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Strandings of a neonate and a pregnant Sowerby's beaked whale (*Mesoplodon bidens* (Sowerby, 1804)) in Ireland

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Abstract

Sowerby's beaked whale is a deep-diving cetacean species specialized to live in the deep waters of the North Atlantic, including offshore Irish waters. Sightings of Sowerby's beaked whales in this area are infrequent and a substantial increase in our knowledge of their presence comes from recent static acoustic monitoring (SAM) and passive acoustic monitoring (PAM). However, most information on this species has been derived from stranding records, which provide opportunistic insights into this elusive species' cryptic life history. Here we report on the live stranding of a 1200 mm long neonate and an adult 5 m female Sowerby's beaked whale in July 2015 and on the stranding of a 4.9 m pregnant female in September 2020 with a 495 mm long male foetus in the south-west of Ireland. These stranding events provide an important insight into the reproductive life history of this species and provide further evidence that Sowerby's beaked whales calve in offshore Irish waters.

Introduction

The Sowerby's beaked whale (*Mesoplodon bidens* (Sowerby, 1804)) is a *Mesoplodon* species endemic to the North Atlantic (Pitman & Brownell Jr., 2020). Sowerby's have the most northern range of all mesoplodonts in the Atlantic, where most records are north of 30°N (Pitman & Brownell Jr., 2020). Its distribution in the west extends between Massachusetts, USA and Labrador, Canada and in the east between the Canary Islands, Spain and Norway (Carlström *et al.*, 1997; Martín *et al.*, 2011; Pitman & Brownell Jr., 2020). Extralimital stranding records have reportedly been made in the Gulf of Mexico, Mediterranean Sea, Dominican Republic and Brazil, but the majority of published records have been from strandings around Scotland and Ireland in the North-east Atlantic (MacLeod *et al.*, 2004, 2006; Bachara *et al.*, 2014; Bittau *et al.*, 2018). This species is currently classed as least concern under the International Union for Conservation of Nature (IUCN) red list (Pitman & Brownell Jr., 2020). The population in the eastern Atlantic was estimated to comprise 3518 individuals using aerial survey data (CV = 0.43%, 95% CI 1570–7883; Rogan *et al.*, 2017) while stable isotope evidence from stranded specimens has indicated local site fidelity of whales within the west and east North Atlantic, which suggests the potential for different populations (Smith *et al.*, 2021).

Sightings in addition to both static acoustic monitoring (SAM) and passive acoustic monitoring data (PAM), indicate this species resides within deep-water habitats along the continental shelf, Mid-Atlantic Ridge and within canyon systems (MacLeod *et al.*, 2004; Kowarski *et al.*, 2018; Clarke *et al.*, 2019; Pitman & Brownell Jr., 2020). Information on the species' life history is limited, but stomach content and dive tag analyses indicate it preys on mesobathypelagic fish, cephalopod and crustacean species at depths of between 670–1386 m (Pereira *et al.*, 2011; Spitz *et al.*, 2011; Breen *et al.*, 2020; Pitman & Brownell Jr., 2020; Visser *et al.*, 2022).

One necropsied Sowerby's beaked whale that stranded in Ireland had blue whiting (*Micromesistius poutassou* (Risso, 1827)), whiting (*Merlangius merlangus* (Linnaeus, 1758)), lanternfish (three Myctophids sp.) and *Trisopterus* sp. present (Hernandez-Milian & Rogan, 2011). The gestation period is believed to be 12 months, where calves weigh 185 kg and are between 2.28–2.7 m at birth (Mead, 1984; Reidenberg & Laitman, 2009; Bachara *et al.*, 2016). They appear to be physically mature at 5.05–5.5 m in total length (Reidenberg & Laitman, 2009).

Sowerby's are one of six species of beaked whale that have been recorded in Irish waters from the 1800s as strandings, as well as limited sightings since 2000 and extensive acoustic records since 2015 (Bruton *et al.*, 1989; Kowarski *et al.*, 2018; Richardson *et al.*, 2018). The Sowerby's beaked whale was first recorded in Ireland as a stranding in Brandon Bay, Co. Kerry on 9 March 1864 (Andrews, 1867) and 32 strandings have been recorded up to 13 September 2021 (IWDG, 2022). Strandings occurred between February and November



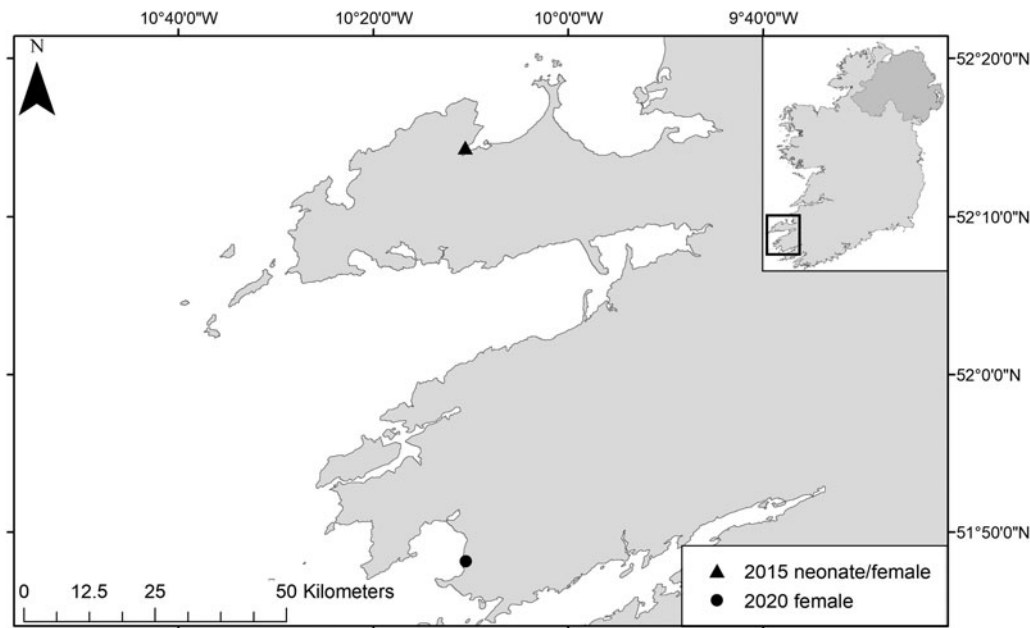


Fig. 1. Location of the case 1 live stranded neonate and adult female Sowerby's beaked whale stranded at Cloghane, Brandon Bay, Co. Kerry on 3 July 2015 and the location of the case 2 pregnant female at Lohar Strand, Ballinskelligs Bay, Co. Kerry on 4 September 2020.

predominantly along Atlantic coasts with a peak between July–September ($N = 17$) (IWDG, 2022). In total, Sowerby's strandings have consisted of 14 males, 11 females and seven unsexed whales (IWDG, 2022). When measurements were available, males ranged from 2.4–4.9 m in length (3.9 m mean, $N = 10$) while females ranged from 3.6–5.5 m (4.59 m mean, $N = 10$) (IWDG, 2022). Four live strandings have occurred (IWDG, 2022). Seventy-five per cent ($N = 24$) of Sowerby's beaked whale strandings have been recorded since 2004 (IWDG, 2022). It is the third most reported stranded beaked whale species in Ireland (five species have been identified stranded to date) after the most numerous, Cuvier's beaked whale (*Ziphius cavirostris* (Cuvier, 1823)) and the northern bottlenose whale (*Hyperoodon ampullatus* (Forster, 1770)) (IWDG, 2022). As of March 2022, Sowerby's consisted of 14.95% of all recorded Irish beaked whale strandings when species identification was possible ($N = 214$) (IWDG, 2022).

This species has infrequently been observed alive in Irish waters on at least 21 occasions between 2000–2017 (Ó Cadhla *et al.*, 2004; Wall, 2013; ORCA, 2016; Rogan *et al.*, 2018; Berrow *et al.*, 2018a, 2018b; Breen *et al.*, 2020; NBDC, 2021). Sightings were concentrated along the north Porcupine Bank, located ~150–250 km west of Ireland, but extended into the Rockall Trough, Rockall Plateau and Porcupine Seabight. Group sizes ranged from 1–6 individuals with mixed sex associations along with juveniles and calves reported (Berrow *et al.*, 2018a). Sightings were made in the months of May, June, August, September and November. Breen *et al.* (2020) estimated the depth of Sowerby's beaked whales foraging on the shelf edge of the Porcupine Bank to be between 324–840 m.

Acoustic detections of Sowerby's were made during all SAM deployment months (March–December) during the OBSERVE Acoustic project in 2015 and 2016 (Berrow *et al.*, 2018b). Sowerby's beaked whales were detected on 58.4% of days and the highest average recordings were in May at the northern stations on the Porcupine Bank and Rockall Trough (Kowarski *et al.*, 2018). This confirmed earlier reports that Sowerby's were found to be more common than other beaked whale species at higher latitudes, especially during the spring months (Kowarski *et al.*, 2018; Barile *et al.*, 2021). Northern areas of the shelf edge, such as the Rockall Trough are exposed to oceanographic

factors including the North Atlantic current, continuous shelf edge current, persistent eddy systems and upwelling areas, which appear to influence the presence of beaked whales, including Sowerby's beaked whales (Barile *et al.*, 2021). The nearly year-round acoustic presence and a rate of 1.3 strandings per year over the last 17 years indicate that offshore Irish waters represent an important habitat for this species within the North-east Atlantic.

Materials and methods

Cetacean strandings in Ireland are responded to by trained volunteers once reported to the Irish Whale and Dolphin Group (IWDG) where photographs, total length measurements and opportunistic tissue samples are taken.

On 3 July 2015 a neonate Sowerby's beaked whale (Case 1) was recorded live stranded at Cloghane, Co. Kerry (Figure 1, Table 1). It was refloated by responders with LO but was not seen again. An adult female Sowerby's beaked whale was also located stranded dead ~1.56 km south of where the neonate had initially stranded on the same day (Figure 1, Table 1).

On 4 September 2020 an adult female Sowerby's beaked whale (Case 2) stranded at Lohar Beach, Ballinskelligs Bay, Co. Kerry in the south-west of Ireland (Figure 1, Table 1). It was photographed, measured and sampled on 5 September 2020 by LH. SAO'C took blubber thickness measurements following Pugliares *et al.* (2007) with LH and DF on 6 September. A gross necropsy was conducted by SAO'C on 9 September to gather additional samples and examine the whale's internal anatomy with assistance from DF following the methodology used by the Irish small cetacean necropsy project and Pugliares *et al.* (2007).

Results

The Case 1 neonate Sowerby's beaked whale calf which live stranded in 2015 was unsexed but measured 1200 mm in length (LO pers. obs; O'Connell & Berrow, 2018). It displayed visible neonatal folds, its dorsal fin was slightly curved to the right and its head was kept well above the water when surfacing in a jerking manner, noted as 'rocketship' surfacing behaviour (Hill *et al.*, 2017). Its folds appeared irregular and wrinkled (Figure 2). The

Table 1. Adult female, neonate and foetus Sowerby's beaked whale stranding summary data from southwest Ireland

Date	Location	Latitude	Longitude	Age class	Sex	Length (mm)
03/07/2015	Cloghane, Co. Kerry, Ireland	52.2489	-10.1593	Neonate	Unsexed	1200
03/07/2015	Cloghane, Co. Kerry, Ireland	52.2395	-10.1762	Adult	Female	5000
04/09/2020	Lohar Beach, Ballinskelligs Bay, Co. Kerry, Ireland	51.8026	-10.1751	Foetus	Male	495
04/09/2020	Lohar Beach, Ballinskelligs Bay, Co. Kerry, Ireland	51.8026	-10.1751	Adult	Female	4900

**Fig. 2.** The neonate Sowerby's beaked whale live stranded at Cloghane, Co. Kerry on 3 July 2015. Photograph by Louise Overy.**Fig. 3.** The adult female Sowerby's beaked whale stranded at Cloghane, Co. Kerry photographed on 5 July 2015 displaying evidence of live-stranding. Photographs by Louise Overy.

adult female, recorded two days later, appeared to be in a good overall nutritional condition and measured 5 m long but lacerations and bruising along its ventral side suggested that it had live stranded (Figure 3). No necropsy was undertaken on this whale, and it was buried where it was found.

When examined externally, the Case 2 female Sowerby's beaked whale in 2020 was 4.9 m long and appeared emaciated with the rib cage, left scapula, lumbar/thoracic vertebrae and skull shape clearly visible (Figure 4). It was in a fresh decomposition condition following O'Connell & Berrow (2013). It had a blubber thickness of 31 mm on the dorsal, 23 mm lateral and 27 mm ventral sides. Hypostatic congestion was noted on the female's lungs which suggested that it had live stranded (Davison pers. comm; Davison *et al.*, 2015). The stranding occurred during a period of large spring tides which deposited the carcass above the high tide line. The beak was fractured which was most likely attributed to the boulders in the stranding area.

There was no evidence of recent feeding or marine debris present within its examined stomach chambers. A light orange/brown substance was present in the large intestine which may have been bile. One skin lesion was apparent on the whale's skin left abdomen which might be attributed to a parasitic sea lamprey (*Petromyzon marinus* (Linnaeus, 1758)) but a *Phyllobothrium* species was present in its blubber layer in low numbers. The uterus was found to be enlarged and filled with transparent amniotic fluid when initially examined. When it was opened and handled, the foetus' head came into view so it was kept *in situ* until suitable photographs could be taken to document the record appropriately (Figure 5).

The foetus was identified as being male (Figure 5). It was 495 mm in total length when measured in a straight-line distance, 210 mm in girth and weighed 1.5 kg (Table 2). Evidence of skin colouration was noted around the beak, eyes and dorsal side of the head where the epidermis was more developed than elsewhere on the body which remained pink in colour (Figure 5). The



Fig. 4. The extremely poor nutritional condition evident externally for the female Sowerby's beaked whale from a head on perspective (A) and along the dorsal side (B) stranded at Lohar Strand, Ballinskelligs Bay, Co. Kerry on 6 September 2020. Photographs by Seán A. O'Callaghan.

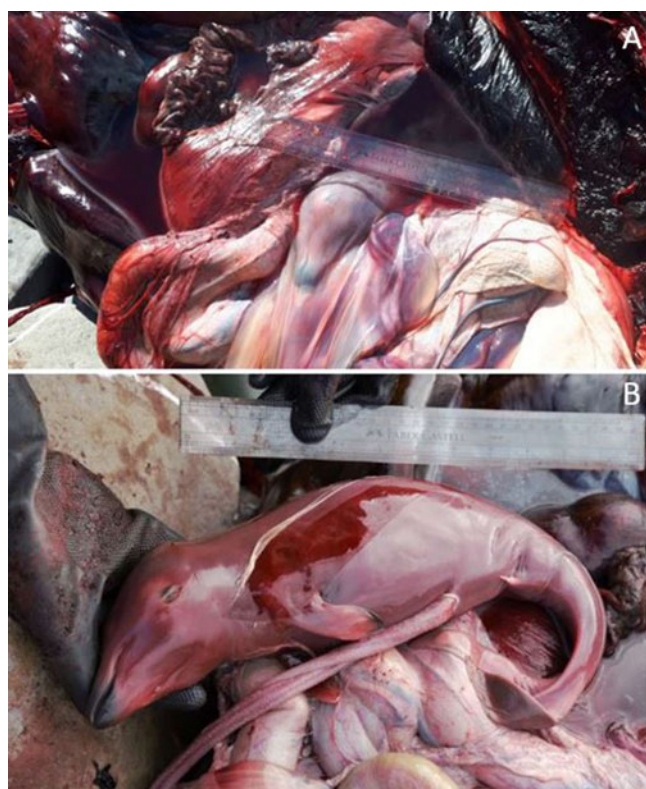


Fig. 5. The male foetus Sowerby's beaked whale on 9 September 2020 when initially found (A) and when removed from the uterus (B). Photographs by Seán O'Callaghan (A) and Damian Foxall (B).

epidermis sloughed off while the foetus was handled gently. It appeared that tooth buds were developing in the lower jaw on inspection. The foetus was preserved in 35% formaldehyde and

Table 2. Morphometric measurements from the male Sowerby's beaked whale foetus in Case 2

Area	Measurement (mm)
Total length	495
Beak to dorsal	315
Dorsal to fluke	173
Girth	210
Skull length	113
Skull width (eye to eye)	67
Beak to end of mouthline	55
Beak to mouth opening	41
Blowhole width	15
Left flipper length	62
Left flipper width	21
Right flipper length	73
Right flipper width	20
Dorsal fin length	31
Dorsal fin height	22
Fluke width	114
Umbilical width	14

donated to the collections of the National Museum of Ireland – Natural History on 11 September 2020 (acquisition number NH:2020:11.1).

Discussion

Other records of pregnant and neonate Sowerby's beaked whales have been reported elsewhere in the North-east Atlantic, which suggests that the species mates and calves across their range. A 540 mm male foetus was uncovered from a 4.85 m female Sowerby's beaked whale which became stranded in a shallow reef and was killed after being harpooned near Vila Franca do Campo at São Miguel Island, the Azores, Portugal on 24 September 1981, while two other individuals from the same group continued along the coast (Reiner, 1986). Another prematurely born calf was recorded as a 1250 mm female in Asturias, northern Spain, on 6 June 2016 (Table 2; Bachara *et al.*, 2016). A mother/calf pair also live stranded at Durness in Scotland on 30 September 2014, the female was lactating and the neonate male appeared to have milk in its stomach (Brownlow *et al.*, 2015). Mead (1984) reported 1570 mm to be the longest foetus length. The size of the Case 1 neonate in Ireland (1200 mm) and its swimming and surfacing behaviour suggests it was prematurely born prior to live stranding.

It seems likely that the apparently poor nutritional condition of the Case 1 neonate at Cloghane was a result of maternal separation, but no genetic testing was carried out between the neonate and the female which stranded dead 2 days after the neonate (given samples from the neonate do not exist) to confirm whether these two events were related. The Case 2 pregnant whale did not display any immediately obvious abnormalities apart from its very poor nutritive condition. While a gross necropsy was performed, without further investigation by a vet or pathologist, it was not possible to determine the underlying cause for the poor condition of this animal.

Between 1 August–31 October 2020, an unusual mortality event (UME) occurred involving 20 separate beaked whale

stranding events, comprising 35 individual animals across six European countries (Hoare, 2020; Ijsseldijk pers. comm; Dolman *et al.*, 2021; SMASS, 2021; IWDG, 2022). Three beaked whale species were recorded stranded across the eastern Atlantic, from the Faroe Islands, Scotland, Ireland, England, the Netherlands and Belgium, including northern bottlenose whales (N = 24), Cuvier's beaked whales (N = 2), Sowerby's beaked whales (N = 7) and one stranding not identified to species level (Hoare, 2020; Ijsseldijk pers. comm; Dolman *et al.*, 2021; SMASS, 2021; IWDG, 2022). The pregnant individual in Case 2 stranded during the 2020 UME, and is included in the above strandings for Sowerby's beaked whales (Ijsseldijk pers. comm; Dolman *et al.*, 2021; SMASS, 2021; IWDG, 2022). Four UMEs involving beaked whales have occurred in European waters since 1994, three of which have taken place since 2008 (in 2008, 2018 and 2020; Dolman *et al.*, 2021). These events suggest there is an increasing trend and magnitude of stranding events involving beaked whales in this region, especially given the world's largest beaked whale mortality event happened in 2018 involving 100 individuals (Brownlow *et al.*, 2019; Dolman *et al.*, 2021). Beaked whale species are known to be sensitive to anthropogenic noise which has been attributed to abnormal stranding events elsewhere in the world (Bernaldo de Quirós *et al.* 2019).

Beaked whale strandings provide important access to rare specimens, which can help to understand their biology and ecology, which highlights the value of coordinating and monitoring long-term stranding datasets to understand spatial and temporal trends. Additionally, the value of empirical data and samples from such rare species emphasizes the need to respond to strandings such as beaked whales with fully trained personnel to conduct necropsies and assess potential underlying conditions or traumas to better understand the species' life history and potential pressures they face.

Conclusion

These two Sowerby's beaked whale stranding records as well as the offshore sightings of both juveniles and calves suggest that Irish waters represent an important calving area for this species. However, additional knowledge of this offshore species life history is required to understand and protect the species better. Increased conservation efforts should be made to evaluate and ensure that this species receives appropriate protection from anthropogenic effects in this area in light of the increasing beaked whale mortality events in Ireland, the apparent increasing frequency of Irish offshore and adjacent international waters being used by military vessels (such as the live fire missile exercises conducted by Russia in February 2022 and by France in June 2022) and because this range-restricted species is likely to be affected by climate change in the years to come.

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Author contributions. SOC conceptualised, analysed and wrote the manuscript. LH collected field data with DF and edited the manuscript. MC assisted in the collection and preservation of the foetus. LO gathered data from the 2015 neonate stranding and assisted in editing. MOC gathered and analysed

all Irish beaked whale strandings up to the point of the 2020 pregnant individual.

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