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## Short communication

# First documented observation of feeding behaviour of humpback whales (*Megaptera novaeangliae*) in its breeding range off the southern coast of Tanzania

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Feeding and breeding activities of humpback whales (*Megaptera novaeangliae*) are generally understood to be geographically and temporally separated, with feeding activities taking place in the higher latitudes and breeding in lower latitudes. However, humpback whales may supplement their energy budgets by feeding outside of their polar foraging grounds, with opportunistic feeding behaviour being observed in mid-to-low latitudes globally. The records of supplementary feeding during migration in the southern hemisphere have been documented for various breeding stocks, with no records for the East African stock. We present the first to our knowledge record of the humpback whales feeding events in the coastal waters of Tanzania, that have been recorded on the dedicated boat surveys conducted during the humpback whales breeding seasons in 2023 and 2024 off Mnazi Bay in Mtwara region. Demonstrated behavioural plasticity may play an important role in adaptation strategies to global environmental changes and prey availability fluctuations, all of which affect recovering populations. Mnazi Bay seascape and its vicinity is an important habitat for at least 11 species of cetaceans documented, all of which depend on its productive waters for foraging, socializing and as a nursery for migrating humpback whales. This record underpins the importance of the protection of this habitat. However, future studies are needed to confirm and understand the details of the observed supplementary feeding behaviour of the humpback whales and the potential reasons behind its occurrence in Tanzania.

KEY WORDS: *Megaptera*, opportunistic foraging, south-western Indian Ocean, supplementary feeding behavioural activities, East Africa.

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## INTRODUCTION

The humpback whale (*Megaptera novaeangliae*) is a cosmopolitan species with a vast movement range covering all oceans. Except for one small isolated non-migratory Arabian Sea subpopulation (Mikhalev 1997), this species demonstrates extensive long-distance annual migration between the low latitudinal breeding grounds and high latitudinal feeding grounds (Clapham & Mead 1999). According to the International Whaling Commission (IWC), seven Breeding Stocks (BS) of humpback whales are recognised in the Southern Hemisphere (named from A to G), of which East Africa holds BS C. Likewise, this breeding stock (BS C) is comprised of sub-stock C1 along the East African coast, C2 along the central Mozambique Channel Islands, C3 along the Madagascar Ridge, which demonstrates extension to northern African coast (Cerchio et al. 2016) and C4 around the Mascarene Islands (La Reunion, Mauritius, Rodrigues) (Best et al. 1998). A significant number of humpback whales utilise the nearshore waters of Tanzania as breeding habitat in the winter (Kalashnikova et al. 2023; Braulik 2024a, 2024b). These whales come from BS C, including the northern extent of C1 (Seyboth et al. 2023) and a probable range expansion from C3 (Cerchio et al. 2016), as well as from the broader Western Indian Ocean as revealed by the photo ID study, with multiple regional matches detected (E. Kalashnikova unpublished data). While uncertainty still surrounds the allocation of these aggregations to their foraging grounds, based on satellite and mark recapture studies (Cerchio et al. 2016; Seyboth et al. 2023), the feeding area for BS C is considered to be between 10°E and 60°E and identified as Management Area III (IWC 1998). Humpback whales are known to demonstrate behavioural plasticity and engage in a wide variety of feeding techniques (Hain et al. 1995; Clapham & Mead 1999). Despite the high behavioural variation, the species shows high site fidelity to their feeding grounds which has been proved by direct visual observations, and stomach content analysis of stranded and/or killed animals during industrial whaling (Clapham 1996; Clapham & Mead 1999; Cerchio et al. 2016; Seyboth et al. 2023). However, in recent years, this concept is being increasingly questioned, as there is growing evidence of humpback whales displaying occasional or regular feeding outside their traditional high latitude foraging ranges, with records from mid-to-low latitude waters, including in Chile (García Cegarra et al. 2021), southern Brazil (Danilewicz et al. 2009; de Sa Alves et al. 2009; Bortolotto et al. 2016; Siciliano et al. 2019), South Africa (Best et al. 1995; Findlay & Best 1995; Findlay et al. 2017), Nicaragua (De Weerd & Ramos 2019), Australia (Dawbin 1956; Stamation et al. 2007; Eisenmann et al. 2016), the Dominican Republic (Baraff et al. 1991), Mexico (Gendron & Urban 1993) as well as Tasmania and New Zealand (Gill et al. 1998). While supplementary feeding has been documented for almost all Southern Hemisphere breeding stocks (Seyboth et al. 2023), the BS C that utilize the archipelagos of the Western Indian Ocean and coastal waters of East Africa, including Tanzanian waters, had no previously reported feeding behaviour within its breeding grounds. The current study is the first to document the opportunistic feeding event of humpback whales in southern Tanzania, a low-latitude area in the Southwestern Indian Ocean, and identify further actions needed for establishing whether these occurrences of this novel supplementary [“feeding beyond their formally described feeding grounds” (Seyboth et al. 2023, p. 1)] foraging behaviour

is more common or frequent than previously believed or documented in this work, articulating the importance of research in this crucial habitat for the species.

## METHODS

Dedicated boat-based surveys have been conducted during the humpback whale breeding season in the Mnazi Bay Ruvuma Estuary Marine Park, Mtwara region, since 2021. A 7 m long fibre boat with an outboard engine of 150 hp was employed as the research boat, and random routes with stratified effort were carried out with a minimum of 3 hr daily effort. During the surveys focal group scan sampling was carried out every 10 min, and spatial and acoustic behaviour, group cohesion, inter-species interactions and photo-identification data were collected via Nikon D7200, equipped with Lens Nikon AF NIKKOR 70–300 mm. A minimum of four observers were present in each survey, where two observers stood on the sides of the boat, scanning the sea between a 270 and 90 degree angle from the bow, with the naked eye. The other two observers were responsible for collecting the acoustic and photo-identification data during the focal follow-up. All the data were stored in Logger2010 software with its associated coordinates.

Overall, 86 days (337 hr) were spent at sea with a survey coverage of 294 km<sup>2</sup> during 2021–2024, of which humpback whales were encountered on 48 days.

## RESULTS

The supplementary feeding behaviour was recorded on 2 days in August 2023 (Fig. 1A–F) and on 1 day in August 2024. The primary cue for feeding activities during the two events in 2023 was a motion characteristic for gulp feeders, performed by at least two individuals on 6 August and one on 15 August 2023 off Mnazi Bay Ruvuma Estuary Marine Park (Fig. 1A–B). Inflated ventral pleats were also observed. Further, secondary cues were collected for 9 days between 24 July and 16 August 2023 and for 1 day in August 2024, and were identified as erratic swimming and surfacing movements in the same general area without much forward movement with repetitive frequent short vertical diving in the same location performed by humpback whales; direct observation of tuna and birds feeding (bait fish in the mouths of the birds and around the tuna) in the close proximity to whales on all three occasions and throughout the surveys in 2023 and 2024 (Fig. 1C); and aggregations consisting of five other cetaceans species throughout the survey with up to four taxa swimming in close proximity to humpback whales, namely Short-finned pilot whale (*Globicephala macro-rhynchus*) (Fig. 1D), Spinner dolphins (*Stenella longirostris*) (Fig. 1E), Risso's dolphins (*Grampus griseus*) (Fig. 1F) and Indo-Pacific bottlenose dolphins (*Tursiops aduncus*) near the groups of whales. Despite there being no direct observations of feeding by these cetacean species when they were near or alongside whales, feeding could not be excluded, and if it took place, multi taxa groups were potentially exemplifying foraging beneficence.

## DISCUSSION

Numerous studies reported the increased evidence of supplementary foraging of humpback whales outside of their recognised feeding areas, including in low latitudes, with the mechanism of this phenomena still being unclear. According to the authors who documented this behaviour, drivers for the recorded supplementary feeding may include

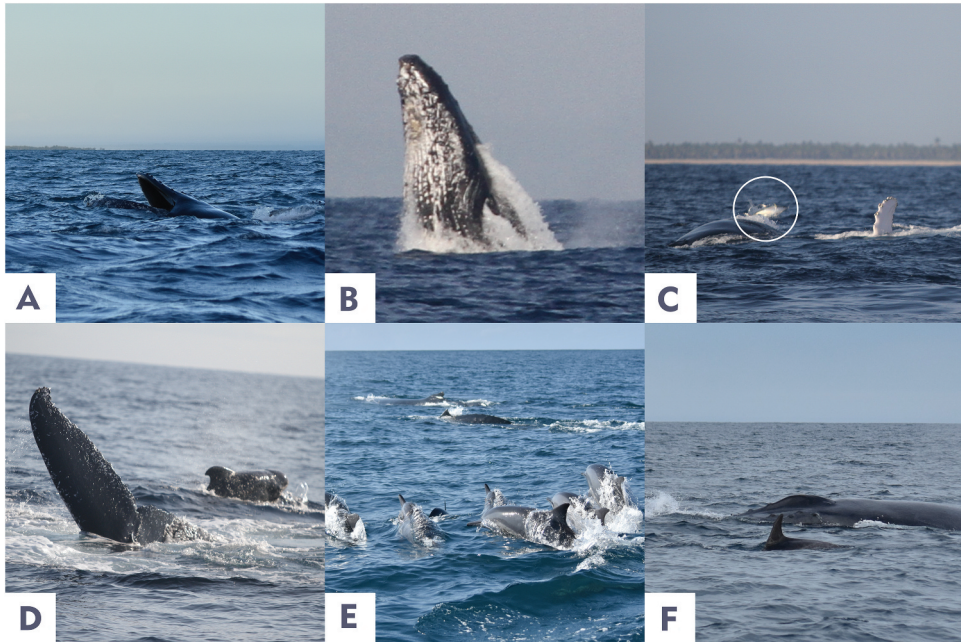


Fig. 1. — Humpback whales during feeding events documented in Mtwaru in August 2023, demonstrating motion characteristic for (A) lateral and (B) vertical lunge feeding; (C) yellowfin tuna leaping out of the water in the proximity to humpback whales; interspecies interaction – (D) short-finned pilot whale (*Globicephala macrorhynchus*), (E) Spinner dolphins (*Stenella longirostris*) and (F) Risso's dolphins (*Grampus griseus*) near potentially feeding humpback whales.

variability or new prey availability and/or changes in its distribution (García Cegarra et al. 2021), redistribution of fast growing populations of humpback whales into new feeding grounds (Findlay et al. 2017), increased water productivity due to upwelling events (Díaz & Methion 2019), ongoing climate-driven shifts in oceanographic parameters and resource availability (King et al. 2021; Dedden & Rogers 2022) or a combination of the above. Direct or indirect records of supplementary feeding during migration in the southern hemisphere outside the traditional feeding range have been documented for all breeding stocks, except the East African stock C (Seyboth et al. 2023). To the best of our knowledge, there have been no previous reports of humpback whales feeding events in Tanzania, that hosts representatives from this stock, which, however, might be a result of there being limited dedicated surveys conducted in this region. Given the amount of energy required for lunge feeding, there should be a certain level of prey for whale feeding to occur. The presence of feeding whales, therefore, may indicate a good oceanographic productivity, and it is plausible that a high prey presence in Mnazi Bay seascape and its vicinity triggered opportunistic feeding behaviour. At the same time, feeding whales increase productivity by dispersing nutrients essential for phytoplankton growth and consecutive consumption by the upper trophic strata (Roman et al. 2014). Therefore, this record underpins the importance of the enforced protection measures within and in the neighbouring waters of Mnazi Bay Ruvuma Estuary MPA. It

is important to note, however, that this newly documented behaviour may also lead towards increased competition between cetaceans and local communities for the same resources and, as a result, entanglements of whales in the fishing gear, and so-called bycatch, may inevitably become more frequent. Therefore, it is important to further investigate migratory ecology of humpback whales in Tanzania, including probable drivers and exact locations of feeding behaviour, in order to assist in national management of the species and mitigate possible anthropogenic threats, including bycatch and understanding of its magnitude. In addition, it is essential to conduct an array of further research activities, including investigating the presence of prey items, detection of the whales' faeces, acoustic behaviour analysis including detection of the feeding calls, analysis of the stomach content of the stranded animals, etc., to further document supplementary feeding of humpback whales in Tanzania. These activities may be realised via dedicated surveys as well as with the help of visual observations of the fishermen network and properly leveraged citizen science.

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#### DISCLOSURE STATEMENT

No potential conflict of interest was reported by the authors.

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The study has been self-funded by the PI.

#### AUTHOR CONTRIBUTION

E. Kalashnikova: writing – original draft, project administration, investigation, funding acquisition, formal analysis, conceptualization. D.G. Orio: writing – review and editing, project administration, logistics on the ground, governmental liaison, research permit acquisition, data collection. A. Akkaya: writing – review and editing, writing – visualization, methodology, data curation, supervision.

#### ETHICAL STANDARD

This study has been conducted under the research permit N 2023-482-NA-2021-138 from the Tanzania Commission for Science and Technology.

## DATA ACCESSIBILITY

The data that support the findings of this study are available from the corresponding author upon request.

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