

## Biological and Physical Characteristics of the North Pacific:

In this opening session of the meeting we were given an orientation to the biophysical processes that shape the North Pacific Ocean from physics to forage fish, including the unusual warm water event from 2014-2016 (aka "the Blob."). The presenters focused on the California Current and Gulf of Alaska ecosystems, including recorded impacts of the Blob on the biology at the base of the food web.

## Impacts of a Changing Ocean:

Building on the information presented in the morning, the first two presenters in this session focused on impacts to of a changing ocean. The first presentation provided information on harmful algal blooms in the region, highlighting the extreme domoic acid event in 2015. This bloom was the longest recorded (lasting for months) and included the highest values of domoic acid toxin ever detected in sardines. It led to the closure or postponed opening of several fisheries including the Dungeness crab fishery, one of the west coast's most profitable with an estimated loss of \$100M. The second presentation reviewed recent unusual marine mammal mortality events on the west coast and how those may or may not be tied to a changing ocean.

The final two presentations provided overviews of the status and trends of large whales and pinnipeds in the region, including observed variability in abundance or distribution possibly linked to a changing ocean.

## Emerging Tools & Technologies:

In the final session today we heard from scientists and one equipment manufacturer in the region about emerging tools and technologies and how they are being used in response to the challenge of understanding the impacts of a changing ocean on marine mammals and their conservation and management. We heard about new developments for several technologies and fields of study. We learned a great deal from presentations and discussion about 1) biologging devices carried by the animals themselves that can report on their location, behavior (e.g., diving and acoustic/vocalization patterns), environment (e.g., ocean temperature and oxygen levels), and even physiology (e.g., heart rate), 2) unmanned surface vessels surveying the feeding habitat of fur seals over many days and listening for right whales, 3) listening to the ocean for sounds made by marine mammals and what we are learning from them, and 4) advances in molecular biology and conservation from collection of a water sample and extraction of environmental DNA (eDNA).