Monitoring Baleen Whales with the Offshore Component of the Amphibious Array Facility

William S. D. Wilcock and Michelle Weirathmueller, University of Washington

Baleen whales are challenging to study – they are too big to be held in tanks, they spend most of their time underwater and each individual ranges over large distances that extend well offshore. Acoustic monitoring is one of the few effective tools available to study baleen whales. It can contribute to efforts to monitor the recovery of whale populations from the impacts of commercial whaling; biological studies of seasonal movements, habitat usage, and feeding and mating patterns; and applied work to assess and minimize the impact of anthropogenic activities on whale activities.

Blue and fin whales are the two largest whale species and they both vocalize at frequencies that are low enough to overlap the recording band of ocean bottom seismometers. Quite a few opportunistic studies have demonstrated the potential of ocean bottom seismometer (OBS) experiments to detect and track these species. However, the scientific impact of these studies to date has been limited by the small footprint and short duration of most OBS networks. Working in collaboration with researchers at the Oregon State University and with funding from the Office of Naval Research, we have initiated an effort to utilize the Cascadia Initiative OBS data to study blue and fin whales. We are working to develop and apply tools to estimate the spatial and temporal density of vocalizing whales using OBS data – a measurement that is of particular interest to the Navy because of their desire to quantify and minimize the impact of Navy activities on marine mammals. We are also taking advantage of the unprecedented spatial scale of the experiment to investigate seasonal migration patterns and the influence of environmental parameters on spatial and temporal distributions. By demonstrating that community OBS experiments provide unique opportunities for baleen whale studies, we hope that the marine mammal science community will be motivated to coordinate complementary studies such as visual surveys and whale tagging with future deployments of the Amphibious Array Facility (AAF) OBSs.

Although the plans for the future of the Amphibious Array Facility will be driven by scientific challenges in solid earth science, its use for whale studies can benefit marine seismology. Large whales capture the public's imagination but to date the impact of this public interest on marine seismology has been mostly negative because of efforts by poorly informed environmental advocacy groups to block academic seismic imaging experiments. Whale studies with the AAF represent an opportunity to engage the public in a positive way while gaining opportunities to explain the importance of seismic experiments in general and efforts to mitigate the impact of academic airgun experiments on marine mammals.

Since baleen whales are found throughout the world's oceans and tend to congregate near shore for part of their seasonal migratory cycle, the AAF can support whale studies wherever it is redeployed. However, the Gulf of Alaska would be a particularly intriguing location because it supports high levels of seasonal biological productivity that attract migrating whales in the summer. One enhancement to the AAF OBSs that would be particularly useful for baleen whale studies would be increased sampling rates. Some baleen whales calls extend to frequencies of several thousand Hertz but a sample rate of just 200 Hz would cover the full bandwidth of blue and fin whale calls and capture the lower frequency components of calls from most other species.