The Call of The Wily: Acoustic Species Identification of Delphinids Around the Northern Mariana Islands

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Goal

To classify groups of dolphins that were detected acoustically but not visually in order to increase our understanding of species occurrence in the waters surrounding Commonwealth of the Northern Mariana Islands (CNMI).

Background

- In 2007, the first large-scale combined visual and acoustic line-transect survey -- the Mariana Islands Sea Turtle and Cetacean Survey (MISTCS) -- was conducted in the U.S. Navy's Mariana Islands Range Complex.
- Delphinid whistles were frequently detected from a towed hydrophone array system, but detections were not always associated with visual observations.
- The ability to acoustically identify delphinid species that are not sighted can provide important information about occurrence and distribution.
- A whistle classification algorithm called ROCCA (Real-time Odontocete Call Classification Algorithm) was developed in 2007 and integrated into PAMGuard (bioacoustic signal processing software) to allow for the acoustic identification of delphinid whistles occurring in the tropical Pacific Ocean.

Methods

- ROCCA was used to extract, measure, and classify whistles.
- A random forest classifier was trained using single species recordings from the tropical Pacific ocean.
- Whistles were classified to one of four species-groups:
  1) **large delphinids** (false killer whale, short-finned pilot whale)
  2) **medium-sized delphinids** (bottlenose dolphin, pantropical spotted dolphin)
  3) **small delphinids** (spinner dolphin, striped dolphin, short-beaked common dolphin)
  4) **rough-toothed dolphins**
- Encounters were classified based on the cumulative results of individual whistle classifications.
- Acoustic encounters with visual confirmation of species identity were used to test the accuracy of the classifier.
- Non-sighted acoustic encounters were identified to species groups based on the results of the classifier.
- Only encounters that occurred more than 3 nautical miles from any other encounter were included in the analysis.

Results

Table 1: Percentages of individual whistles and encounters that were correctly classified when the random forest classifier was tested using visually validated acoustic data collected in the tropical Pacific Ocean. Overall, 72% of whistles and 70% of schools were correctly classified. Correct classification expected by chance was 25%.

Species	% of whistles correctly classified	n	% of encounters correctly classified	n
Small delphinids	62	122	57	47
Medium-sized delphinids	62	115	60	25
Large delphinids	91	128	95	19
Rough-toothed dolphin	71	101	67	12

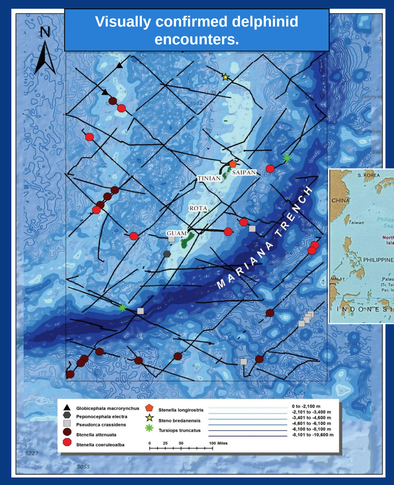

Figure 1: Locations of visually confirmed delphinid encounters plotted along survey transects.

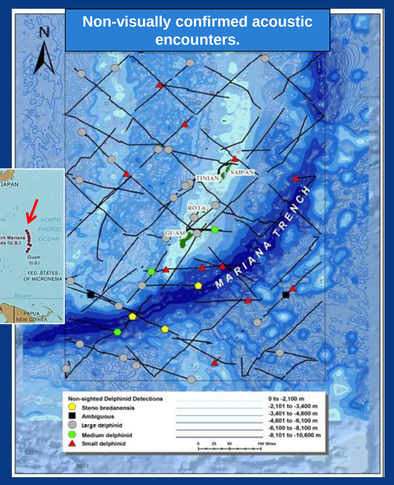

Figure 2: Locations of non-visually confirmed acoustic encounters based on classification results, plotted along survey transects.

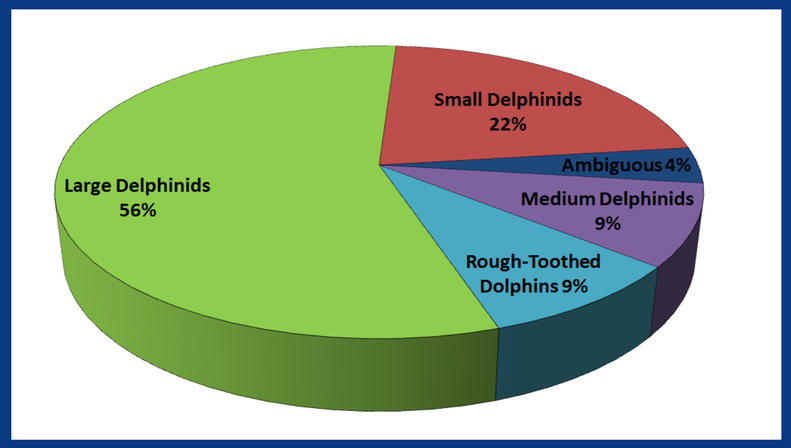

Figure 3: Distribution of species predictions for non-sighted acoustic encounters. Predicted species are based on the four-class random forest model. "Ambiguous" means that the encounter could not be classified because there were not enough whistles present.

Discussion

- Classifying the species into species-groups allowed for greater accuracy of classification results, as species with similar whistle characteristics were grouped together.
- Due to expected geographic variation in whistle structure, a classifier trained with whistles collected around the CNMI may produce more accurate results.
- Some species included in the 'large delphinid' group often travel in dispersed pods and surface inconspicuously, making it difficult to detect them visually. This may be why a large proportion of non-sighted encounters were classified as large delphinids.

Photo: Short-finned pilot whale spyhopping. Photo taken by Julie Rivers under NMFS research permit #1039-1699.

Conclusions and Way Forward

- This study has provided new and important information about the occurrence and distribution of cetaceans in an area where very little information exists. This information could not have been collected using standard visual or acoustic methods.
- The CNMI is an important area for military operations which may affect marine mammals, so the development of tools to effectively study, monitor and mitigate these populations is crucial.
- Identifying encounters to species-group is an important first step, however the ability to identify whistles to species is vital for effective mitigation and monitoring.
- Not enough acoustic data currently exist to fully test the tropical Pacific classifier or to develop a dedicated classifier for CNMI populations. Effort should be made to collect visually-validated acoustic recordings in the CNMI.
- The development of a dedicated CNMI classifier would make it possible to identify species recorded during future towed array surveys, acoustic glider surveys and using autonomous recorders.

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