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Aerial Acoustic-Behavioral Monitoring Using Sonobuoys Deployed from Observation Aircraft:

Coupled Acoustic and Visual Observation from Slow Flying Observation Planes

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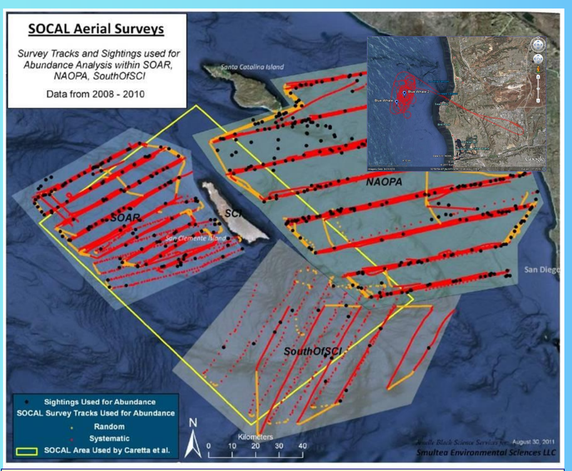
Dr. Bernd Wursig, Mari Smultea, and Tom Norris

BACKGROUND

- Aerial behavioral studies of cetaceans have been conducted for the Navy in SoCal bight for the last 2 years.
- We have recently been funded to add an acoustic component to concurrently monitor acoustically.
- This is a pilot study to match visual and acoustic data
- We would appreciate any feedback or suggestions!

METHODS

- Sonobuoys (radio-linked hydrophones) will be deployed on groups of animals that are being visually observed.
- Single and 'arrays' of sonobuoys will be deployed.
- Detailed surface behaviors will be matched to sounds.
- DiFAR based methods will be used to directional-ize and (in some cases) localize animals from their sounds.
- Data will be post-processed to match group size, behaviors, and other relevant biological information to sounds recorded from cetacean groups and individuals.



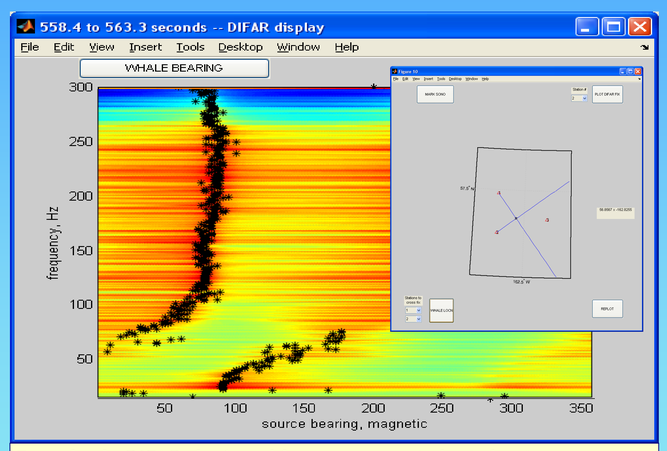
Study area where flights are being conducted (line-transect surveys are part of a related but separate effort)

GOALS

- To match vocalizations to individuals and groups of animals visually observed during focal follows.
- To obtain information about vocalizations relative to behaviorsal states and events, group size, and other biological paramters that can be observed visually.
- To obtain recordings of cetaceans for validation of other recording methods (e.g. autonomous recorders)
- To further refine DiFAR processing methods to localize sounds produced by animals and human sources.

WHAT DO WE WANT TO LEARN

- How does group size relate to vocalization rate and type?
- How do behavioral states relate to vocalization rates?
- Are there different types of vocalizations that are produced during different behavioral states and events?
- Do animals react to noise from the airplane and if so at what distances and received noise levels?
- How can we improve localization methods for sonobuoys?



Example of a DIFAR plot (sound frequency on vertical axis, bearing to source on horizontal axis) produced by the program used to process and plot the data.

SONOBUOYS AND DIFAR

What are Sonobuoys?

- Sonobuoys are radio-linked hydrophones that transmit audio to a radio receiver at a remote location (e.g. an airplane).
- They are useful for remote monitoring of sounds or in cases where the location of hydrophone deployment cannot be fixed.

What is DIFAR?

- **DiFaR** stands for **Di**rectional **F**requency **a**nd **R**anging.
- It is one of the 4 'modes' for which sonobuoys can be configured.
- DIFAR uses a directional sensor and a compass to determine the direction that the sounds are coming from.
- The DIFAR signal is coded in a 'carrier' signal sent to the receiver which must be 'de-modulated' to obtain the bearing.
- The demodulated DIFAR signal provides information about the time, frequency, and bearing of the sources and can be plotted.

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DIFAR processing code originally developed by Mark McDonald and modified by Catherine Berchok (NMML) and Mike Oswald (BioWaves). NMML provided the DIFAR processing images for this poster.