Characterization of short-finned pilot whale (*Globicephala macrorhynchus*) clicks and calls near the Hawaiian Islands
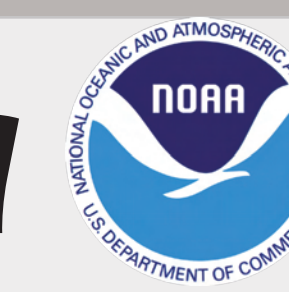
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Background

Little is known of the vocal repertoire of short-finned pilot whales (SFPW) in the Pacific Ocean. While there has been a recent surge in the use of passive acoustics to identify cetaceans around the Hawaiian Islands, SFPW calls are easily confused with false killer whales, which occupy the same geographic range. Characterizing the calls of SFPW will improve the capacity to use passive acoustics to monitor both these species. This will allow a better understanding of the social structure and ecology of SFPW, improving scientific knowledge of the link between social structure, ecology and speciation.

Methods

- Study area: western coast of Hawai'i.
- Nine acoustic encounters in May 2012.
  - Species' ID visually confirmed.
- Acoustic recorder: Biological Underwater Recording Package (BURP).
  - Two hydrophones, sensitivity to 150 kHz, resonance at ~32 kHz.
  - Korg recorder, 192 kHz sampling rate.
- Whistles and burst pulses extracted manually and identified as calls [1,2].
- Spectrograms made using Raven Pro (1024 FFT, 20 kHz)[3].
- Calls characterized in order of encounter.
- "Predominant call types": calls that occur more than ten times.
- Clicks extracted using Triton detector in Matlab[4].
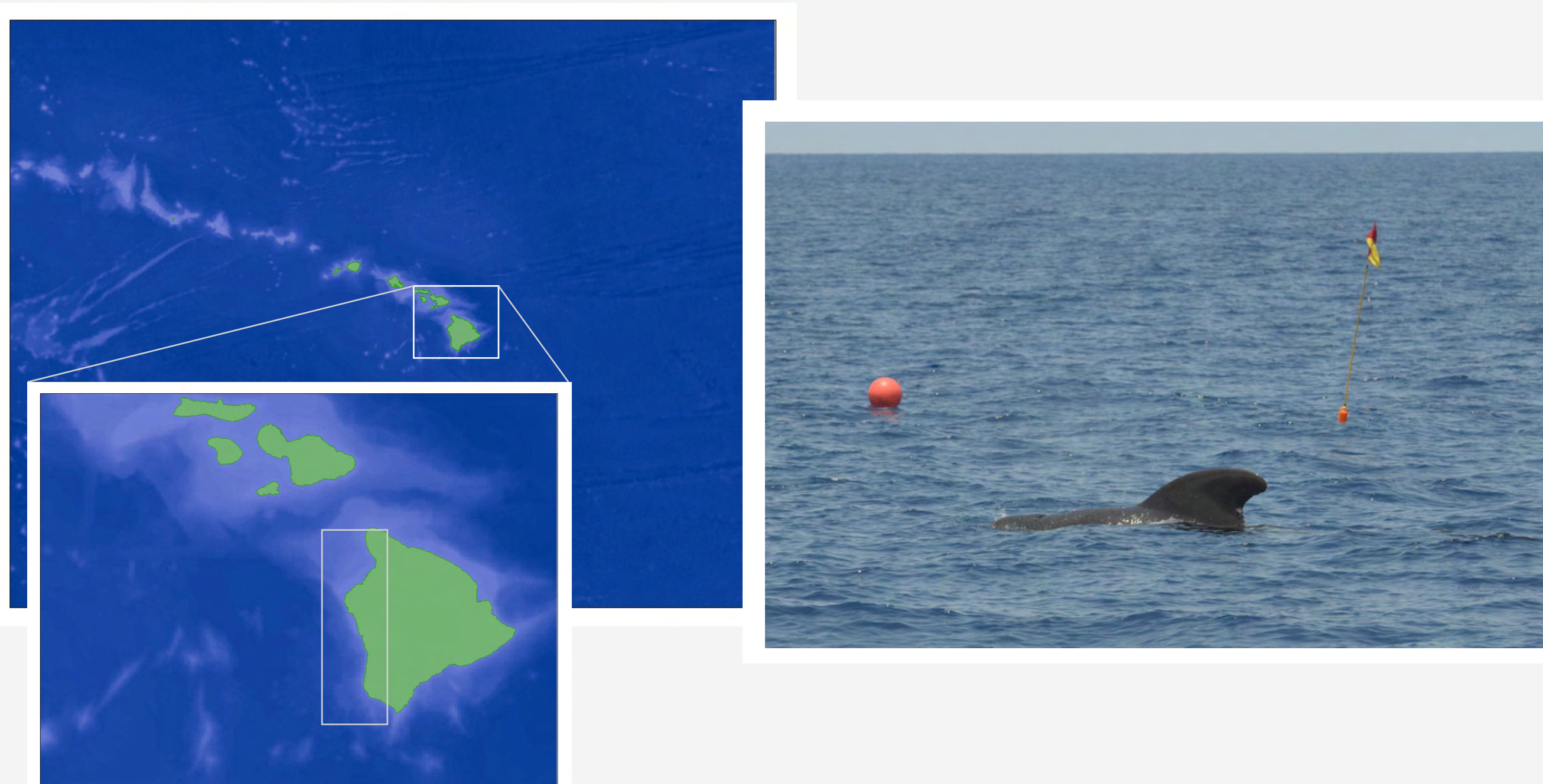- Click analysis included peak frequency and duration.

Figure 1. The above figure shows (a) a map of the study area, and (b) a short-finned pilot whale swimming near a deployed BURP.
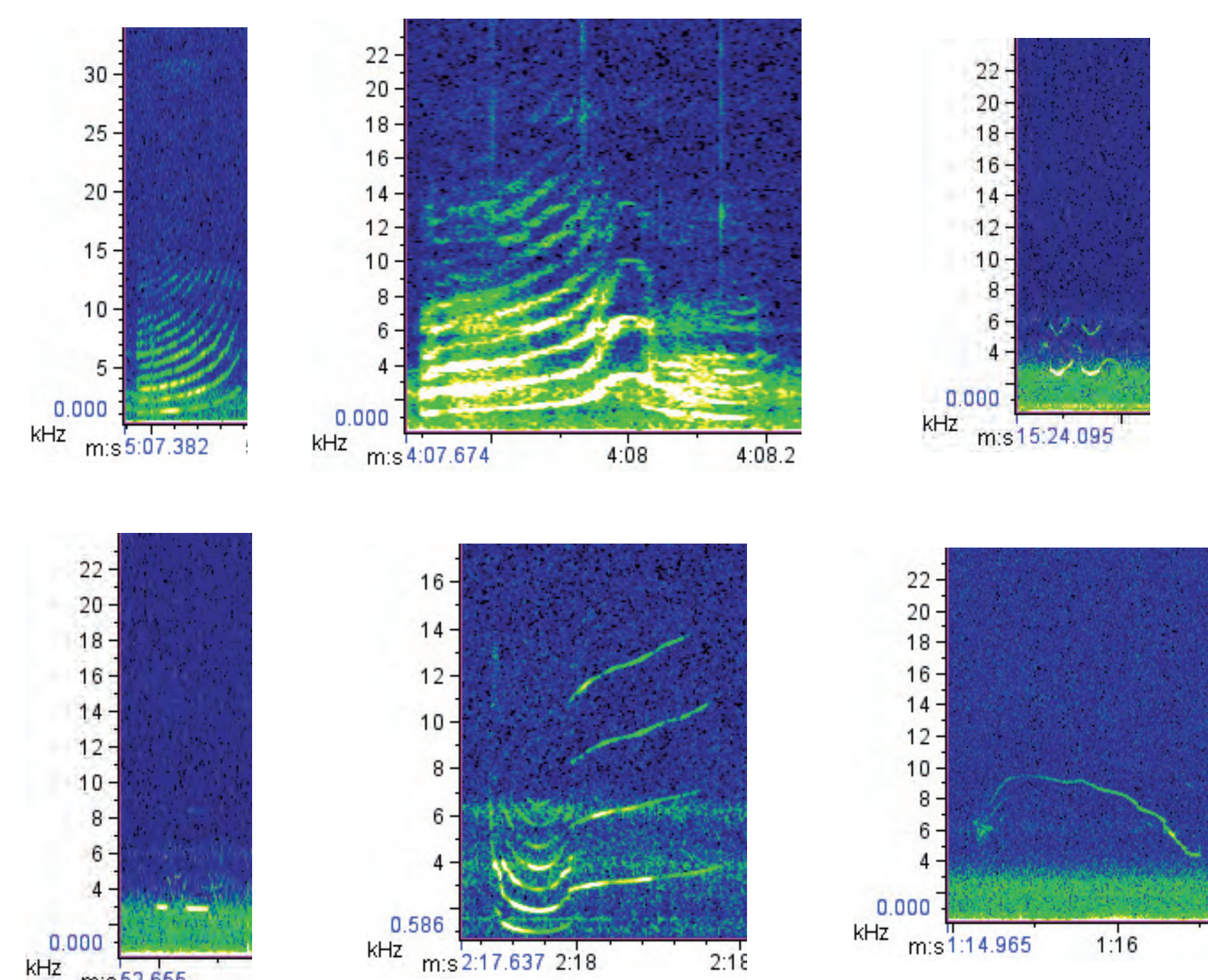

Figure 3. Six examples of discrete calls, the most common call type. Those that were found more than 10 times are considered predominant call types. Discrete calls were also incorporated into complex calls types, or used as the basis for variable call types.
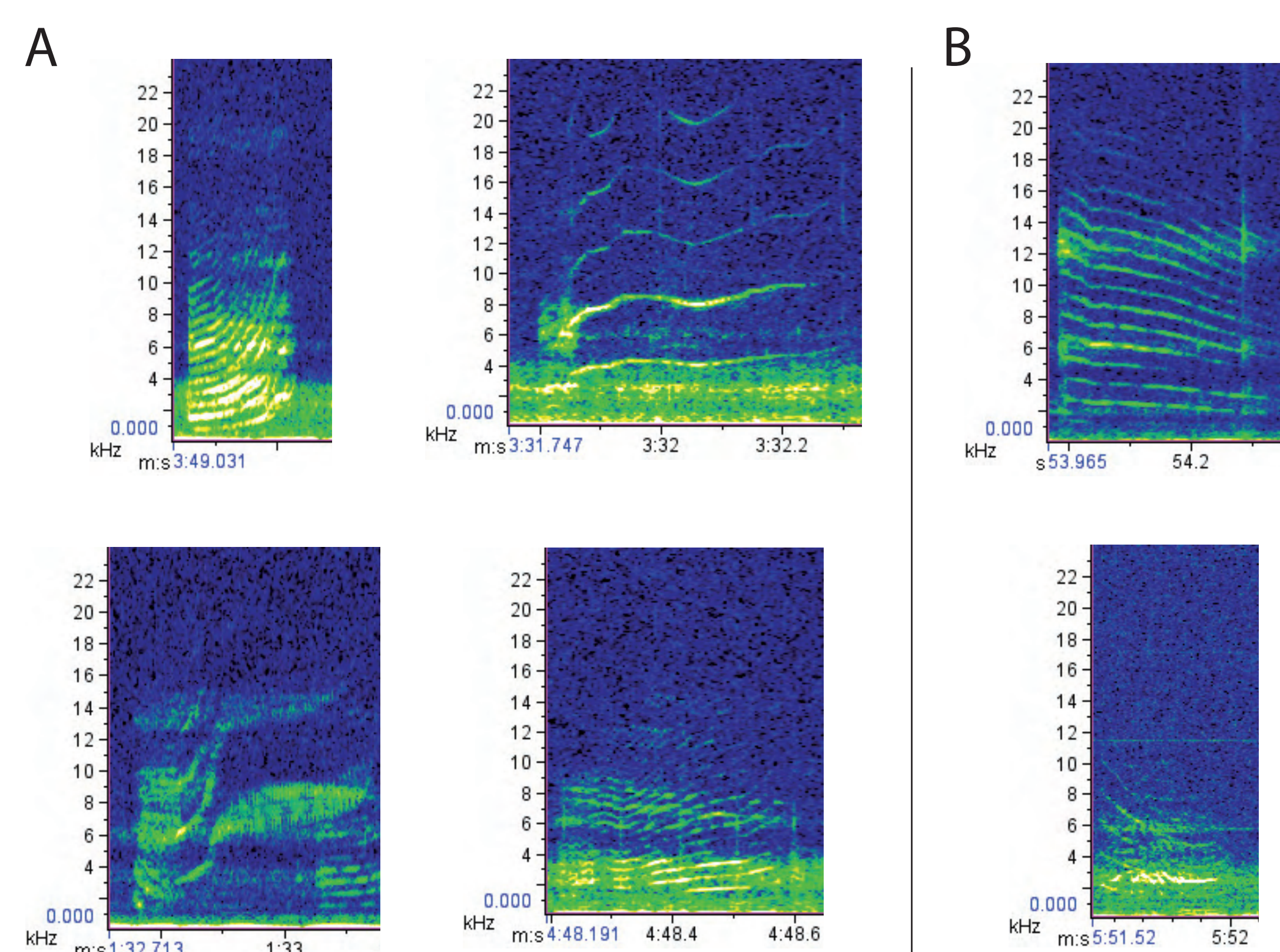

Figure 4. Examples of calls that were based on discrete calls but possessed some variation, characterized as variable calls. A) discrete upsweep (top left) and three upsweep variations; B) discrete downsweep (top) and downsweep variation.
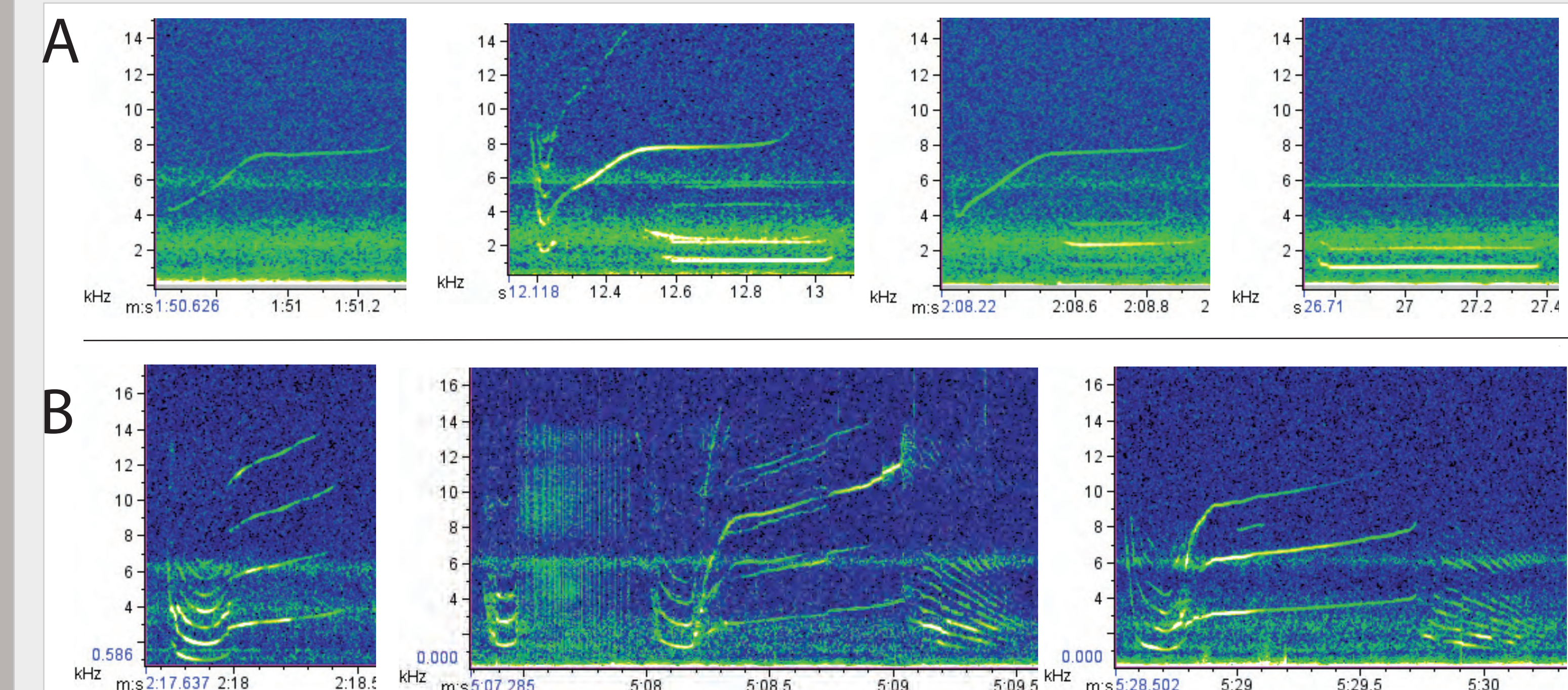

Figure 5. Hawaiian pilot whales exhibited the ability to combine several discrete components to form complex calls in consistent patterns. Above, examples of (a) three- and (b) five-component calls, showing varying numbers of components with a constant order.

Major Findings

Clicks:
- 1,436 clicks were extracted and analyzed.
- Results of click analysis are pending BURP calibration.

Calls:
- Over 600 calls were manually extracted and characterized.
- 88 call types were identified.
- 11 call types occurred more than ten times and are considered predominant call types.
- Three different call categories: discrete, variable and complex.
  - Discrete calls (Figure 3) are the largest category, comprising the majority of call types.
  - Variable calls (Figure 4) have a discrete call type as a basis, but vary in the way the call is produced.
  - Complex call types (Figure 5) include multi-component calls of varying complexity but with a consistent pattern.

Future Work

- Examine variability in vocal repertoire between social clusters [5] and behavioral categories.
- Compare patterns of geographic variability in vocal repertoire and genetic segregation.

References

[1] Sayigh et al. 2012. *Marine Mammal Science*. DOI: 10.1111/j.1748-7692.2012.00577.x
[2] Murray et al. 1998. *J. Acoust. Soc. Am.* 104 (3)
[3] Bioacoustics Research Program. 2011. Raven Pro. Ithaca, NY.
[4] Scripps Whale Acoustic Lab. 2011. Triton. La Jolla, CA.
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