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Communication sounds of Commerson's dolphins (*Cephalorhynchus commersonii)* and contextual use of vocalizations

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ABSTRACT

Cetaceans produce a variety of vocalizations to communicate; however, little information exists on the acoustic behavior displayed by Commerson's dolphins (*Cephalorhynchus commersonii*) in the wild other than their echolocation behavior. Most available literature suggests that Commerson's dolphins do not produce any other sound type besides narrow-band high-frequency (NBHF) clicks, such that no signals are emitted below 100 kHz. We conducted acoustic recordings together with sightings to study the acoustic behavior of Commerson's dolphins in Bahia San Julian, Argentina. This is the first study that provides evidence that this species produces a variety of acoustic signals, including whistles and broad-band clicks (BBC), with frequency content well below 100 kHz. Whistles were recorded mostly in the presence of mother and calf and were associated with parental behavior. BBC may be used for communication purposes by adults. These vocalizations are within the hearing range of killer whales and so could pose a risk of predation for Commerson's dolphins. Whether this population of Commerson's dolphins produce all these types of signals while they are in the open sea out of the waters of Bahía San Julián, which are apparently safe from predation, remains unknown.

Key words: communication, vocalizations, acoustic behavior, Commerson's dolphin, *Cephalorhynchus commersonii*, Bahía San Julián.

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Communication implies the transmission of information through a signal from a sender to a receiver, who then uses that information to make a behavioral decision (Bradbury and Vehrencamp 1998). Aquatic environments are characterized by an efficient propagation of sound over long distances and a rapid attenuation of light (Au 1993) in comparison to airborne environments. In this context, communication mediated by acoustic signals has a crucial role in behavior and social interactions of marine mammals for which visual communication is limited (Au 1993). Toothed whales produce a variety of vocalizations over a broad range of frequencies. These sounds can be broadly divided into communication and echolocation signals, according to their assumed function. Communication signals consist of whistles, clicks, and burst-pulsed calls (Tyack and Clark 2000). Whistles are frequency-modulated, long duration tonal calls, typically produced between 5 kHz and 20 kHz, that often have harmonic components (Richardson *et al.* 1995). Clicks are high-frequency, directional transients that are assumed to be mainly produced for echolocation purposes, but also used for social communication by some species of odontocetes (Dawson 1991, Madsen *et al.* 2005, Clausen *et al.* 2010). Burst pulse signals are click trains emitted with very short interclick intervals (Lammers *et al.* 2003). Additional sounds that cannot be easily included in these categories have been described for some species of dolphins, such as various low-frequency sounds (Schultz *et al.* 1995, Herzing 1996, Van Parijs and Corkeron 2001, Simard *et al.* 2011).

Most toothed whales produce whistles and burst pulses for social communication and clicks for echolocation. However, there are some species that apparently only produce narrow-band high-frequency (NBHF) clicks with no energy below 100 kHz and do not whistle (Morisaka and Connor 2007). The NBHF group includes at least four species of porpoises in the family Phocoenidae (Silber 1991, Li *et al.* 2007, Villadsgaard *et al.* 2007, Basset *et al.* 2009), the four species of *Cephalorhynchus* dolphins (Kyhn *et al.* 2009, 2010; Götz *et al.* 2010; Morisaka *et al.* 2011; Reyes Reyes *et al.* 2015), two species of *Lagenorhynchus* dolphins (Kyhn *et al.* 2009, 2010), the Franciscana dolphin (*Pontoporia blainvillei)* (Melcón *et al.* 2012), and the pygmy sperm whale (*Kogia breviceps)* (Madsen *et al.* 2005). Some of these species have been shown to vary the emission rate of the NBHF clicks during the display of different behaviors, thereby managing to communicate with conspecifics by acquiring information from the repetition rate pattern of their clicks (Dawson 1991, Clausen *et al.* 2010, Yoshida *et al.* 2014). Available literature (Andersen and Amundin 1976, Madsen *et al.* 2005, Morisaka and Connor 2007, Khyn *et al.* 2013) supports the "acoustic crypsis" hypothesis, which assumes that killer whale predation risk was the primary selective factor favoring an echolocation and communication system in NBHF species restricted to sounds that killer whales cannot hear, above 100 kHz (Szymanski *et al.* 1999).

Commerson's dolphins (*Cephalorhynchus commersonii*) are small dolphins that inhabit exclusively cold temperate coastal waters in the Southern Hemisphere (Goodall *et al.* 1988). Along the southern coast of Argentina, this species is found in cold inshore waters, bays, harbors, and river mouths. Between September and May, a population of Commerson's dolphins socializes, breeds, forages, rests, and commutes in Bahía San Julián (Iñíguez *et al.* 2000). Other than their echolocation behavior, which has been studied in captive dolphins (Watkins and Schevill 1980, Kamminga and Wiersma 1982, Schochi *et al.* 1982) and to a lesser extent in the wild (Evans *et al.* 1988, Kyhn *et al.* 2010, Reyes Reyes *et al.* 2015), little information exists about their acoustic communication signals (Yoshida *et al.* 2014). Echolocation signals of this species consist of NBHF clicks with peak frequencies between 129 kHz and 173 kHz, 3 dB bandwidth between 5 kHz and 21 kHz and duration between 56 µs and 80 µs (Kyhn *et al.* 2010, Reyes Reyes *et al.* 2015). Only a few studies reported low-frequency pulses with frequency emphases between 1 and 6 kHz described as "cry sounds" in captivity (Watkins and Schevill 1980, Schochi *et al.* 1982, Dziedzic and de Buffrenil 1989).

The aim of this study was to describe nonecholocation acoustic signals produced by Commerson's dolphins in the wild. Furthermore, simultaneous visual and acoustic recordings were analyzed to get an insight into the behavioral contexts in which these sounds are emitted.

METHODS

Field Site and Data Collection

The data analyzed for this study were collected from Commerson's dolphins over 30 sessions during January 2011–2013, October 2011, March 2012, and April 2013 in Bahía San Julián, located in the Southwest Patagonia, Argentina (49°14′S, 67°36′W; Fig. 1).

Underwater sound recordings were made under suitable weather conditions (low winds, Beaufort scale <2), using an omnidirectional, spherical hydrophone Reson TC 4033 (http://www.teledyne-reson.com/product/tc-4033/) with a built-in preamplifier suspended from a semirigid boat (with the engine off) or a pier. Sound was digitized at a sampling rate of 500 kHz by Avisoft Ultrasound-Gate, obtaining recordings

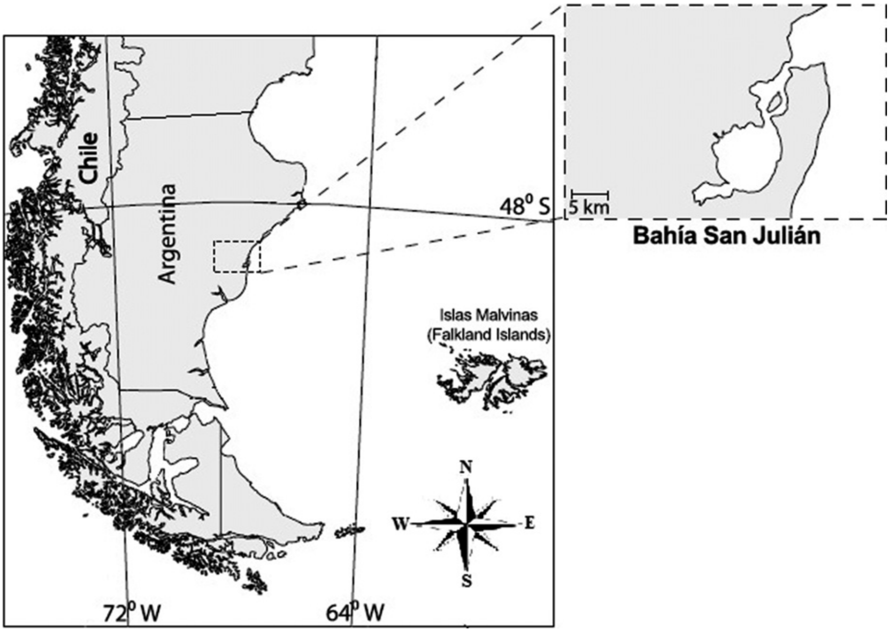

Figure 1. Map of southern South America. Insert box indicates our study location in Argentina.

with frequencies ranging from 10 Hz up to 250 kHz, and stored as 1 min WAV files in a laptop. Since the equipment did not have a flat response over the desired range, the inverse of the transfer function was applied to correct the recorded levels.

Weather conditions, such as sea state, wind speed, and temperature were noted every half hour. Each time an individual or group of dolphins was sighted surface behavior, age category, group size, and position of the observed animals were recorded using a visual survey follow protocol, which includes encountering groups or individual animals and staying with those animals for brief periods, and a focal group sampling method, which refers to a continuous assessment of group activity (Mann 1999). A group was defined as those dolphins associated closely and engaged in similar activities. Three ages categories (adult, juvenile, and calf) were distinguished. Adults have a very distinct black and white pattern; juveniles are medium-sized animals with a clear light gray rather than white pigmentation on the sides and back; a calf is distinguished by its dark brown to gray color pattern (Goodall *et al.* 1988).

Due to the unique features of the study area (relatively small area with shallow waters, *i.e.*, <35 m, and many sandbars), the acoustic detection range is restricted and marine mammals are easy to sight. In addition, given the historic records of the area and the fact that we did not see other cetaceans during the acoustic recordings, it is highly unlikely that other marine mammals were in the area.

Behavioral and Acoustical Analysis

Behaviors were assigned to the following categories (modified from Iñíguez and Tossenberger 2007, Herzing 1996): foraging (dolphins chase fish at the surface, dive deep, and circle around), traveling (dolphins swim consistently in one direction at a moderate to fast speed, usually in a relatively tight formation), resting (dolphins typically group tightly together abreast or alone, dive, and surface as a cohesive unit, normally heading opposite to the current and then slow down), interacting with boat (dolphins approach the boat to bowride or swim closely around it), socializing (includes aerial displays like jumps, tail or body slaps, or mating behavior) and parental (mother interacted with or supervised calf).

To study the behavioral context of the different sound types, all acoustic data were cut into 30 s intervals following Henderson *et al.* (2011). The spectrograms of each 30 s file were examined and the presence of whistles, complex signals (composed of more than one type of sound), broad-band clicks (BBC), as well as echolocation signals such as NBHF regular and buzz clicks were logged. Regular and buzz clicks differ in their production rate: buzz clicks are emitted at intervals of 5 ms or less, while regular clicks are emitted at greater intervals (Reyes Reyes *et al.* 2015). When visual data were also available, a behavioral category was assigned to each of those segments.

The acoustical analysis focused on the characterization of signals other than the typical NBHF clicks used by this species for echolocation purposes. Audio files were scanned using a custom software program, TRITON (Wiggins 2003), developed in Matlab (The MathWorks, Inc., Natick, MA) and the occurrence of whistles, BBC, and complex signals were logged. Only those files with high signal-to-noise ratio (>12 dB) were selected for further analysis. Recordings made while there were other boats navigating in the bay were discarded, as well as files containing clipped signals. A 1,024-point Hanning window with 90% of overlap was used to plot all spectrograms with a high-pass filter at 2 kHz to get rid of the low-frequency noise. The analysis frequency range was set between 2 and 80 kHz for whistles and complex signals, and 2 and 200 kHz for BBC, and the display frame duration was 0.4 s for whistles and complex signals, and 0.2 s for BBC. Spectrograms were visually inspected and parameters were measured directly on the computer screen using the cursor supplied by the program. Only whistles with a clear start and end and without overlap in time and frequency with other sounds were selected for further analysis. For each whistle, the following parameters were measured: peak frequency (defined as the frequency at the maximum intensity), start frequency (the criterion for whistle onset was a signal to noise ratio over 10 dB) and end frequency (defined as the frequency just before the signal to noise ratio fell below 10 dB), minimum and maximum frequency (defined as the lowest and highest frequency in the spectrogram with a signal to noise ratio of 10 dB or more, respectively), number of inflection points (defined as a change in the slope of the contour of a signal from positive to negative or *vice versa*; Ding *et al.* 1995), duration and number of harmonics. Contours were classified into the following tonal classes based on the frequency modulations: "constant" (signals with no inflection points and constant frequency), "ascending" (signals with no inflection points and rising in frequency), "descending" (signals with no inflection points and falling in frequency), descending-ascending (signals first falling in frequency, one inflection point, and then rising in frequency), ascending-descending (signals first rising in frequency, one inflection point, and then falling in frequency) (Azevedo *et al.* 2007). No whistles with more than one inflection point were recorded. For each click, the following parameters were calculated: peak frequency, 10 dB bandwidth (defined as the bandwidth at −10 dB points below the maximum intensity), 3 dB bandwidth (defined as the bandwidth at −3 dB points below the maximum intensity), and duration. The fact that the distance of animals from the hydrophone was unknown precluded measurements of sound pressure levels.

Multiple correspondence analysis was carried out to investigate the associations between the presence of the different sound types, and behavioral categories (Hawkins and Gartside 2009). This is an exploratory method that can be applied to contingency tables and provides a means of displaying a set of data in a low-dimensional graphic.

Results

Sound Types

Three different types of sounds were recorded from Commerson's dolphins in Bahía San Julián and described here, excluding NBHF clicks, which are shown only for comparison (Fig. 2f): whistles (n = 117), complex signals (n = 1) and BBC (n = 355) (Table 1). The only complex signal recorded, which we called "crowing," had a duration of 0.3 s, started with a burst pulse followed by three "descending" tones with harmonics and ended with an "ascending" tone (Fig. 2a). BBC have an interference pattern with multiple energy peaks of varying amplitude and a median peak frequency at 44 kHz (Fig. 2e). Three different whistles, which resemble whistles produced by most delphinid species, were recorded. Whistle A (n = 1) has an "ascending-descending" pattern with one inflection point and harmonics (Fig. 2b). Whistle B (n = 115) is continuous and 60% of them had from one up to six detectable harmonics ranging from 16 kHz to 48 kHz. In 74% of B whistles with one or more detectable harmonics, the most emphasized frequency was 16 kHz. The single tones, *i.e.*, no harmonics detected, recorded in 40% of these signals had a frequency of 16 kHz in 93% of the cases, 24 kHz in 5%, and 48 kHz in 2%. It is notable that in all cases, those frequencies coincided with some of the harmonics of the B whistles

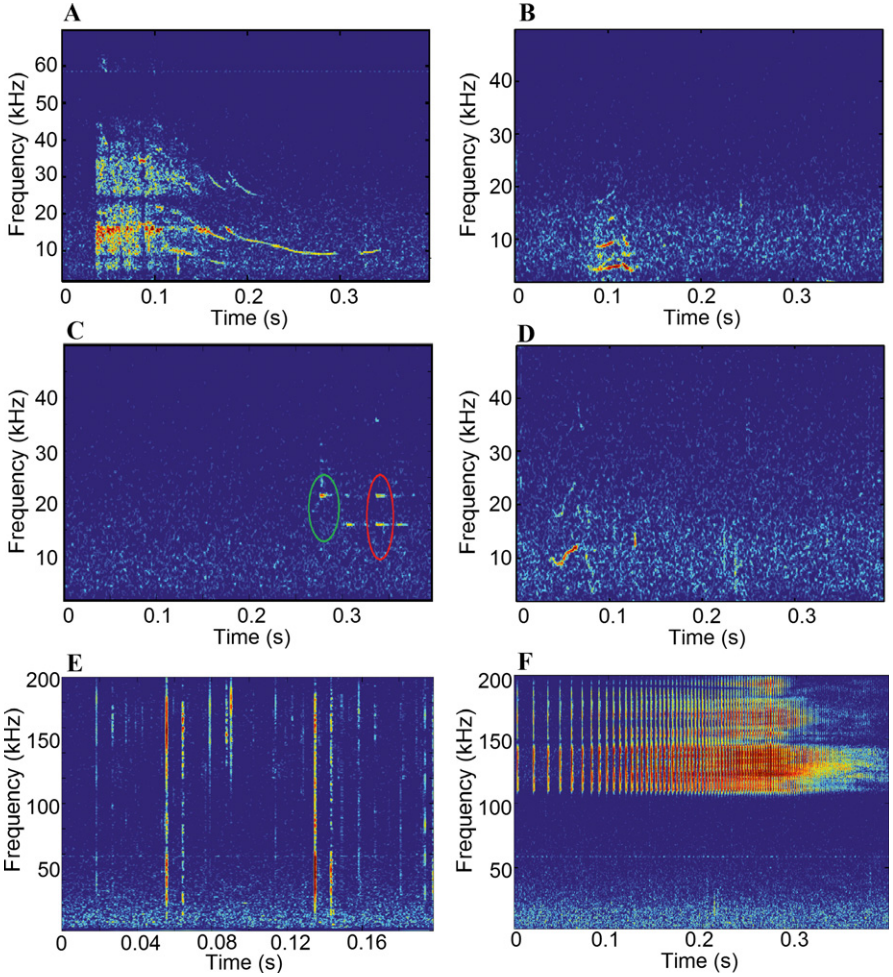

Figure 2. Spectrograms (nfft = 1,024, overlap = 90%, Hanning window) of the different sounds produced by Commerson's dolphins. Panels (a)–(e) show the signals described in this paper: (a) complex signal, (b) whistle A, (c) whistles B without harmonics (green circle) and with harmonics (red circle), (d) whistle C, (e) broad-band clicks (note a BBC with the peak frequency at 158 kHz at 0.55 s and a BBC with the peak frequency at 46 kHz at 0.135 s). Panel (f) depicts an echolocation click train showing regular clicks in the first 0.1 s followed by buzz clicks at the end of the train. Note the different time and frequency scales. Amplitude is color-coded, with higher values shown in red and lower in blue.

with harmonics. An example of this observation can be found in Fig 2c where the frequency of the B whistle without harmonics marked with the green circle coincides with the first harmonic of the B whistle inside the red circle. Whistle C (n = 1) is a "descending-ascending" tone with the first harmonic visible (Fig. 2d). Two more whistles were found, however, they did not meet the requirements for further analysis.

Table 1. Characteristics of the different sound types described in this paper. Where the sound type was recorded more than once, we have reported the median of each parameter.

Sound type	Description of sound	Fpeak (kHz) (median, Q1, Q3)	BW 3 dB (kHz)	BW 10 dB (kHz)	Fstart (kHz)	Fend (kHz)	Fmax (kHz)	Fmin (kHz)	Duration 10 dB (ms)	Harmonics
Complex signal "Crowing" ($n = 1$)	burst pulse	15	2	8	—	—	—	—	73.4	—
	"descending" tone	10	—	—	11	9	11	9	25.4	Yes
	"descending" tone	7	—	—	8	7	8	7	23.1	Yes
	"descending" tone	16	—	—	16	9	16	9	118	Yes
	"ascending" tone	10	—	—	9	10	9	10	20.5	No
Whistle A ($n = 1$)	"ascending-descending" tone	5	—	—	4	4	5	4	39.7	Yes
Whistle B ($n = 116$)	"constant" tone	16 (16–16)	—	—	—	—	—	—	18 (13–27)	Yes/No
Whistle C ($n = 1$)	"descending-ascending" tone	12	—	—	10	12	12	9	26.3	Yes
BBC ($n = 56$)	broad-band click	44 (29–96)	49 (21–110)	161 (144–170)	—	—	—	—	0.18 (0.14–0.22)	—

Behavior

A total of 31 groups of Commerson's dolphins were selected for analysis from 19 d of the 30 sampling days, and 610 30 s intervals were evaluated out of which 265 were associated with a behavioral category. Group size varied from 1 to 5, with a mode of two individuals. Groups were composed of either adults only (n = 20), adults and juveniles (n = 7), or mother with calf (n = 4).

The most frequent behavioral category in the area was traveling (32.3%), followed by parental (12.9%), foraging (9.7%) and socializing (6.5%). Interacting with boat was registered in only 6.5% of the cases since generally the dolphins did not approach the boat to interact while we were making acoustic recodings with the engine off, and the least frequent behavior was resting (3.2%). However, for 29% of the 265 intervals associated with behavioral categories, the animals were swimming slowly in the opposite direction of the boat's drifting, so we lost visual contact with the animals before we could discriminate the exact behavior. Because we could not discriminate between traveling and resting, we classified the behavior as undefined.

Over the total 30 s intervals analyzed, BBC were present in 69.5%, whistles in 7.2%, and complex signals in 0.002%. Most of the time more than one type of sound, including NBHF regular and buzz clicks were recorded simultaneously. The percentages of cooccurrence of the different types of sounds are shown in Table 2. All types of whistles and complex signals were recorded only when there were groups of mother and calf in the area (Table 3), with the only exception of whistle C for which visual data were not available. The complex signal "crowing" and whistles A and C were recorded on only one occasion. In Table 3 each behavioral category is described in terms of the percentages of events with each sound type, including regular and buzz clicks, in order to have a better understanding of the contextual use of the whole

Table 2. Percentages of coocurrence of different sound types of Commerson's dolphins (columns) recorded within audio files containing whistles and BBC (rows).

Type of sound	% Whistles	% BBC	% Regular clicks	% Buzz clicks
Whistles	100.0	57.5	97.5	35.0
BBC	5.4	100.0	66.0	13.9

Table 3. Presence of the different types of vocalizations described for Commerson's dolphins within each behavior category.

	Type of sound			
	Whistle B	BBC	Regular clicks	Buzz clicks
Behavioral category				
Foraging	0.0%	68.4%	100.0%	42.1%
Interacting with boat	0.0%	84.2%	89.5%	0.0%
Parental	27.3%	37.9%	97.0%	34.8%
Resting	0.0%	100.0%	0.0%	0.0%
Socializing	0.0%	61.9%	90.5%	9.5%
Traveling	0.0%	75.3%	79.5%	9.6%
Undefined	0.0%	67.5%	75.0%	12.5%

acoustic repertoire of the species. Regular clicks were the most frequent sounds in almost all behavioral categories, followed by BBC. Resting was characterized by the absence of any sound type other than BBC. Buzz clicks were present in a higher proportion during foraging and parental behavior. A distinct feature of parental behavior was the presence of whistles, which were absent in the other behavioral categories.

The multiple correspondence analysis is a test to assess the association degree between two variables (behavioral category and sound type). This statistical analysis showed that there was a significant association among the variables sound types and behavioral categories ($\chi^2 = 2,025$, df = 5, $P < 0.0001$), which means that both variables are not independent from each other. The first three dimensions accounted for only 51% of the variance in the data set, which may be due to a low sample size. This is especially true for the number of whistles recorded in the study, which in turn were almost exclusively associated with parental behavior.

Biplots have two functions: (1) to visualize dependence between variables as the distance of the points to the origin—the longer the vector, the stronger the dependence; and (2) to illustrate the association between categories of the two different variables—the closer the points, the higher the association. For example, resting and parental behavior were the most distant points from the origin (Fig. 3a) which was reflected in the highest inertia values (1.24 and 1.00, respectively). In other words, these behavioral categories were the most strongly associated with certain sound types. The highest variability was explained by the association between resting with the absence of regular clicks, and parental behavior with the presence of whistles (Fig. 3a). Additionally, the association between foraging and the presence of buzzes explained some variability of the data (Fig. 3b).

DISCUSSION

In this paper, we described new vocalizations for wild Commerson's dolphins, including whistles, supposedly lost in the evolution of *Cephalorhynchus* dolphins (May-Collado *et al.* 2007, Morisaka and Connor 2007). Until now only high-frequency clicks had been described for Commerson's dolphins (Kamminga and Wiersma 1982, Evans *et al.* 1988, Kyhn *et al.* 2010, Yoshida *et al.* 2014, Reyes Reyes *et al.* 2015), with the exception of three studies that described low-frequency pulsed sounds (Watkins and Schevill 1980, Schochi *et al.* 1982, Dziedzic and de Buffrenil 1989).

Whistles

The recorded whistles were found only in the presence of groups consisting of a mother and calf, with the exception of whistle C, which suggests that these signals may be used to establish and maintain contact between the mother and its calf. The function of whistles as contact calls between individuals, particularly mother and calf, have previously been reported for other species of dolphins, such as bottlenose dolphins (*Tursiops truncatus)* (Sayigh *et al.* 1990, Smolker *et al.* 1993), spotted dolphins (*Stenella frontalis)* (Herzing 1996) and Pacific humpback dolphins (*Sousa chinensis)* (Van Parijs and Corkeron 2001).

The majority of the recorded B whistles (60%) had one or more harmonics. The remaining 40% without harmonics had frequencies that in all cases coincided with some of those harmonics. It remains uncertain whether those signals were actually

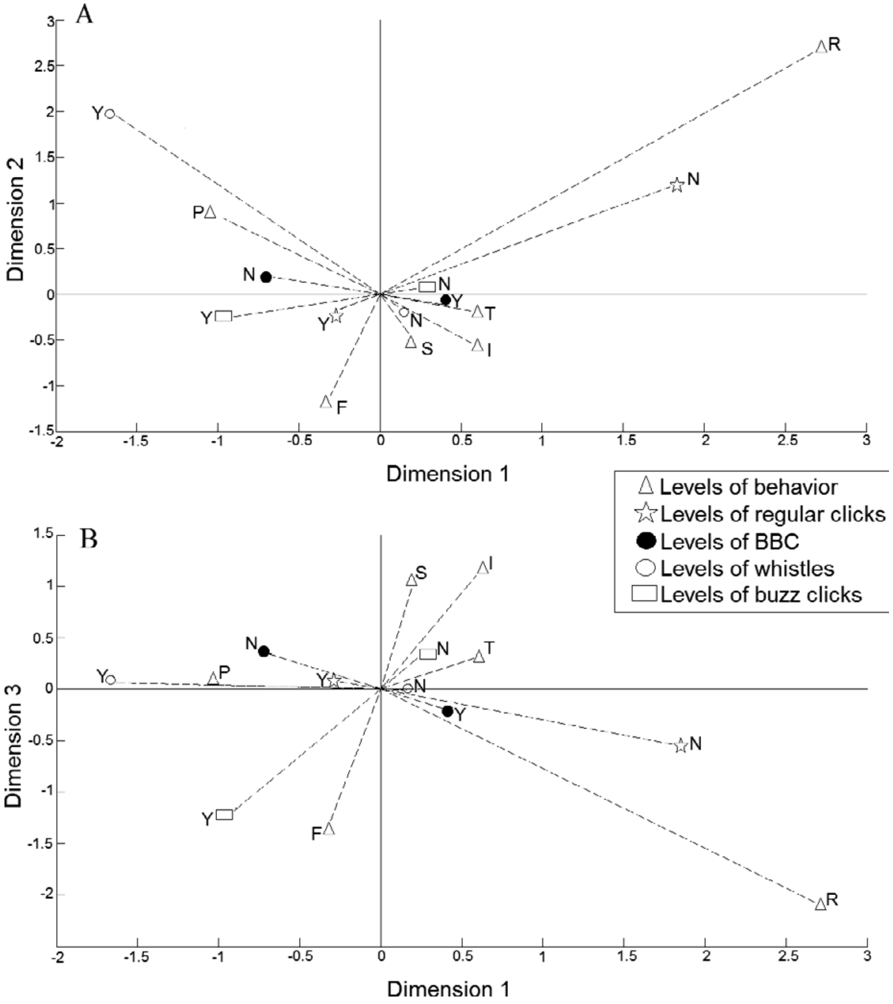

Figure 3. Correspondence analysis biplots of presence of sound types (Y = yes, N = no) and behavioral categories (P = Parental, S = Socializing, T = Traveling, I = Interacting with boat, F = Foraging, R = Resting).

whistles without harmonics, or signals in which a particular harmonic was emphasized and the others were not detected by our recording system (Fig. 2c). Lammers and Au (2003) showed that whistles recorded from free-ranging spinner dolphins (*Stenella longirostris)* were richer in harmonic structure when animals were swimming towards the recording device, and concluded that directionality exists in the transmission pattern of the whistles. Whether a distinct beam is present in the whistles emitted by Commerson's dolphins and whether the harmonic structure depends on the relative position of the receiving system relative to the acoustic axis of the animal remain unknown. Another possibility is that dolphins actively exert some control over the harmonic composition of their whistles in order to provide information about location and direction of movement to other group members. Lammers *et al.* (2003) observed that spotted and spinner dolphins produced whistles with harmonics that varied in number and amplitude. They suggested that dolphins should be quite sensitive to harmonics, after using a delphinid audiogram to infer the way whistles with harmonics might be heard by nearby conspecifics. Additionally they found that levels received by listeners were higher for harmonics rather than the fundamental frequency and concluded that sometimes harmonics might be heard as the dominant frequency of the whistle. It has been shown with bats that under certain conditions the animals enhance some harmonics of their signals due to the advantage of high directionality at higher frequencies (Sümer *et al.* 2009). It is also possible that Commerson's dolphins often hear harmonics as the dominant frequency of a whistle, and in such a case most of the time the fundamental frequency was not expressed in the recorded B whistles.

In this study, whistles of type B were recorded in 27.3% of the recorded parental behavior events (Table 3), which suggests that whistles may be used only in particular situations between a mother and its calf. The presence of regular and buzz clicks during parental behavior events could be due to the fact that on several occasions the mother was foraging while it was with the calf; however, it is also likely that NBHF clicks serve some communication purposes as well as echolocation. Furthermore, regular clicks were present in a high proportion of all behavioral categories except resting (Table 3). The use of NBHF clicks for communication have been described for captive Commerson's dolphins (Yoshida *et al.* 2014) as well as Hector's dolphins (*Cephalorhynchus hectori)* and harbor porpoises (Dawson 1991, Clausen *et al.* 2010).

Broad-band Clicks

These signals have a highly variable peak frequency and 3 dB bandwidth due to the interference pattern that can be seen in their spectrogram (Fig. 2e). It is possible that (1) the animals have the ability to intentionally change the spectral content of these signals, (2) interindividual differences exist, and (3) some of the variability in the peak frequency and bandwidth may be due to different orientations of the animal's head with respect to the hydrophone. We cannot rule out any of these possibilities in this study, since our recording setup prevents us from discriminating between signals recorded on and off the acoustic axis of the animal.

BBC were recorded in high proportion during all the behavioral categories. To assess a possible echolocation function of BBC, it would be helpful to make a comparison between some properties of these signals and the previously described NBHF echolocation clicks. Khyn *et al.* (2013) showed that for the same energy flux density level, the narrow bandwidth of echolocation signals with a peak frequency around 130 kHz is very well suited for short-range sonar in cluttered, shallow water habitats and will have the best echo-to-noise ratio. On the other hand, signals with a broader bandwidth, as it is the case of BBC, would enhance details about ensonified targets, such as localization, size, shape and material, while narrow-band clicks will have poorer range resolution (Møhl and Andersen 1973). However, for the same size of sound transmitting organ, a greater bandwidth involves a lower directionality of the emitted signal (Au 1993), which means that the signal will ensonify a larger area and so the amount of clutter (unwanted echoes from nontarget objects) will increase, reducing detectability of the target (Miller and Wahlberg 2013). We were not able to measure the sound pressure levels of BBC, which would allow us to compare better the efficiency of these signals for a potential sonar function with regard to the regular clicks. However, as most of the BBC were not emitted in regular click trains, but rather were isolated or with very irregular ICIs, we propose that BBC may be used for communication among individuals. Nevertheless, we cannot discard an echolocation role of these signals. If that would be the case, we think that BBC could be used to perceive the long-range objects while performing short-range echolocation on closer objects with the NBHF clicks.

Acoustic Crypsis

Available literature suggests that NBHF species don't produce any other sound type rather than NBHF clicks. This study is the first evidence that wild Commerson's dolphins in Bahía San Julián produce a variety of acoustic signals, including whistles and broad-band clicks in addition to NBHF clicks. The idea of convergent evolution of whistle loss and high-frequency click production linked to the avoidance of acoustic detection by killer whales for NBHF species has been supported by Madsen *et al.* (2005) and Morisaka and Connor (2007). The adaptative value of whistles and BBC remains uncertain, but in line with the acoustic crypsis hypothesis we speculate that Commerson's dolphins may take advantage of using a variety of vocalizations while they are in Bahía San Julián where they are apparently protected from killer whale predation. Whistles and the complex signal "crowing" may be produced by calves to call their mothers during the first stages of their lives, or *vice versa*, while BBC may serve as communication signals that animals use while they are in Bahía San Julián. Whether this population of Commerson's dolphins produce all these signal types while they are in the open sea out of the safe waters of Bahía San Julián remains unknown. Further studies should be conducted to improve our understanding of the production and function of whistles and BBC by small cetaceans species.

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