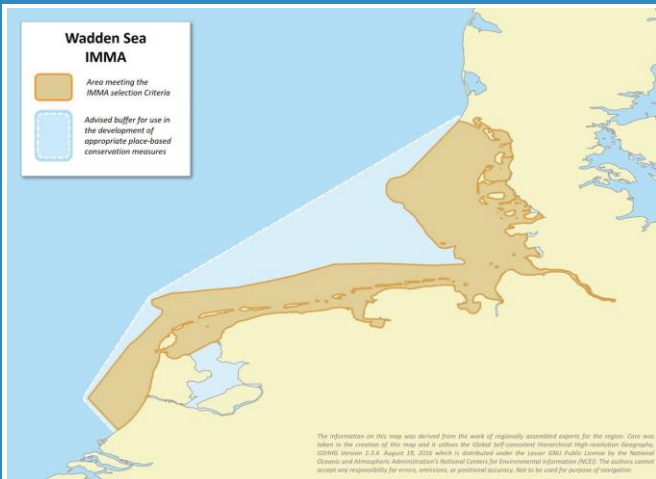


Wadden Sea IMMA

Description:

The Wadden Sea is a large tidal area, contiguous with the southeastern North Sea, stretching along the coasts of Denmark, Germany and the Netherlands. As the largest unbroken system of intertidal sand and mud flats in the world, it is characterised by ecological and morphodynamical vulnerability (Unger et al., 2022). It is an important flatfish nursery (van der Veer et al., 2022) and is considered as one of the most productive coastal areas worldwide (Lotze, 2007). Rising sea levels due to climate change will affect the area in the coming decades (Vermeersen et al., 2018), especially tidal sand banks used by the seals to haul out. The adjacent North Sea waters are included in the IMMA, as harbour seals forage more there than within the Wadden Sea (Tougaard et al., 2008; Aarts et al., 2019). They predominantly feed on flatfish, but also on sandeel, cod and whiting (Aarts et al., 2019), and analysis of the stable isotopes of harbour seals' vibrissae revealed a change in their diet from pelagic sources in spring to a benthic based diet in summer, and an increasing use of the North Sea resources in fall and winter (de la Vega et al., 2016). The waters of the Wadden Sea and the nearby North Sea are therefore important for the feeding of this large harbour seal population.

The Wadden Sea was designated as a UNESCO World Heritage region in 2009. The IMMA includes (totally or partially) 16 existing Natura 2000 sites: Borkum-Riffgrund, Hamburgisches Wattenmeer, Noordzeekustzone, Sydlige Nordsø, Schleswig-Holsteinisches Elbästuar und angrenzende Flächen, Steingrund, Unterems und Außenems, Unterweser, Vadehavet med Ribe Å, Tved Å og Varde Å vest for Varde, Waddenzee, Helgoland mit Helgoländer Felssockel, Hund und Paapsand, NTP S-H



Area Size

27 514 km²

Qualifying Species and Criteria

Harbour seal – *Phoca vitulina*

Criterion B (2); C (1,2)

Summary

The Wadden Sea is a very large intertidal area hosting one of the two largest harbour seal (*Phoca vitulina vitulina*) populations in the Northeast Atlantic. The area is a UNESCO World Heritage site, consisting of vast bare, intertidal sand and mud flats, and is highly productive. Harbour seals, heavily hunted until the second half of the 20th century and later stricken by the Phocine Distemper Virus, have shown exceptional recovery. The growth of the population has levelled off, and is now receding despite good pup production. The genetically distinct population of probably 30-40,000 harbour seals is a flagship species for the area. The sand and mudflats of the Wadden Sea are used for resting and breeding, while the Wadden Sea and the adjacent North Sea is used for foraging.



Figure 1: Harbour seals (*Phoca vitulina*) in the Wadden Sea IMMA. Photo credit: Abbo van Neer

Wattenmeer und angrenzende Küstengebiete, Nationalpark Niedersächsisches Wattenmeer, Sylter Außenriff and Unterelbe. In 1991, the Agreement on the Conservation of Seals in the Wadden Sea (WSSA) negotiated by Denmark, Germany and the Netherlands entered into force. The Agreement was concluded under the auspices of the UN Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention, CMS). The WSSA was the first daughter agreement concluded under CMS.

Criterion B: Distribution and Abundance

Sub-criterion B2: Aggregations

The latest count conducted in 2022 during the harbour seal (*Phoca vitulina*) moult in the Wadden Sea resulted in 23,654 seals counted (Galatius et al., 2022). This is one of the largest populations of harbour seals in the Northeast Atlantic, after Scotland (26,846 in 2016–2021, SCOS 2021). The harbour seals in the Wadden Sea are part of a metapopulation (Carroll et al., 2022). However, this count from 2022 constitutes a decrease of 12% relative to 2021 and is the lowest since 2011. The drop continued in 2023

when the counts dropped another 4%. The Wadden Sea harbour seals are identified as separate genetic units from the Skagerrak, the western Baltic and Central Limfjord populations (Olsen et al., 2014). Two Phocine Distemper Virus (PDV) epizootics led to high seal mortalities in 1988 and 2002 (Härkönen et al., 2006). The population later quickly recovered, and started to stabilise from 2012–2013, despite a continuous increase in pup production until 2022 (Galatius et al., 2023). It is unclear if this indicates the population is approaching carrying capacity. Also, in 2022 the number of pups born in the area dropped by over 20% compared to the year before, indicating that there could be a change in breeding or in recruitment of pups into the breeding population.

In the south, the population extends to the Dutch Delta area, where numbers counted grew from 14 in 1990 to a moult count of 1162 in 2021 (Hoekstein et al., 2023). However, these are mostly visitors from the Wadden Sea as too few pups are born to explain the growth and tracked females have been observed to swim back to the Wadden Sea to breed (Brasseur, 2017).

Criterion C: Key Life Cycle Activities

Sub-criterion C1: Reproductive Areas

The Wadden Sea is an important breeding area for harbour seals in the Northeast Atlantic (Unger et al., 2022). Most pups are born on the tidal flats of the Wadden Sea. In 2023, a total of 9,334 pups were counted (Galatius et al., 2023). While this number had increased over recent decades, the accounts showed a decrease of 22% in 2022 relative to the 2021 count of 10,903 pups (Galatius et al., 2022). Pup production is not often estimated in other harbour seal populations, so these figures cannot be compared to other colonies in the region; however, according to the total number of adult seals counted, this must be one of the main harbour seal breeding colonies in the North East Atlantic (ICES, 2022).



Figure 2: Harbour seal (*Phoca vitulina*) photographed in the IMMA.
Photo credit: Anders Galatius

Sub-criterion C2: Feeding Areas

Numerous telemetry studies have been conducted to assess harbour seals' movements and foraging areas from the haul-out sites in the Wadden Sea (Tougaard et al., 2008; Liebsch et al., 2010; Rojano Doñate, 2014; Wilson et al., 2015; Aarts et al., 2016; Vance et al., 2021; Nachtsheim et al., 2023). They show that like in other areas, harbour seals are benthic feeders, favouring areas over 30 m deep with low mud content. Their feeding grounds are usually in the North Sea (Liebsch et al., 2006; Tougaard et al., 2008; Nachtsheim et al., 2023) and they travel to offshore areas located tens of kilometres, sometimes more before returning to the same haul-out site. Although some offshore feeding hotspots are apparent from tracking data, the seals' foraging distribution includes most of the coastal zone (<50 km offshore), (Rojano Doñate, 2014; Vance et al., 2021; Aarts et al., 2016; Brasseur, 2017).



Figure 3: Harbour seal (*Phoca vitulina*) from the Wadden Sea equipped with a satellite transmitter.
Photo credit: Dominik A. Nachtsheim

Supporting Information

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