Mobile Autonomous Passive Acoustic Monitoring of Marine Mammals in the Catalina Basin

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Research Question
What marine mammals are present in the Catalina Basin in late July, early August?

Introduction
- Traditional visual survey methods for marine mammals can only detect a fraction of the animals present.
- Even if the animal can be observed from the surface, visual limitations such as time of day and weather conditions can impede this ability. Acoustic observations can be completed without these limitations, contributing to the rapid growth of passive acoustic monitoring [1].
- This limited viewing window also denies us the ability to fully understand their foraging, social, mating, and other behaviors that occur below the surface.
- Oceanographic gliders equipped with passive acoustic recording systems can be used to detect the presence of cetaceans over large spatial and temporal scales which can be used for both studies of basic ecology as well as conservation and management purposes [2-3].
- These include examination of seasonal presence and abundance, modeling of important habitat, studies of foraging, social, and other vocal behavior, the potential effects of noise on marine mammals (individuals and populations), and surveys that estimate animal density and/or abundance [4-5-6-7].

Methods
- **Field**
  - A Seaglider and QUEPhone, equipped with passive acoustic recorders, were deployed off the coast of Catalina Island from 19 July to 01 August 2016. These were simultaneously positioned in the vicinity of two mini-HARPs (High-frequency Acoustic Recording Package) [8].
  - At depths from 25-1000 m audio files were recorded continuously at a 125-KHz sampling rate. A total of 295 hours of recordings were collected from the Seaglider and another 219 hours from the QUEPhone.
- **Lab**
  - Recordings were analyzed for multiple cetacean species present using aural and visual methods in both MATLAB based Triton and Raven programs.
  - Additional sounds including anthropogenic and pinniped sources were also recorded.

Study Area
Location of the field experiment in the Catalina Basin, California USA (Figure 3).
- The coordinates of the mini-HARPs (red points)
- The continuous track of the Seaglider between north and south waypoints (yellow track)
- The five tracks of the profiling QUEPhone (red tracks)

Results
![Spectrogram](https://www.pmel.noaa.gov/acoustics/)

Figure 4. The number of hours with calls recorded over the 313 hour sampling period.

- **Unidentified Delphinid, 247**
- **Unidentified Mysticeti, 34**
- **Unidentified Odontoceti, 15**
- **Blue whale (Balaenoptera musculus), 14**
- **Humpback whale (Megaptera novaeangliae), 14**
- **Minke whale (Balaenoptera acutorostrata), 7**
- **Risso’s dolphin (Grampus griseus), 6**
- **Cuvier’s beaked whale (Ziphius cavirostris), 4**

Figure 5. Spectrogram of unidentified delphinid clicks, buzzes, and whistles. (Top) 1 hour (Bottom) 30 seconds

Figure 6. Spectrograms sized zoomed into second or millisecond long durations of each species call.
- (A) Unidentified Mysticeti - DownswEEP (B) Blue whale - D call (C) Humpback whale - Call (D) Minke whale - Bouncing (E) Unidentified Odontoceti - Barks (F) Risso’s dolphin - Clicks. (G) Cuvier’s beaked whale - Click
- (H) Unidentified Delphinid - Click

Conclusions
1. There are at least 8 different marine mammal species found in the Catalina Basin during this time period, with the possibility for more species that weren’t identified or recorded.
2. Passive acoustic gliders are powerful tools to detect the presence of marine mammals. 163 out of 295 hours contained marine mammal encounters, predominately unidentified delphinid.

References

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