

Hawaiian Islands Humpback Whale National Marine Sanctuary

Monitoring Distribution and Abundance of Key Resources

Management Issue

The central North Pacific stock of humpback whales is generally considered to be recovering. The most recent estimates place the population at more than 20K (Calambokidis *et al*, 2008). In order to continue managing and conserving this key resource, the Hawaiian Islands Humpback Whale National Marine Sanctuary (Sanctuary) needs to be able to determine robust estimates of density and distribution of humpback whales throughout Sanctuary and nearby waters. Information will provide a measure of population health through relative abundance, and habitat usage, both spatially and temporally. Spatial information will help determine preferred habitats, site fidelity considerations, and usage patterns (e.g. high-use areas by mother and calves). As the humpback whales' presence in the Sanctuary is seasonal, temporal parameters, such as arrival, residency times, and peak usage, need to be considered. With the likely continued near-term increase in humpback whale population numbers, their spatial and temporal habitat usage will likely change, and will likely have greater bearing on the ecology and impact on other organisms, including humans (e.g. ship-strikes).

Description

Means of determining abundance and habitat usage of large whales has been done through use of acoustics; and visual-based aerial, shipboard, and shore-based monitoring. The number of singing humpback whales has been shown to correlated with the relative density of all whales through the season, therefore the level of song energy can be a reliable proxy for the numbers of whales using the area at any given time. The use of acoustics has the advantage of providing cost-effective information remotely and over large areas. Aerial surveillance provides greater area coverage as well, and also has been used to provide population estimates and distribution patterns for large whales (Mobely *et al*, 1999). Shipboard surveys typically cover less area, but have the advantage of greater detail (e.g. Photo-ID on humpback whales, demographics, associated behaviors). Shore-based surveys while limited in their reach have the advantage of not influencing the animals they are attempting to monitor. The different techniques can complement each other and provide much needed detail towards humpback whale abundance estimates and distribution patterns.



*Example of passive acoustic recording device (EAR).
Photo Credit: Hawai'i Institute of Marine Biology*

Questions and Information Needs

- Can acoustic monitoring of singing humpback whales (or simply song energy) be a reasonable proxy for the relative density of whales in a given location and seasonal use patterns in Hawaiian waters?
- Can that knowledge be used to help to determine when whale densities have reached certain thresholds at which potential management initiatives could be put into place (e.g. seasonal arrival, speed limits, vessel alerts)?
- Can cost-effective and safe aerial surveys be done to provide an update on population numbers and thereby trends, distribution and habitat use patterns?
- Can aerial and shipboard surveys ground truth acoustic monitoring?
- Can shipboard monitoring provide information on demographics, behaviors, and habitat usage to provide the necessary detail and complement the broader monitoring methods?
- Can shore-side monitoring provide useful trends on relative abundance and habitat usage, while accounting for its limitations?

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Scientific Approach and Actions

- Coordinate the deployment of passive acoustic recording devices at key locations throughout the Sanctuary
- Conduct periodic aerial surveys, using methodologies that are comparable to historical methods (for maximum benefit), and meet all safety requirements, throughout the Sanctuary and nearby waters.
- Investigate the feasibility of using UAVs towards aerial monitoring of humpback whale and other marine life resources.
- Conduct small vessel surveys periodically at several key locations in order gain additional fine scale data.
- Coordinate acoustic and visual-based techniques (aerial, ship-based, and shore-side) to provide complementary information and determine the best and most cost-effective means of monitoring the resource.
- Correlate acoustic “counts” with visual surveys in order to calibrate the relationship between the number of singing whales and the overall density of whales.
- Opportunistically record levels of anthropogenic sound at locations throughout the Sanctuary to determine impact on acoustic environment

Potential Key Partners and Information Sources

NOAA Fisheries’ Pacific Islands Regional Office and Pacific Islands Fisheries Science Center, Hawaiian Institute of Marine Biology, Hawaii Marine Mammal Research Consultants, University of Hawaii at Hilo, Ocean Science Institute, Stellwagen Bank National Marine Sanctuary, Papahānaumokuākea Marine National Monument.

Management Support Products

- Researchers’ analyses of best and simplest method to estimate density of singers (e.g. individual counts, overall acoustic energy at certain frequencies....etc.)
- Best method correlating density of singers to overall whale density
- Recommendations for key locations to monitor for best overall estimate of density throughout the Sanctuary
- Compare and determine best method for monitoring populations accounting for strengths and weaknesses of different techniques.

Planned Use of Products and Actions

The Sanctuary needs a flexible, cost-effective means to estimate humpback whale densities and distribution (habitat usage) within the Sanctuary and nearby waters throughout a season and over years, in order to best manage this key resource. The last best estimate of humpback whale numbers making up the Hawaiian population (central North Pacific stock) is nearly a decade old. More recent quantifiable data on population numbers and growth trends is needed. While the overall timing and distribution of whales around the islands are fairly predictable, the densities and distribution remain very dynamic. Densities and habitat usage are different from those at feeding grounds because they are not directly based on a food resource, but rather on the animals themselves. Information gained could be used to further inform issues related to the Endangered Species Act listing of humpback whales; as well as notify ocean users when whale densities have reached particular thresholds, which could then be used to trigger either voluntary or regulatory management actions, and/or generally better manage the resource.

Program References

HIHWNMS Management Plan

- RM-1 activity A. Continue to monitor and estimate the numerical abundance of humpback whales in the main Hawaiian Islands.
- RM-1 activity B. Continue to examine and describe the spatial and temporal aspects of humpback whale distribution, movement and demography in the main Hawaiian Islands
- RM-2, activity A. Assess and monitor existing and potential threats and impacts to humpback whales and their habitat.

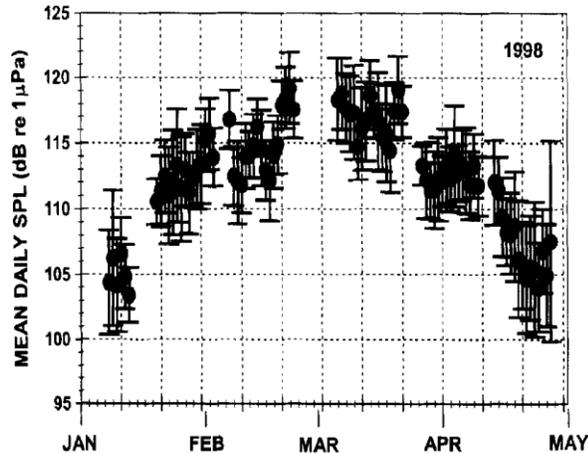
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HIHWNMS Condition Report

- What is the status of key species and how is it changing?
- What are the levels of human activities that may influence living resource quality and how are they changing?



Seasonal change in song energy off Western Maui corresponds with seasonal density of all whales. Image Credit: Au et. al., 2000.

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