

VOCALIZATIONS OF A FEMALE HUMPBACK WHALE IN ARRAIAL DO CABO (RJ, BRAZIL)

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Male humpback whale (*Megaptera novaeangliae*) sound emissions are well known, however little is known about female vocalizations. Arraial do Cabo, Brazil is located at 23°03'S, 42°02'W, it has an area of 98 km² with 65 km of oceanic beaches (Fig. 1), and is adjacent to a deep-water region where upwelling occurs. This phenomenon makes these waters highly productive, providing ideal conditions for several cetacean species. The Arraial do Cabo region is a migratory corridor for great whales, including humpback whales.

On 28 July 2000, at 0920, a humpback whale mother and calf pair was observed from a 10-m high observation point at Pontal de Atalaia about 50 m offshore. There were no other whales or dolphins in the nearby. We followed the whales in a 4.5-m Zodiac with a 45-HP engine (at a minimum distance of 100 m) to record vocalizations. The engine was turned off during recordings and the female's vocalizations were recorded for 18 min 36 sec in 13 m of water. At 1020, the recording was interrupted as the pair left the area.

Vocalizations were recorded by a C-54 hydrophone (Cetecean Research Technology), with a 3-m cable, coupled to a professional walkman (Sony WM-D3; frequency range 60–16,000 Hz \pm 3 dB; 1% total harmonic distortion) with chromium oxide tapes (Sony UCX-s). The analog recordings were digitized (SoundBlaster 64 AWE) and analyzed by the Cool Edit Pro 1.2 software (44,100 kHz sample rate, 32-bit resolution, mono, FFT filtering, size 512 bands resolution, Hamming).

The vocalizations did not resemble male vocalizations described by Payne and McVay (1971). There was only one rather stable unit, repeated 47 times, featuring only ascending frequency with harmonics.

Only the first 27 units were of a high enough quality to analyze. The maximum frequency of the environmental noise was 2 kHz. The units duration ranged between 0.71 and 1.03 sec (mean = 0.97 \pm 0.10 sec SD; n = 27), the initial frequencies ranging from 5.0 to 5.3 kHz (mean = 4.9 \pm 1.0 kHz SD), final frequency from 5.4 to 5.7 kHz (mean = 5.4 \pm 1.0 kHz SD), with -14.37 dB the peak with the most amplitude. The interval between units had a duration between

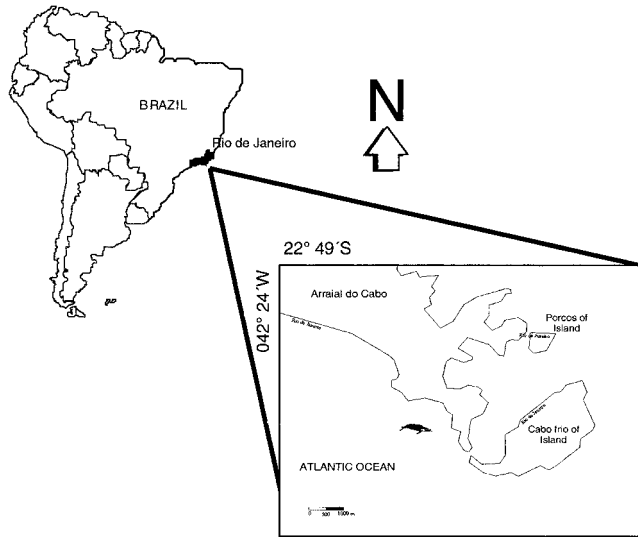


Figure 1. Map of Arraiial do Cabo showing recording location of cow-calf pair in 2000.

of 21.49 and 21.58 sec, with one exception (14.44 sec). All the vocalizations were followed by about a 10-sec echo, coming from the rocky coast (Fig. 2A, B).

The male song is complex, with many varied types of units (Payne and McVay 1971; Winn *et al.* 1973; Tyack 1981, 1983; Silber 1986; Mobley Jr *et al.* 1988; Helweg *et al.* 1990, 1998; Cerchio *et al.* 2001; Cerchio and Dahlheim 2001). The songs are variable and change between seasons. The frequencies vary from 20 Hz to 4 kHz, and occasionally they reach 8 kHz (Richardson *et al.* 1995) with mean source level of 174 dB re 1 μ Pa (Frankel 1994 in Au *et al.* 2001).

Other types of humpback whale vocalizations are called social sounds (Tyack 1983, Silber 1986, Mobley *et al.* 1988), which are produced mainly in groups of three or more adults, with males engaged in competition for a mature female (Tyack 1983). The vocalization extend from 50 Hz to ≤ 10 kHz, with the highest energy below 3 kHz (Silber 1986), being broadband burst pulses with an average length of 0.45 sec, and an average interpulse interval of 0.91 sec. The main energy lies between 0.2 and 3.0 kHz, with frequency peaks at 4.7 kHz.

“Feeding sounds,” unlike song and social sounds, are highly stereotyped series of narrow-band trumpeting calls. The principal frequency varies from 400 to 800 Hz with 3–58 sec in duration, and harmonics (D’Vincent *et al.* 1985, Baker 1985 in Mobley *et al.* 1988). Baker suggested that the vocalizing animal in each one of five recorded sessions was the same specific mature female. Mobley *et al.* (1988) attribute these sounds to the function of helping in the food capture process. Thompson *et al.* (1986) also recorded feeding sounds in southeast Alaska, their sounds are at ~ 20 –200 Hz, having an average duration of 0.2–0.8 sec.

Cerchio and Dahlheim (2001) analyzed sounds of humpback whales that were feeding in southwest Alaska, and they highlighted a kind of “cry” sound formed by three elements: A—a short swept up (mean start frequency 584 Hz; mean end

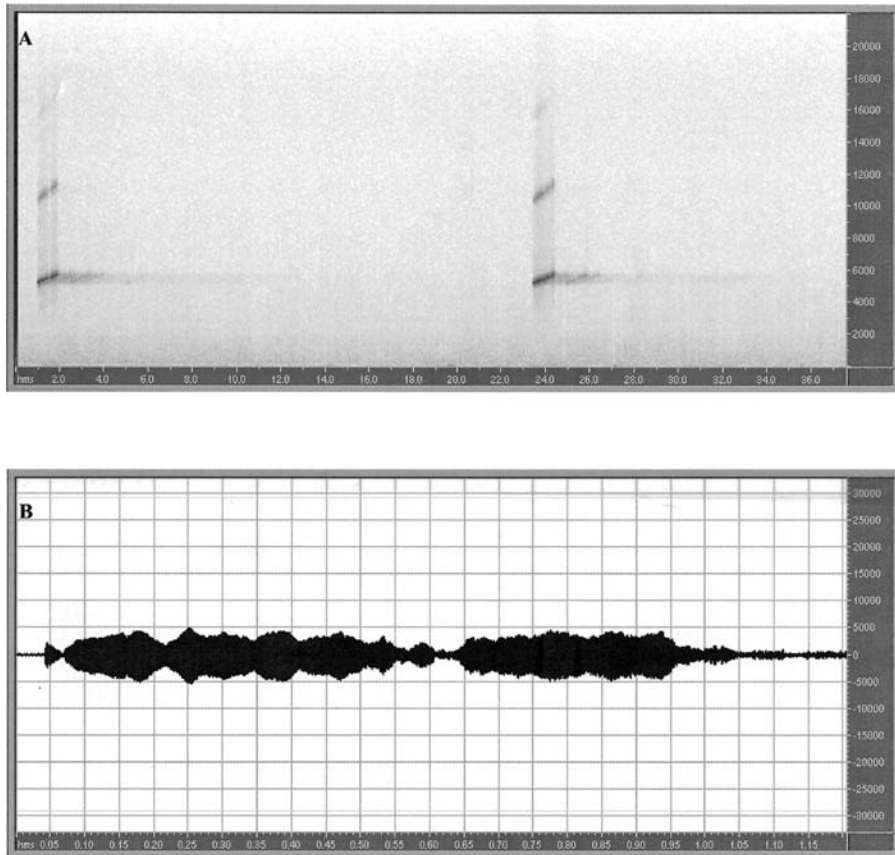


Figure 2. Acoustic parameters of female's calls: (A) spectrogram of two units (x -axis = 2 sec and y -axis = Hz), and (B) oscillogram of an unit (x = 0.5 sec and y = dB).

frequency 616 Hz; duration 0.21 sec); B—a prolonged unmodulated section (mean start frequency 594 Hz; mean end frequency 596 Hz; duration 2.27 sec); and C—a short swept down final (mean start frequency 601 Hz; mean end frequency 515 Hz; duration 0.21 sec).

In all the types of humpback whale vocalizations described in the literature, the closest sound to our recording was the feeding sound, that Baker (1985 in Mobley *et al.* 1988) attributed to a humpback whale. However, the call frequencies were higher in the Brazilian case and all the calls were the same, without variation.

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