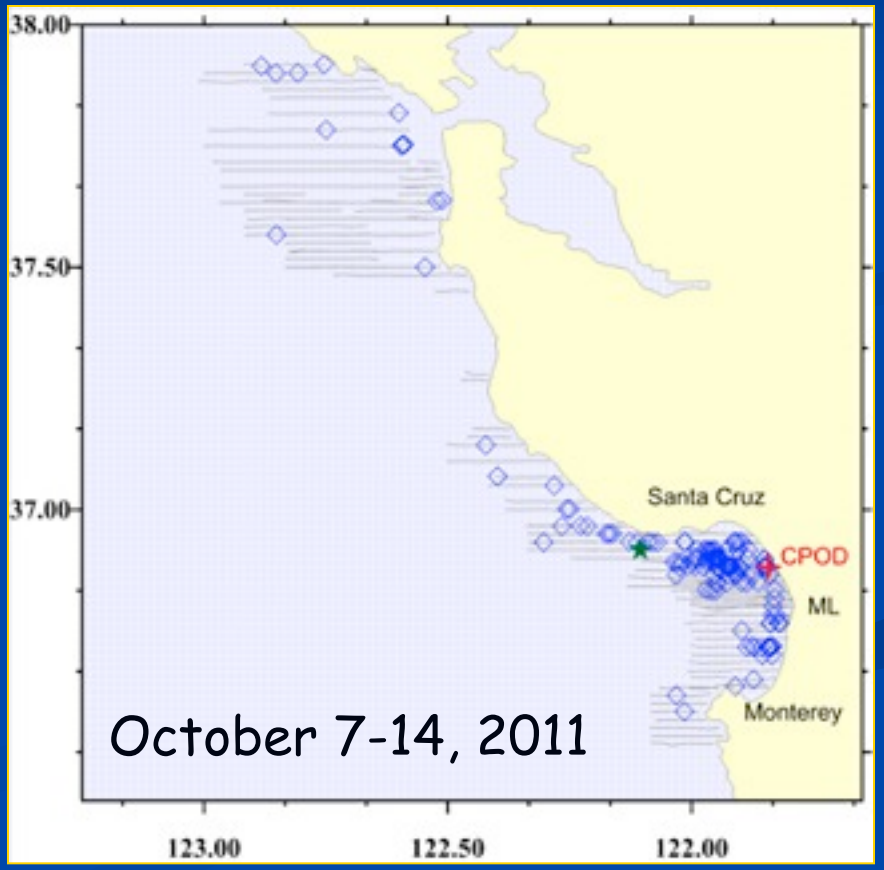
New study to monitor porpoises acoustically using CPOD



PILOT STUDY: Acoustic monitoring and habitat use of harbor porpoise in Monterey Bay



Collaboration between: Karin Forney, Scott Benson, Eiren Jacobson (NOAA) and Jim Harvey (MLML)



Coordinated study:

- CPOD (porpoise click detector) moored off Sunset State Beach
- Aerial surveys
- Cliff-top observations

Ultimate goals:

- Monitor abundance and trends
- Link movements with oceanography and climate

Beaked whales

- Difficult to observe and identify at sea
- New species still being described (e.g. *M. perrini*)
- Highly sensitive to sound
- Deaths caused by naval/ seismic activities worldwide

Cuvier's beaked whale

~ 6 species of *Mesoplodon*

Baird's beaked whale

Emerging Issues – Minimizing risk to cetaceans

Potential Threats:

Ship strikes

Fishing gear entanglements

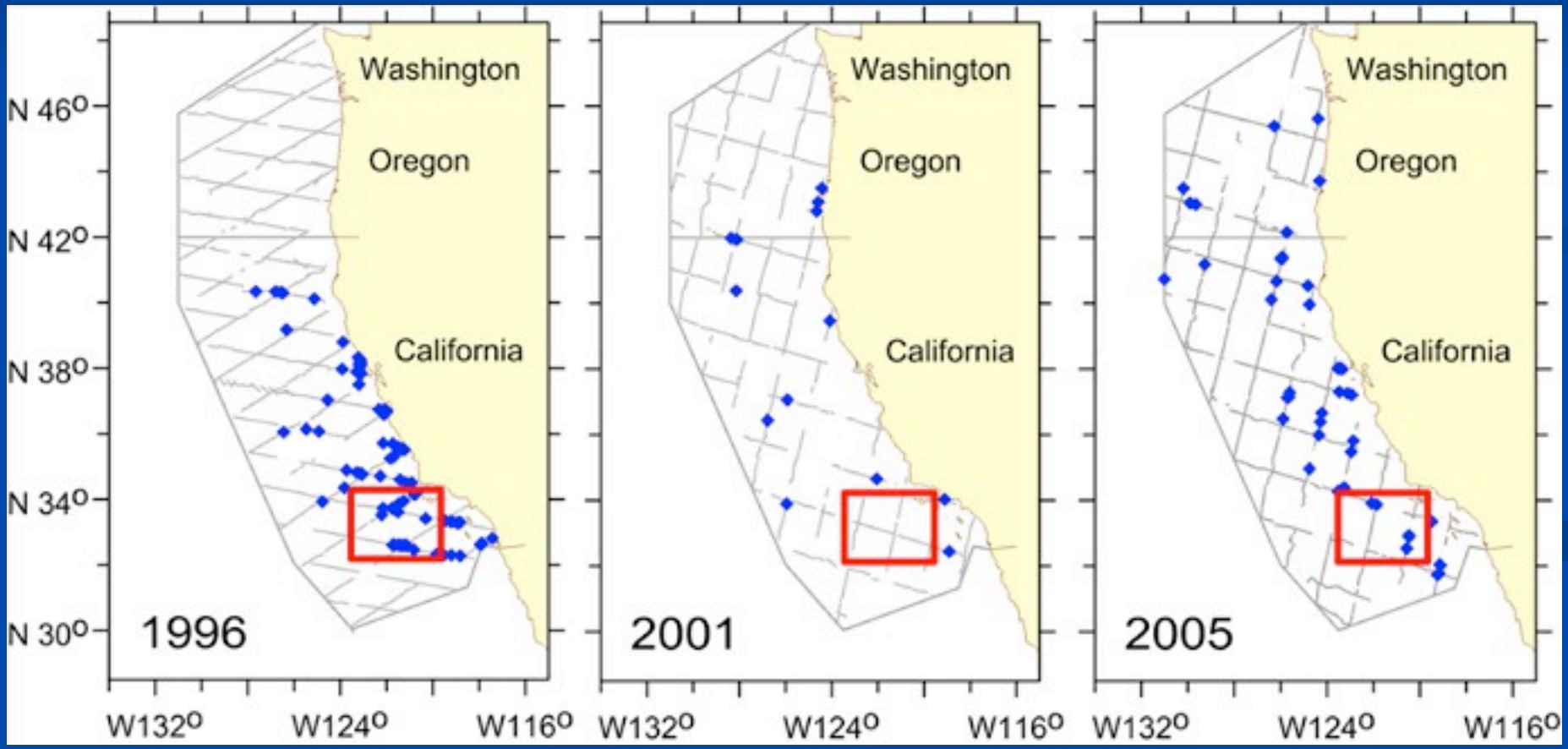
Naval/seismic activities

Coastal marine development

Cetacean distributions are dynamic

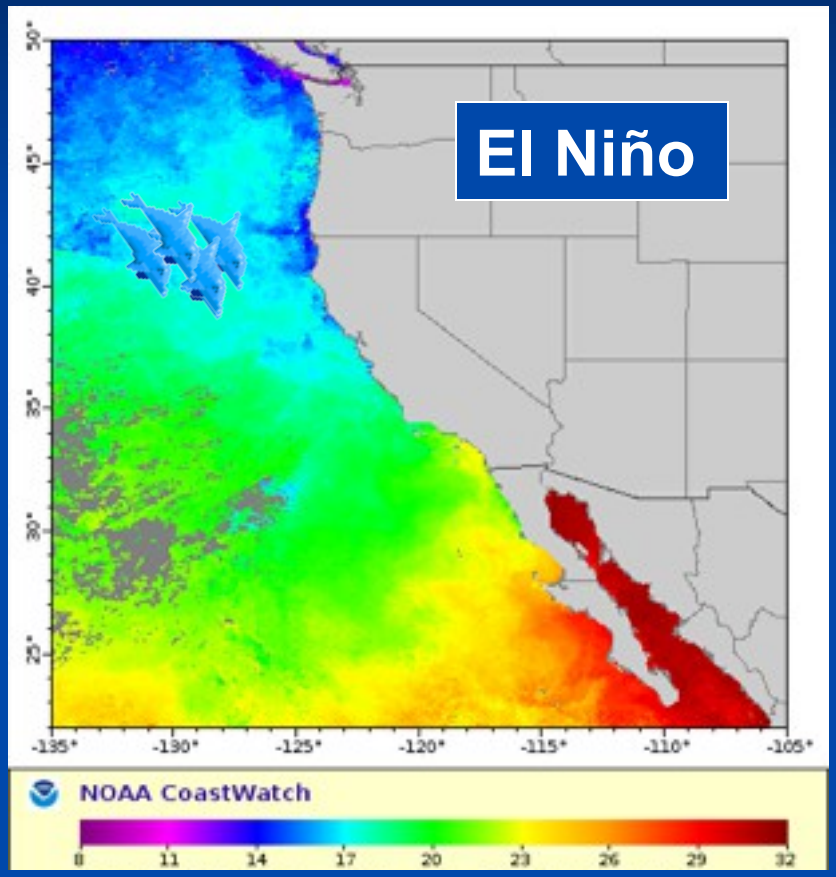
Blue whale

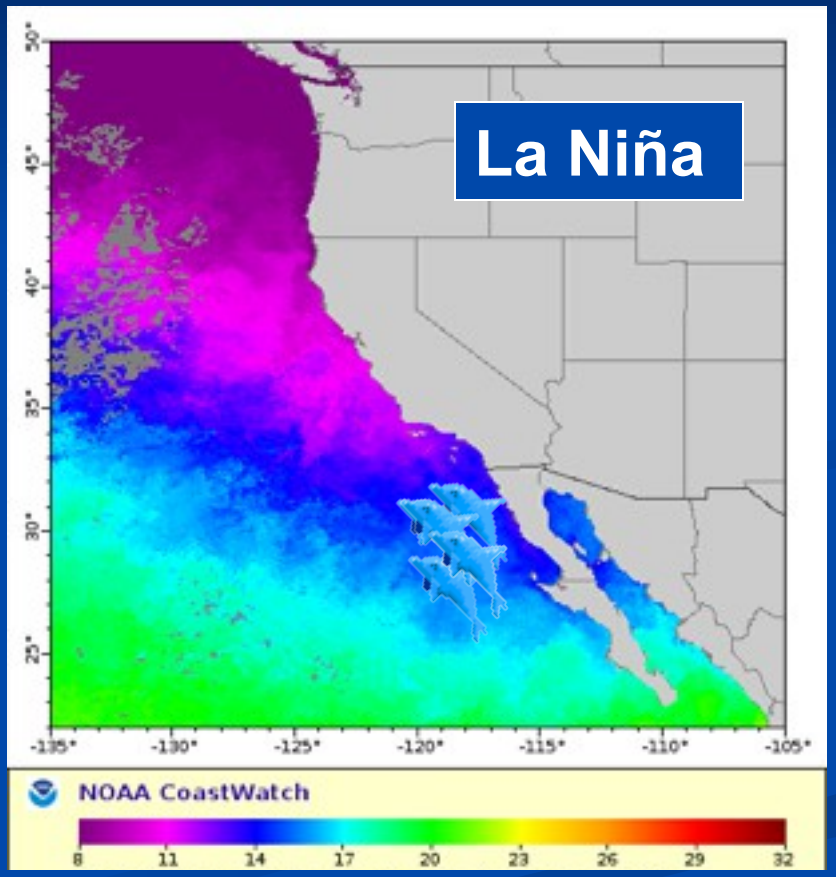
Blue whale



Environmental variability

Marine mammals are highly mobile; distributions change on seasonal, interannual and decadal time scales

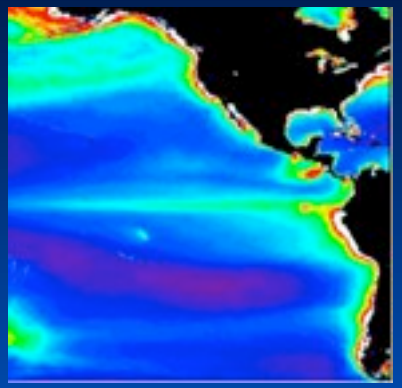




Challenge: How can we predict high/low density areas to minimize risks to cetaceans?

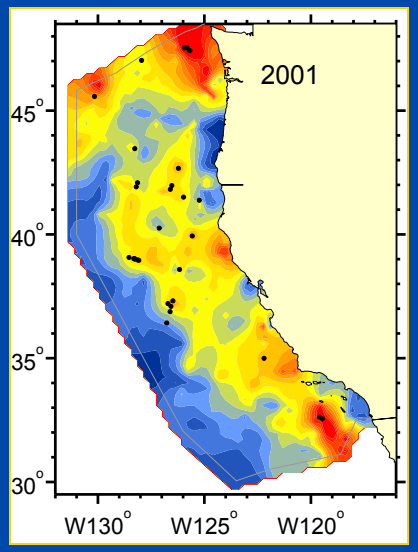
HABITAT-BASED DENSITY MODELS

Marine Mammal Survey Data

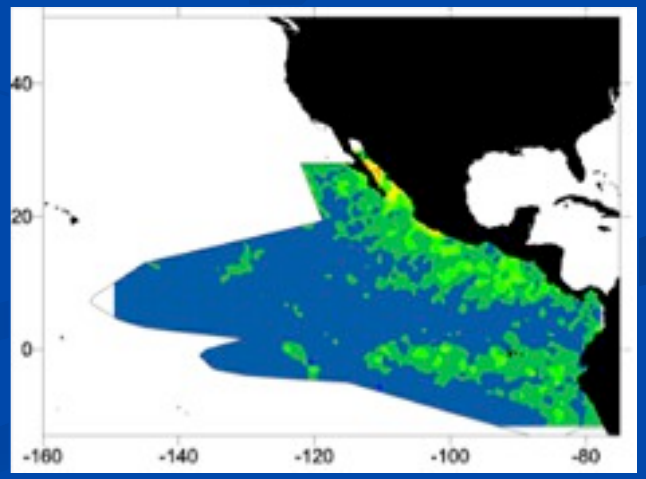


Habitat Data

Statistical models of marine mammal density relative to habitat variables



California Current Ecosystem

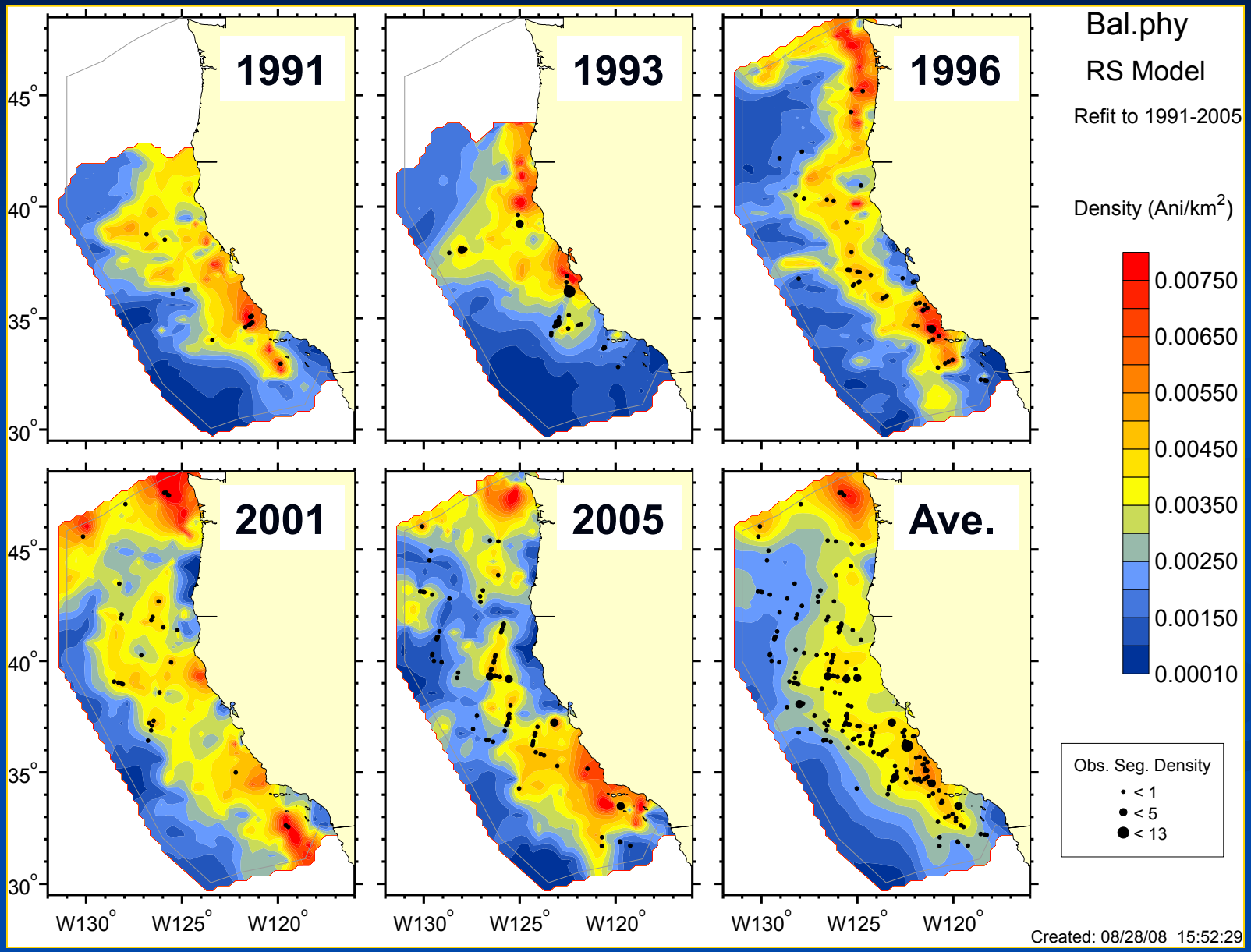


Eastern Tropical Pacific Ocean

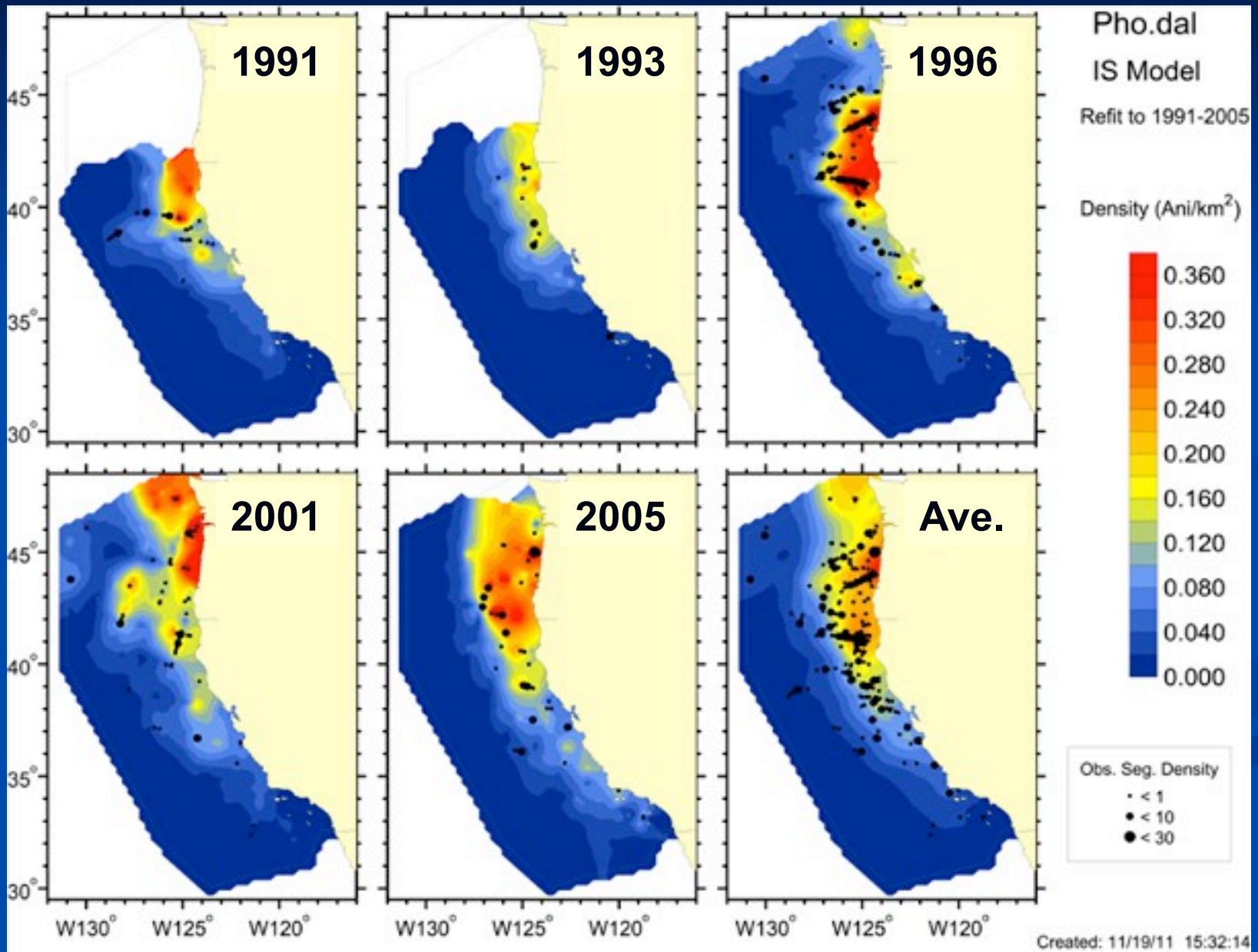
Ferguson et al. 2006, Barlow et al. 2009, Forney et al, in press

Fin whale densities

Key predictor variables
Depth, Slope, SST



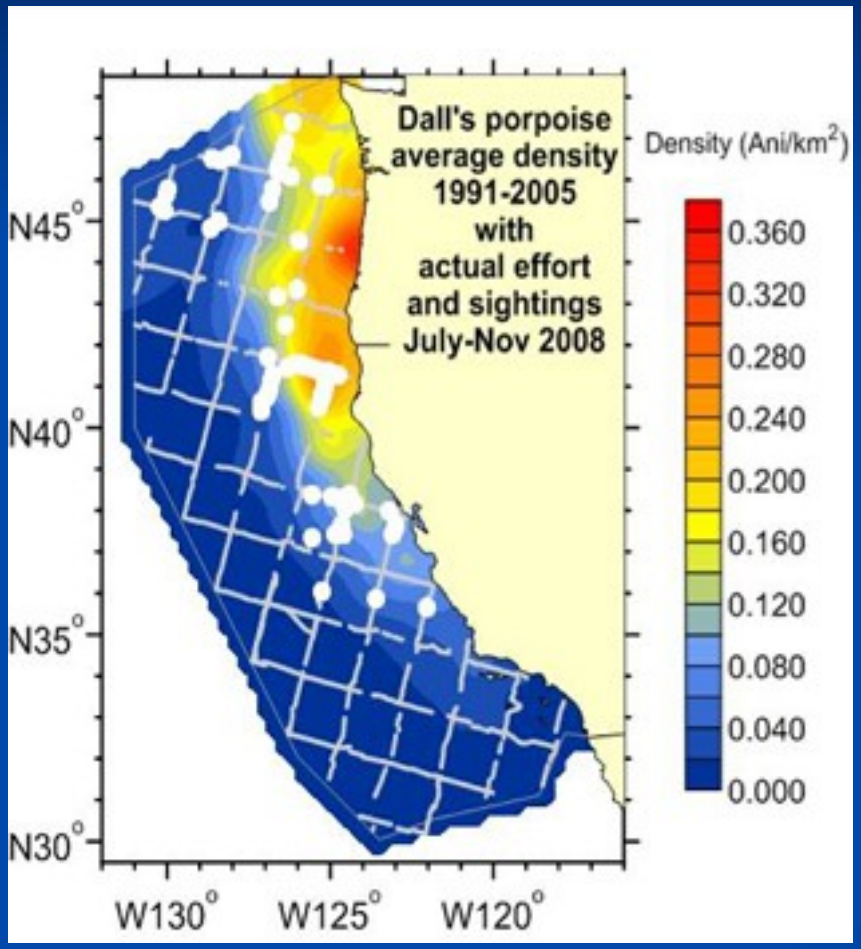
Dall's porpoise densities



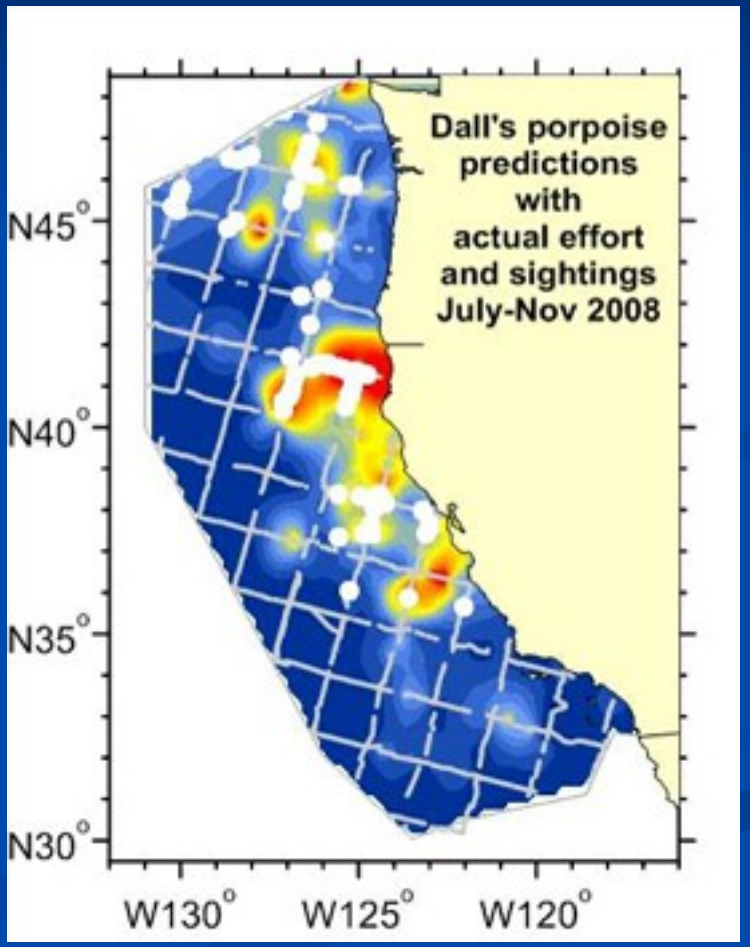
NOWCASTS - using satellite derived data

July – Nov 2008 Dall's porpoise sightings

1991-2005 Average model



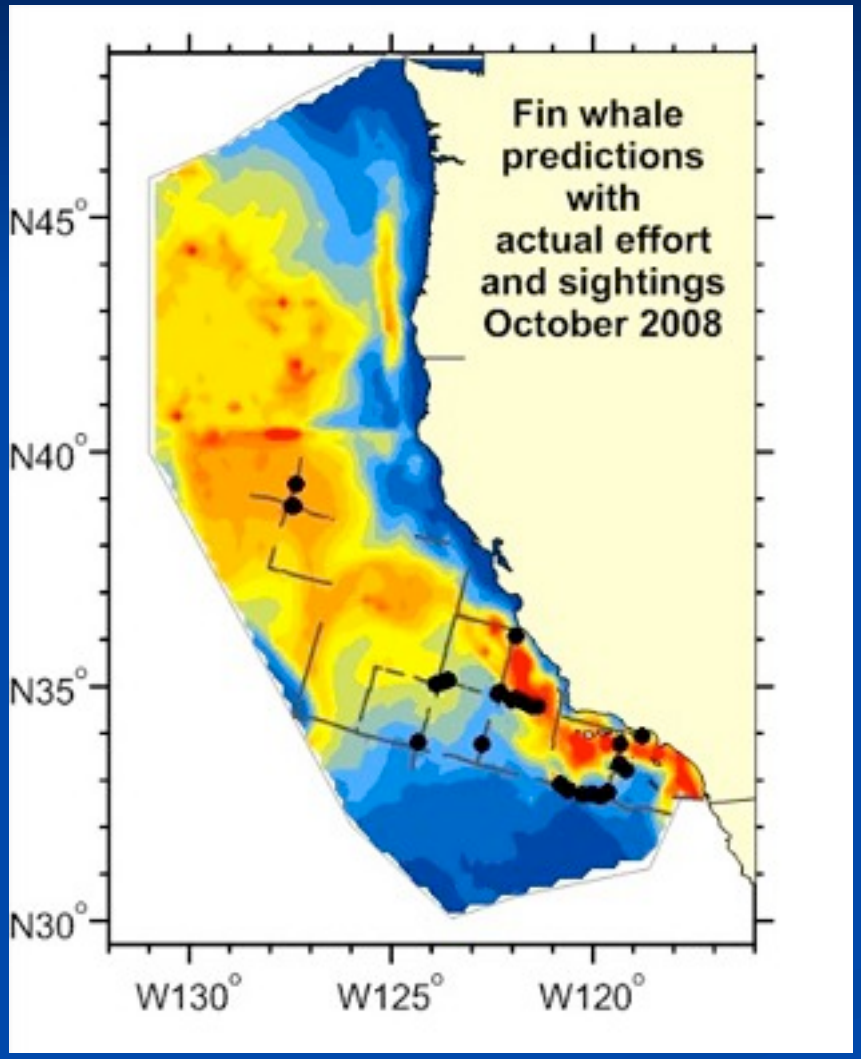
NOWCAST model

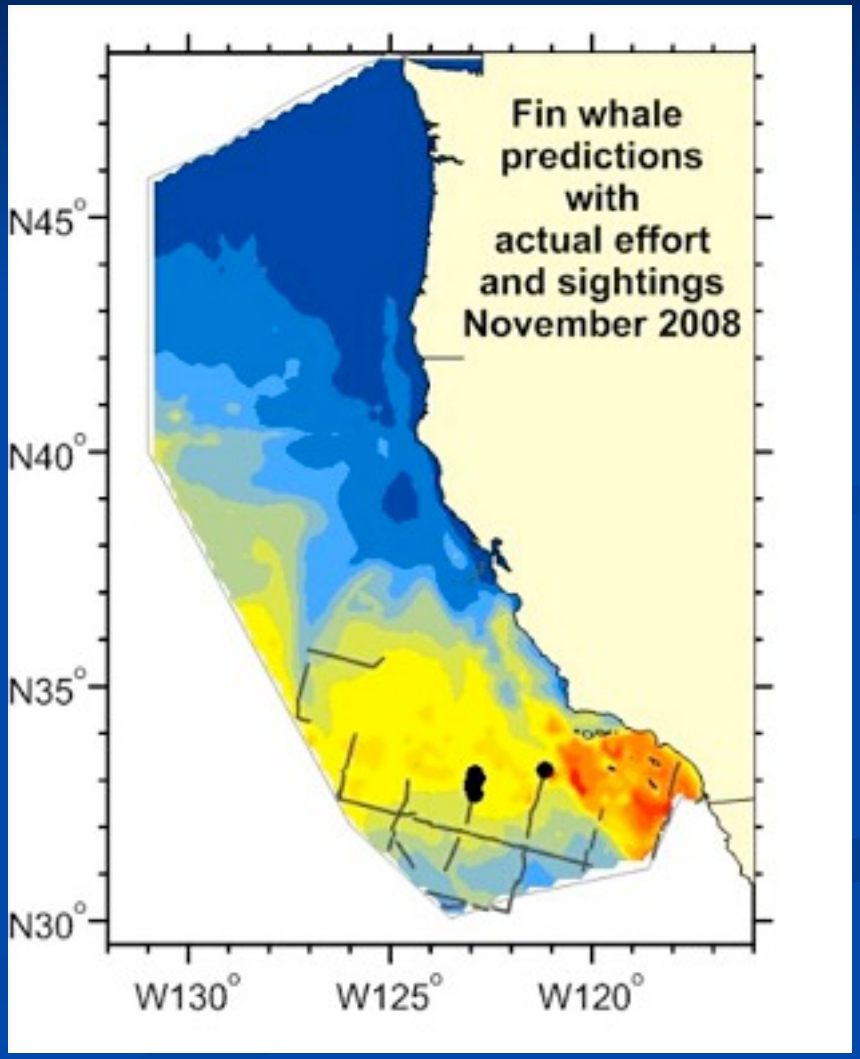


Becker, Forney, Foley, Barlow (in press, Endangered Species Research)

FORECASTS - using ocean circulation models

July 2008 predictions for Oct/Nov 2008





Conclusions

- We live in an amazing place!
- MBNMS waters are important habitat for many, diverse cetacean species
- Cetaceans, esp. coastal species, can be impacted by a variety of anthropogenic activities
- Sentinels of ocean health within the MBNMS

http://swfsc.nmfs.noaa.gov/PRD/

Thanks!
Any questions?