New sounds identified in two different species of beaked whale

Article

CITATIONS
0

READS
74

3 authors, including:

Hilary Moors-Murphy
Fisheries and Oceans Canada
42 PUBLICATIONS **404** CITATIONS

SEE PROFILE

New sounds identified in two different species of beaked whale

Dunn, Charlotte*[1,2]; Moors, Hilary[3] *cw246@st-andrews.ac.uk

1. Sea Mammal Research Unit, University of St Andrews, Scottish Oceans Institute, Gatty Marine Lab, St Andrews, Fife KY16 8LB, U.K.
2. Bahamas Marine Mammal Research Organisation, P.O. Box AB-20714, Marsh Harbour, Abaco, Bahamas
3. Department of Biology, Dalhousie University,1355 Oxford Street, Halifax, Nova Scotia, Canada, B3H 4J1


Male Blainville's beaked whale (photo taken by C. Dunn)


Male northern bottlenose whale (photo taken by H. Moors)

ABSTRACT

While echolocation in beaked whales has been studied extensively, the use of sound for communication in these animals is largely unexplored. We present analyses of acoustic recordings from two species of beaked whale describing a vocal pattern we term the 'double-click' – a pair of clicks with inter-click intervals (ICIs) much smaller than those of immediately following clicks. We analysed opportunistic recordings of northern bottlenose whales (*Hyperoodon ampullatus*) from field efforts in 2006 and 2007 in the Gully, south of Nova Scotia, and recordings of Blainville's beaked whales (*Mesoplodon densirostris*) from 3 DTAGs placed on animals off Andros Island in the Bahamas in 2007. Double-clicks were produced by *Hyperoodon* at the start of regular echolocation click trains both when apparently socialising at the surface and after individuals began foraging dives, and were produced by *Mesoplodon*, again at the start of regular click trains, while foraging at depth. DTAG data for the *Mesoplodon* shows that all click trains may commence with a double-click. The double-clicks of both species have a mean ICI less than half the duration of a regular click ICI (172.14ms (SE = 20) double-click ICI versus 388.53ms (SE = 18.24) regular ICI for *Hyperoodon*, and 124.59ms (SE = 1) versus 353.30ms (SE = 7.4) for *Mesoplodon*). We can only speculate on the function of this vocal pattern, but double-clicks are unlikely to be directly used for foraging, as they show no correlation with buzzes thought to indicate prey capture attempts. It is possible that the double-click serves some initiation function for echolocation click trains, either psycho-physically by recalibrating an acoustic-scene or physiologically associated with air circulation and sound production. It is also possible that double-clicks may serve a social communication function, as in sperm whale codas, and may act as cues on the age/sex class of the vocalising individual.

METHODS

- Acoustic recordings of northern bottlenose whales were obtained on an opportunistic basis from the Gully, south of Nova Scotia, in 2006 and 2007 using a towed hydrophone array when individuals were at the surface near the research vessel and after individuals dove.
- Acoustic recordings of Blainville's beaked whales were obtained from the Tongue of the Ocean off Andros Island in the Bahamas in 2007 using DTAGS: 12 hours of recording were obtained from an adult female tagged on August 15th and 14 hours of recording each were obtained from an adult female and adult male tagged on September 15th.
- Recordings were scanned either visually and aurally (for the bottlenose whale recordings) or using automated analysis techniques (Blainville's beaked whales) for the presence of double-clicks (Figures 1 and 2).
- ICI durations were calculated for each double-click, and the first seven ICIs of the regular click train following each double click were calculated.
- Mean double-click ICI durations were compared to the mean regular click ICI duration (Figure 3).

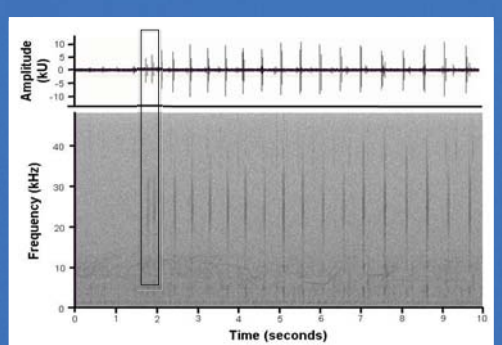

Figure 1. Waveform and spectrogram of a northern bottlenose whale double-click commencing a regular foraging click train (double-click shown in box).

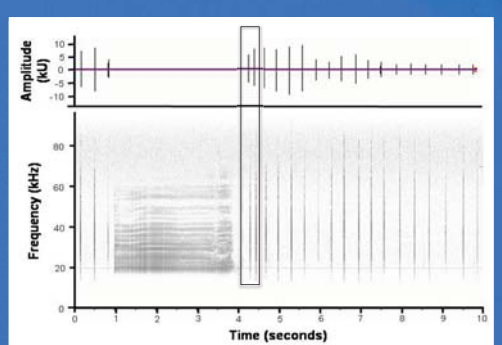

Figure 2. Waveform and spectrogram of a Blainville's beaked whale double-click following a buzz and commencing a regular foraging click train (double-click shown in box).

RESULTS AND DISCUSSION

- 19 double-clicks with a mean ICI = 172 msec were identified on the northern bottlenose whale recordings (mean regular click ICI = 389 msec). Sample size was likely limited because the beginning of all click trains were not recorded.
- 358 double-clicks with a mean ICI = 114 msec were identified on the Blainville's beaked whale recordings (mean regular click ICI = 309 msec). These whales appear to begin every regular click train with a double-click.
- The mean ICI of double-clicks was significantly shorter than the mean ICI of regular clicks for both bottlenose whales ($t_{0.05(2)}$ = -7.99, df = 55, p < 0.001) and Blainville's beaked whales ($t_{0.05(2)}$ = -121.04, df = 1182.53 p < 0.001). Double-click ICIs tended to be half the length or less of the following regular click ICIs (Figure 3).
- The vocal repertoire of beaked whales is currently understood to be limited mainly to clicks, however the types of social dynamics observed in bottlenose whales (Gowans *et. al.* 2001) and Blainville's beaked whales (Claridge 2006) likely require a means of communication to provide information about species identity, sex or age-class of individuals and even social or sexual status (Bradbury and Vehrencamp 1998).
- The double-clicks described here may represent social signals used by the animals to communicate with each other (for example, they may be used by individuals to broadcast their identity and location to conspecifics during foraging dives).
- Although the double-click vocalization needs further investigation before its function can be determined, it does suggest that beaked whales may use clicks for social communication, similar to the coda's produced by sperm whales.

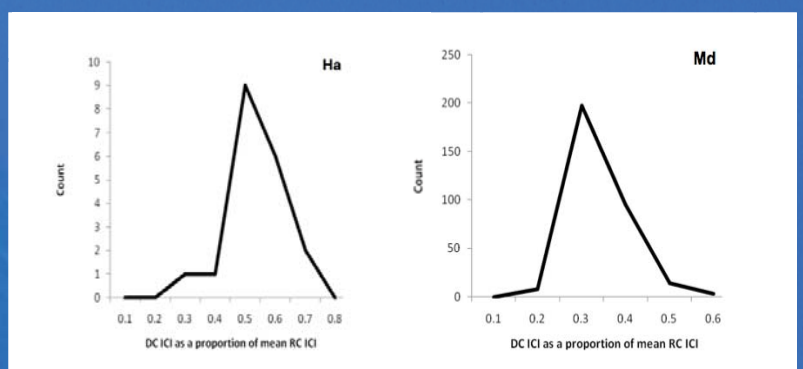

Figure 3. Histogram of double-click (DC) ICI as a proportion of the mean ICI of the following seven regular clicks (RC) for northern bottlenose whales (Ha) and Blainville's beaked whales (Md).

REFERENCES

Bradbury, J. W., and Vehrencamp, S. L. (1998). Principles of Animal Communication. Sinauer Associates, Inc., Sunderland, MA.
Claridge, D. E. (2006). Distribution and habitat selection of beaked whales. MSc dissertation. University of Aberdeen. 119pp.
Gowans, S., Whitehead, H., and Hooker, S. K. (2001). Social organization in northern bottlenose whales, *Hyperoodon ampullatus*: not driven by deep-water foraging? Animal Behaviour. 62, 369-377.

ACKNOWLEDGEMENTS

We would like to thank everyone involved in the fieldwork for this study including Dr. H. Whitehead and members of the Whitehead Lab at Dalhousie University, BMMRO's field assistants and Earthwatch Institute. NSERC funding was provided to H. Whitehead and H. Moors for the northern bottlenose whale fieldwork and the towed hydrophone array was loaned by L. Rendell of the University of Saint Andrews.. Funding for the collection of Blainville's beaked whale data was provided by the Office of Naval Research, and fieldwork was conducted under Bahamas research permit #1 (Bahamas Marine Mammal Protection Act 2005). A. MacKenzie helped in the acoustic analysis of the bottlenose whale data, and L. Rendell was a very helpful reviewer.