




NOTE

Potential vocalizations of Bryde's whales in False Bay, South Africa

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Bryde's whales are one of the lesser-known species of baleen whales that inhabit tropical and subtropical waters across the globe (Kato & Perrin, 2018). Individuals from both subspecies, *Balaenoptera edeni edeni* (Anderson, 1878) and *B. e. brydei* (Olsen, 1913), also referred to as the offshore and inshore forms (Best, 1977; Best, 2001), respectively, can be found inhabiting the waters off the South African coast (Constantine et al., 2018; Penry et al., 2016). The two subspecies designations had originally been synonymized (Junge, 1950) but were later recognized as distinct, as suggested by Rice (1998), and recently confirmed genetically (Penry et al., 2018). Bryde's whales are often misidentified as other species, and their taxonomy has yet to be well resolved (Smultea et al., 2010). Further studies of the phylogenetic relationships between geographically isolated populations of Bryde's whales, by means of differences in behavior, vocalization, and mitochondrial DNA, are required to avoid conservation risks to genetically distinct populations, such as those now faced by Rice's whale (Constantine et al., 2018; Penry et al., 2018). Aside from the issues regarding taxonomy and population abundance of isolated stocks, relatively little is known regarding the swimming behavior, migratory habits, vocalizations, and the current population trend of Bryde's whales (Constantine et al., 2018; Helble et al., 2024; Penry et al., 2016).

Inshore Bryde's whales do not partake in long distance migrations but rather make small local migrations. This may be linked to the pursuit of local pelagic fish on which they feed, including anchovy *Engraulis capensis* and sardine *Sardinops sagax* (Best, 2001; Penry et al., 2016), allowing them to remain in shallower waters year-round (Izadi et al., 2022). In South Africa, the seasonal redistribution is believed to occur within a range of a few hundred kilometers, between the south-east coast and the west coast of the country. Remaining near the coast makes the whales vulnerable to impacts with vessels, which occur frequently and account for many deaths for the subspecies

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(Constantine et al., 2015). Bryde's whales also display unique feeding behavior, they are known to adapt their feeding strategy depending on prey type, and specific strategies vary between different populations (Constantine et al., 2018; Iwata et al., 2017; Soldevilla et al., 2017). Globally, Bryde's whales are listed as being of least concern by the International Union for Conservation of Nature's (IUCN) Red List of Threatened Species (Cooke & Brownell, 2018). However, the South African National Biodiversity Institute (SANBI) and Endangered Wildlife Trust classifies the South African Bryde's whale inshore population as vulnerable due to its low population level of less than 1000 individuals (Penry et al., 2016).

The South African inshore Bryde's whales occasionally engage in short, high-speed underwater pursuits of fish (Segre et al., 2022), making them vulnerable to entanglement in fishing gear such as octopus traps. This often results in the death or mortal wounding of the tangled individual (Reeves et al., 2013; Segre et al., 2022). The known threat of vessel impacts and fishing gear entanglement, as well as potential new threats, may be better managed by knowledge of where individuals are found and how they maneuver and migrate locally within a region. A possible approach for tracking Bryde's whales is the use of satellite-tagging, as has been used in previous studies (Liu et al., 2021; Murase et al., 2015). However, these whales are often solitary and elusive (Lodi et al., 2015) presenting a challenge toward tagging them.

Passive Acoustic Monitoring (PAM), utilizing single or multiple acoustic sensors, is believed to be a more achievable objective if the sources of sounds detected within the hydrophone detection range are known. Data from these sensors are versatile and are useful in a wide range of applications including studies on animal behavior, vocalization, population abundance, and density for vocally active species (André et al., 2011; Browning et al., 2017; Fleishman et al., 2023; Shabangu & Findlay, 2014). Long-term hydrophone deployments in the Pacific have collected a large quantity of data on Pacific Bryde's whale vocalizations and have been able to track and localize individuals, providing valuable insight into their swimming behavior, seasonal occurrence, and abundance (Helble et al., 2016; Helble et al., 2024). This approach has also been successfully applied to Rice's whales *B. ricei* in the Gulf of Mexico (Soldevilla et al., 2024).

Bryde's whales produce a variety of different sounds (Oleson et al., 2003), the call types and rate of their use vary geographically (Heimlich et al., 2005) and studies of isolated populations occasionally report sounds that may be unique from existing literature (Helble et al., 2016). There have been previous studies on the application of potentially useful and novel signal processing techniques to Bryde's whale vocalizations. For example, to distinguish between calls from different local populations (Romero-Vivas et al., 2013; Viloria-Gomora et al., 2021) or to classify calls as belonging to Bryde's whales (Babalola et al., 2021). However, despite published literature as Bryde's whale vocalizations, there is a lack of accessible data with which to devise and test these techniques for South African inshore Bryde's whales. The literature has provided some examples that potentially link specific call types to a social context. For example, a call type recorded on multiple occasions from a mother and calf pair (Figueiredo & Simao, 2014), or calls recorded by a juvenile in distress (Edds et al., 1993). Wang et al. (2022) has proposed that swept tonal calls and swept biphonated calls act as contact calls from lone individuals and that diversified call types are used for communication between individuals within groups. Building a large catalog of call types and instances of their occurrence may help to answer these questions and improve our understanding on the function of the various calls and habitat use by whales.

There is currently no published long-term acoustics work on the acoustic ecology of the South African Bryde's whales. Previous studies on inshore Bryde's whales in False Bay, by Ogundile et al. (2020) and Babalola et al. (2021), have presented possible methods for detecting Bryde's whale calls. However, they have not provided a thorough treatment of the call types and unique call features of the population. To fill this knowledge gap, we made acoustic recordings in False Bay (Figure 1), southeastern Atlantic Ocean, with the intention of capturing Bryde's whale vocalizations. In this current study, we aim to report on a small subset of the data recorded to date. Recordings were made by a single stationary recording device that was anchored to the sea floor (Figure 2). Each recording was conducted at the same location within False Bay, off the shore near Gordons Bay, at a depth of 20 to 30 m (Figure 1). The recordings were taken in April and June of 2023. Bryde's whales were regularly spotted near the recording device during several deployment and recovery operations.

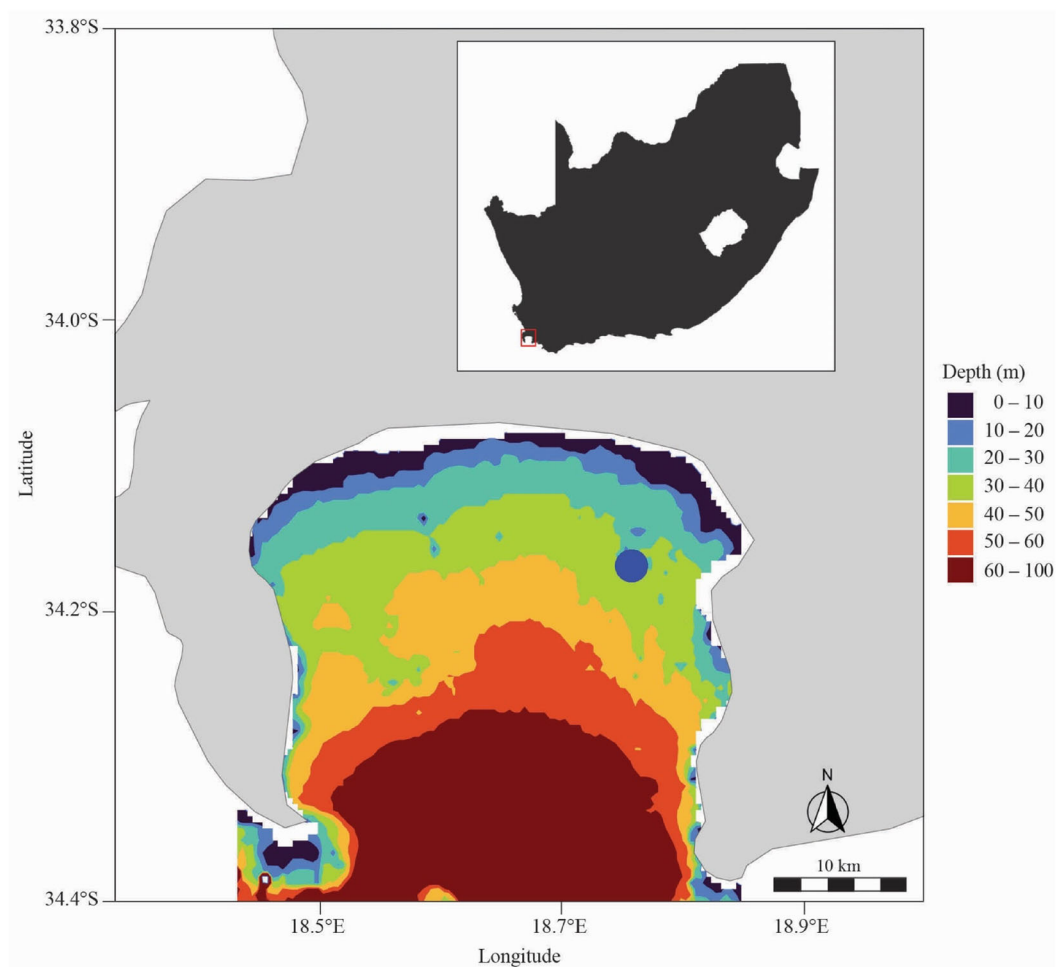


FIGURE 1 Map showing the location (blue circle) on the acoustic mooring within False Bay, South Africa. Inset map shows the position of False Bay (red box) on the west coast of South Africa.

The acoustic recording device comprised a single hydrophone, a battery-powered recording device enclosed in a water-tight cylinder, and a mooring frame to secure the system in place (Figure 2). The cylinder that housed the recording equipment was fastened to the mooring by means of threaded PVC couplings. This allowed the recording device to be easily attached and separated from the stationary mooring, which was kept in place by an angle iron frame. The hydrophone converted fluctuations in the amplitude of water pressure to a proportional electrical voltage that was subsequently sampled by an analog to digital converter. The digital representation of the waveform was stored in nonvolatile memory, which was the data analyzed in this study. The hydrophone was an Aquarian H2C model, an omnidirectional transducer usable over the band spanning from 10 Hz to 100 kHz. The hydrophone sensitivity was -180 dB relative to 1 V per μ PA. The recording device was an AudioMoth board (Hill et al., 2019), which wrote the recorded acoustic data to an SD card as a single 72-h .wav file. The data were recorded at an 8 kHz sampling rate with a 16-bit resolution, the recorded data had a Nyquist frequency of 4 kHz. A relatively low sampling rate allowed for extended battery life of the instrument while still being sufficient for the study of baleen whales. For each recording period, the recording device was deployed by a team of professional divers who then retrieved the device once the recording was concluded.

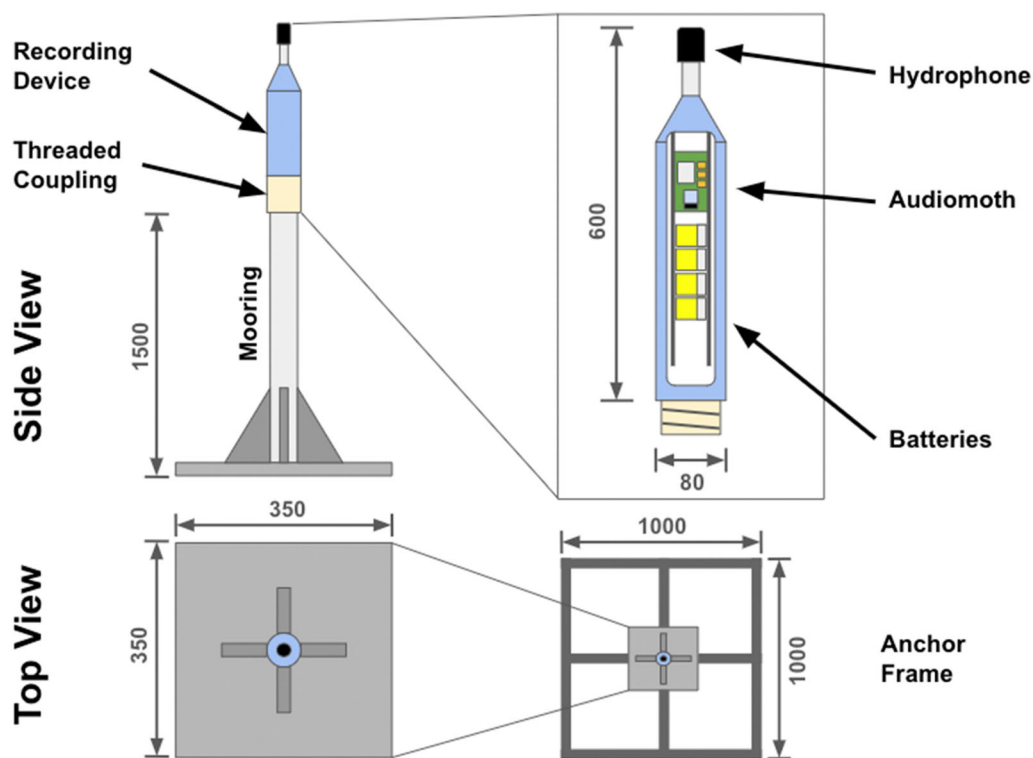


FIGURE 2 An illustration of the hardware used to record the acoustic data reported in this study. Dimensions are provided in millimeter.

The acoustic data (openly accessible from <https://doi.org/10.25413/sun.25108016>) were imported into Raven Pro version 1.6.5 (K. Lisa Yang Center for Conservation Bioacoustics, 2024). The spectrogram view applied to the data was set for a window size of 4096 samples with a 95% window overlap. A band-limited energy detector was applied to flag signals of interest within a band spanning between 20 and 400 Hz. Each potential call was inspected visually, both as a waveform and as a spectrogram. Signals of interest were added to a detection table. The Raven Pro software was then used to measure several key parameters for each detection: the duration, maximum frequency component, frequency sweep rate, and the UTC (coordinated universal time) time of the call. Some parameters were determined manually, such as the number of tones and whether the various tones in multitone detections were harmonically related. The detection table was then exported and included with the available raw data.

A total of 1032 signals of interest were detected within the April recordings. The sounds were separated into four distinct classes. The first and most common sound was a single-tone call (Figure 3a) with a mean frequency of 42.2 Hz [31.3–74.2] ($CV = 0.059$) and a mean duration of 0.21 s [0.1–0.65] ($CV = 0.35$). We referred to this call type as ST-42. It occurred 538 times in the April recordings. Another common sound in the data was one consisting of multiple tones (Figure 3b,c). In this study, the sound was referred to as the multi-tone (MT-42). This sound was recorded 315 times within the April recordings, most of the occurrences contained only two tones (Figure 3b), approximately 80% of those detected. The lower tone had a mean value of 41.8 Hz [35.2–52.7] ($CV = 2.1$) and was dominant in 95.5% of occurrences of this sound. The upper frequency component was far more variable and had a bimodal distribution. Sounds that we referred to as burst tonals (BT-42) were found within the April recordings (Figure 3d,e). These were characterized by a brief burst of wideband noise, and they occurred 478 times in the data. The burst tonals often had a dominant frequency component that was more powerful than the noise and persisted

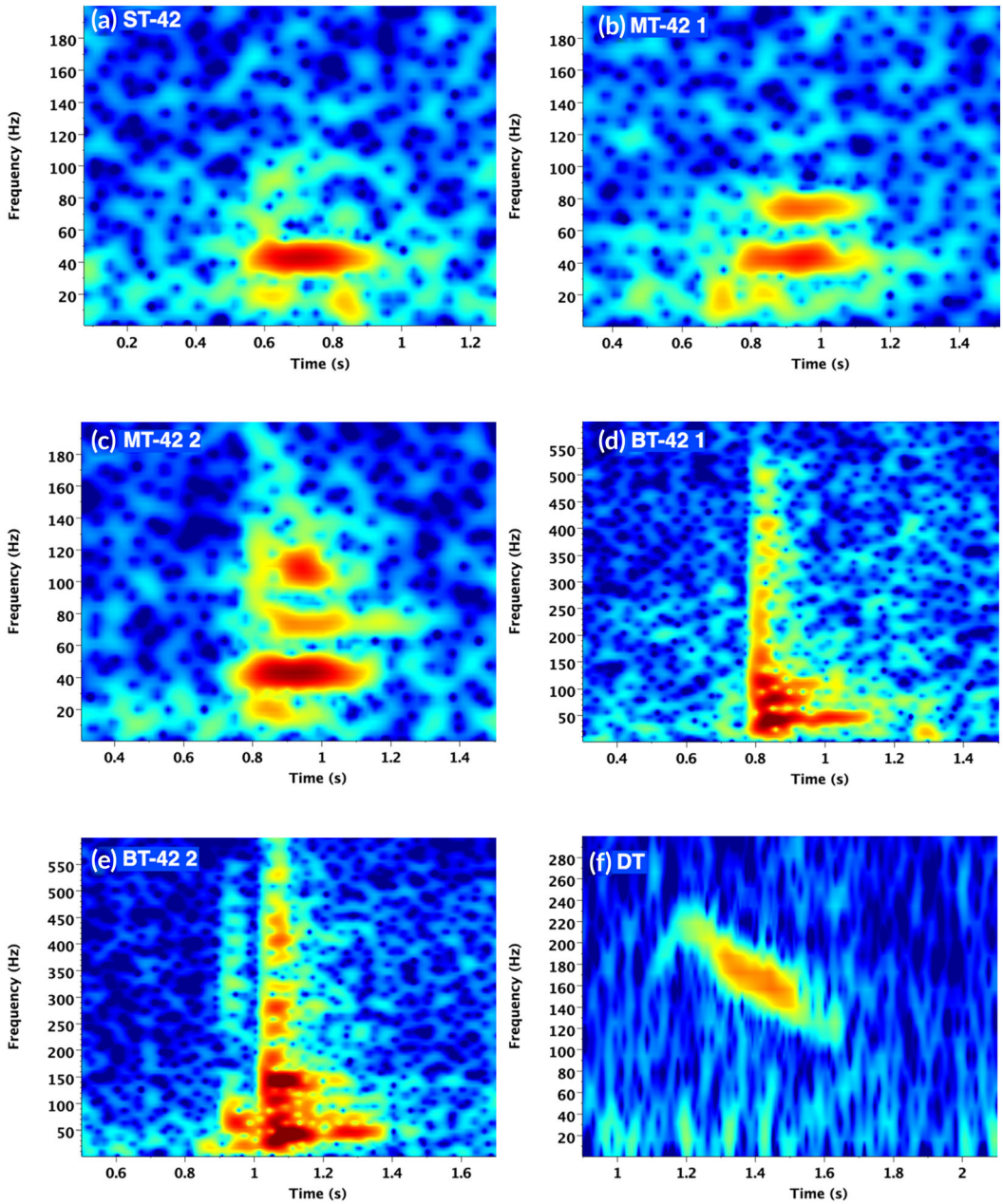


FIGURE 3 The various call types identified in the April recordings.

longer than the noise. The dominant and persistent component had a mean value of 41.8 Hz [35.2–74] (CV = 4.7). Lastly, the recordings had captured a series of regularly repeating down swept tonals (TD) (Figure 3f). This sound occurred on only one occasion as a continuous and prolonged bout, containing 57 individual calls (Figure 4). The individual calls were single tones that swept down by approximately 50 Hz, beginning at approximately 200 Hz (Figure 4), with a mean sweep rate of 147 Hz per second (CV = 0.41). The inter-call interval (ICI), measured as the difference between the start time of a call and the start time of the preceding call, had a mean period of approximately 10 s. Table 1 provides a list of the four sounds reported and the number of recorded occurrences for each sound.

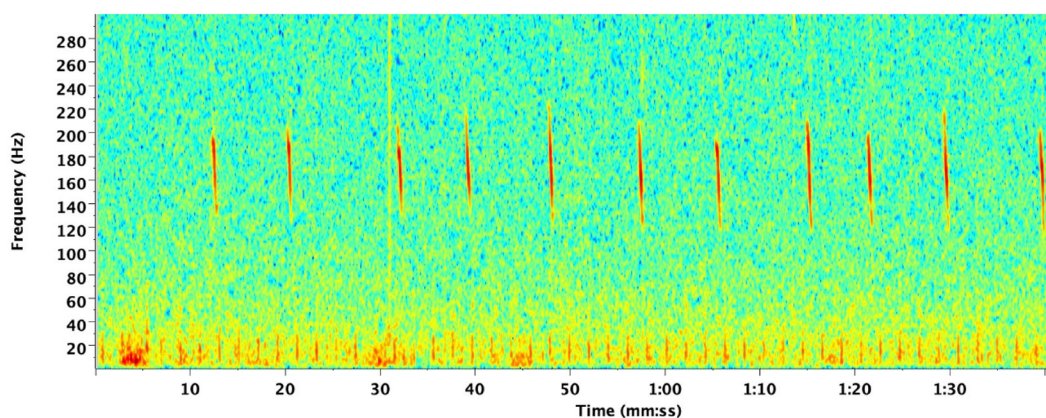


FIGURE 4 A sequence of consecutive tonal downsweep calls.

TABLE 1 The number of each call type recorded per data file analyzed. Each recording begins on the specified date and continues for 72 h.

Date	ST-42	MT-42	BT-42	TD	Total
22/04/2023	259	197	110	57	622
26/04/2023	241	91	9	0	342
29/04/2023	36	25	11	0	68
Total	536	313	130	57	1032

Note: The call types reported are single tones (ST-42), multi-tones (MT-42), burst tonals (BT-42), and the tonal downsweep (TD). Only five individual calls were detected in the June data, all of which were the BT-42 type.

The frequency of the upper tone of the dual-tone vocalizations was measured for recorded outcomes. A two-component Gaussian mixture model was fitted to the data (Figure 5). The means of the lower and upper components were 74.6 and 105.8 Hz (Figure 5), with coefficients of variation of 0.052 and 0.117, respectively. The weights of the two components were 0.66 and 0.34, with the more common mode being the higher frequency. While the frequency of the lower tone exhibits similar statistics to the single-tone vocalization—a tight clustering around 42 Hz—the upper tone, which was far more variable, seemed to have a bimodal distribution in frequency (Figure 5). When triple-tone vocalizations were observed, the two upper frequencies were typically located close to the means of the two mixture components. That is, the stereotypical tritone vocalization has a lower frequency very near 42 Hz and two upper frequency components with a greater scatter but clustered separately around 74.6 and 105.8 Hz (Figure 5).

Sounds reported in this study are attributed to Bryde's whales by means of comparison with existing literature (Helble et al., 2024; Oleson et al., 2003; Wang et al., 2022) since we could not attribute them to the species using direct methods. Though studies of isolated Bryde's whale populations often report novel call types, and parameters of the call types may vary between populations, there are similarities between call types reported in previous studies (Helble et al., 2016). We attribute the sounds reported here to Bryde's whales on account of one distinct feature—the wideband noise component of the BT-42 call type. The noise flares up over the band all at once, most often displaying a single dominant tonal component that is louder than the noise component. The tonal component often begins at the same time as the noise, or very soon after, but persists longer. Often the duration of the noise component is inversely proportional over frequency, producing a fin shaped spectrogram. This time-frequency form was present in the burst tonals reported by Heimlich et al. (2005) and the Be3 call type reported by Oleson et al. (2003).

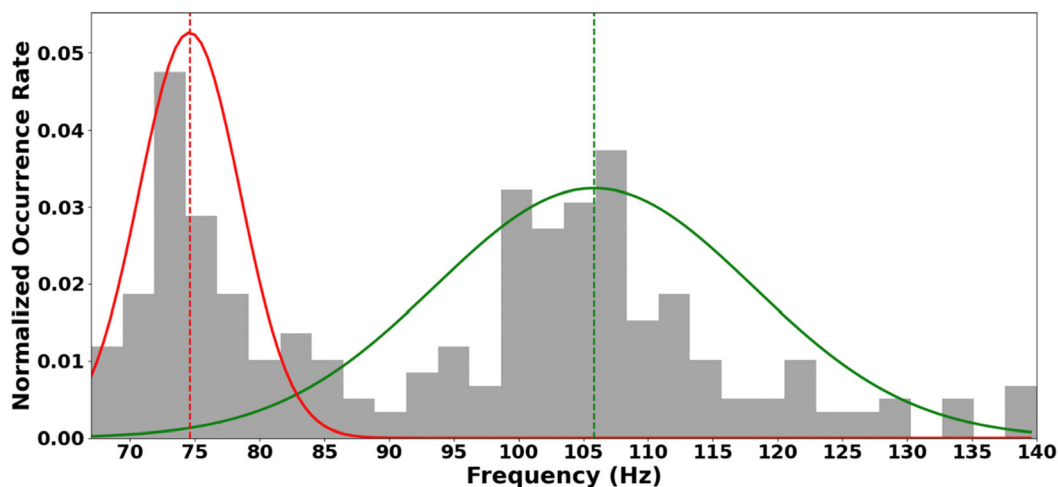


FIGURE 5 The distribution of the upper frequency component of dual tone calls in the April recordings. The best fitting Gaussian mixture model is overlaid on the distribution.

Similar spectrogram forms have been attributed to Bryde's whales in several previous studies (Brodie & Dunn, 2014; Figueiredo & Simao, 2014; Helble et al., 2016; McDonald, 2006), including the recent study of Pacific Bryde's whales by Helble et al. (2024). A sound with this form, but different time and frequency parameters to those reported here, has recently been recorded on the west coast of South Africa near Hondeklip Bay and attributed to the offshore form of southern African Bryde's whales (Shabangu FW, unpublished data).

The ST-42 and MT-42 call types we attribute to Bryde's whales on account of their proximity in time to the recorded BT-42 sounds. The ST-42, MT-42, and BT-42 calls occur as bouts of repeated regularly occurring calls in which all three call types were usually present. The TD call type we attributed to Bryde's whales on account of the frequent reporting of swept tonal calls in previous literature (Cummings et al., 1986; Oleson et al., 2003; Širović et al., 2014; Wang et al., 2022), notably, the Be6 of Oleson et al. (2003) and the swept tonal of Wang et al. (2022). However, there were significant differences between the sounds we report in this study and the previously reported literature. Sounds reported in this study potentially provide indications that vocalizations of this Bryde's whale population may be unique.

The bimodal nature of the upper frequency components of MT-42 calls is a feature not previously reported in the literature. The repeating tonals reported by this study differ in frequency to the Be1 and Be4 reported by Oleson et al. (2003), with mean frequencies of 21.2 Hz and 60 Hz, respectively. The repeating single tones of McDonald (2006) also appear in the low 20 Hz range. The mean frequency reported for the Be2, 41.7 Hz, is very similar to the frequency of the dominant tone in this study. However, the Be2 was reported to often be accompanied by harmonic components, whereas the MT-42 sounds are distinctly nonharmonic. The variability of the upper tones may result in occasional harmonic relations, but it is simply coincidence. The MT-42 sounds had discrete tones at similar frequencies to those of the Be4 calls reported by Kerosky et al. (2012) and Viloría-Gomora et al. (2015), despite differing in frequency to the Be4 reported by Oleson et al. (2003). However, the lower tonal component in the 20 Hz range, present in these Be4 calls, was not present in the MT-42 sounds. Additionally, the ST-42, MT-42, and BT-42 did not have significant frequency sweeps in their tonal components. The TD calls in this study have a similar duration and ICI to the downswept tonals reported by Wang et al. (2022) but were higher in frequency and were not biphonated. The range of the frequency sweep and call duration was similar to the Be6 of Oleson et al. (2003), but did not occur as regular clusters, instead each individual down sweep was separated by several seconds. In general, the Southern African inshore Bryde's whale calls are shorter than those reported in previous literature. Table 2 provides the mean

TABLE 2 A comparison of the duration of various call types between different sources.

Call type	Source	Designation by source	Mean duration (seconds)
Single Tone	Oleson et al. (2003)	Be4	1.4 [0.8–3.0]
	McDonald (2006)	Tonal Call	5.0 [4.0–7.0]
	This study	ST-42	0.2 [0.1–0.65]
Burst Tonal	Oleson et al. (2003)	Be3	1.7 [1.0–4.0]
	Heimlich et al. (2005)	High Burst Tonal	1.0 ± 0.5 [0.3–2.5]
	This study	BT-42	0.34 [0.13–2.5]
Downswept Tonal	Oleson et al. (2003)	Be6	0.7 [not specified]
	Wang et al. (2022)	Down swept Tonal	0.48 [0.24–0.72]
	This study	TD	0.38 [0.13–0.7]

duration of call types with similar spectrogram shapes reported in previous literature. For all three call types considered, the mean duration of the call made by the Southern African inshore Bryde's whale was the shortest.

There was also a potential significance to the presence of a strong tonal component near 42 Hz, which is why call designations in this study, other than the TD, include the suffix 42. The ST-42 sounds in this study were clustered tightly around 42 Hz. The multitone calls were found to consistently contain the 42 Hz tone as one of the components. The persistent component of the burst tonals was tightly clustered around 42 Hz. Heimlich et al. (2005) reported that the dominant and persistent component of burst tonals recorded in the Gulf of California has a bimodal distribution which allows for this call type to be subclassified into high and low burst tonals. For the calls recorded in False Bay, this was not the case. Instead, the frequency distribution of the lingering component of the burst tonal forms a single cluster around a mean of 42 Hz.

There are four species of baleen whale that have been reported to enter False Bay: southern right whales *Eubalaena australis*, humpback whales *Megaptera novaeangliae*, pygmy right whale *Caperea marginata*, and Bryde's whales (Pfaff et al., 2019). Southern right whales, humpback whales, and the rarely sighted pygmy right whales are transient in the bay, whereas Bryde's whales are present year-round. Humpback whales had migrated out of the bay prior to April 2023 but were reported to be moving back into the bay by June 2023 which also corresponds to the first detection of humpback whale song off the west coast of South Africa (Shabangu & Kowarski, 2022). Curiously, the class of sounds that we report occurring many times in April ceased to occur in June, at which time only five sounds of interest were detected. Bryde's whales were spotted in the vicinity of the recording device by the deployment team during deployment and recovery operations. The sounds reported by this study differ in form to the stereotypical vocalizations of southern right whales, that often take the form of multiple swept tones, producing a comb pattern spectrogram. Though this call type was present in the data. The TD sounds may be compared to regular repeated down swept calls produced by humpback whales. However, the humpback whale vocalization is known to have harmonically related tones and is usually accompanied by other more distinct calls in the humpback whale's repertoire (Shabangu FW, unpublished data¹). The TD sounds do not have a harmonic component (Oleson et al., 2003) and occur continuously without the intermittent use of alternative call types (Figure 4).

The Bryde's whale remains a relatively understudied species. This study is the first to provide a detailed description of Bryde's whale vocalizations in False Bay, South Africa. Sounds that resemble Bryde's whale calls reported in previous literature were recorded within the data, the authors attribute these sounds to the South African inshore Bryde's whale. However, there are some large distinctions between the vocalizations reported here and those in previous literature, which may be population specific. These distinctions provide novel information on the unique

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vocalizations of the local Bryde's whale stock, which will be useful for future PAM studies aiming to understand and improve our understanding of the acoustic ecology of this population. Consequently, these results can also be used to advise management and conservation efforts based on the acoustic presence and absence of the species.

AUTHOR CONTRIBUTIONS

Alexander Faustmann: Data curation; formal analysis; investigation; methodology; visualization; writing – original draft. **Fannie W. Shabangu:** Visualization; writing – review and editing. **Jaco D. J. J. Versfeld:** Conceptualization; data curation; funding acquisition; project administration; resources; supervision; writing – review and editing.

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REFERENCES

- Anderson, J. (1878). Anatomical and zoological research; comprising an account of zoological results of two expeditions to western Yunnan in 1868 and 1875, London. 551–564. <https://doi.org/10.5962/bhl.title.50434>
- André, M., van der Schaar, M., Zaugg, S., Houégnigan, L., Sánchez, A. M., & Castell, J. V. (2011). Listening to the deep: Live monitoring of ocean noise and cetacean acoustic signals. *Marine Pollution Bulletin*, 63(1–4), 18–26. <https://doi.org/10.1016/j.marpolbul.2011.04.038>
- Babalola, O. P., Ayinde, M. U., Olayinka, O. O., & Versfeld, D. J. J. (2021). Detection of Bryde's whale short pulse calls using time domain features with hidden Markov models. *SAIEE Africa Research Journal*, 112(1), 15–23. <https://doi.org/10.23919/SAIEE.2021.9340533>
- Best, P. B. (1977). Two allopatric forms of Bryde's whale off South Africa. *Reports of the International Whaling Commission, Special Issue*, 1, 10–38.
- Best, P. B. (2001). Distribution and population separation of Bryde's whale *Balaenoptera edeni* off southern Africa. *Marine Ecology Progress Series*, 220, 277–289. <https://doi.org/10.3354/meps220277>
- Brodie, D. C., & Dunn, R. A. (2014). Low frequency baleen whale calls detected on ocean-bottom seismometers in the Lau basin, Southwest Pacific Ocean. *The Journal of the Acoustical Society of America*, 137(1), 53–62. <https://doi.org/10.1121/1.4904556>
- Browning, E., Gibb, R., Glover-Kapfer, P., & Jones, K. E. (2017). Passive acoustic monitoring in ecology and conservation. Woking, UK, WWF-UK, 76pp. (WWF Conservation Technology Series 1(2)). <https://doi.org/10.25607/OBP-876>
- Constantine, R., Iwata, T., Nieukirk, S. L., & Penry, G. S. (2018). Future directions in research on Bryde's whales. *Frontiers in Marine Science*, 5. <https://doi.org/10.3389/fmars.2018.00333>
- Constantine, R., Johnson, M., Riekkola, L., Jervis, S., Kozmian-Ledward, L., Dennis, T., Torres, L. G., & Aguilar de Soto, N. (2015). Mitigation of vessel-strike mortality of endangered Bryde's whales in the Hauraki gulf, New Zealand. *Biological Conservation*, 186, 149–157. <https://doi.org/10.1016/j.biocon.2015.03.008>
- Cooke, J. G., & Brownell, R. L. (2018). The IUCN Red List of Threatened Species 2018. <https://doi.org/10.2305/IUCN.UK.2018-1.RLTS.T2476A50349178.en>
- Cummings, W. C., Thompson, P. O., & Samuel, J. H. (1986). Sounds from Bryde, *Balaenoptera edeni*, and finback, *B. Physalus*, whales in the Gulf of California. *Fishery Bulletin (Washington DC)*, 84(2), 359–370.
- Edds, P. L., Odell, D. K., & Tershy, B. R. (1993). Vocalisations of a captive juvenile and free-ranging adult-calf pairs of Bryde's whales, *Balaenoptera Edeni*. *Marine Mammal Science*, 9(3), 269–284.
- Figueiredo, L. D., & Simao, S. M. (2014). Bryde's whale (*Balaenoptera edeni*) vocalizations from Southeast Brazil. *Aquatic Mammals*, 40(3), 225–231. <https://doi.org/10.1578/AM.40.3.2014.225>
- Fleishman, E., Cholewiak, D., Gillespie, D., Helble, T., Klinck, H., Nosal, E. M., & Roch, M. A. (2023). Ecological inferences about marine mammals from passive acoustic data. *Biological Reviews*, 98(5), 1633–1647. <https://doi.org/10.1111/brv.12969>

- Heimlich, S. L., Mellinger, D. K., & Nieuwkirk, S. L. (2005). Types, distribution, and seasonal occurrence of sounds attributed to Bryde's whales (*Balaenoptera Edeni*) recorded in the eastern tropical Pacific, 1999–2001. *The Journal of the Acoustical Society of America*, 118(3), 1830–1837. <https://doi.org/10.1121/1.1992674>
- Helble, T. A., Alongi, G. C., Guazzo, R. A., Allhusen, D. R., Martin, C. R., Martin, S. W., Durbach, I. N., & Henderson, E. E. (2024). Swimming and acoustic calling behavior attributed to Bryde's whales in the central North Pacific. *Frontiers in Marine Science*, 11. <https://doi.org/10.3389/fmars.2024.1305505>
- Helble, T. A., Henderson, E. E., Lerley, G. R., & Martin, S. W. (2016). Swim track kinematics and calling behaviour attributed to Bryde's whales on the Navy's Pacific missile range facility. *Journal of the Acoustical Society of America*, 140(6), 4170–4177. <https://doi.org/10.1121/1.4967754>
- Hill, A. P., Prince, P., Snaddon, J. L., Doncaster, C. P., & Rogers, A. (2019). AudioMoth: A low-cost acoustic device for monitoring biodiversity and the environment. *HardwareX*, 6, e00073. <https://doi.org/10.1016/j.ohx.2019.e00073>
- Iwata, T., Akamatsu, T., Thongsukdee, S., Cherdusukjai, P., Adulyanukosol, K., & Sato, K. (2017). Tread-water feeding of Bryde's whales. *Current Biology*, 27(21), 1154–1155. <https://doi.org/10.1016/j.cub.2017.09.045>
- Izadi, S., Aguilar de Soto, N., Constantine, R., & Johnson, M. (2022). Feeding tactics of resident Bryde's whales in New Zealand. *Marine Mammal Science*, 38(3), 1104–1117. <https://doi.org/10.1111/mms.12918>
- Junge, G. C. A. (1950). On a specimen of the rare fin whale, *Balaenoptera edeni* Anderson, stranded on Pulu Sugi near Singapore. *Zoologische Verhandelingen*, 9(1), 1–26.
- K. Lisa Yang Center for Conservation Bioacoustics. (2024). *Raven pro: Interactive sound analysis software (version 1.6.5) [computer software]*. The Cornell Lab of Ornithology. <https://ravensoundssoftware.com/>
- Kato, H., & Perrin, W. F. (2018). Bryde's whales: *Balaenoptera edeni*. In B. Würsig, J. G. M. Thewissen, & K. Kovacs (Eds.), *Encyclopedia of marine mammals* (3rd ed., pp. 143–145). Academic Press Books Elsevier.
- Kerosky, S. M., Širović, A., Roche, L. K., Baumann-Pickering, S., Wiggins, S. M., & Hildebrand, J. A. (2012). Bryde's whale seasonal range expansion and increasing presence in the southern California bight from 2000 to 2010. *Deep Sea Research Part 1 Oceanographic Research Papers*, 65(2), 125–132. <https://doi.org/10.1016/j.dsr.2012.03.013>
- Liu, M., Lin, W., Lin, M., Liu, B., Dong, L., Zhang, P., Yang, Z., Wang, K., Dai, L., & Li, S. (2021). The first attempt of satellite tracking on occurrence and migration of Bryde's whale (*Balaenoptera edeni*) in the Beibu Gulf. *Journal of Marine Science and Engineering*, 9(8), 796.
- Lodi, L., Tardin, R. H., Hetzel, B., Maciel, I. S., Figueiredo, L. D., & Simao, S. M. (2015). Bryde's whale (Cetartiodactyla: Balaenopteridae) occurrence and movements in coastal areas of southeastern Brazil. *Zoologia*, 32(2), 171–175. <https://doi.org/10.1590/S1984-46702015000200009>
- McDonald, M. A. (2006). An acoustic survey of baleen whales off great Barrier Island, New Zealand. *New Zealand Journal of Marine and Freshwater Research*, 40(4), 519–529. <https://doi.org/10.1080/00288330.2006.9517442>
- Murase, H., Tamura, T., Otani, S., & Nishiwaki, S. (2015). Satellite tracking of Bryde's whales *Balaenoptera edeni* in the off-shore western North Pacific in summer 2006 and 2008. *Fisheries Science*, 82(1), 35–45. <https://doi.org/10.1007/s12562-015-0946-8>
- Ogundile, O., Ayinde, U., Babalola, O., & Versfeld, J. (2020). A hidden Markov model with selective time domain feature extraction to detect inshore Bryde's whale short pulse calls. *Ecological Informatics*, 57, 101087. <https://doi.org/10.1016/j.ecoinf.2020.101087>
- Oleson, E. M., Barlow, J., Gordon, J., Rankin, S., & Hildebrand, J. A. (2003). Low frequency calls of Bryde's whales. *Marine Mammal Science*, 19(2), 407–419. <https://doi.org/10.1111/j.1748-7692.2003.tb01119.x>
- Olsen, Ø. (1913). On the external characters and biology of Bryde's whale (*Balaenoptera brydei*), a new rorqual from the coast of South Africa. *Proceedings of the Zoological Society of London*, 1913, 1073–1090. <https://doi.org/10.1111/j.1096-3642.1913.tb02005.x>
- Penry, G. S., Findlay, K., & Best, P. (2016). A conservation assessment of *Balaenoptera edeni*. In M. F. Child, L. Roxburgh, E. Do Linh San, D. Raimondo, & H. T. Davies-Mostert (Eds.), *The red list of mammals of South Africa, Swaziland and Lesotho*. South African National Biodiversity Institute and Endangered Wildlife Trust.
- Penry, G. S., Hammond, P. S., Cockcroft, V. G., Best, P. B., Thornton, M., & Graves, J. A. (2018). Phylogenetic relationships in southern African Bryde's whales inferred from mitochondrial DNA: Further support for subspecies delineation between the two allopatric populations. *Conservation Genetics*, 19, 1349–1365. <https://doi.org/10.1007/s10592-018-1105-4>
- Pfaff, M. C., Logston, R. C., Raemaekers, S. J. P. N., Hermes, J. C., Blamey, L. K., Cawthra, H. C., Colenbrander, D. R., Crawford, R. J. M., Day, E., du Plessis, N., Elwen, S. H., Fawcett, S. E., Jury, M. R., Karenyi, N., Kerwath, S. E., Kock, A. A., Krug, M., Lamberth, S. J., Ouardien, A., ... Kirkman, S. P. (2019). A synthesis of three decades of socio-ecological change in False Bay, South Africa: Setting the scene for multidisciplinary research and management. *Elementa: Science of the Anthropocene*, 7, 32. <https://doi.org/10.1525/elementa.367>
- Reeves, R. R., McClellan, K., & Werner, T. B. (2013). Marine mammal bycatch in gillnet and other entangling net fisheries, 1990 to 2011. *Endangered Species Research*, 20, 71–97.
- Rice, D. W. (1998). *Marine mammals of the world, systematic and distribution*. Society for Marine Mammalogy, Special Publication 4.

- Romero-Vivas, E., Viloria-Gomora, L., Urban-Ramirez, J. (2013). Morphological and gradient power spectrum representations for Bryde's whale (*Balaenoptera edeni*) geographical call differentiation. *1er Coloquio Nacional de Acustica*, New Delhi.
- Segre, P. S., di Clemente, J., Kahane-Rapport, S. R., Gough, W. T., Meyer, M. A., Lombard, A. T., Goldbogen, J. A., & Penry, G. S. (2022). High-speed chases along the seafloor put Bryde's whales at risk of entanglement. *Conservation Science and Practice*, 4(5), e12646. <https://doi.org/10.1111/csp2.12646>
- Shabangu, F. W., & Findlay, K. (2014). Passive acoustic monitoring of marine mammals in South Africa, with special reference to Antarctic blue whales. In N. Funke, M. Claassen, R. Meissner, & K. Nortje (Eds.), *Reflections on the state of research and development in the marine and maritime sectors in South Africa* (pp. 153–173). Council for Scientific and Industrial Research.
- Shabangu, F. W., & Kowarski, K. A. (2022). The beat goes on: Humpback whale song seasonality in Antarctic and south African waters. *Frontiers in Marine Science*, 9, 827324. <https://doi.org/10.3389/fmars.2022.827324>
- Širović, A., Bassett, H. R., Johnson, S. C., Wiggins, S. M., & Hildebrand, J. A. (2014). Bryde's whale calls recorded in the Gulf of Mexico. *Marine Mammal Science*, 30(1), 399–409. <https://doi.org/10.1111/mms.12036>
- Smultea, M. A., Jefferson, T. A., & Zoidis, A. M. (2010). Rare sightings of a Bryde's whale (*Balaenoptera edeni*) and sei whales (*B. borealis*) (Cetacea: Balaenopteridae) northeast of O'ahu, Hawai'i. *Pacific Science*, 64(3), 449–557. <https://doi.org/10.2984/64.3.449>
- Soldevilla, M. S., Debich, A. J., Perez-Carballo, I., Jarriel, S., Frasier, K. E., Garrison, L., Gracia, A., Hildebrand, J. A., Rosel, P. E., & Serrano, A. (2024). Rice's whale occurrence in the western Gulf of Mexico from passive acoustic recordings. *Marine Mammal Science*, 40(1), e13109. <https://doi.org/10.1111/mms.13109>
- Soldevilla, M. S., Hildebrand, J. A., Frasier, K. E., Dias, L. A., Martinez, A., Mullin, K. D., Rosel, P. E., & Garrison, L. P. (2017). Spatial distribution and dive behavior of Gulf of Mexico Bryde's whales: Potential risk of vessel strikes and fisheries interactions. *Endangered Species Research*, 32, 533–550. <https://doi.org/10.3354/esr00834>
- Viloria-Gomora, L., Romero-Vivas, E., & Urban, R. J. (2015). Calls of Bryde's whale (*Balaenoptera edeni*) recorded in the Gulf of California (L). *The Journal of the Acoustical Society of America*, 138(5), 2722–2725. <https://doi.org/10.1121/1.4932032>
- Viloria-Gomora, L., Urban, R. J., Leon-Lopez, B., & Romero-Vivas, E. (2021). Geographic variation in Bryde's whale Be4 calls in the Gulf of California: An insight to population dynamics. *Frontiers in Marine Science*, 8, 651469. <https://doi.org/10.3389/fmars.2021.651469>
- Wang, Z., Duan, P., Chen, M., Mei, Z., Sun, X., Nong, Z., Liu, M., Akamatsu, T., Wang, K., & Wang, D. (2022). Vocalization of Bryde's whales (*Balaenoptera edeni*) in the Beibu gulf, China. *Marine Mammal Science*, 38(3), 1118–1139. <https://doi.org/10.1111/mms.12917>

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