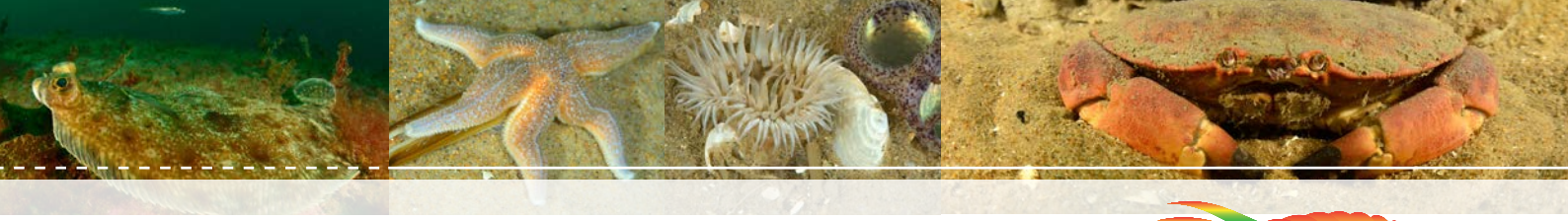
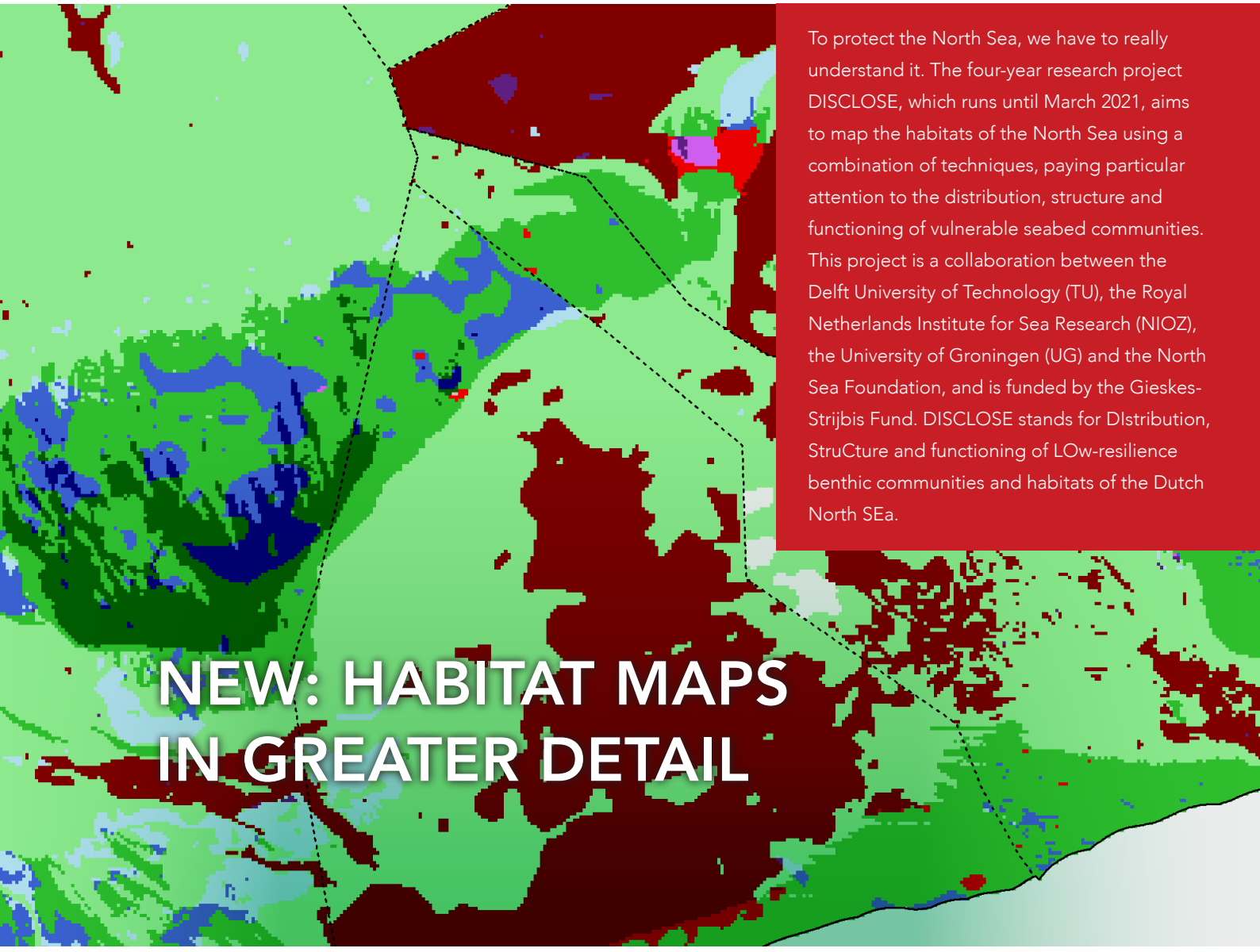


*Newsletter 7*

**January 2021**

# DISCLOSE



To protect the North Sea, we have to really understand it. The four-year research project DISCLOSE, which runs until March 2021, aims to map the habitats of the North Sea using a combination of techniques, paying particular attention to the distribution, structure and functioning of vulnerable seabed communities. This project is a collaboration between the Delft University of Technology (TU), the Royal Netherlands Institute for Sea Research (NIOZ), the University of Groningen (UG) and the North Sea Foundation, and is funded by the Gieskes-Strijbis Fund. DISCLOSE stands for DIstribution, StruCture and functioning of LOw-resilience benthic communities and habitats of the Dutch North SEa.

## NEW: HABITAT MAPS IN GREATER DETAIL

**In this newsletter:**

# Colouring habitat maps with biological data

**Habitat maps of the North Sea often leave room for improvements. They draft a coarse grouping into a few classes only. Karin van der Reijden from the University of Groningen thought of a new method to create habitat maps. She does not rely solely on environmental factors, which is standard practice. Instead, she takes biological data as a starting point. By combining it with environmental variables and machine learning, she produces better habitat maps with more detail.**

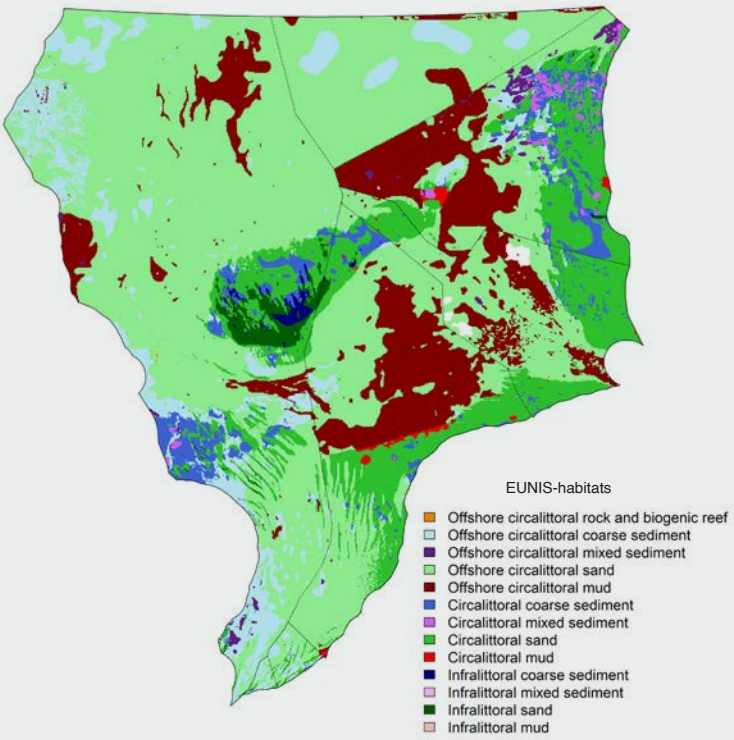
Current habitat maps of the North Sea often fall short. They present an insufficient image of the various seafloor habitats. Van der Reijden partly blames the methodology. "Habitat maps are often based on a limited set of environmental factors, dominantly sediment and depth. After the classification process, it is assumed that each category represents a unique community." Reality appears to be more complex. Van der Reijden takes the habitat map of the International Council for Exploration of the Sea (ICES) as an example. "Parts of the Dogger Bank and the coastal zone are classified as a similar habitat type in the ICES-map. But we know their communities differ. ICES acknowledges some problems with the habitat classifications".

*Karin van der Reijden:*

*'My habitat maps have more detail'*

## Three datasets

Van der Reijden chose a different route. She doesn't base her maps on abiotic data, but on biological data. Three existing North Sea datasets form the basis: fish living close to the seafloor, animals living within the seafloor (endobenthos), and animals living on top of the seafloor (epibenthos). "International monitoring of demersal fish is performed annually with a beam trawl for stock assessments of plaice and sole. Herein, all caught fish are identified and counted. I further use targeted surveys for epifauna and endobenthos, performed with a small-meshed beam trawl (epibenthos) and a box corer (endobenthos)."




***Management map***
*This habitat map of the North Sea is frequently used. It shows a coarse distinction in only a few classes, based on the EUNIS (European Nature Information System) classification. The map is solely based on the abiotic factors depth and sediment. Examples of EUNIS habitats are for instance 'Sublittoral coarse sediment', 'Sublittoral mud' and 'Sublittoral mixed sediments'.*

## Machine learning

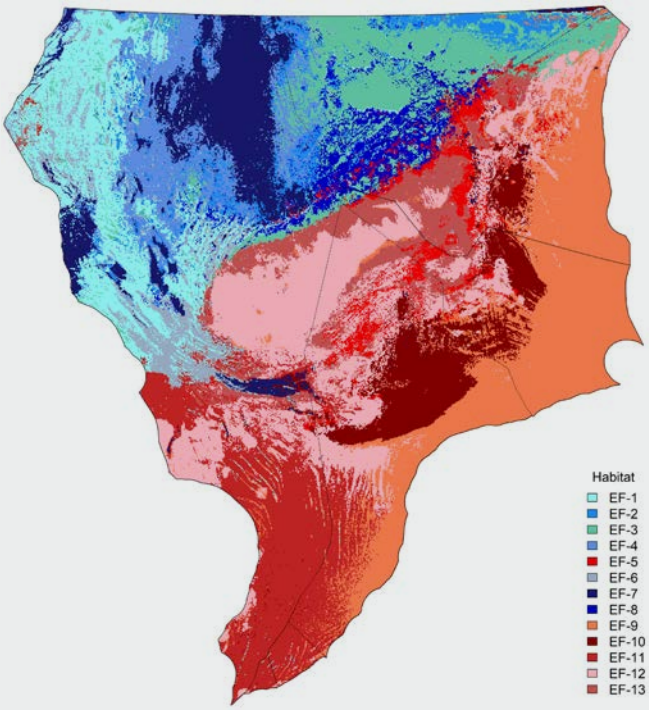
A hierarchical cluster analysis divides all sampling locations into distinct communities, based on the observed species. The three maps initially show the different communities at the sampling locations only. To fully colour the maps, Van der Reijden links the biological data to a set of 21 environmental factors such as depth, sediment and wind-driven bottom disturbance. “Machine learning allows for the model to determine the most important environmental variables for a community.” Three habitat maps are created this way, in which the demersal fish habitat map looks least detailed. “The map comprises of only six different habitats. That is because of the limited diversity and wide-spread distributions of demersal fish in the North Sea.”

## A more detailed image

The habitat map for epibenthos distinguishes no less than thirteen different habitats. The map gives a more detailed image than the management maps. “My maps have more detail. Using these maps, spatial analyses on fisheries distributions, offshore windfarms and Natura 2000 sites can be improved. Because these maps are based on species abundances, it is easy to link species characteristics to each habitat. Species composition can for instance indicate the vulnerability of a habitat to disturbances.”

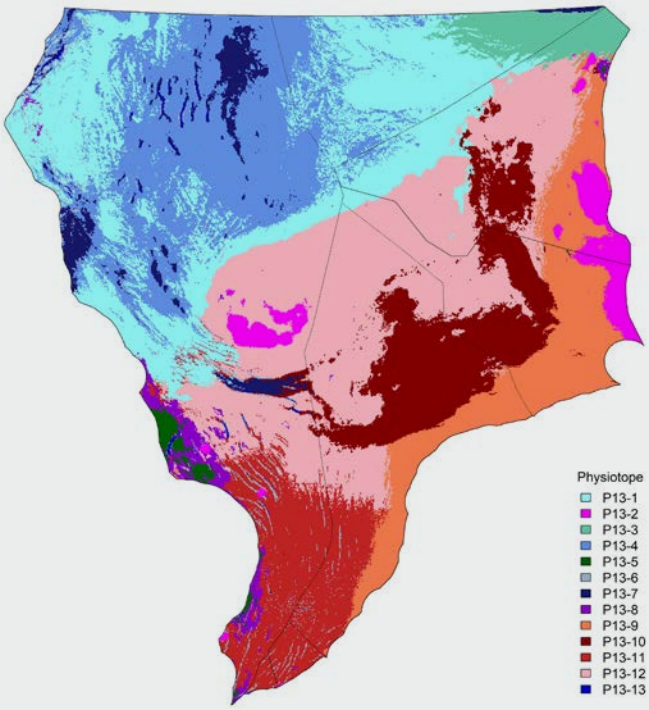
## Up-to-date biological data

Which of her three habitat maps is best? “That depends on the application”, she states. The communities cannot easily be merged according to her. “If you would like to determine the impact of demersal fisheries, the epibenthos living on top of the seafloor are the obvious community to consider. After all, that group is most susceptible.” Her method also has some drawbacks. More detail is not always necessary or even desired to make decisions. “My approach requires much recent biological data and abiotic data at high resolutions. Many datasets are, however, out-dated and have coarse scales.”




***Habitat map epibenthos***

*This habitat map is based on organisms living on top of the seafloor (epibenthos) and multiple environmental variables. The map gives a more detailed image of the benthic habitats in the North Sea than the management map. Its resolution is higher and more classes are defined. The map could, amongst others, be used to determine habitat-specific fishing impact.*




***Habitatkaart fysiotopen***

*In comparison to the epibenthos habitat map, Van der Reijden also shows a physiotope map with a similar number of classes (thirteen). This map is solely based on environmental factors, the same as used in the habitat maps. There are multiple differences with the epibenthos map. This map shows that her method, based on biotic datasets, results in a better image of the seabed life with more detail. When taking the physiotope map as a base, habitats like EF-5 and EF-13 would be missed.*

# Advise: Include a no fishing zone in the southern North Sea

The North Sea Agreement designates an ecological network of protected areas. Sebastiaan Mestdagh, DISCLOSE researcher, compares the map with currently protected areas to existing datasets of seafloor organisms. His main conclusion: the southern North Sea lacks an area that is permanently closed to demersal fisheries.

It is getting busier in the North Sea. Offshore wind farms, shipping lines, Natura 2000 sites, military training areas, fisheries: the recently approved North Sea Agreement between government and various organisations divides the restricted space left. One of the agreements: in 2023 is 13.7% of the North Sea completely free of demersal fishing activity. This percentage will rise to 15% in 2030. "At this moment bottom trawling fisheries are allowed to fish almost everywhere, including the Natura 2000 sites", Mestdagh says.

### Focus on the northern part

Are the 8.032 km² no fishing located at the right locations? Mestdagh investigates this question using biological data of seabed organisms. He bases his analysis on the dataset from the 'Monitoring Waterstaatkundige Toestand des Lands (MWTL)'. Mestdagh elaborates on the findings of Peter Herman from Delft University of Technology. Out of the 103 sampling locations in the North Sea, Herman determined which eleven hotspots together contained the highest biodiversity. Many of those hotspots are located within the designated no fishing zones. "Previous studies show that the northern North Sea inhabits most species. The protected areas with fisheries restricting measures are therefore dominantly located in the northern part, like the Central Oyster Grounds, the Frisian Front and the Dogger Bank."

### Southern sand wave areas

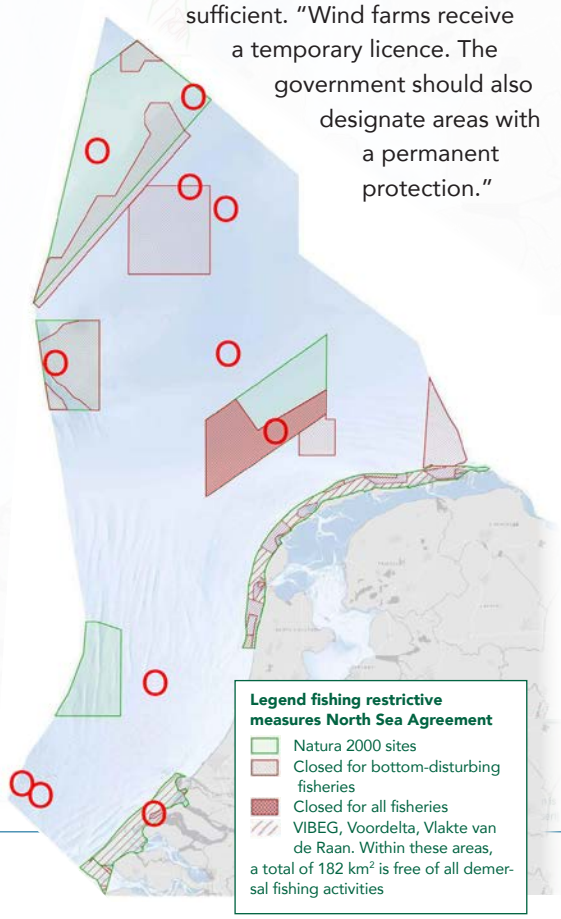
Mestdagh understands the northern focus in the North Sea Agreement, but would like to add an area in the southern North Sea. According to him, the southern part is less species rich than the north. But the southern-species are not or only scarcely found elsewhere. "If we want to protect the species richness of the entire Dutch North Sea, we should also designate a protected area in the dynamic habitat of sand waves and sand banks." The Brown Bank would be a good choice, he advises, also because of the Sabellaria reef presence. "The Brown Bank will become a Natura 2000 site, and will be protected under the Birds Directive. But demersal fisheries are still allowed. Under the North Sea Agreement, this will remain the case."

*Sebastiaan Mestdagh:*

*'Some species in the southern part hardly occur elsewhere'*

### Offshore wind farms

Naturally dynamic areas, like the southern North Sea, benefit from fisheries restricting measures as well. "In Belgium, for instance, we observe that the closure of sand wave areas for demersal fisheries can have positive effects on the benthic communities." Mestdagh already expects an effect in the designated wind farms, as bottom trawling is not allowed within the parks. However, wind farms are not sufficient. "Wind farms receive a temporary licence. The government should also designate areas with a permanent protection."




*Eleven of the 103 sampling locations that together contained the highest biodiversity.*

# Waddenmozaïek replicates DISCLOSE-methods in the Wadden Sea

The research project Waddenmozaïek applies the DISCLOSE methodology. Similar to the North Sea, the combination of multiple techniques should result in an improved habitat map of the Wadden Sea. But the question remains whether they will succeed. Turbidity seems to form a bottleneck.

*Box corer sample with the seabed surface on top, and sand underneath*

Underwater life of the Wadden Sea appears a largely unexplored research area. "The intertidal wad is well studied, but we know little from the ecology in the deeper areas that are permanently covered with water. That sums up to half of the Wadden Sea, especially in the western part" says Oscar Franken, scientific coordinator of Waddenmozaïek, a collaboration of the University of Groningen, the NIOZ and Natuurmonumenten. The research project is a sequel of Waddensleutels, in which the intertidal mud flats have been mapped by the same partners.

*Oscar Franken:*

*'Similar to DISCLOSE, we want to combine multiple techniques'*

**1.394 samples**

The approach is twofold: on the one hand they perform recovery-experiments to restore seagrass, shellfish beds and hard substrates. On the other hand they map nature in the deeper parts. Regarding the latter, the researchers contacted DISCLOSE. "Similar to DISCLOSE, we want to combine multiple techniques to improve the resolution and accuracy of our habitat maps." The first samples have been gathered. The Navicula, the NIOZ research vessel, collected no less than 1.394 bottom samples in the deeper parts last year, one at every kilometre. Meanwhile, all organisms are counted, weighted and identified. "We have just started our analyses", says Franken. In addition to the species, the researchers scanned the surface of each sample with a small 3D-scanner. "That way we know what the seafloor is comprised of. Whether there is just sand or a shell fish bank."

**Bad visibility in turbid waters**

Despite the many samples Franken has, they are not sufficient to accurate create a habitat map. "They remain single point samples. The Wadden Sea has large variations at a small scale. If a sample contains bioengineering species, such as mussels or sand mason worms, then we would like to know the size of that 'patch'." To colour the white space in between sampling locations, Franken wants to apply the DISCLOSE-approach. Meaning a combination of sediment samples, video footage and acoustic techniques. However, a first test last year had disappointing results. "The Wadden Sea is a highly dynamic system with lots of suspended sediment particles. Acoustic signals were reflected from these suspended particles. Filming with an underwater drone also proved difficult due to the turbidity. Despite large underwater lights, visibility was poor." Filming is a precise undertaking, Franken states. The seafloor only shows under calm conditions with quiet waters and little wind.

**Learn from each other**

Next year, the Navicula sets sail for a second sampling survey. Franken hopes to apply acoustic techniques then. Before the survey he would like to talk extensively with DISCLOSE-researchers. "I have close contact with the DISCLOSE-researchers from the University of Groningen. We are in the same research group. But we can learn from the acoustic researchers at TU Delft as well."

# NORTHERN NORTH SEA TROUGH DISCLOSE EYES

DISCLOSE set sail for the last time in October last year, to investigate the still missing part of the North Sea with the DISCLOSE-approach. DISCLOSE combines measuring methods. The threefold of measurements – video footage, acoustic measurements and box cores – together form a completer and more detailed image of the seafloor. Leo Koop from the Delft University of Technology processes the acoustic dataset. That requires more than a simple press of the button.

*Research vessel Pelagia*

Koop now has a clear acoustic map of the Cleaver Bank. He has also acoustically sampled the southern sandy area, especially the Brown Bank area. What was lacking was the northern part of the North Sea in particular. "Within DISCLOSE, we wanted to map the Dutch North Sea. No acoustic data was yet available for the Central Oyster Grounds and the Dogger Bank." That is why his colleague Timo Gaida – Koop and his wife were expecting a baby – joined the NIOZ research vessel Pelagia in October 2019.

*Leo Koop:*

*'I first had to calibrate the measurements'*

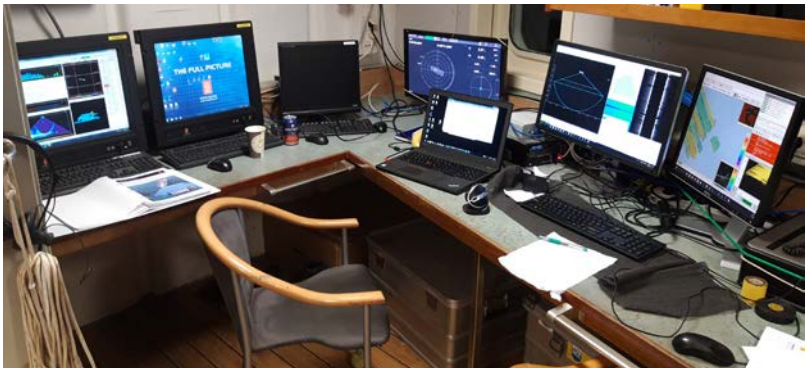
Op vijf locaties tussen de Doggersbank en Terschelling verrichtte Gaida metingen met het multispectrale multibeam echolood. Aan boord was ook Karin van der Reijden van DISCLOSE, die op dezelfde plekken de bodem met Bruce, haar video-installatie, filmde.

### Backscatter data

It is up to Koop to process the acoustic data. For this, and for finalising his thesis, he received an extension of his contract. He mainly uses the reflected signal – the backscatter – with which he can determine the sediment type at the seabed. A first glance at the data, already on-board the vessel, yields an image relatively quickly. "Within half an hour you know whether the location is interesting enough to investigate more thoroughly." The final checking and processing of the dataset appears a time-consuming job. "That takes me over a month. Easiest scenario for calibration is when a hull-mounted multibeam is used. Measurements can then easily be compared. That was not the case for our multi-spectral multibeam. Therefore, I first had to calibrate and clean the measurements."

### Software development

Koop notices that many software programs improve fast. "Within the five years I work with multibeam echo sounders, software development took off. Back in the days, I was not able to exchange data between two programs. Now I can." However, data processing is far from just a press on a button. "I still have to check all data and remove errors. In the fastest scenario, for instance when you have experience with data processing of that specific device, processing will still take you a week." Each measurement covers an area of roughly one by three kilometres. Koop expects relatively homogenous maps. "Only at the Cleaver Bank one encounters multiple sediment types within a small area in the Dutch North Sea."



*Data-analysis on-board the research vessel*

# Wind at Sea: Possibilities for benthic organisms

DISCLOSE seeks collaboration. In this section, external people with overlapping interests get to have their say. How do they view the research? What are the opportunities and the pitfalls? In this episode: Maarten de Jong, marine biologist at the Directorate-General for Public Works and Water Management, department Sea and Delta.

*Maarten de Jong*

De Jong is involved in Wozep, wich stands for 'Wind at sea ecological program'. Aim: to investigate the effects of wind parks on the ecosystem. "Wozep focusses dominantly on birds, bats, and porpoises. I study the effects on benthic organisms and demersal fish." A wind park could turn out positive for these organisms, the hypothesis goes. "Wind parks exclude all seabed-disturbing fishing activity, which potentially enables benthic communities to develop." In 2017, the first survey of Wozep was performed in the Prinses Amalia wind park, close to the coast of Ijmuiden, ten years after its construction. "We monitored organisms at the sandy seafloor using a bottom dredge and used a box corer for sediment characteristics. The next survey will take place in 2022. I am curious what DISCLOSE can do for Wozep."

## More accurate image

Wozep wants to monitor the hard substrates in addition to the sandy seafloor. Wind turbines are located within a stone layer of granite, deposited to stabilize the seabed. "The added substrate could enrich the ecosystem. It harbours amongst others mussels, sponges, star fish and anemones." The challenge is that scuba-diving is no longer permitted near the wind parks, De Jong states. Cables and other restrictions also complicate the monitoring in wind parks. Wozep therefore explores new monitoring techniques, like the multibeam in DISCLOSE. "Using a multibeam, we can hopefully study the seafloor in wind parks at a high resolution. At the end of 2016 a first test was performed in the Prinses Amalia park, but there was little to be seen on that scan." He hopes that the developments within DISCLOSE regarding the acoustic techniques and backscatter-analysis can yield a more accurate image. "Wind parks may provide opportunities to reef-building species, such as the Ross worm *(Sabellaria spinulosa)* and Sand mason worm *(Lanice conchilega).* Due to the discovery at the Brown Bank area, DISCLOSE potentially knows how to locate Ross worm reefs using a multibeam." Apart from DISCLOSE, he envisions numerous other promising techniques, such as a Remotely Operated Vehicle (ROV) with automated species recognition to quickly identify seabed life.

## Exciting times

Monitoring of underwater life receives increasing attention, De Jong states. Exciting times, he calls it. "Many developments come together now; the growth of wind parks – now 133 km$^2$ (1 GW), in 2023 954 km$^2$ (4.5 GW), and in 2030 over 1.600 km$^2$ (11 GW) –, the nature inclusive construction of wind parks – for example the introduction of Flat oysters around foundations and nature developments at the sandy seabed – and the North Sea Agreement, causing for available budget for research and monitoring. Experts and stakeholders decide this fall on the most urgent research questions." He hopes for a DISCLOSE 2.0 and already reaches out to them. "I see plenty of opportunities to collaborate in the North Sea."

*Prinses Amalia windpark (PAWP)*

# DISCLOSE webinar provides input in monitoring program

DISCLOSE disseminates her results. Friday November 13th, an online webinar was organized, partly due to corona. Over thirty experts involved in the research and monitoring agenda from the North Sea Agreement participated. "We shared our DISCLOSE-results with experts and policy-makers during this webinar", Serena Rivero tells, a marine ecologist at the North Sea Foundation.


This fall, the framework of future monitoring of the North Sea is established. The North Sea Agreement, established by the government last summer, emphasizes the need for adequate monitoring. The agreement states that 'policy development is complicated by a structural lack of knowledge'. A total of 55 million euros is reserved within the agreement for research and monitoring. The assignment for this fall: draft an integral monitoring and research program. "Under the working name MONS, which stands for 'Monitoring Research Nature Enhancement and Species Conservation', a perennial monitoring program is drafted. Three expert groups elaborate on research questions regarding capacity, pressures, and species conservation at the moment. The results of those three groups will be merged in a definite program", Rivero explains.

*Serena Rivero:*

*'We updated the experts with the state-of-the-art techniques of DISCLOSE'*

## Three presentations

Rivero invited the experts of the three expert groups for the webinar. Over thirty experts joined from amongst others the Directorate-General for Public Works and Water Management, knowledge institutes and nature organisations. "We updated the experts with the state-of-art techniques that have been developed within DISCLOSE. That way, they can integrate our results and ideas in the future monitoring program", she says. Three presentations were given. Leo Koop from DISCLOSE presented on about acoustic monitoring, while Karin elaborated on the monitoring, protection and ecology of Sabellaria-reefs. Rivero: "One of the three expert groups focuses on species conservation and nature restoration. Hard biogenic reefs, like Sabellaria, lend themselves perfectly for research in favour of species conservation strategies."

## Effect sand nourishments

Also experts of 'Naturally safe', a national study into the ecological effects of coastal nourishments, joined the webinar. For six years, the Directorate-General for Public Works and Water Management and nature organisations jointly investigated the ecological effects of sand nourishments along the coast. "Those effects are still not known. Sand nourishments will increasingly be needed in the future, due to sea level rise. That makes it even more important to get a clear picture of the ecological effects. Researchers involved in the project are therefore looking for new and better monitoring techniques. That explains their interest in DISCLOSE."

**Colophon**
Text: Addo van der Eijk
Translation: Karin van der Reijden
Lay-out: Greetje Bijleveld; Design: Sense Visuele Communicatie
Photography: NIOZ (p. 1 big photo, p. 3 en 4), OCEANA/Carlos Minguell (photo's in the banner), Maarten de Jong (p. 1 small photo, pictures p. 7), Jip Vrooman (p. 2), Waddenmozaïek (p. 5), Leo Koop (p. 6 top), Timo Gaida (p. 6 bottom).

**More information over the project**
www.discloseproject.nl and from the project leader Mirjam Snellen of the TU Delft, e-mail: m.snellen@tudelft.nl.

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