“Keeping a finger on the pulse of the Sanctuary”

Beach COMBERS uses marine birds & mammals as indicators of natural and human-related changes in the marine environment
Marine birds & mammals often inhabit top trophic positions in a food web, they can serve as indicators of health of the ecosystem.
Fish-eating seabirds and marine mammals are particularly vulnerable to toxins

- **Bioaccumulation:**
  - increase in concentration of a pollutant from the environment to the first organism in a food chain

- **Biomagnification:**
  - increase in concentration of a pollutant from one trophic level to the successive level
For biomagnification to occur, toxins must be:

- long-lived
- mobile
- soluble in fats
- biologically active

In mammals, we often test milk produced by females, since the milk has a lot of fat in it and because the very young are often more susceptible to damage from toxins.
Example 1: Coastal Pelagic Food Chain

Diatoms >> Anchovy >> Murre, Sea Lion, Pelican
Example II: Nearshore Benthic Food Chain

Diatoms $\rightarrow$ Emerita $\rightarrow$ Sea Otter, Surf Scoter
Food Web
Biomass

- Biomass is defined as the combined weight of all organisms within a trophic level.

- Each successive trophic level has less biomass than the one below it.

- Efficiency is ~10%, because:
  - Not everything gets eaten
  - Digestion is inefficient
  - Energy is lost as heat
Coastal Ocean Mammal/Bird Education & Research Surveys
COMBERS Objectives:

- Obtain baseline rates of deposition of beach cast marine birds and mammals
- Document causes of mortality
- Assess abundance of tarballs on beaches
- Assist in early detection of mortality events
- Build network of interacting citizens, scientists and resource managers
- Disseminate information to the public and educational institutions
Beach COMBERS

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Obtain baseline rates of deposition of beach cast marine birds and mammals

- Monthly surveys
- Standard effort (two observers)
- Pre-defined segment of beach (2-3 mi.)
- Record all dead marine birds, mammals, and turtles
In the Monterey Bay National Marine Sanctuary

- 11 Beaches- Monterey Bay
- 5 Cambria
- 3 more added in 2003!
- Builds on past surveys
- Other survey programs
6 years of deposition, 1997 - 2002
Document causes of mortality in the field:

• Human-caused
  – Entanglement in fishing gear
  – Oiling

• Natural
  – Starvation
  – Shark/predator attack (e.g. sharks, peregrine falcons)
Entanglement by fishing gear

- Affects fish-eating birds - caught on bill, wings or feet (e.g. cormorant, shearwater, murre, pelicans)
- Marine mammals often entangled around neck, whales get flukes caught in nets.
Oil exposure

- Affects diving birds
  - e.g. loons, grebes, murres, murrelets
- Sea otters most vulnerable mammals
Rarely is cause of death easy to determine

Elephant seal – shark bite
Early Detection of Mortality Events

- Gill net by-catch of murres, porpoise
- Domoic Acid (e.g. Sea lions, 1998)
- Starvation of young cohorts (e.g. spring grebe die-off 2000)
- Other diseases, pathogens (e.g. sea otter-acanacephalan peritonitis)
Building a network of citizens, scientists & resource managers

Scientists
Students

Moss Landing Marine Labs
CA State Universities (MLML)

SIMoN

Citizens
Scientists
Resource Managers

Monterey Bay National Marine Sanctuary (MBNMS)

California Dept. of Fish & Game (CDFG)

Oil Spill Response (OSPR)

Veterinary Care & Research Center (MWVCRC)

Resource Managers
Scientists

UCSC
UCD
Others
Conclusions

• Beach survey programs are important for understanding impacts to the marine ecosystem
• Upper trophic-level organisms are relatively easy to sample
• Long-term, systematic datasets are essential to interpret trends in mortality both natural and human-related
• Data integrity is important – “Garbage in = garbage out”
Acknowledgements

• Beach COMBERS support by a grant from MBNMS – Science Integrated Monitoring Network (SiMoN)
• Moss Landing Marine Laboratories, California State Universities
• California Department of Fish and Game, Marine Wildlife Veterinarian Care and Research Center
• Thanks to the past and current COMBER volunteers!!
Questions?