

Further Evidence for Breeding White-Beaked Dolphin (*Lagenorhynchus albirostris*) in Inner Danish Waters

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Abstract: The white-beaked dolphin (*Lagenorhynchus albirostris*) is the second most frequently stranded cetacean species along the Danish coastline. The northern North Sea, the Skagerrak, the Kattegat and the Danish straits are part of the species distributional range. Here, we present eight incidents of breeding activity for the white-beaked dolphin in the inner Danish waters, reviewed from yearly reports made by the National Contingency Plan concerning strandings of marine mammals in Denmark from 2009 to 2023, Danish Wildlife Diseases Surveillance reports from 2014 to 2023 and the citizen science database Naturbasen in the period 2002 to 2023. Three pregnant females, three lactating females and one calf were found stranded in the inner Danish waters. Besides this, there have been live sightings of a female with a newborn calf. We conclude that the white-beaked dolphin is breeding in the inner Danish waters.

Keywords: strandings; cetacean; Danish waters; Delphinidae; Odontoceti; reproduction



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1. Introduction

The white-beaked dolphin (*Lagenorhynchus albirostris*) belongs to the family of oceanic dolphins (Delphinidae) in the suborder of toothed whales (Odontoceti). The white-beaked dolphin is endemic to the temperate and subarctic North Atlantic, where it usually inhabits shelf waters [1].

White-beaked dolphin females become sexually mature at 6–10 years of age and 230–240 cm in length, while males become sexually mature about two years later than females and are typically 230–260 cm in length [2]. The length at birth is estimated to be 110–120 cm [2]. White-beaked dolphins usually only give birth to one calf in the summer time (the parturition time is typically in July), approximately every second year [2]. Newborn calves have been reported in the greater North Sea (as defined by OSPAR: North Sea and Skagerrak) since the 1880s [3] (skull given as *Delphinus* sp.) [4,5]. Around the United Kingdom, strandings of calves smaller than 130 cm in length are reported almost exclusively between June and September, supporting the assumption that parturition occurs during this period [6].

The white-beaked dolphin is ranked as Least Concern (LC) in the IUCN Red List from 2018 (www.iucnredlist.org, accessed on 22 February 2024). The white-beaked dolphin is the second most frequently stranded cetacean species along the Danish coastline [1,2].

The northern North Sea, the Skagerrak, the Kattegat and the Danish straits are part of the species' range [1,2]. The white-beaked dolphin was discovered in the Danish part of the North Sea in 1845 and in the Sound, between Denmark and Sweden, already in 1844, i.e., two years before its formal description. In 2003, it was formally recognized as a breeding species in the North Sea [5,7].

In April 2023, an adult female white-beaked dolphin (total length 240 cm and total weight 233 kg) was stranded in Nekselø Bay, Kattegat (coordinates 55.755978, 11.324722). A necropsy of the dolphin revealed an almost full-term fetus (15.2 kg, length: 101 cm) (Figure 1). This discovery indicated breeding activity in the inner Danish waters, i.e., Kattegat, the Danish Straits and the southwestern Baltic Sea, and served as the starting point for this investigation.



Figure 1. Two of the authors (NMK and AKOA) with the 15.2 kg, 101 cm long fetus from the pregnant female white-beaked dolphin stranded 26 April 2023 in Nekselø Bay, Kattegat (coordinates 55.755978, 11.324722).

As the background to this study, we will first describe the current knowledge on discoveries of white-beaked dolphins in the inner Danish Waters, which is based on citizen science and the National Contingency Plan concerning strandings of marine mammals in Denmark. The Danish citizen science database Naturbasen [8] lists 27 reports of the white-beaked dolphin in Denmark, with a total of 109 live or stranded individuals observed between 2002 and 2023 (Figures 2A,B and 3). The observations of white-beaked dolphins are year-round, but the highest frequencies are seen in January and February and between May and August (Figure 2B).

Of the 48 stranded white-beaked dolphins recorded by the Danish Contingency Plan concerning strandings of marine mammals in Denmark, 26 were necropsied by the Danish National Surveillance of Diseases between 2014 and 2022 [9–17]. In recent years, most strandings have occurred along the North Sea and Skagerrak coastlines. According to Galatius and Kinze 2016 [18], the Danish individuals belong to a larger North Sea popula-

tion of white-beaked dolphins. The species has been recorded from western Greenland, in the north (71°N) to Cape Cod, Massachusetts, in the south (41°N) [18].

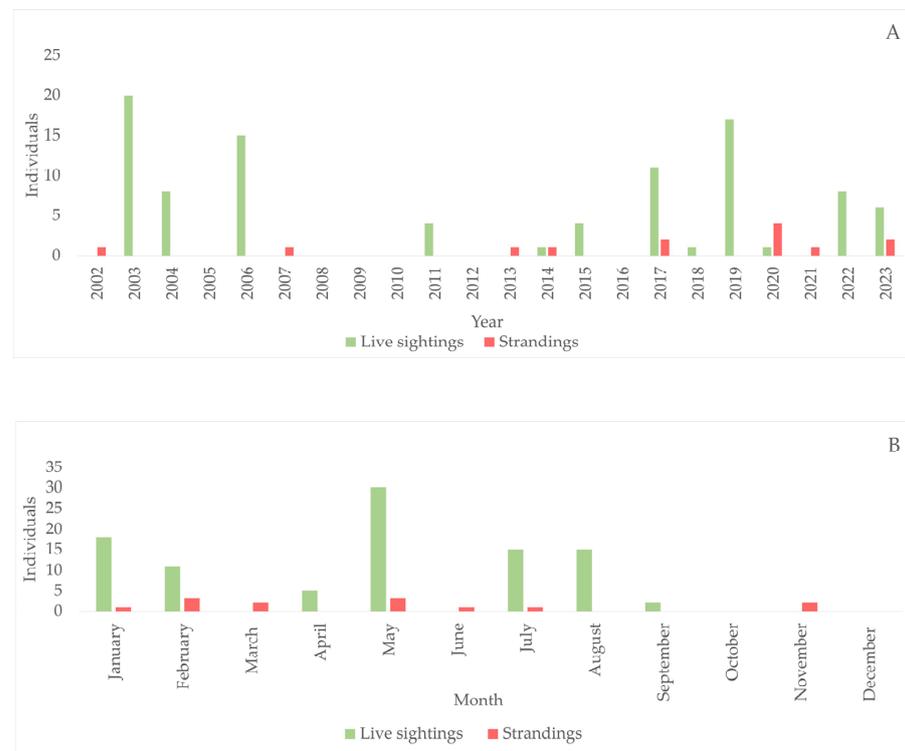


Figure 2. Sightings from the citizen science reporting database Naturbasen from 2002 to 2023. (A) Yearly live sightings and sightings of stranded white-beaked dolphins in Danish waters. (B) Monthly observations and stranding records of white-beaked dolphins in Danish waters. In 2002, the total number of reports to Naturbasen was 8000, and currently, there are around 400,000 citizen science reports per year. Sightings in Naturbasen are verified by experts based on photos or detailed descriptions of the observations.

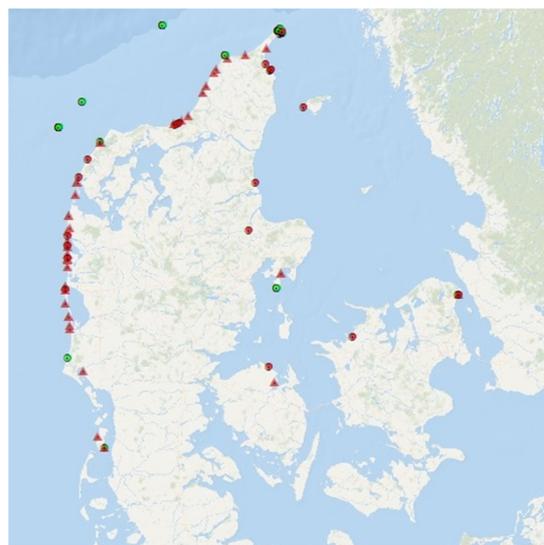


Figure 3. Map of citizen science sightings of white-beaked dolphins (circles) from Naturbasen from 2002 to 2023 [8]. There were 27 live sightings (green circles) and 109 sightings of strandings (red circles). Red triangles indicate stranding reports of 48 white-beaked dolphins to the National Contingency Plan concerning strandings of marine mammals in Denmark between 2009 and 2023 [19–31]. Reportings from Naturbasen and from the National Contingency Plan may overlap.

The EU Habitats Directive (Council Directive 92/43/EEC, <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:01992L0043-20130701>, accessed on 22 February 2024) was adopted in 1992 and requires all member states to establish a strict protection regime for species listed in Annex IV, both inside and outside of Natura 2000 sites. All cetaceans are listed in Annex IV and are therefore subject to this protection. The Habitats Directive states that member states must prohibit (i) deliberate disturbance, e.g., during breeding, rearing, hibernation and migration as well as (ii) the deterioration or destruction of breeding sites or resting places. In addition, each member state must propose a national list of important sites to be protected for those species and habitats present in their territory. Therefore, it is important to assess whether the white-beaked dolphin is a Danish breeding species with a distribution that extends to the inner Danish waters as this would necessitate that special areas of conservation should be appointed.

Here, we review sightings from the last two decades and necropsy reports between 2009 and 2023 of white-beaked dolphins to find further evidence of breeding activity in the inner Danish waters and, if possible, change its status to a native breeding species in Denmark.

2. Materials and Methods

This study is based on a review of national stranding reports made by the Danish National Contingency Plan concerning strandings of marine mammals from the past 14 years, 2009–2023 [19–31], as well as necropsies of stranded white-beaked dolphins performed by the Danish Wildlife Diseases Surveillance in the past nine years, 2014–2023. The necropsies followed the same procedures as in Hansen and coworkers [32], and the age class was defined based on Galatius and coworkers [2]. The breeding activity was defined as females with fetuses, females that were lactating (presence of milk in the mammary glands), calves with milk in their stomachs or males with spermatozoa activity, which is a sign of active mating readiness in dolphins. Likewise, the scientific literature for stranded white-beaked dolphins was reviewed for the same period. This was supplemented with a review of our own notes from the necropsies carried out on white-beaked dolphins. Additionally, the citizen science database Naturbasen (www.naturbasen.dk, accessed on 1 January 2023) was searched for records of white-beaked dolphin matings or sightings of mothers with calf from the years 2002 to 2023 [8].

3. Results

During the past two decades, eight incidences of the breeding activity of white-beaked dolphin have been recorded in the inner Danish waters (Figure 4, Table 1). Six reproductively active females, of which three were with fetus and three were lactating, were stranded in that time period. Additionally, a calf with milk in its stomach was also stranded in the inner Danish waters in the same time period. Besides this, there was one live sighting of a female with a calf in August 2011. The three lactating females were stranded in November and January of 2009, 2014 and 2017, respectively (Figure 4, Table 1). In January 2017, a dead calf with milk in its stomach was stranded a few days before the stranding of a lactating female (Figure 4, individuals no 5 and 6). However, it is unknown if the two individual strandings were a mother and her calf, since they were found in two different locations on the coast of Jutland, and no DNA tests were performed (Figure 4 and Table 1). Two females with smaller fetuses (0.455–1.9 kg) were stranded in 2014 and in 2017, respectively (Figure 5). Furthermore, in 2023, a female with an almost full-term fetus weighing 15.2 kg and 101 cm was stranded in the inner Danish waters (Table 1 and Figure 4). Figure 6 shows the gestation month by length of fetuses for all three fetuses included in this paper.

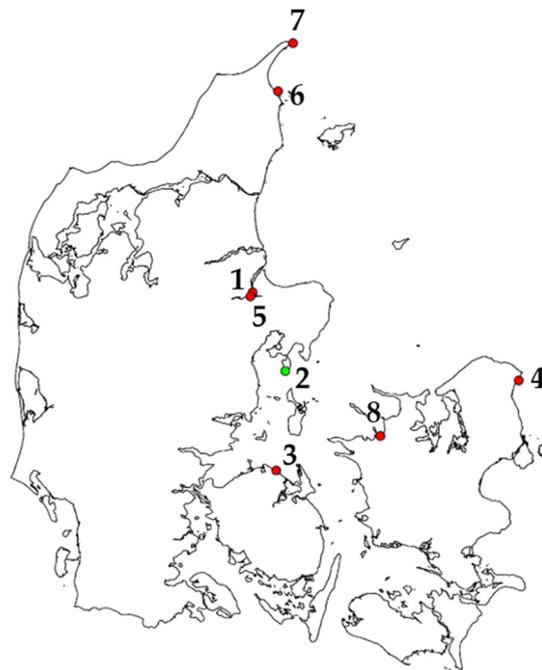


Figure 4. Map of observations of white-beaked dolphin with signs of breeding activity in the inner Danish waters. Numbers refer to the numbers and descriptions in Table 1.

Table 1. Overview of breeding activity of white-beaked dolphin in the inner Danish waters between 2009 and 2023. Female lactating (FL), live sightings of female with calf (FC), female with fetus (FF), calf with milk in the stomach (CM).

No	Time of Observation or Stranding	Location	Collection ID	Sighting	Source
1	17.11.2009	Randers fjord, Sødriøholm	C314	FL	Necropsy report, Fisheries and Maritime Museum, Esbjerg Denmark
2	25.08.2011	Syddjurs (Sletterhage)	-	Live FC	[8]
3	18.01.2014	Fuglsang Strand, Fyn	C349	FF (fetus, 1.91 kg, 60 cm) (Figure 5)	[33] [24] [5]
4	29.01.2014	Nordsjælland syd for Snekkersten Havn.	MCE1643	FL	[24]
5	20.01.2017	Randers Fjord	MCE1680	FL	[26]
6	16.01.2017	Strandby	MCE1680	CM (Calf length 182 cm)	[26]
7	28.11.2017	Skagen	MCE1690	FF (fetus of 455 g, 31 cm)	[26]
8	26.04.2023	Nekselø Bugt, nord for Havnsø	AAU3128	FF (fetus of 15.2 kg and 101 cm)	Necropsy at the University of Aalborg



Figure 5. The 1.91 kg and 60 cm fetus found in a pregnant white-beaked dolphin (no 3, C349) stranded on 18 January 2014 at Fuglsang Strand, Fyn, Denmark (inner Danish waters).

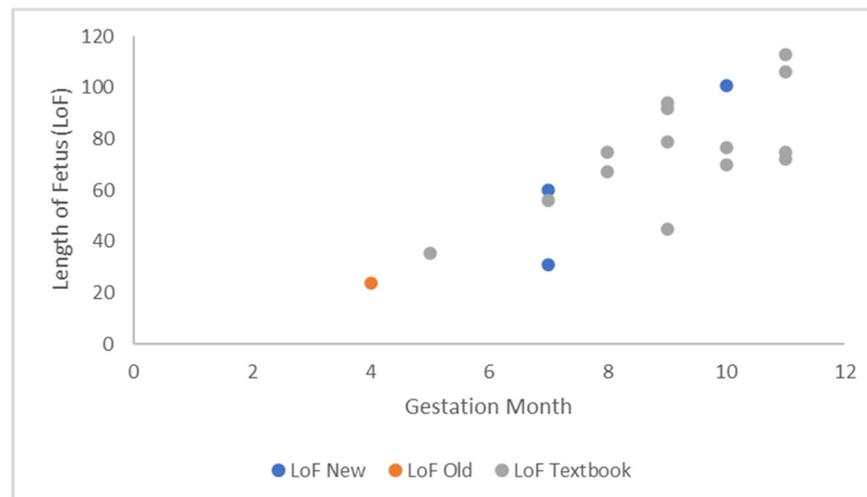


Figure 6. Gestation month by length of fetuses (parturition month set to July) for the three fetuses from this review (LoF new) in Table 1, an earlier Danish finding from 2002 (LoF Old), as well as findings from the entire North Atlantic after [34].

4. Discussion

The described eight incidents of breeding activity of white-beaked dolphins were observed in the inner Danish waters during the past two decades. The observations include live sightings of a mother with a calf, necropsy findings of a newborn calf, pregnant females with fetuses and milk-producing females.

The incidences of breeding white-beaked dolphins in the inner Danish waters support the conclusion that white-beaked dolphin should be considered a breeding species in Danish waters. Besides the breeding activity in the inner Danish waters described in this review, white-beaked dolphins with signs of breeding activity have also been recorded along the Danish west coast, e.g., a lactating female (ID C348) on 10 December 2013 at Stenbjergs Landingsplads [23,33] and an adult male with testicles containing sperm on 16 June 2016 at Lodbjerg Fyr [25]. However, these may be individuals driven out of their known breeding grounds in the greater North Sea. It should be noted that our study did not include the creation of a carcass drifting model or study, in part due to the limitations of the data available. A carcass drifting study may have been able to support the assumption

that the stranded individuals described in this study originated from Danish waters and not from other known breeding grounds.

Of the 26 white-beaked dolphins necropsied by the Danish National Surveillance of Diseases between 2014 and 2023, 12 were adult females, and of these, two (17%) were pregnant and two (17%) were lactating. In comparison, a review of the necropsy reports between 2014 and 2023 showed that, among 123 necropsied harbor porpoises, 56 were adult females, and of these, eight (14%) females showed signs of pregnancy either with a fetus or lactating [9–17]. Therefore, despite the low number of necropsied white-beaked dolphins, the proportion of pregnant females is on par with what has been observed with harbor porpoises.

Pregnant white-beaked dolphins were found in the months of November, January and April. While the two found during the winter had small fetuses (31–60 cm), the fetus from April was almost full term (101 cm). This is consistent with the expected time of birth being in the summer and with July as the parturition month (Figure 6) [34]. We are furthermore aware of a white-beaked dolphin (242 cm with a 26 cm long fetus) from Thy in October 2002, which was supposed to be the first known pregnant specimen stranded in Denmark, as well as a newborn (121 cm, male) white-beaked dolphin found on Tranum Strand in June 2003.

White-beaked dolphins are listed in Annex IV of the Habitats Directive. This means that they are subject to strict protection throughout their distributional range and that special areas of conservation should be appointed to protect, for example, breeding sites. The directive specifically stipulates that member states must prohibit “deliberate disturbance, e.g., during breeding, rearing, hibernation and migration” and “deterioration or destruction of breeding sites or resting places” (Habitats Directive, https://environment.ec.europa.eu/topics/nature-and-biodiversity/habitats-directive_en, accessed on 22 February 2024). It is hence only possible to live up to the Habitats Directive if sufficient knowledge is acquired for the relevant species. We have here documented that white-beaked dolphins do breed in the inner Danish waters, which means that special areas of conservation should be appointed, and that the species should be monitored there. The monitoring of toothed whales is possible by means of passive acoustic monitoring because they regularly emit sound for echolocation and communication. Passive acoustic monitoring is a very cost-effective monitoring tool. Harbor porpoises are already monitored by means of passive acoustic monitoring in six Danish Natura 2000 sites [35], which is used to monitor the relative abundance of the species. It would therefore be straight forward to supplement this monitoring with an extra species.

5. Conclusions

Our study provides evidence supporting the classification of white-beaked dolphins as a breeding species within Danish waters. Through a comprehensive review of sightings and necropsy reports spanning two decades, we have identified multiple instances of breeding activity among white-beaked dolphins in the inner Danish waters. These observations include live sightings of mother–calf pairs, as well as necropsy findings of newborn calves and pregnant or lactating females. Furthermore, our findings suggest that white-beaked dolphins with signs of breeding activity have also been documented along the Danish west coast. Overall, our findings underscore the importance of recognizing and conserving white-beaked dolphin breeding habitats within Danish waters. As a species listed in Annex IV of the EU Habitats Directive, white-beaked dolphins are entitled to strict protection measures, including the designation of special conservation areas. By documenting breeding activity in the inner Danish waters, our study highlights the need for ongoing monitoring, such as passive acoustic monitoring, and conservation efforts to ensure the long-term viability of this population.

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draft preparation A.K.O.A., C.C.K. and S.P.; writing—review and editing, N.M.K., T.H.J., C.B.T., H.L.L., K.A.S., L.A.K., T.E.H. and J.J.S. visualization, N.M.K. All authors have read and agreed to the published version of the manuscript.

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