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HEALTHY SEAS THROUGH PORPOISE-LED SCIENCE



Messengers of the sea

The harbour porpoise is one of the smallest whale species and a key indicator of marine health in the North and Baltic Seas. Exposed to mounting anthropogenic pressures, populations today are declining in the Baltic Sea, while in the North Sea they are shifting southward. But what is this elusive little cetacean, and what can be done to safeguard its future?

Words and photography by Lana Tannir



“Harbour porpoises are said to live life in the fast lane. While they can live up to 20 years in the wild, most individuals do not survive beyond eight.”

The floor of the rescue facility glistens with water as Norah, a juvenile harbour porpoise, lies on the examination table. Guided by porpoise expert and station director at the time, Annemarie van den Berg, animal care workers Hester Simons and Mariëlle Staal attend to her with coordinated efficiency. Simons hydrates Norah's skin with a soaked sponge, while Staal disinfects her fluke and collects a blood sample. The team moves in a synchronized rhythm - efficient and swift.

“The major challenge in the rehabilitation of harbour porpoises is that they do not show when something is wrong. If they would do so in the open sea, they would become easy prey,” explains van den Berg, as she measures Norah's temperature and inspects her blowhole with a torch. For harbour porpoises, even subtle changes can signal a shift in health. “This is why we must examine them regularly and adjust their treatment accordingly,” she adds.

Norah was brought to the rescue facility in 2023 after a passerby found her stranded on the shoreline, severely weakened, dehydrated, and underweight. First responders from the Sea Animal Rescue Team transported her to the station in a specialised dolphin ambulance, where she was diagnosed with throat ulcers, a stomach inflammation, lungworms, as well as fungal and parasitic infections to the respiratory tract. Unable to swim independently, she required constant support and physical therapy to relieve muscle spasms.

Based in the Netherlands, the SOS Dolfijn Foundation is Europe's only rescue station specialised in the rehabilitation of harbour porpoises. The facility has two indoor pools and an outdoor enclosure. Strict hygiene protocols are followed to prevent the spread of disease and ensure patient safety. The experienced team consists of veterinarians, animal care staff, and volunteers who administer food and medications, monitor each animal's health status, conduct physical examinations, and support sick patients in the pool around the clock. Rehabilitated cetaceans are released back into their natural environment only when they have a fair chance of long-term survival. Each porpoise must be clinically healthy, free of medication, and able to swim normally. Since its foundation in 2004, SOS Dolfijn has achieved a rehabilitation rate of above 50%. This record is somewhat unprecedented in cetacean rehabilitation initiatives, making SOS Dolfijn something of a world leader.

In the Netherlands, between 500 and 600 harbour porpoises strand annually, the majority of which are already deceased. “Harbour porpoises are said to live life in the fast lane,” says van den Berg. “While they can live up to 20 years in the wild, most individuals do not survive beyond eight. Since they reach sexual maturity

between three and five years of age, this relatively short lifespan gives adult harbour porpoises only a limited window for reproduction, posing a threat to the long-term viability of populations.”

Under human care, the patients at SOS Dolfijn also provide valuable opportunities to deepen scientific knowledge of the species. In collaboration with research institutes in the Netherlands and Germany, both laboratory analysis and behavioural studies contribute important data for the conservation of these small cetaceans. “Due to their elusive nature, harbour porpoises are difficult to observe in the wild. Here, we actually carry them in our arms. It's easy for us to provide research opportunities as we're already taking samples to monitor the health of each animal,” explains van den Berg.

To date, relatively little is known about the harbour porpoise. Of the eight extant porpoise species, the harbour porpoise is the only one inhabiting the North Sea and the Baltic Sea. Adult animals can grow up to 170 centimetres in length and 50 to 70 kilograms in weight. These shy creatures will often live alone and if not, only in small groups. Female harbour porpoises give birth to a single calf at a time. With a gestation period of ten and a half months, they may reproduce in consecutive years, though some females may reproduce less frequently, depending on their physical condition and the environmental circumstances they find themselves.

Until the early 20th Century, harbour porpoises were hunted for their meat and blubber, which was consumed and used to produce lamp oil and other products. In 1994, the Agreement on the Conservation of Small Cetaceans of the Baltic, North East Atlantic, Irish and North Seas (ASCOBANS) was signed, establishing an international framework for the protection of small whales in the North Sea, Baltic Sea, and North Atlantic. Even so, today, harbour porpoises continue to face numerous threats. Populations in the Baltic Proper have dwindled to around 500 individuals, classifying this group as Critically Endangered. In the western Baltic, the population is estimated at approximately 14,000 individuals. To date, the North Sea population remains largely stable at roughly 340,000 porpoises.

To uncover the factors driving harbour porpoise strandings, the Stranding Research Program, conducted at the pathology division of Utrecht University's Faculty of Veterinary Medicine, examines deceased individuals. “Porpoises are apex predators and indicators of environmental health,” explains Dr Lonneke IJsseldijk, programme leader and assistant professor at Utrecht University. “Any changes in the food chain are likely reflected in their own diet. Necropsies, in particular, can reveal the reason why an individual has stranded, while

| OPPOSITE: Harbour porpoises at the Danish research station Fjord&Bælt help scientists better understand their wild counterparts.

| PREVIOUS PAGE: A group of harbour porpoises swim in Romsø Sund in Denmark. Porpoises are mainly solitary cetaceans or live in small groups. In 1994, the Agreement on the Conservation of Small Cetaceans (ASCOBANS) was signed, creating an international framework for the North Sea, Baltic Sea and North Atlantic.

excluding other factors.” Since 2013, IJsseldijk and her colleagues have performed over 2,000 necropsies on stranded harbour porpoises. “The causes of death are diverse, and no two cases are ever alike,” she observes.

Beyond determining the cause of death, each necropsy offers valuable information, which can be used to investigate further research questions. Samples collected during examinations are preserved in tissue banks and archives, where they remain available for long-term studies. Others are sent to partner institutes for specialised research projects, helping to build a broader picture of the pressures faced by harbour porpoises across European waters.

One such institution is Wageningen University, where the stomach contents of cetaceans are routinely analysed. By examining otoliths – small calcium carbonate ear structures from bony fish – scientists can determine the range of species most commonly consumed by harbour porpoises as well as estimate the size of their prey. This research provides critical insight into the porpoises’ diet while helping to monitor any changes in fish communities in the North Sea. “Healthy porpoises eat mainly small, fatty schooling fish such as herring, sprat and sand eels, while larger porpoises eat mainly whiting,” explains Dr Mardik Leopold from Wageningen University’s Marine Research division. “When porpoises are sick, they usually have only lean fish in their stomachs. Hence, the amount of fatty fish in their diet tells us both about the state the porpoise is in, and about the state of the sea itself. We use all of this data as a monitoring system for the health of the environment.”

Leopold’s research indicates that porpoises in the southern North Sea predominantly consume lean fish, rather than the fatty prey typical of animals in other parts of their range. Such a diet is problematic, as harbour porpoises must consume about 10% of their body weight per day due to their high metabolic rate. Beyond affecting their physical condition, inadequate nutrition can also reduce their reproductive success. One contributing factor to the decline in porpoise health is chemical pollution at sea. Warming sea temperatures and contamination have resulted in smaller, leaner fish that provide less energy and force porpoises to expend more energy to meet their nutritional needs. Moreover, as top predators, the cetaceans accumulate contaminants such as mercury in their tissues, which can impair nervous system function and disrupt fat metabolism. Despite being banned in the 1980s, polychlorinated biphenyls (PCBs) also still persist in the environment and have been linked to compromised immune function. “Even low levels of certain chemicals can have a major impact, and now we see new chemicals, such as PFAS accumulating in porpoises,” explains Leopold.

Each year, somewhere between 500 and 600 porpoises strand on the coast of the Netherlands.



“Changes in the food chain are reflected in their diet. Necropsies can reveal why an individual has stranded.”



“Even low levels of certain chemicals can have a major impact, and now we see new ones such as PFAS accumulating in porpoises.”



| MAIN IMAGE: Volunteers at SOS Dolfijn hold the fluke of a juvenile patient before taking a blood sample.
| FROM TOP TO BOTTOM: Juvenile harbour porpoise Norah is examined by animal care worker Hester Simons and volunteer Marcus Bierman. | Every hour, volunteers monitor the breathing rate of their patients. | Animal care worker Hester Simons holds a lungworm sample coughed up by juvenile harbour porpoise Norah at the rescue station SOS Dolfijn.

“Training sessions are based on stimulating the animals mentally and physically while preparing them to participate in research that can help us protect wild populations.”



The juvenile harbour porpoise, Norah swims in a pool at the rescue and rehabilitation facility SOS Dolfijn.



“When porpoises are sick, they usually have only lean fish in their stomachs. Their diet tells us both about the health of the porpoise and the health of the sea itself.”

The porpoises at Fjord&Bælt are regularly monitored to assess their physical condition.



| TOP LEFT: Harbour porpoise Freja prepares to perform an experiment measuring her echolocation clicks at the Danish research facility Fjord&Bælt.
 | TOP RIGHT: Using ultrasound, animal trainers Mathilde Kjølbj and Christina Andersen measure the blubber thickness of Freja.
 | BOTTOM: Freja participates in non-invasive behavioural research.

These sentinel species also have the issue of increasing levels of noise pollution to contend with. Such pollution produced by busier shipping lanes, offshore construction, seismic surveys, and wind farm development all interferes with a porpoise’s echolocation, impacting its ability to hunt and navigate its environment. Porpoises emit high-frequency clicks and use the returning echoes to locate prey, avoid obstacles, and master their surroundings. Studies combining aerial surveys and ship-tracking data indicate that while cetaceans avoid areas with heavy boat traffic, the impact of shipping noise extends far beyond the shipping lanes themselves, reducing their presence even in more distant regions. The construction and operation of offshore wind parks also produce intense underwater noise from pile-driving and machinery. Over time, the displacement of porpoises from noisy areas can limit access to feeding grounds, disrupt social interactions, and threaten survival in an increasingly industrialised marine environment.

To inform effective strategies for the protection of porpoises and their habitats, scientists at Fjord&Bælt – a research and education centre in Denmark – study the animals in collaboration with the University of Southern Denmark. Their goal is to gain a deeper understanding of the species in order to develop technologies that can help protect them and other cetaceans in the wild. Freja – a captive harbour porpoise who was by-caught in a fishing net and brought to the centre in 1997 – plays a central role in these studies. She now lives with two other porpoises, Saga and Eskild, who were also brought to the centre after by-catch in 2020. Today, Freja is 30 years old and is the oldest recorded harbour porpoise in the world.

“By learning more about the biology and behaviour of harbour porpoises, we can better protect them in the wild,” says Dr Kirstin Anderson Hansen, who until the end of 2024, was the head of training and research at Fjord&Bælt. Anderson Hansen has worked closely with Freja since she was a juvenile.

“The primary goal of the training is to make sure that the welfare of the animals is always intact. The training sessions are based on stimulating the animals mentally and physically, while also preparing them to participate in research that can help us protect wild populations. All exercises are paired with positive reinforcement and rewarded with fish,” adds Anderson Hansen.

It’s on a regular basis that Freja now participates in a long-term biomonitoring programme at the facility. Once a week, she slides herself onto a large scale so that her weight can be recorded, and her blubber thickness can be measured. To assess her metabolic rate, scientists encourage her to breathe into a floating dome, enabling them to measure her carbon dioxide to oxygen ratio, offering valuable information about her energy use and overall health. Another central research project investigates how Freja orientates herself underwater using

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echolocation. In this experiment, her eyes are gently covered with soft suction cups, and she is tasked with distinguishing between two objects – one made of plastic and the other of metal – relying solely on the echoes from her echolocation clicks. A Digital Acoustic Recording Tag (DTAG), also secured to her back with soft suction cups, records her movements, depth, heart rate, echolocation clicks, and communication signals. Insights from Freja’s behaviour and acoustic patterns allow researchers the chance to better understand how wild porpoises navigate, use sound throughout their dive cycle, and respond to noise in their environment.

The work with Freja also contributes to a greater effort aimed at reducing porpoise by-catch in fishing nets – a leading cause of mortality in not just this species, but many other marine mammals. The thin nylon fibres used in gillnets are particularly difficult for porpoises to detect with echolocation, and because these cetaceans are air breathing mammals, most entanglements prove fatal. To reduce by-catch and entanglement, scientists from the German Oceanographic Museum, the Thuenen Institute of Baltic Sea Fisheries, and Aarhus University in Denmark have been testing Porpoise Alerting Devices (PALs). Developed in 2016, these devices emit high-frequency sounds that mimic porpoise warning signals. When mounted in fishing nets, the signals are inaudible to humans but detectable by porpoises, prompting them to avoid the area. The effectiveness of PALs was initially tested on Freja, and since 2021, these devices have been trialled on wild harbour porpoises around the Danish island of Funen. The PALs are mounted in a non-harmful test net in the open sea, and the porpoises’ reactions are monitored using drones and underwater acoustic recordings. Initial results indicate that these devices can help reduce by-catch by up to 70%.

Today, harbour porpoise Norah is confronting the many challenges of life at sea. Released into the North Sea in September 2023, her story underscores the importance of favourable environmental conditions for the resilience of the species. Yet the future of the species rests now in the hands of scientists, conservationists, veterinarians, and volunteers who strive to protect these elusive cetaceans and restore the health of the seas they depend on. ●