The Acoustic Repertoire Of Ross Sea Killer Whales

Il Repertorio Acustico Delle Orche Del Mare di Ross

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INTRODUCTION

Ross Sea killer whales are also known as **Type C** ecotype.

This ecotype has some **specific characteristics** that allow an easier identification:

- The **smallest form known**
- Narrow, **slanted eyepatch**
- Black Dorsal Cape

ACOUSTIC REPERTOIRE

Killer whales acoustic repertoire is composed by three broad classes:

- Clicks (navigating and foraging)
- Whistles (communication)
- Burst-pulse sound (communication)

«VOCAL CULTURE»

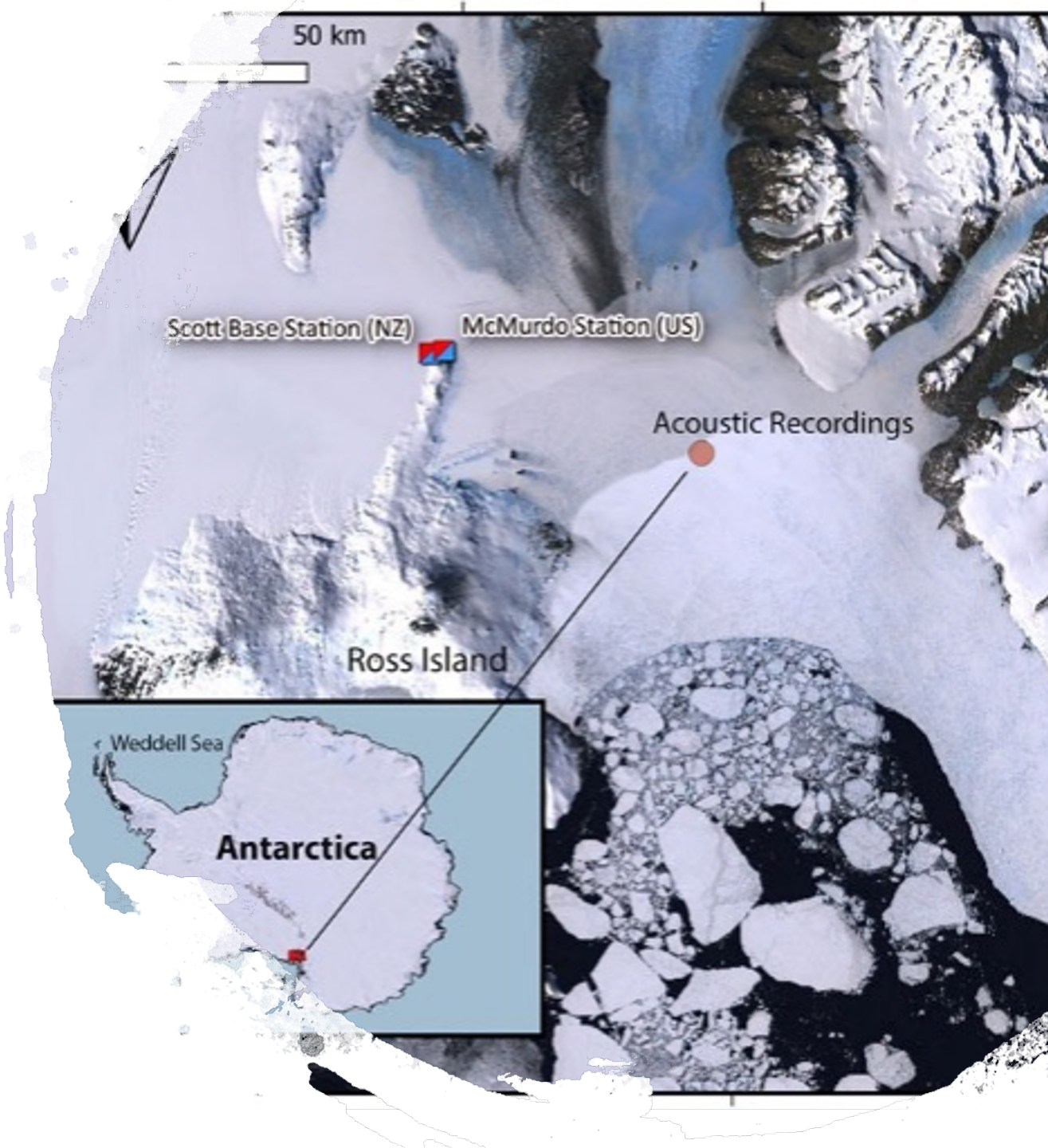
Previous studies on vocal characteristics of killer whales have identified the presence of a **«vocal culture»** where different populations exhibit different dialects.

This discovery shows that groups with **similar dialects** are closely related.

METHODS:

Study area and data collection

- **Data collection:**
  - December 2012 - January 2013
  - Scouting flight by helicopter
  - Acousting recordings using:
    - M-Audio Microtrack recording unit
    - Lab-Core LAB-40 Hydrophone system
    - 20dB in-line amplifier.
  - Noting killer whales **ecotype** and **surface behaviour.**



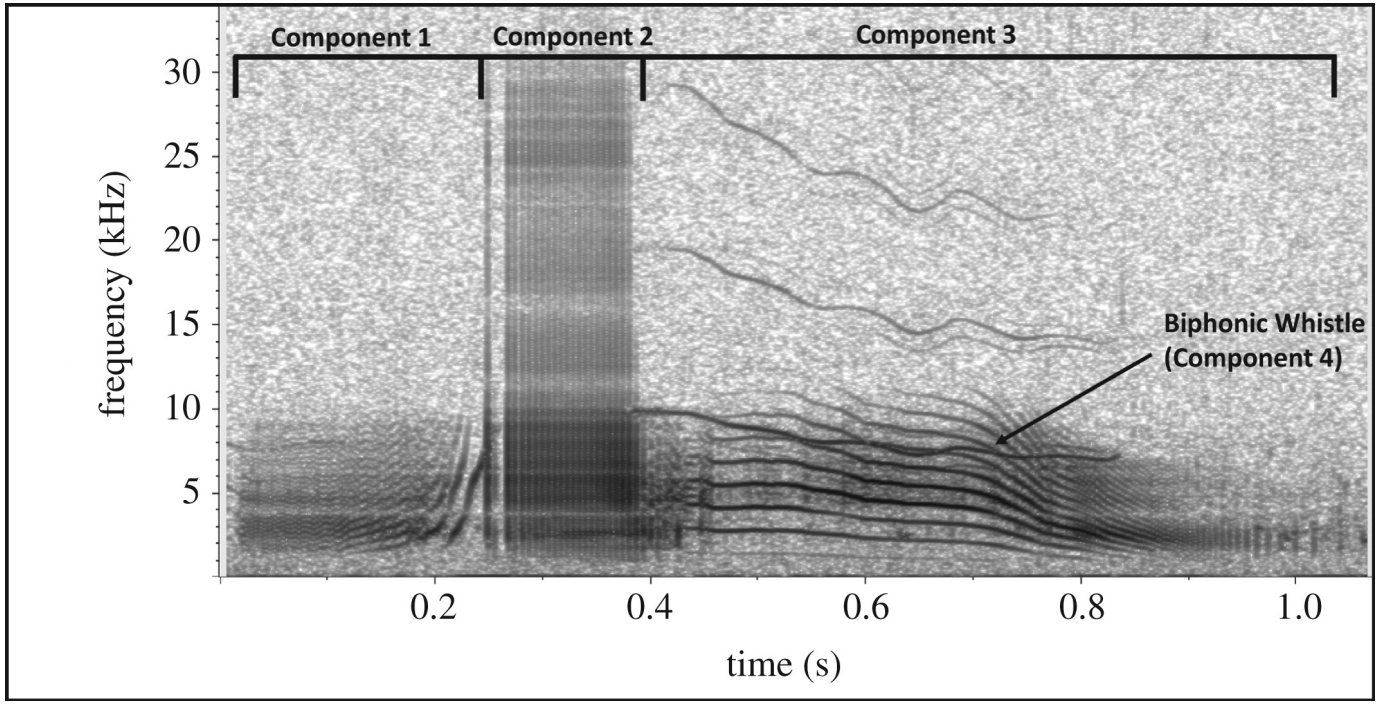
METHODS: Analysis, Categorization & Measurements

1. Calls were graded on their signal-to-noise ratio (SNR) into three grades: Grade 1,(poor), Grade 2 (average) and Grade 3 (good).

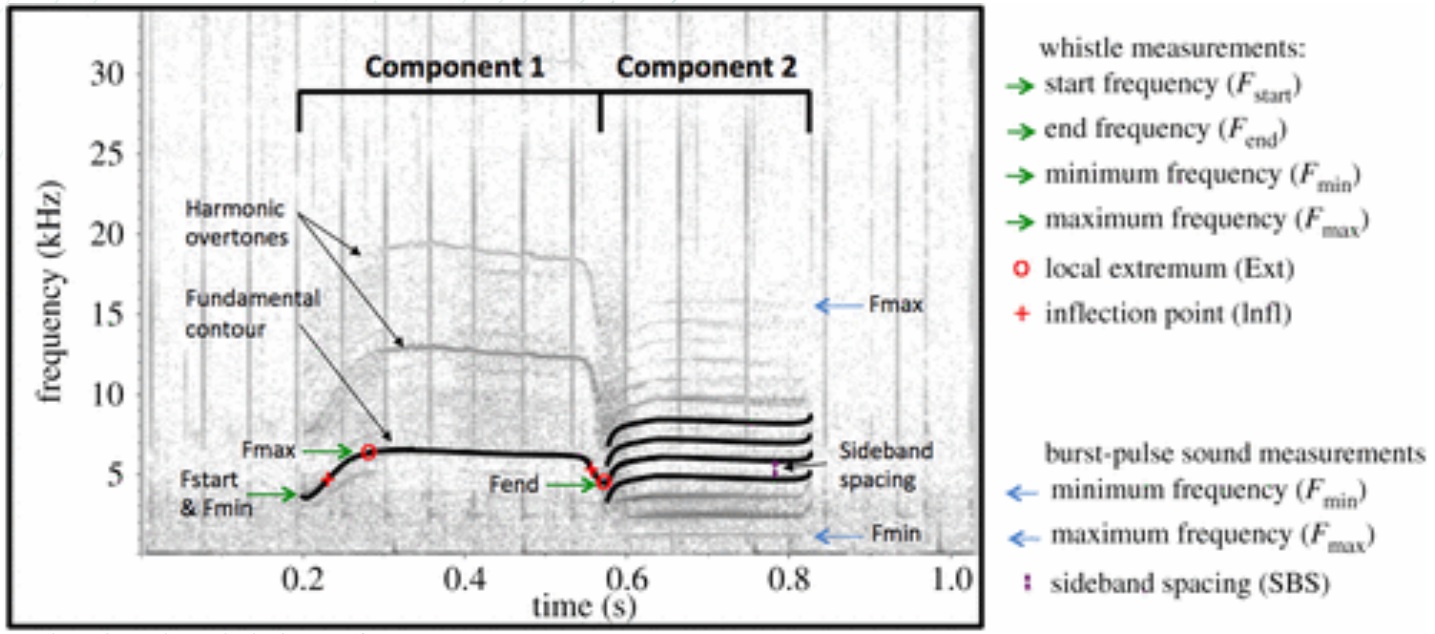
2. Grade 2 and 3 were sorted.

3. Calls were classified as Biphonic or Monophonic.

4. For categories with 10 or fewer calls, all calls were measured.
For calls with more than 10 calls, 20% were measured.



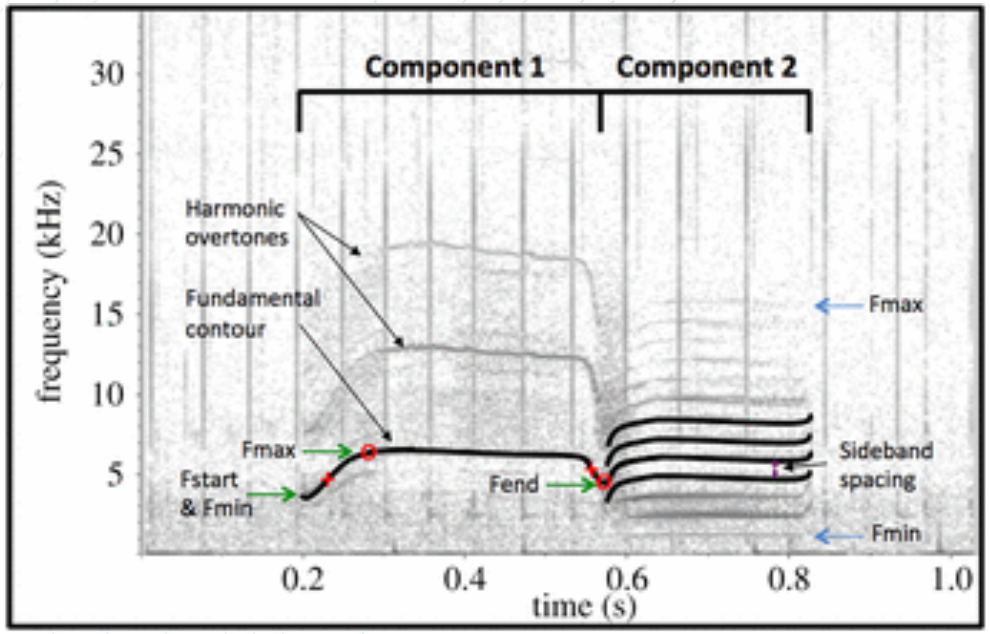
Of each call were measured more than 20 parameters.



For Multi-component calls, parameters were measured for each component.

Components have different wave form:

- **Whistles:** sinusoidal;
- **Burst-pulse:** series of rapid pulse.



whistle measurements:
- start frequency (F_{start})
- end frequency (F_{end})
- minimum frequency (F_{min})
- maximum frequency (F_{max})
- local extremum (Ext)
- inflection point (Infl)

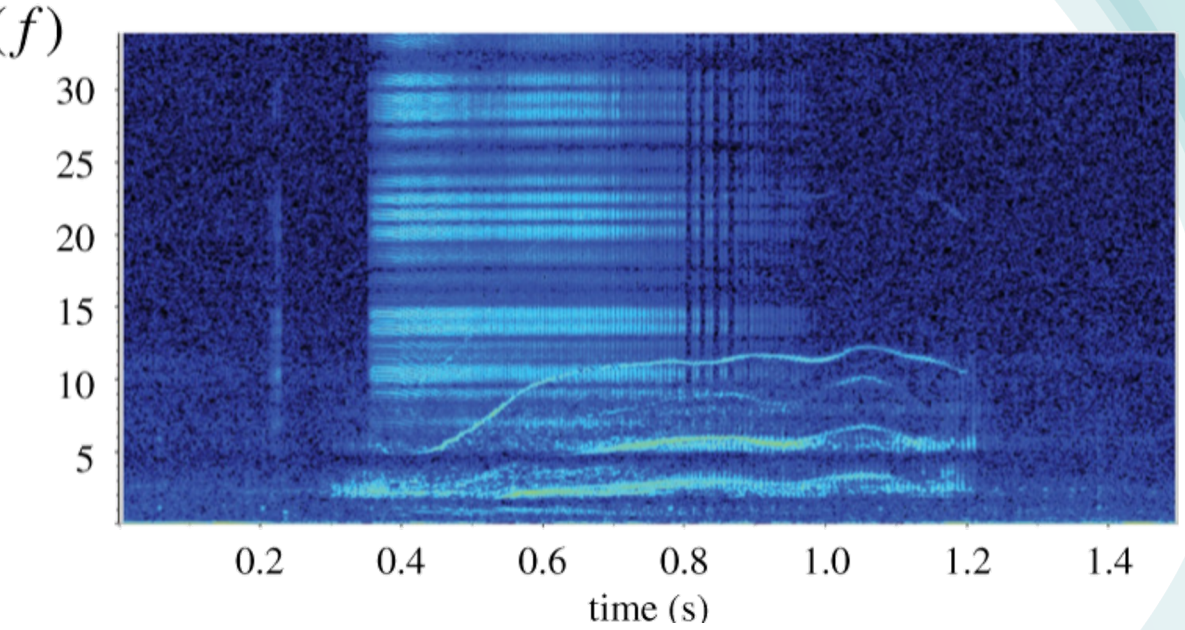
burst-pulse sound measurements
- minimum frequency (F_{min})
- maximum frequency (F_{max})
- sideband spacing (SBS)

However in the field there is always interfering sound (ice noise, ecc.)

Therefore burst-pulse sounds can appear as multiples of a fundamental.

This makes impossible to define if the underlying call is a whistle with harmonics or a series of rapid pulses. In order to identify these two components, calls with fewer than five harmonics are called "whistle" , otherwise "burst-pulse".

RESULTS

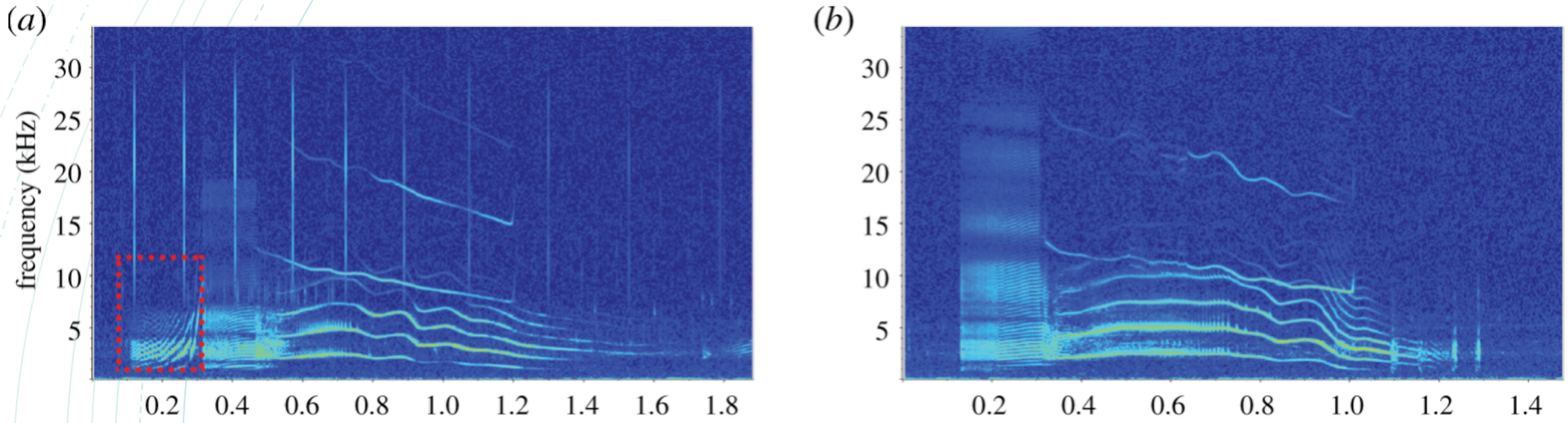


- Nine separate encounters with Tipe C killer whales;
- 392 killer whales (47 re-sightings).

- 3h 33' of calls were analysed;
  - 28 categories
    - 46% biphonic calls (all defined as multi-component)
    - 54% monophonic calls
- N° multi-component calls > N° single-component calls

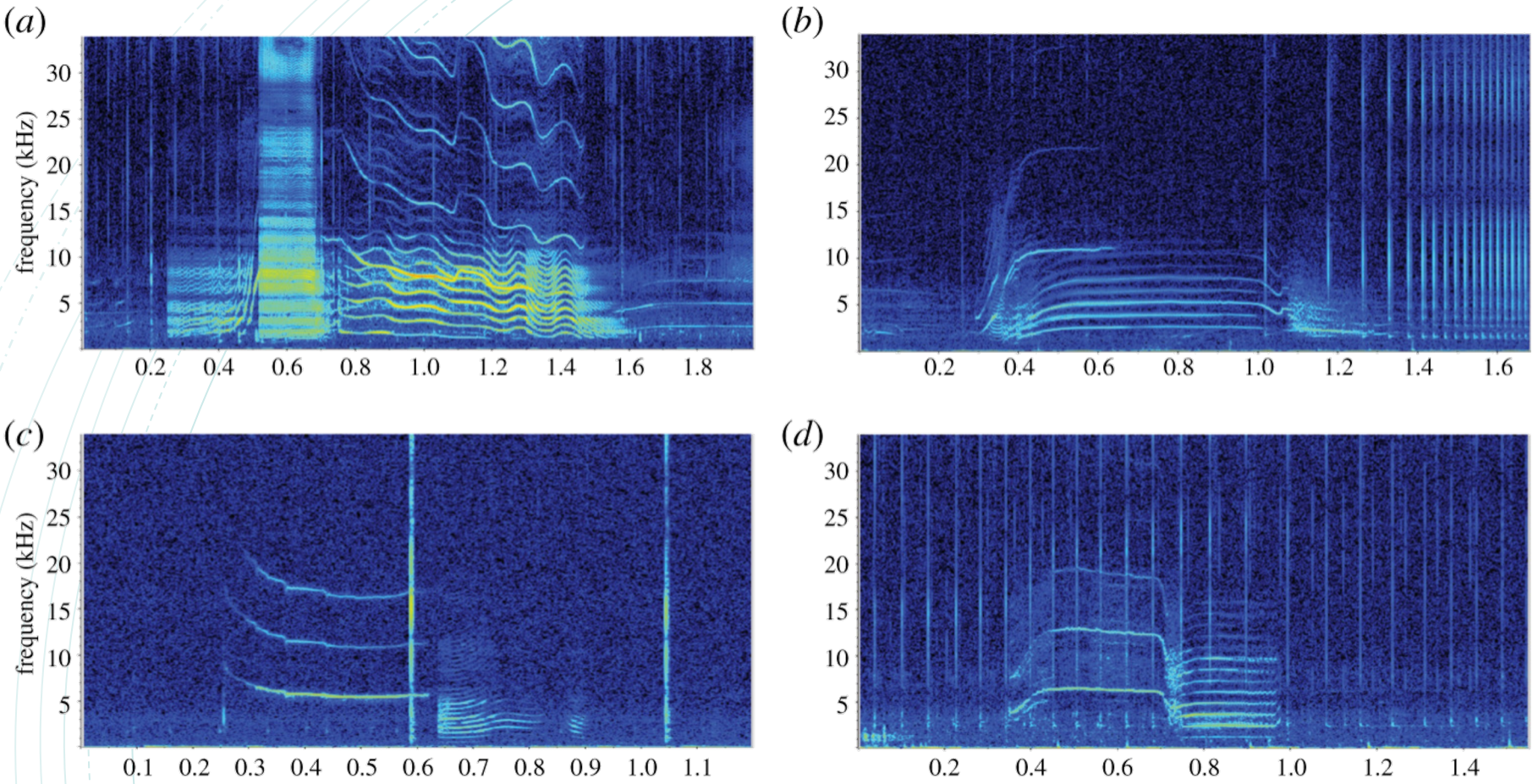
Of the 28 categories 7 call categories were defined as most common.

Within the remaining 21, 4 call categories were defined as subtypes.



Three of the subtypes have a deletion of one or more components from the primary call.

The other has a variation in one of the component's frequency contour.



The majority of call types described in this study are multi-component calls with many of them containing transition from whistles to burst-pulse and vice versa.

DISCUSSION

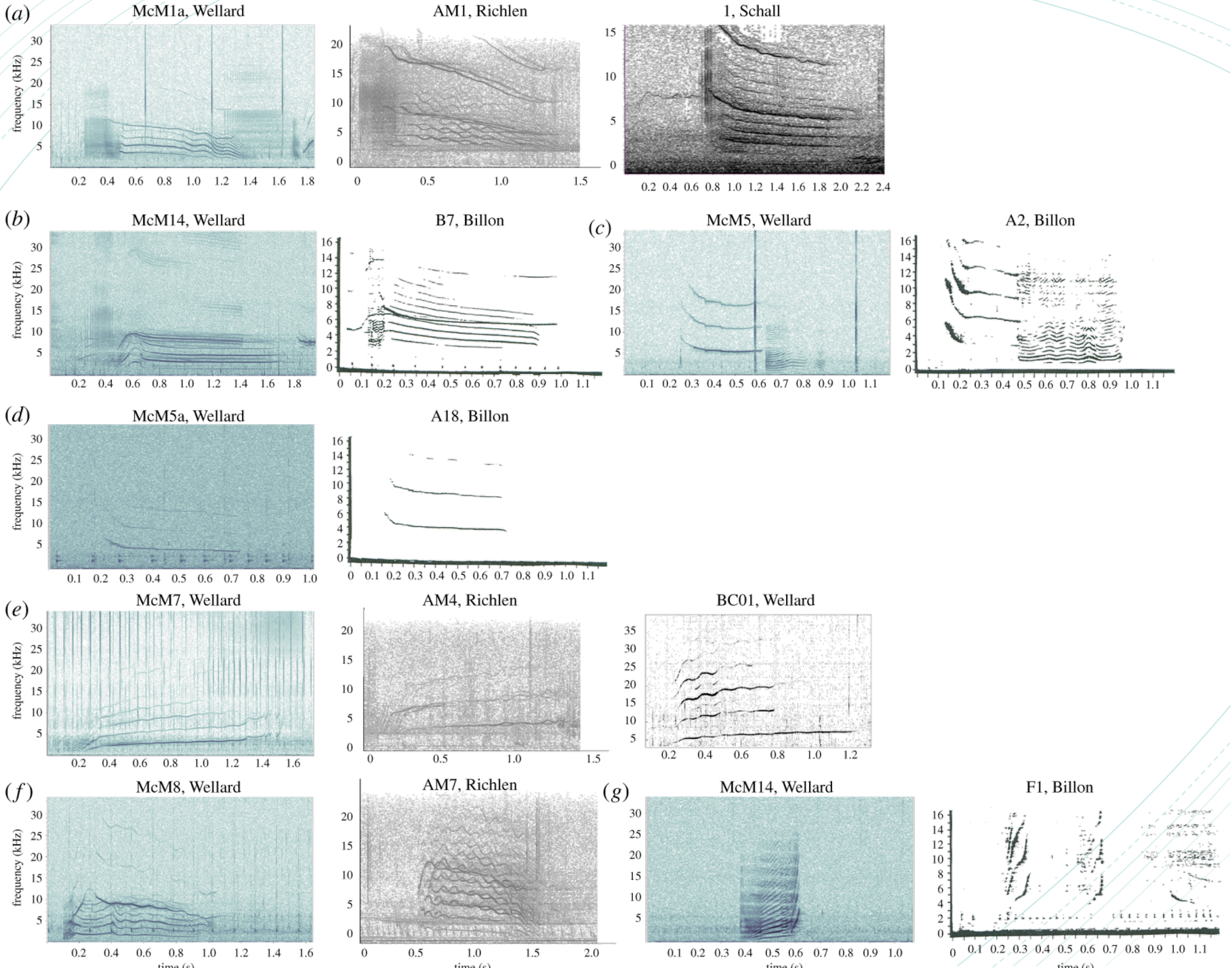
Type C killer whales are known to produce calls in all behavioural contexts.

It has been noted that during **social and foraging behaviour** the production of calls was **higher**.

A large percentage of calls contained biphonation.

While biphonation function is not clear, its occurrence in vocal repertoire of different species implies an **important communicative role.**

Call types were **compared** with call types found in a study from 1979 in order to find **similarities.**



CONCLUSION

There are very few studies about the stability of killer whales vocal repertoire.

The vocal repertoire of killer whales is thought to be a learned behaviour which can lead to the formation of dialects.

Comparing this study with the previous (1979-1982) and based on the findings in the current study, we can hypothesize that:

- **Call structure** has remained **stable** for decades;
- Type C killer whales in McMurdo Sound may have a **distinct dialect**

Further comparative acoustic research is needed to support the hypothesis.

ABSTRACT

Type C killer whales are the smallest form within the 5 ecotypes that can be found in Antartica.
In McMurdo Sound, acoustic recordings of calls were collected during nine encounters with this ecotype. These recordings were divided in 3 different grades, based on the quality of their spectrograms.
Grade 1 spectrograms were excluded. Instead grade 2 and 3 spectrograms were analysed and catalogued in 28 categories.
Within these 28 categories, seven were defined as "most common" and four as "subtypes".
During the spectrograms analysis, calls were found to be multi-component and to have a large percentage of biphonation.
Results were compared with the ones on a previous study. This leads to hypotesize that Type C killer whales' call complexity is stable over time and that it is related to the different ways of feeding.
The study of Type C acoustic repertoire can be important to develop new methods of recordings that can help monitoring all ecotypes of killer whales in Antarctica.

BIBLIOGRAPHY

- Wellard, Rebecca; Pitman, Robert; Durban, John; Erbe, Christine (2020), Cold call: the acoustic repertoire of Ross Sea killer whales (Orcinus orca, Type C) in McMurdo Sound, Antarctica, Dryad, Dataset, https://doi.org/10.5061/dryad.37pvmcvfr

- **Images**
  1. Wellard et al, 2020
  2. By Callan Carpenter - Own work, CC BY-SA 4.0, https://commons.wikimedia.org/w/index.php?curid=84531256
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