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Short Note

Possible Distress Sounds from a Stranded Humpback Whale (*Megaptera novaeangliae*)

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Humpback whales (*Megaptera novaeangliae*) are one of the best-studied large baleen whales and have one of the most diverse acoustic repertoires. The most famous is their song, which is primarily produced in lower-latitude breeding waters. Since humpback whale song was first described (Payne & McVay, 1971), a large body of research work has been developed to investigate its behavioral context (e.g., Winn et al., 1981; Tyack, 1983; Chu & Harcourt, 1986; Chu, 1988; Frankel et al., 1995; Au et al., 2000, 2001, 2006; Frazer & Mercado, 2000; Miller et al., 2000; Noad et al., 2000; Darling et al., 2006; Smith et al., 2008). However, an understanding of the function of the acoustic display remains elusive. Even less described are social sounds or any nonsong phonations (Stimpert et al., 2011; Rekdahl et al., 2013, 2016).

As defined by Silber (1986), a social sound is any phonation that does not possess the rhythmic and continuous patterning of song. This type of sound is produced during all phases of the yearly life cycle of humpback whales. Thompson et al. (1986) described five types of aurally classified sounds: (1) moans, (2) grunts, (3) pulse trains, (4) blowhole-associated sounds, and (5) surface impacts.

This note describes the sound production by a stranded humpback whale off the coast of Uruguay (35° S) in the Rio de la Plata estuary. No previous study of humpback whale sounds in Uruguayan waters exists, potentially due to the open sea habitat of Uruguay and the even rarer occurrence of a stranding. Herein, we present the results of an analysis of sounds recorded from a stranded humpback whale until it died.

On 23 August 2016, a humpback whale was found stranded in the Buceo Harbor Bay in Montevideo, Uruguay (34º 54' S, 56º 07' W) at 15 h (Local Time [LT]). The area where the whale was stranded had a depth of 2 m. Several attempts were made by local people to rescue and help the whale to get back to open waters, but the whale returned to the same place and stayed there until its death 3 d later. The whale expired on 26 August, and the body was removed from the beach for a necropsy. The whale was a young female with a total length of 9.7 m and a weight of 7 tons; she had a few scars and appeared to exhibit healthy body conditions. No signs of bruises or cuts by boat propellers were found. Gross necropsy findings include emaciation, skin ulcerations, pneumonia, and generalized signs of septicemia such as congestion and edema of internal organs with great accumulation of serosanguinous fluid in the pleural and peritoneal cavities. There was no evidence regarding the original cause of infection, but no parasites were observed in the lungs or gastrointestinal tract.

Single hydrophone recordings were made with a custom built hydrophone (sensitivity of -40 dB re 1 V/µPa; linear from 20 Hz to 60 KHz). The recordings were made on a digital recorder TASCAM HD-P2, with a sampling frequency of 44.1 kHz. Sound analysis was performed using *Audacity*, Version 1.2.6 (Mazzoni, 2006) and *Raven Lite* 1.0 (free license). Power spectra were calculated using a 1,024 point Fast Fourier Transform (FFT) with a Hanning window. The hydrophone was placed 10 m from the whale. The whale remained motionless during the recording period and only moved vertically to breath. We recorded continuously from 23 August at 2000 h (after the rescue attempt was completed) to until 0500 h on 26 August when it expired. A total of

58 h of recordings were made of which just over 58 s in total contained whale vocalizations.

Two clearly different sounds were recorded and were designated as sound 1 and sound 2, respectively (Table 1). Sound 1 was characterized as a low tonal sound with a duration of 1 ± 0.8 s (mean ± SD), and with a frequency of peak energy of 332 ± 6.2 Hz (Figure 1). Sound 2 had a duration of 0.5 ± 0.6 s and a peak frequency of 189 ± 2.3 Hz (Figure 2); this sound was emitted in a train of three sounds (Figure 2) twice on 24 August between 0400 and 0530 h (Figure 3). Sound 1 was produced most often, while sound 2 was only emitted in the first 10 h of recordings (Figure 3).

Table 1. Summary of acoustic parameters by sound, mean parameters, and standard deviations (SD) are shown.

	Sound 1 (grunt)		Sound 2 (wops)	
	n = 47		*n* = 11	
Sound parameters	Mean	SD	Mean	SD
Duration (s)	1	0.8	0.5	0.6
Peak frequency (Hz)	332	6.2	189	2.3
Start frequency (Hz)	53	7.8	62	1.1
End frequency (Hz)	221	4.9	168	1.7

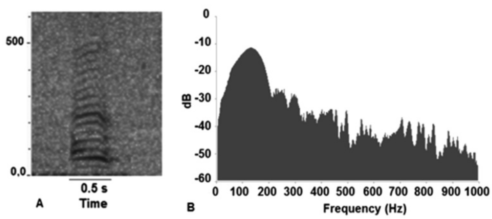

Figure 1. An example of sound 1 (grunts) emitted by the female humpback whale: (A) spectrogram (Hanning window FFT: 1,024) and (B) spectrum of single sound showing the frequency of peak energy.

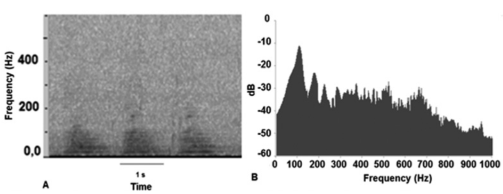

Figure 2. An example of sound 2 (wops), the three sounds emitted by the stranded female humpback whale: (A) spectrogram (Hanning window FFT: 1,024) and (B) spectrum of single sound 2 showing the frequency of peak energy.

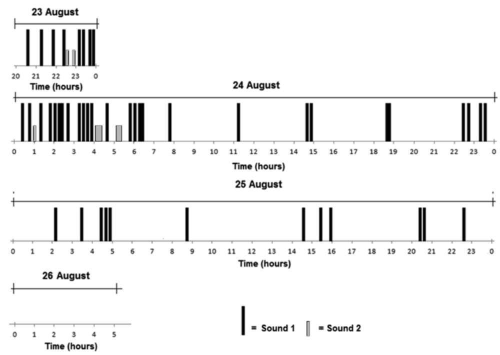

Figure 3. Timeline of sounds emitted during the recording period

Both sounds described herein were low in frequency, under 350 Hz peak frequency, and had a maximum duration of 1.3 s. Compared with reported humpback whale sounds in the literature, the duration and frequency metrics (i.e., peak frequency, start frequency, and end frequency) from these two sounds are similar to the "grunt" for sound 1 and "wops" for sound 2; these sounds are both recorded widely for this species (Au et al., 2006; Dunlop et al., 2007; Stimpert et al., 2011; Rekdahl et al., 2013). However, the degree of similarity in the measured parameters of these sound types needs to be assessed from a quantitative point of view.

Grunts have been mentioned in research conducted by Thompson et al. (1986) in the Alaskan feeding grounds, by Dunlop et al. (2007) who documented relatively uncommon sound types on the migration route, and by Stimpert et al. (2011) who found this sound to be more specifically related to foraging activities.

The wops sound type occurs in all three of the major behavioral contexts of humpbacks—feeding, breeding, and migration—and in three different populations—North Pacific, North Atlantic, and East Australian—indicating that it may be an important sound reflecting a flexible context or one that has multiple uses during different activities (Stimpert et al., 2011). It would be interesting to obtain recordings of stranded or entangled humpback whales to see if these sound types are also present in other stressful situations. If so, it would further suggest that these sounds are generally used as a distress signal.

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Literature Cited

Au, W. W. L., Frankel, A., Helweg, D. A., & Cato, D. H. (2001). Against the humpback whale sonar hypothesis. *IEEE Journal of Oceanic Engineering*, *26*, 295-300. https://doi.org/10.1109/48.922795

Au, W. W. L., Mobley, J., Burgess, W. C., Lammers, M. O., & Nachtigall, P. E. (2000). Seasonal and diurnal trends of chorusing humpback whales wintering in waters off western Maui. *Marine Mammal Science*, *16*, 530-544. https://doi.org/10.1111/j.1748-7692.2000.tb00949.x

Au, W. W. L., Pack, A. A., Lammers, M. O., Herman, L. M., Deakos, M. H., & Andrews, K. (2006). Acoustic properties of humpback whale songs. *The Journal of the Acoustical Society of America*, *120*, 1103-1110. https://doi.org/10.1121/1.2211547

Chu, K. C. (1988). Dive times and ventilation patterns of singing humpback whales (*Megaptera novaeangliae*). *Canadian Journal of Zoology*, *66*, 1322-1327. https://doi.org/10.1139/z88-194

Chu, K., & Harcourt, P. (1986). Behavioral correlations with aberrant patterns in humpback whale songs. *Behavioral Ecology and Sociobiology*, *19*, 309-312. https://doi.org/10.1007/BF00295703

Darling, J. D., Jones, M. E., & Nicklin, C. P. (2006). Humpback whale songs: Do they organize males during the breeding season? *Behaviour*, *143*, 1051-1101. https://doi.org/10.1163/156853906778607381

Dunlop, R. A., Noad, M. J., Cato, D. H., & Stokes, D. (2007). The social vocalization repertoire of east Australian migrating humpback whales (*Megaptera novaeangliae*). *The Journal of the Acoustical Society of America*, *122*, 2893-2905. https://doi.org/10.1121/1.2783115

Frankel, A. S., Clark, C. W., Herman, L. M., & Gabriele, C. M. (1995). Spatial distribution, habitat utilization, and social interactions of humpback whales, *Megaptera novaeangliae*, off Hawaii, determined using acoustic and visual techniques. *Canadian Journal of Zoology*, *73*, 1134-1146. https://doi.org/10.1139/z95-135

Frazer, L. N., & Mercado, E. (2000). A sonar model for humpback whale song. *IEEE Journal of Oceanic Engineering*, *25*, 160-182. https://doi.org/10.1109/48.820748

Mazzoni, D. (2006). *Audacity 1.2.6*. Retrieved from http://audacity.sourceforge.net

Miller, P. J. O., Biassoni, N., Samuels, A., & Tyack, P. L. (2000). Whale songs lengthen in response to sonar. *Nature* (*London*), *405*, 903. https://doi.org/10.1038/35016148

Noad, M. J., Cato, D. H., Bryden, M. M., Jenner, M. N., & Jenner, K. C. S. (2000). Cultural revolution in whale songs. *Nature* (*London*), *408*, 537. https://doi.org/10.1038/35046199

Payne, R. S., & McVay S. (1971). Songs of humpback whales. *Science*, *173*, 585-597. https://doi.org/10.1126/science.173.3997.585

Rekdahl, M. L., Dunlop, R. A., Goldizen, A., & Noad, M. (2013). Temporal stability and change in the social call repertoire of migrating humpback whales. *The Journal of the Acoustical Society of America*, *133*, 1785-1795. https://doi.org/10.1121/1.4789941

Rekdahl, M., Tisch, C., Cerchio, S., & Rosenbaum, H. (2016). Common nonsong social calls of humpback whales (*Megaptera novaeangliae*) recorded off northern Angola, southern Africa. *Marine Mammal Science*, *33*(1), 365-375. https://doi.org/10.1111/mms.12355

Silber, G. K. (1986). The relationship of social vocalizations to surface behavior and aggression in the Hawaiian humpback whale (*Megaptera novaeangliae*). *Canadian Journal of Zoology*, *64*, 2075-2080. https://doi.org/10.1139/z86-316

Smith, J. N., Goldizen, A. W., Dunlop, R. A., & Noad, M. J. (2008). Songs of male humpback whales, *Megaptera novaeangliae*, are involved in intersexual interactions. *Animal Behaviour*, *76*, 467-477. https://doi.org/10.1016/j.anbehav.2008.02.013

Stimpert, A. K., Au, W. W. L., Parks, S. E., Hurst, T., & Wiley, D. N. (2011). Common humpback whale (*Megaptera novaeangliae*) sound types for passive acoustic monitoring. *The Journal of the Acoustical Society of America*, *1*, 476-482. https://doi.org/10.1121/1.3504708

Thompson, P. O., Cummings, W. C., & Ha, S. J. (1986). Sounds, source levels, and associated behavior of humpback whales, southeast Alaska. *The Journal of the Acoustical Society of America*, *80*, 735-740. https://doi.org/10.1121/1.393947

Tyack, P. L. (1983). Differential response of humpback whales, *Megaptera novaeangliae*, to playback of song or social sounds. *Behavioral Ecology and Sociobiology*, *13*, 49-55. https://doi.org/10.1007/BF00295075

Winn, H. E., Thompson, T. J., Cummings, W. C., Hain, J., Hudnall, J., Hays, H., & Steiner, W. W. (1981). Song of the humpback whale population comparisons. *Behavioral Ecology and Sociobiology*, *8*, 41-46. https://doi.org/10.1007/BF00302842