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Previously Undocumented Long-Finned Pilot Whale (*Globicephala melas*) Placental Expulsion in Coastal Waters of Shetland, United Kingdom

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This paper describes the first documented observation of placental expulsion by a long-finned pilot whale (*Globicephala melas*), which was captured on video by an unmanned aerial system (UAS) in coastal waters of the Shetland Isles, Scotland, United Kingdom. The advent and development of UAS technology provides novel opportunities to observe and document biologically significant events that are challenging, if not impossible, to observe via boat or from land (Ransome et al., 2022).

Around Scotland, long-finned pilot whales show a strong association for deep water off the continental shelf edge (Weir et al., 2001; Hammond et al., 2017; Rogan et al., 2017) and thus are relatively infrequently sighted in coastal Scottish waters. Due to the logistical challenges of studying pelagic species, the understanding of some attributes of long-finned pilot whales remains limited, with courtship, mating, and parturition poorly described and rarely (if ever) observed. Therefore, the identification of Shetland's coastal waters as a site of placental expulsion provides new insights for the North Atlantic population of long-finned pilot whales.

Observation

On 27 September 2019 at 1351 h (BST), an unmanned aerial system (DJI Mavic 2 Pro and then a DJI Inspire) was launched following land-based sightings of a group of long-finned pilot whales in the Shetland Isles (Figure 1). During the 1.5 h encounter, 19 min 39 s of aerial video captured a series of events associated with the apparent placental expulsion from one of the presumed (based on body length) adult long-finned pilot whales. (Cropped video of the encounter is available in the "Supplemental Material" section of the *Aquatic Mammals* website: https://www.aquaticmammals-journal.org/index.php?option=com_content&view=article&id=10&Itemid=147).

The group, comprising a minimum estimate of 40 individuals, was first observed at 1354 h within Yell Sound, located 1.5 km northwest of the Isle of Lamba, Shetland (60.521261, -1.306385; water depth at location: 40 to 60 m; Figure 1). The group swam directionally north at ~7 km/h. At 1423 h, the group was located 2 km due north of the Isle of Lamba (60.5340771, -1.2900745), still tracking directionally north in a tight-knit formation and travelling at pace (~11 km/h). Leading the fast-paced group were two presumed adults travelling in parallel and flanking a young calf that swam in echelon between the two adults. The calf had a flaccid dorsal fin and pale gray colouration (Figure 2), a characteristic prevalent in newborn long-finned pilot whales (Auger-Méthé & Whitehead, 2007; Verborgh et al., 2021). The calf was in close proximity with the adult that expelled the "placenta," so it is plausible that the calf may have been a neonate. The video resolution was insufficient to determine whether diagnostic fetal folds were present on the calf; these have been used previously to identify pilot whale neonates (Verborgh et al., 2021).

At 1423 h, one of the two leading adults provided a hard kick with its fluke and then expelled a globular white and red tissue, assumed to be from its genitals (60.5353853, -1.2899942; water depth at location: 60 to 80 m; Figure 3a; Supplemental Video). The tissue immediately surfaced upon expulsion. Morphologically, the tissue was similar in gross appearance to other cetacean placental tissue documented within the literature, with a crescent-shaped bicornuate structure evident and visible umbilical cord (Benirschke &

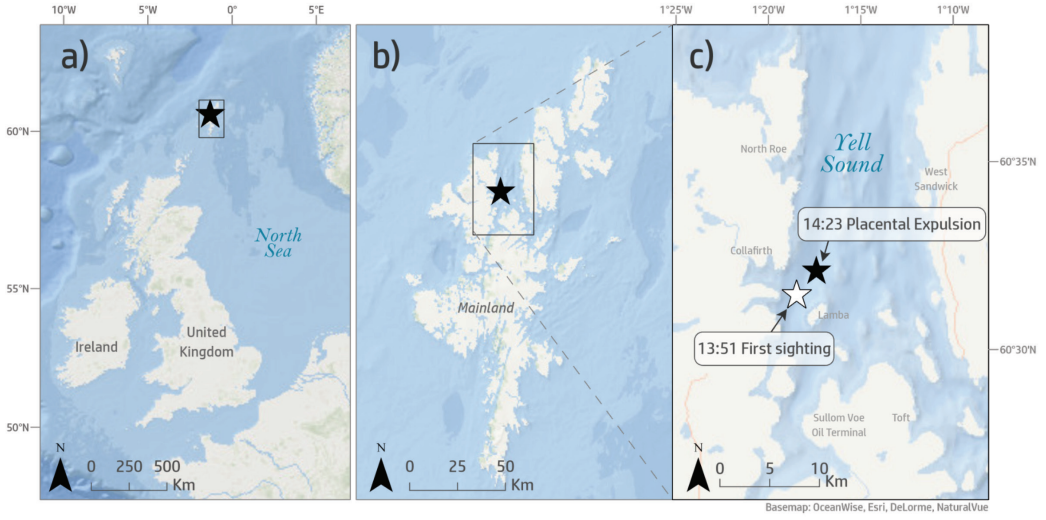

Figure 1. (a) Location of the Shetland Isles in relation to the rest of the United Kingdom and the North Sea; (b) location of the placental expulsion observation (black star) near the Shetland Isles; and (c) detailed location where the long-finned pilot whales (*Globicephala melas*) were first sighted (white star), with site of placental expulsion (black star) within Yell Sound.

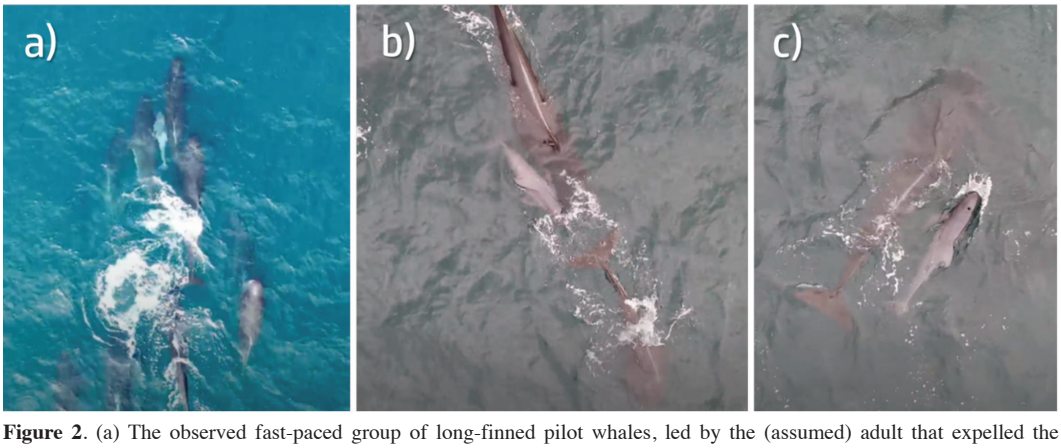

Figure 2. (a) The observed fast-paced group of long-finned pilot whales, led by the (assumed) adult that expelled the placental-like tissue, who also had a calf swimming in the echelon position; (b) example of the calf's flaccid dorsal fin; and (c) calf in echelon position to adult that expelled placental-like material. (*Drone footage credit:* Nick McCaffrey)

Cornell, 1987; Silvers et al., 1997; Jones et al., 2022; Figure 3b). The pilot whales immediately orientated themselves at least 270° towards the putative placenta before momentarily leaving the UAS's field of view. The group then encircled the biological material, milling in direct proximity to the tissue (Figure 3c). One presumed adult surfaced closely alongside the material, while another smaller individual swam directly under it and touched the tissue via its tail fluke. A third presumed adult surfaced alongside the putative placenta and orientated its body to kick the material with its flukes. At 1424 h, the group then resurfaced approximately three adult body lengths away from the tissue and reorientated parallel line abreast to one another (Neumann & Orams, 2003). The UAS abandoned the putative placenta to follow the group. When the tissue was next in the field of view (1425 h), at least 12 pilot whales surfaced and milled in close proximity, with one individual spy-hopping alongside it (Figure 3d). The spy-hopping behavioural event could have been in response to the presence of the UAS (Fettermann et al., 2019).

The UAS was returned to land at 1427 h and exchanged for a second UAS (DJI Inspire). At

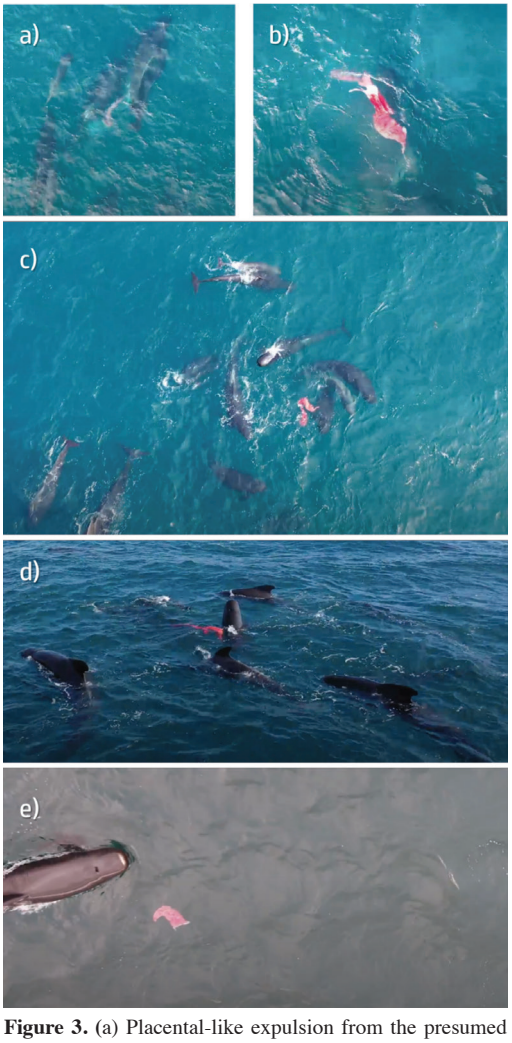

Figure 3. (a) Placental-like expulsion from the presumed adult long-finned pilot whale; (b) first observation of placental-like material; (c) milling and circling around first observed placental-like material; (d) spy-hop next to initial placental-like material; and (e) second observed placental-like material (potential second horn). (*Drone footage credit:* Nick McCaffrey)

1439 h, the group was relocated and observed for 5 min 1 s swimming slowly and logging at the surface. The next video clip begins at 1515 h, showing the group still swimming slowly and logging at the surface, with one individual tail slapping twice in quick succession. At 1519 h, a second piece of apparent biological matter, again resembling placental material, was further observed proximate to the group (Figure 3e; Supplemental Video). Three individuals swam alongside the floating tissue. As long-finned pilot whales have a bicornuate uterus, with each horn of the placenta typically expelled in succession (Blanchet et al., 2009), it is plausible that the second observation of assumed placental tissue represented the second horn. The second observed biological material appeared to be different from the first observed tissue, comparatively smaller in size and paler in colour, with apparent differences in texture and shape also noted (Figure 3e).

At 1525 h, ~40 pilot whales were visible within the UAS field of view, which provides a minimum estimate of group size during this encounter. This observation suggests that the expulsion of putative placental tissue (and potentially parturition itself) represents a social rather than solitary activity. Further, there were multiple presumed mother–calf pairs observed in this group, supporting close kinship for this species, where some groups consist of closely related adult females and their offspring (Amos et al., 1991). The group forms part of the Northeast Atlantic population of long-finned pilot whales, with recent abundance estimates predicting 172,195 (CV = 0.35) individuals in this oceanic and shelf region (Rogan et al., 2017).

Due to the inherent difficulties in studying mobile marine megafauna, knowledge of reproductive parameters for pilot whales has arisen through analyses of individuals harvested during drive-fisheries (e.g., Martin & Rothery, 1993) and via analyses of individuals stranded during mass stranding events (MSEs) of which pilot whales are particularly prone (Martin et al., 1987; Gales et al., 2012; Brownlow et al., 2015; Anabella et al., 2017; Betty, 2019; Betty et al., 2019, 2020, 2022). An analysis of almost 2,000 females captured during the Faroese drive hunts between 1986 and 1988 estimated the average age at sexual maturity (8 y), inter-birth interval (average 5.1 y), a 12-mo gestation period, and a peak in conceptions and births in boreal summer and autumn (Martin & Rothery, 1993). In contrast, data from pilot whales captured on the east coast of the Atlantic suggest a longer gestation (15.5 to 16 mo) and births to be most prevalent in mid-August (Newfoundland, Canada; Sergeant, 1962). Similar reproductive insights into the North Atlantic population have been obtained through MSEs in British waters, which has enabled estimation of female age and length at sexual maturity (7 y; 300 to 400 cm), inter-birth interval (3.5 y), and reproductive rate (11%). No apparent seasonality in parturition was noted (Martin et al., 1987). The present observation of putative placental expulsion, likely indicative of recent birth, occurred late in September, which is in line with drive-fisheries-derived estimates of birth seasonality.

Parturition and associated placental expulsion have been documented for some cetaceans

in captivity (e.g., Essapian, 1963), with time between parturition and placental expulsion varying somewhat between species (bottlenose dolphin [*Tursiops truncatus*]: $n = 13$, range = 220 to 570 min [Biancani et al., 2021], and $n = 1$, 10 h [McBride & Kritzler, 1951]; killer whale [*Orcinus orca*]: $n = 1$, 10 h [Asper et al., 1988]; beluga whale [*Delphinapterus leucas*]: $n = 18$, average = 7.6 h [Robeck et al., 2005]; finless porpoise [*Neophocaena asiaeorientalis asiaeorientalis* and *N. a. sunameri*]: $n = 11$, average = 7 h 21 min [Deng et al., 2019]; pantropical spotted dolphin [*Stenella attenuata*]: $n = 1, 4.5$ h [Ikeshima et al., 2021]). As parturition was not directly observed during the observation described herein, it is not possible to report time between parturition and placental expulsion. However, given evidence of the time elapsed between parturition and placental expulsion for captive cetaceans, it is likely that the observation of this expulsion is an indication of a birth within the previous 12 h. Furthermore, we observed two expelled pieces of apparent placental material. Expulsion of > 1 piece of placental material has only previously been recorded for a captive harbour porpoise (*Phocoena phocoena*), with the suspected left- and right-horn expelled 5 h and 7 h after birth, respectively (Blanchet et al., 2009).

In contrast to captivity, cetacean parturition is seldom observed in the wild. Observations from a vessel of ante- and postpartum behaviour have been recorded opportunistically for killer whales (Stacey & Baird, 1997), false killer whales (*Pseudorca crassidens*; Notarbartolo di Sciara et al., 1997), beluga whales (Béland et al., 1990), bottlenose dolphins (Perrtree et al., 2016), sperm whales (*Physeter macrocephalus*; Weilgart & Whitehead, 1986), southern right whales (*Eubalaena australis*; Sironi et al., 2019), and humpback whales (*Megaptera novaeangliae*; Silvers et al., 1997; Faria et al., 2013; Ransome et al., 2022). However, vessel platforms typically limit direct observations of parturition itself, which usually occurs underwater; thus, expulsion of the calf and/or placental tissue may be missed. For some vessel-based observations, blood and tissue were observed floating on the surface instantaneously or up to 15 min post first observation of a neonate (e.g., false killer whale: Notarbartolo di Sciara et al., 1997; humpback whale: Silvers et al., 1997; Ransome et al., 2022), or retrieved the following day (Sironi et al., 2019). In contrast to a typical subsurface birth for cetaceans, Mills & Mills (1979) directly observed the birth of a gray whale (*Eschrichtius robustus*) because the mother maintained her back arched and head underwater in an apparent attempt to keep the head of the emerging neonate above the water. No placental tissue was witnessed nor located despite a dedicated search (Mills & Mills, 1979). Observations of ante- and postpartum behaviour have also been recorded opportunistically during two independent aerial surveys of a North Atlantic right whale (*Eubalaena glacialis*); large clouds of bloody discharge were visible in the water, with "a solid mass at the surface nearby," which potentially may have represented placental tissue (Zani et al., 2008, p. 23; also see Foley et al., 2011).

Along with the inherent challenges of observing placental expulsion in free-ranging cetaceans (e.g., subsurface, rarity), ocean turbidity, sea state, and/or low water visibility may further limit observations (Ransome et al., 2022). Observations may also be rare because placental tissue may sink (Silvers et al., 1997) or may attract and then be consumed by scavengers such as sharks or seabirds (Taylor et al., 2013; Ransome et al., 2022). While there are currently no recorded observations of placentophagia (consumption of the placenta) by marine mammals, the energy-rich placenta is known to be consumed by many terrestrial eutherian mammalian species (Mota-Rojas et al., 2020). Placentophagia may be absent for cetaceans as birth is aquatic, and mothers often focus on aiding their offspring to breathe at the surface immediately following parturition (Kristal et al., 2012). Placental material is estimated to contain 5% of the total energy of gestation (southern right whales; Christiansen et al., 2022) and may weigh approximately 10 to 17% of calf birth weight (killer whales; Benirschke & Cornell, 1987). During the observation described herein, there was no apparent evidence of placentophagia, though some pilot whales did interact with and kick the biological material with their flukes, which may plausibly represent an attempt to break it apart or facilitate sinking to reduce predator attraction.

Building a knowledge base of observations of biologically significant events, along with identification of areas that are important to marine mammal life history and survival (e.g., important foraging, resting, calving, and breeding areas), is essential to inform and improve current conservation measures. Using the unique perspective of a UAS, this paper describes placental expulsion by a long-finned pilot whale in the waters around the Shetland Isles. As UAS use increases, it is likely that similar observations of previously undocumented biologically significant events will also increase. Through documentation of such observations, these new insights and perspectives may serve to highlight important regions for conservation.

Acknowledgments

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