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# Drift reconstruction of a fin whale cadaver in the Southern Bight (North Sea)

## Abstract

On August 20th, 2017, a fin whale carcass was found on the beach of the Dutch island of Texel. The whale had already been dead for four to six weeks while drifting in the North Sea. Cause of death was the collision with a ship. By means of the drift model of the German Federal Maritime and Hydrographic Agency (Bundesamt für Seeschifffahrt und Hydrographie - BSH), it became possible to retrace the carcass drift route in the Southern Bight. The model is, among other things, based on data of the North Sea currents. Its results were checked against sightings of the carcass. The findings are helpful in better understanding the floating behaviour of a whale carcass in the sea. The fin whale's skeleton and some of the research results will soon be displayed at Ecomare centre for Wadden- and North Sea on the island of Texel.

## Keywords

Whale, drift, North Sea, current, decomposition, fin whale, stranding, marine mammals

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## Introduction

The fin whale (*Balaenoptera physalus*) is part of the rorquals (*Balaenopteridae*) which, comprising nine species, constitutes the largest family of baleen whales (*Mysticeti*). Fin whales are the second largest whales after the blue whale, the largest animal in the world. There are two subspecies of the fin whale, one of which lives in the northern, the other in the southern hemisphere. The northern subspecies can reach a length of up to 22.5 meters and a weight of 40 to 50 tons (Soury 2006: 38). The dorsal side is of a dark grey colour, whereas the ventral side is brighter. What is characteristic about the colouring of the fin whale is that its head is dark grey on the left side and light grey or white on the right side, especially the lower lip. This also extends to the baleen plates while the buccal cavity and tongue are inversely coloured.

As all baleen whales, fin whales mostly feed on krill and other plankton. Additionally, fin whales in the northern hemisphere also feed on small fish, for example herrings and sardines. For that, they swim through fish swarms near the water

surface with their mouths open (lunge feeding). In summer they migrate to Arctic waters to feed; in winter, they move to tropical regions in order to reproduce and rear their calves. In the temperate latitudes of the northern hemisphere they can be observed the whole year round. They dive mostly 100 to 200 meters deep in intervals of around ten minutes (Soury 2006: 39f.). Although they do not dive as deep as, for example, sperm whales, they cannot usually be observed in shallow coastal seas like the North Sea, as they are more common in areas with a water depth of more than 500 meters (Reid et al 2003: 20f.). Nevertheless, there have repeatedly been reports of fin whale sightings in the North Sea and sometimes even in the Baltic Sea; strandings have been registered there as well (w.a. 2015).

On August 20th, 2017, a fin whale with 18 to 19 m in length stranded on the beach of the island of Texel. The whale was already in the process of rotting and showed a large indentation on its left side (see figure 1). In order to further knowledge of the behaviour of this species and its potential im-

pairment by human activities on the sea, it is crucial to understand the circumstances which have caused the death and subsequent stranding of this particular whale. Therefore, it is also necessary to retrace the drift route of its carcass. The results obtained might prove valuable with a view to marine mammal conservation.



*Fig. 1: Fin whale carcass on the beach of the island of Texel. The carcass lies on its right side and has partly sunk into the sand. The photo shows the dorsal side, cranial side is on the right, caudal on the left side of the photo. The indentation on the whale's left side is clearly visible (own photo 2017)*

### Course of events after the stranding

The fin whale carcass was found by a jogger on the beach of Texel in the early morning of August 20th, 2017. The carcass had been washed up the night before, probably with high tide at 5:00 UTC (Rijkswaterstaat 2017). Later that morning it turned out that, despite the advanced state of decomposition, the whale's skeleton was still complete. This led to the decision by Ecomare scientists, in consultation with Rijkswaterstaat and the mayor of Texel, to recover the fin whale carcass so that the skeleton would remain intact. Given that the carcass was situated at the flood line, the recovery depended on the tide and thus could only start with falling sea levels the following morning. This, however, entailed the risk of the skeleton being damaged in the surf during high tide throughout the night. During the afternoon and evening of August 20th, Ecomare staff informed beach visitors about the fin whale stranding. Due to a possible risk of

infection following the decomposition, the carcass was cordoned off. The dissection of the carcass began on the morning of August 21st. In the course of the dissection scientists from Wageningen University & Research (WUR) examined the content of the whale's intestines, the skeleton was secured and the other remains were discarded. Owing to the incoming tide, the dissection was suspended in the afternoon of August 21st and continued on the morning of August 22nd; it was successfully completed later that morning. The bones were then shipped to the mainland for preparation. During the entire dissection Ecomare staff informed curious onlookers about the procedure, which was necessary given that the stranding took place close to one of the island's touristic hot spots during high season.

### Knowledge gained through the dissection

It was established that the stranded fin whale was a female measuring 18.5 meters. Its estimated weight was 40 tons. The massive indentation on the left side of the cadaver led to the supposition that the whale had collided with a ship and succumbed to that injury. The discovery of coagulated blood in the surrounding tissue further corroborated this assumption (see figure 2), as it allows the conclusion to be drawn that the whale was alive when it collided with the ship. Furthermore, the



*Fig. 2: Coagulated blood in the area of the indentation, found during the dissection (Leopold 2017)*

whale's intestines were filled, which means that it had not been injured or ill for a long time before death occurred.

### Retracing the cadaver's drift route

According to initial information by Adrie Vonk, fishermen sighted a fin whale carcass at the Brown Ridge on August 9th. Further research has since shown that a fin whale carcass had already been observed on August 7th by a Dutch coast guard aircraft in position 52° 24' N 002° 57' E. Again, on

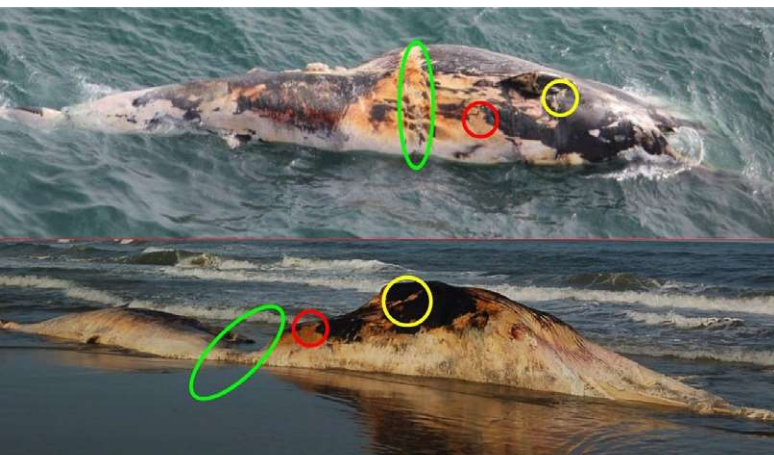


Fig. 3: Comparison between the carcass which was sighted on August 7th and the one which stranded on Texel. Characteristics which prove that it is the same animal are marked with different colours (Upper photo: Netherlands Coast Guard 2017; lower photo: own photo 2017)

August 15th, 16th and 18th a fin whale carcass was observed floating in the Southern Bight off the Netherlands. Image comparison between photos taken by the Dutch coast guard and other boatmen and photos of the stranded carcass on the beach of Texel has verified that all photos depict the same fin whale carcass (see figure 3).

All sightings were charted on a satellite map (see figure 4). The observation data was sent to the German Federal Maritime and Hydrographic Agency (BSH). The BSH works with a drift model that allows to evaluate where lost objects or an oil spill, drift in the North Sea, but also to reconstruct where stranded objects came from (BSH 2018). To recon-

struct the fin whale's drift route, it was necessary to correlate data from the carcass (length, weight, immersion depth while floating) with current and wind data. The carcass data stemmed from measurements taken on the beach as well as estimates based on photos of the floating carcass. The BSH then adapted the data so that the drift route between August 7th and 20th would match with the sightings. With the help of those adapted data sets it was subsequently possible to retrace the drift route of the carcass in the Southern Bight in the days preceding August 7th. However, the further the simulation looks back into the past, originating from the first sighting, the more imprecise its results become. In addition, currents in the Thames estuary are very complex (Maßmann 2018). Two possible routes, based on the drift model, are shown in figure 4. To illustrate that there are multitude of possible routes a drift area is marked as well (see figure 4).

### Conclusions from the drift route

The reconstruction using the BSH model allows to retrace the drift route between the sightings and the stranding. It also shows that the carcass originally approached from a south-western direction before floating at the amphidromic point in the Southern Bight for quite some time. About one or two weeks before the first sighting it was, referring to the model's data, probably floating in the area of the Thames estuary. From there, it drifted

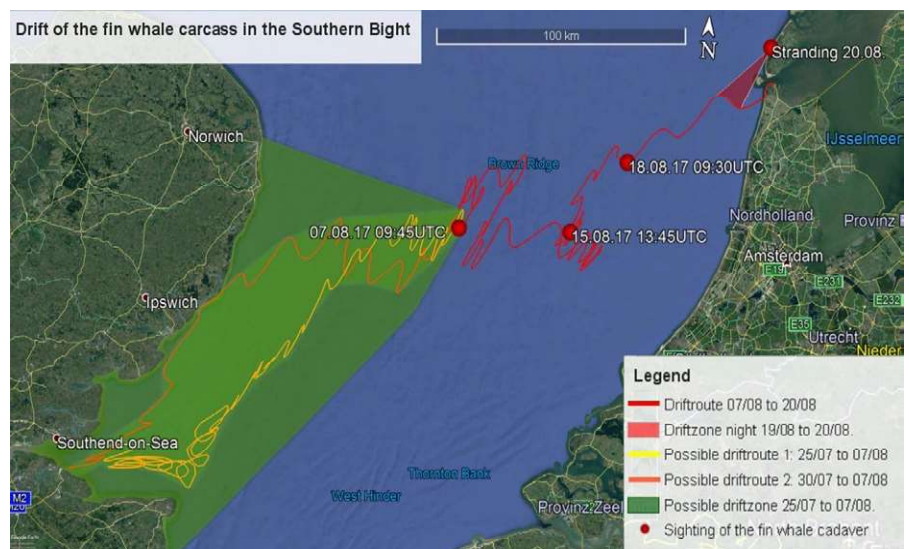


Fig. 4: Map of the sightings and the potential drift route of the fin whale carcass in the Southern Bight (own figure based on: sightings: Keijl 2018; drift data: Maßmann 2018; aerial view: Google Earth 2018)

along the British coast to the point of the first sighting (see figure 4). When found at the beach the fin whale had already been dead for several weeks; with a view to the lack of comparable cases, a more precise determination of the time of death is not possible (Leopold 2018). This means that the whale might have been hit by a ship somewhere in the possible drift area between July 25th and August 7th (see figure 4) or it might also have been hit somewhere else, then pushed into the North Sea while stuck on a ship's bow and finally released in the drift area. Although it is possible that the whale was hit in the North Sea, this is rather unlikely, because fin whales are not very common there - especially not in the Southern Bight (Reid et al 2003: 21). Furthermore, the photos taken by the Dutch coast guard show that the carcass was floating at the surface of the sea. This supports the theory that the carcass had been stuck on a ship's bow for some time, so that putrefaction gases could develop before it was released on the drift route. *Balaenoptera physalus*, like most cetaceans, have a higher density than seawater so that they will sink to the seabed following death unless putrefaction gases develop. The latter is possible when sea temperatures exceed 4 °C and when the carcass does not sink deeper than 50 m (pressure component) (Reisdorf et al 2012: 72). The most plausible course of events is that the carcass was released between July 25th and 30th in the area of the Thames estuary, for this is where ships sailing to London change their speed and course. In addition, there was constant wind from the south-west since the evening of July 26th, with up to 6 Bft on average (gusts 7-8 Bft) on the evening of July 29th (Worldweatheronline 2018). This caused a significant wave height of up to 290 cm in the Southern Bight, measured at Eurogeul / DWE (Rijkswaterstaat 2018). Such wind waves from southwest are likely to release a whale carcass from the bow of a ship which changes her course towards the Thames. There are some other known cases where fin whales were brought into harbours on ships' bows (w.a. 2015a). Studies have also shown that fin whales are hit by ships more often than other great whales (Laist et al. 2001: 39).

## Significance of the results

The results confirm the assumption that the whale was hit by a ship and brought by her into the Southern Bight. The possible floating time based on drift data also matches with the predicted floating time based on the state of decomposition of the carcass. Unfortunately, on the basis of the data obtained, the origin of the fin whale remains unclear. One can only speculate as to where exactly it was hit - possibly in the Bay of Biscay or the Norwegian Basin, where many fin whales live (Reid et al. 2003: 21), but it is also possible that the collision occurred in the North Sea. Ongoing research on the intestinal contents may help to determine the precise origin of the whale.

Nevertheless, the results are of high significance because there is not yet much data available regarding the behaviour of (floating) whale carcasses at sea. As a result of the observations at hand, data with a view to the floating and the decomposition process of a great whale has been gained. Although the accuracy of the drift model gradually decreases as time elapses, it has, in combination with the sightings, proven its worth when it comes to reconstructing the carcass drift of a great whale. It could possibly be applied to other strandings of dead whales to reveal more information about their drift and origin. Such an approach might even be feasible in other regions of the world, assuming that a drift model similar to the one used by the BSH is available for the respective sea areas. Overall, further research in the field of behaviour of whale carcasses is necessary, in particular to ensure a better protection of whales. This can be furthered by gaining ever more information about risks for whales, taking into account their respective causes of death as well as the places of origin of their carcasses.

## Outlook

Following its preparation, the whale's skeleton will be displayed at the Ecomare museum for Wadden- and North Sea on the island of Texel. Along with the skeleton, there will be an exhibition about the stranding and the research results. In order to exhibit the skeleton in its entirety, some modification measures of the museum's whale room are still necessary. Furthermore, it is conceivable

that the results can be used to investigate future strandings of whale carcasses as described above. It also seems possible that upon future sightings of whale carcasses at sea, their drift routes can be predicted one or two days in advance by means of a drift model. A probable stranding zone could thus be identified, which would allow local authorities to take adequate precautions.

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## References

- BSH (Ed.) (2018): Operationelle Modelle im BSH. Hamburg [https://www.bsh.de/DE/THEMEN/Modelle/modelle\\_node.html;jsessionid=5960C4EA6692F8115A5F347C52D23D86.live11293](https://www.bsh.de/DE/THEMEN/Modelle/modelle_node.html;jsessionid=5960C4EA6692F8115A5F347C52D23D86.live11293) [10.07.18].
- Google Earth (Ed.) (2018): Arial view of the Southern Bight (North Sea).
- Keijl, G. (2018): Information obtained through personal correspondence with Guido Keijl – Naturalis biodiversity center Leiden.
- Laist, D.W.; Knowlton, A.R.; Mead, J.G.; Collet, A.S.; Podesta, M. (2001): Collisions between ships and whales. In: Marine Mammal science. 17(1): 35-75. [https://www.greateratlantic.fisheries.noaa.gov/shipstrike/whatsnew/Laist%20et%20al\\_2001.pdf](https://www.greateratlantic.fisheries.noaa.gov/shipstrike/whatsnew/Laist%20et%20al_2001.pdf) [26.06.18].
- Leopold, M. (2017): Photos of coagulated blood found in the fin whales tissue. Texel.
- Leopold, M. (2018): Information obtained through personal correspondence with Dr. Mardik Leopold – Wageningen University and Research, Department Wageningen Marine Research, research focus on marine mammals and animal ecology
- Maßmann, S. (2018): Information obtained through personal correspondence with Dr. Silvia Maßmann – Department Operationelle Modelle at the Bundesamt für Seeschifffahrt und Hydrografie.
- Netherlands Coast Guard (2017): Photo of the drifting fin whale carcass, taken on August 7th, 2017. Den Helder.
- Reid, J.B.; Evans, P.G.H.; Northridge, S.P. (2003): Atlas of Cetacean distribution in north-west European waters. Peterborough. [http://jncc.defra.gov.uk/PDF/CetaceansAtlas\\_web.pdf](http://jncc.defra.gov.uk/PDF/CetaceansAtlas_web.pdf) [24.06.18].
- Reisdorf, A.G.; Bux, R.; Wyler, D.; Benecke, M.; Klug, C.; Maisch, M.W.; Fornaro, P.; Wetzel, A. (2012): Float explode or sink: postmortem fate of lung-breathing marine vertebrates. In: Palaeobiodiversity and Palaeoenvironments 92: 67-81. [https://www.researchgate.net/publication/235972915\\_Float\\_explode\\_or\\_sink\\_Postmortem\\_fate\\_of\\_lung-breathing\\_marine\\_vertrebrates](https://www.researchgate.net/publication/235972915_Float_explode_or_sink_Postmortem_fate_of_lung-breathing_marine_vertrebrates) [24.06.18].
- Rijkswaterstaat (Ed.) (2017): Getijden Texel Noordzee. Den Haag. [https://getij.rws.nl/getij\\_resultaat.cfm?page=home&from=20170820&from2=20-08-2017&location=TEXNZE&Timezone=GMT&refPlane=NAP](https://getij.rws.nl/getij_resultaat.cfm?page=home&from=20170820&from2=20-08-2017&location=TEXNZE&Timezone=GMT&refPlane=NAP) [04.04.18].
- Rijkswaterstaat (Ed.) (2018): Golfhoogte ter Eurogeul /DWE van 25.07.17 t/m 07.08.17. Den Haag. <https://waterinfo.rws.nl/#!/nav/bulkdownload/huidige-selectie/> [10.07.18].
- Soury, G. (2006): Baleins en liberte. Paris.
- Vonk, A. (2017): Information obtained through personal correspondence with Adrie Vonk – Dutch whale expert from Texel
- w.a. (2015): Meeressäuger in der Ostsee. Großer Finnwal schwimmt in der Flensburger Förde. In: Flensburger Tageblatt, 15/07/15. <https://www.shz.de/lokales/flensburger-tageblatt/grosser-finnwal-schwimmt-in-der-flensburger-foerde-id10227231.html> [24.06.18].
- w.a. (2015a): Schip brengt vinvis van 25 ton mee naar haven van Gent. In: Het Nieuwsblad, 09/11/2015 [https://www.nieuwsblad.be/cnt/dmf20151109\\_01961605](https://www.nieuwsblad.be/cnt/dmf20151109_01961605) [24.06.18].
- Worldweatheronline (Ed.) (2018): Weather data from Manston (UK) from 25/07/17 to 31/07/17. Manchester. <https://www.worldweatheronline.com/manston-weather-history/kent/gb.aspx> [10.07.18].