

## At a Glance

### What it is

- The Office of Naval Research (ONR) Marine Mammals and Biology program supports basic and applied research on a wide range of topics related to the effects of sound on marine life. This research enables the Navy to meet its operational training and testing objectives in an environmentally responsible and legal manner.

### How it works

- Program thrusts:
  - Monitoring and Detection
  - Integrated Ecosystems Research
    - Sensor and Tag Development
    - Effects of Sound on Marine Life
      - Behavioral Response Studies
      - Physiology/Stress
      - Population Level Effects of Sound Exposure
  - Models and Databases for Environmental Compliance

### What it will achieve

- ONR investments produce unprecedented new knowledge regarding the behaviors, hearing and physiology of marine mammals.
- ONR investments stimulate development and testing of new technologies (e.g., tags that attach to animals) that provide critical data on animal activities in the wild and critical information for environmental compliance and regulatory requirements.

### Point of Contact

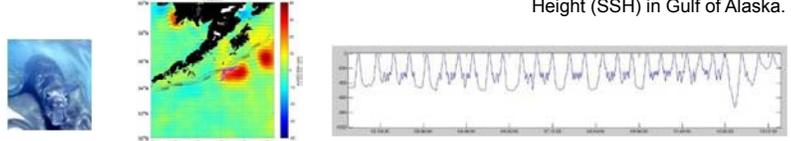
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### Integrated Ecosystems Research

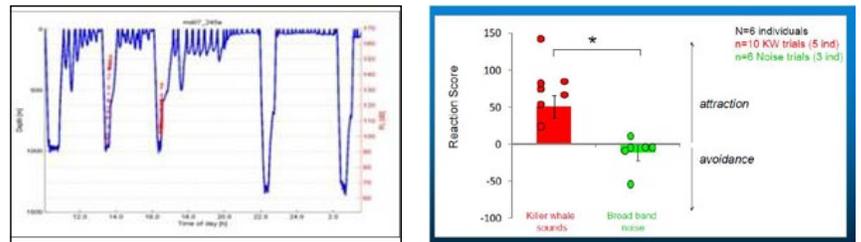
Increase our understanding of the basic behavior, patterns and causes of variability in distributions of marine mammals over space and time

Costa, Block, Bograd – TOPP Program; Northern Elephant seal satellite track (left) and dive profiles (below) in relation to eddy observed using Sea Surface Height (SSH) in Gulf of Alaska.



### Effects of Sound/Behavioral Response Studies

Provide critical data on the defining/characterizing behavioral effects of sound exposure on tagged whales and measure the exposure required to elicit responses that are safe but indicate potential for risk

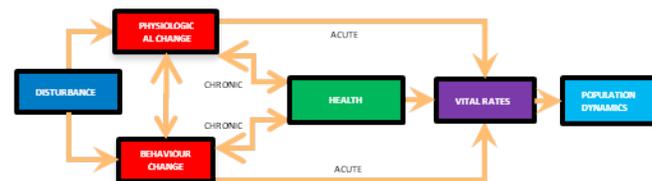


### Effects of Sound/Stress Physiology

Evaluate and characterize the relationship between the physiological stress response in marine mammals and disturbance to better understand the long-term effects of stress on individuals and populations in marine mammals

### Population Consequences of Acoustic Disturbance

Translate the National Research Council's 2005 conceptual model on population-level consequences of sound into formal, species-specific and ultimately transferable mathematical structures



Updated version of NRC conceptual model on population-level consequences of sound based on 2011 ONR Working Group.

### Research Challenges and Opportunities

- Developing and testing new technologies is critical to:
  - Documenting behavior and movements of animals in situ, both naturally and in response to sounds
  - Assessing hearing sensitivities of marine mammal species
  - Understanding physiology and gas kinetics in diving animals
- Understanding animal responses to natural and human-induced stresses is important to understanding population-level effects