Newsletter 6

May 2020

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 dispersal, structure and functioning of vulnerable seabed communities. This project is a collaboration between Delft University of Technology (TU), the Royal Netherlands Institute for Sea Research (NIOZ), the University of Groningen 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.

BENTHIC NATURE OF THE NORTH SEA MAPPED IN DETAIL

In this newsletter:

Improved recipe for monitoring the North Sea

Good news. The primary objective of DISCLOSE – namely, to combine different techniques to map marine life on the seabed – has now been realized. In 2017, a DISCLOSE expedition took place at the Brown Bank with three different measuring technologies onboard. Sebastiaan Mestdagh, a researcher with the Royal Netherlands Institute for Sea Research (NIOZ) was able to bring together the previous results and latest data interpretation, for the final piece of the puzzle; a benthic trait analysis.

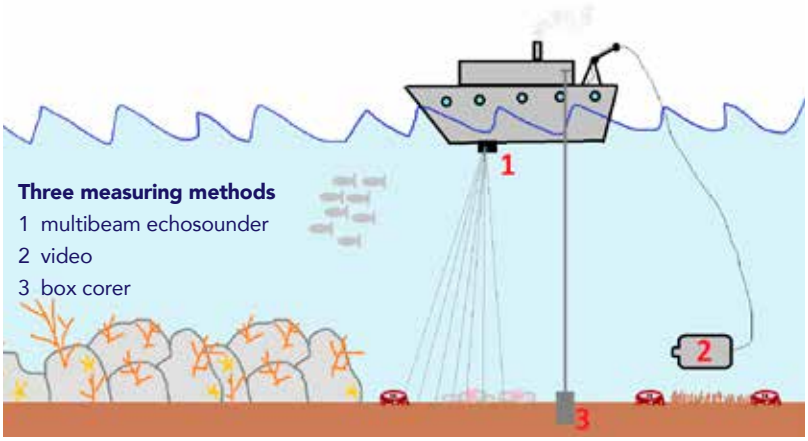
DISCLOSE was initiated to develop a new measuring method, a more refined method to map seabed habitats. The current monitoring of the Dutch North Sea falls short of the target. It sketches a fragmented image. "Now, benthic samples are taken here and there in the North Sea. We don't know what lies between the samples," said Han Olff from the University of Groningen last autumn during the DISCLOSE symposium. He compared this method of monitoring with plucking grass tussocks near the roadside during a nighttime drive through the Netherlands. "With this, you wouldn't be able to put together a vegetation map of the Netherlands. But the North Sea is actually monitored like this."

Sebastiaan Mestdagh (NIOZ):

'The three mesuring methods complete each other nicely.'

Combination of measuring techniques

A comprehensive monitoring scheme requires an adequate spatial interpolation between samples. Therefore, DISCLOSE combines three research fields: those of acoustic remote sensing, landscape ecology and the functioning of different species. After multiple expeditions,



DISCLOSE researchers sailed to the Brown Bank in 2017 for the ultimate test. Mestdagh: "During the expedition, researchers mapped the Brown Bank using three measuring methods, each at different scales. TU Delft scanned the seabed at the large scale using the multibeam echosounder, the University of Groningen recorded video images of the seabed and NIOZ collected sediment samples at the small scale using the box corer."

Complementary

Mestdagh subsequently integrated the results from the three datasets. This delivered a comprehensive image of marine communities on the seafloor. "The three methods are very complementary. With the acoustic data, we can distinguish the structure of the sediment. We can detect among other things the tops and valleys of sand ridges and waves. Thanks to these benthic samples and video images, we know which sea creatures live there and what the seabed looks like. By combining the data, we can make predictions about the presence of marine seabed communities on the basis of acoustic parameters." Mestdagh published a scientific article on his analysis together with the other DISCLOSE researchers in Estuarine, Coastal and Shelf Science. More research is needed, he states. The DISCLOSE method has yielded results for the Brown Bank, but it would be interesting to see how it works out in other ecosystems, such as the Frisian Front."

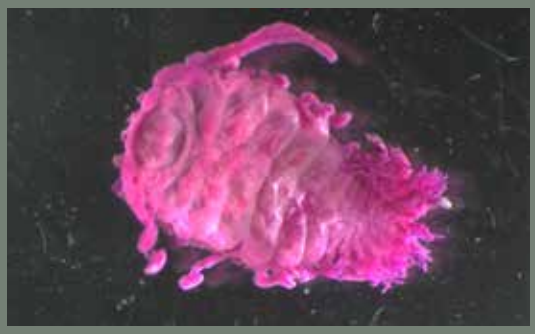
Unravelling sediment samples

In May 2019, the DISCLOSE expedition took 45 sediment samples at the Brown Bank. In the laboratory of the Royal Netherlands Institute for Sea Research (NIOZ) on Texel, all the benthic organisms were identified. With a total of 109 species, this was good for 320 hours of manual lab work. Loran Kleine Schaars, taxonomist in charge of identification, describes.

"I am Loran Kleine Schaars and I work at the NIOZ laboratory. After the DISCLOSE expedition in May, we were able to process the sediment samples. We couldn't wait to get started. We analyze five thousand samples from the Wadden Sea each year, with lots of benthic organisms, but only a few species. The Brown Bank is much more species-rich. Very exciting."

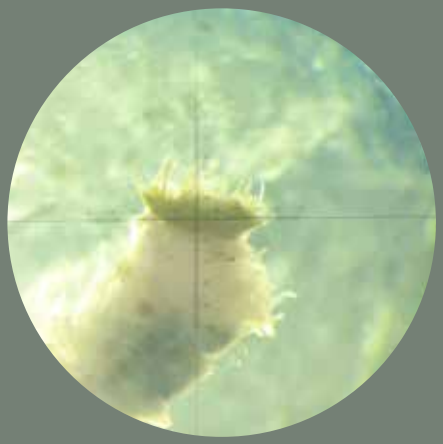
"The 45 samples taken with the box corer from the Brown Bank were brought in sample jars. In the photo you can see the hard tubes of honey-comb worms. Once aboard, they were rinsed clean and immediately put in formalin. If the animals were kept alive, then a crab or a big worm could brunch on the smaller organisms in a couple of hours."

"Immediately after receiving the samples, we add rose bengal. This stain colours proteins. In this way, we can make it easy to see everything that was alive. The stain needs a couple of days to set in. Students help to sort all the individuals. For them, it's interesting to see fauna from a habitat other than the Wadden Sea."



"In total we found 109 different species, including very rare ones, and some that have never been reported before in the Dutch North Sea. The variation per sample is large. The lowest number of individuals in a sample was 14, the highest was 1368, of which half were juvenile starfish of one to two millimeters in length. I find *Ione thoracica* very beautiful, a sort of parasitic woodlouse that lives in the operculum of mudshrimp. The pink colour is due to the rose Bengal that was added."

"We identify each individual under the microscope. In this photo, my colleague Bianka Rasche, an experienced taxonomist, is determining species. Together, we identified all the 4807 sea creatures. It took us two hundred hours of poring over the samples."



"Here, everything revolves around the rare ross worm. At sea, the researchers thought that all the tubes were empty, but we still found four ross worms. When we find them, we're very happy. A golden discovery."

"Our new automatic robot accurately weighs the benthic fauna to a tenth of a milligram. In this way, we know the total biomass from the different benthic samples. These measurements indicate if the biomass found in the area of ross worm reefs differ from other sites in the Brown Bank."

SAND RIPPLES IN FOCUS

Leo Koop scans the seafloor with acoustic signals. During the DISCLOSE expedition in May 2019, he mapped the Brown Bank. Once home, the acoustic data proved to be brain-racking. He saw patterns that appeared to be time dependent. The search led to the detection of even smaller landscape elements: sand ripples.

The Brown Bank has a seafloor of sand waves. There are mega ripples of fifteen meters on top of sand saves of three hundred meters on top of sandbanks of twelve kilometers. Koop was already able to recognize these with his multibeam echosounder from earlier DISCLOSE expeditions. This time, he came across a surprising signal during the analysis that could not easily be traced back to a cause. Are these measurements right, he thought doubtfully. "Measurements of the backscatter (the reflected signal) as a function of the angle varied with the navigational direction of the research vessel. At one moment, the curve showed a small peak to the left, at another moment a peak to the right."

Leo Koop (TU Delft):

'The video images of the sea bottom indeed showed small sand ripples, such as often found on beaches.'

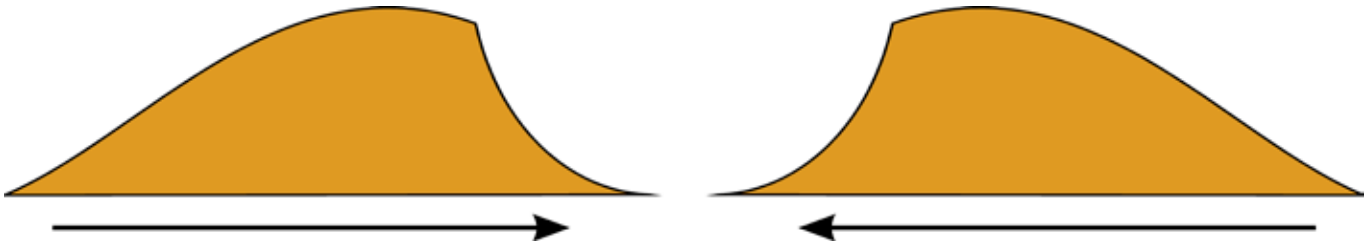
Changing sand ridges

Koop had the advantage that two multibeams had made measurements at the same time: the 'normal' multibeam under the research vessel and the ultramodern multispectral multibeam echosounder. "The backscatter curves of both systems showed the same pattern," says Koop. He sought countless explanations. Finally, he found support in recent literature. The peaks in the curves could indicate the existence of ripples on the sediment. The integrated approach of DISCLOSE using multiple methods yielded critically needed results. "The video images of the sea bottom indeed showed small sand ripples, such as often found on beaches. The sand ripples are fifteen centimeters wide and one centimeter high. They are formed through flood or ebb tides, through which they change form every six hours. The ridge slopes for six hours in one direction, six hours in the other. The tide thus has an effect on the backscatter curve."

A still image from a video of the seafloor. The black arrow shows the direction of the tide, the yellow stripes are measurements used to determine the length of sand ripples.

Detecting sand ripples

This result means that Koop can detect even smaller landscape elements in the North Sea, namely sand ripples of only a centimeter in height. "These ripples can't be found with depth measurements, rather, the backscatter curve tells us if the seabed is flat or ribbed. With this, we have an extra parameter to characterize the seafloor. It also means that we should take into consideration the phase of the tide when analyzing acoustic data." Koop is happy that he now understands the time dependence of the curves. "Otherwise, I would have been left with this uncertainty in the data."



The form of the sand ripples at the Brown Bank. The arrows indicate the direction of the tide. The slope of the sand ripple points in one direction for six hours, then six hours in the other direction.

Linking conservation measures to solid research

WWF's 3D-printed reef structures facilitate multiple species, among others the plumose anemone

Emilie Reuchlin-Hugenholtz

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: Emilie Reuchlin-Hugenholtz, marine biologist and ocean expert from the World Wide Fund for Nature.

The largest nature area in the Netherlands, the North Sea, is barely protected. "Less than one percent is truly protected," ascertains Reuchlin-Hugenholtz. Within WWF, she leads the portfolio 'protected areas.' Her target: the setting up of an ecological network of protected nature areas in the North Sea. This network needs enough space, roughly a third of the area. "In this way, we protect the whole ecosystem of the North Sea, also the parts that fall outside of the network." Her work and that of DISCLOSE are related to each other. "Nature conservation requires sound knowledge of the marine communities of the seafloor. If you want to take remediation measures, then you need a detailed habitat map. DISCLOSE contributes to the required knowledge and maps."

Reuchlin-Hugenholtz (WNF):

'Nature conservation requires sound knowledge of the marine communities of the seafloor.'

Measuring effects

Reuchlin-Hugenholtz finds it very important to strengthen the monitoring and research of the North Sea. Among other things, she is curious about the ecological hotspots that DISCLOSE will identify. More knowledge is needed but not necessary in order to come to action, she proposes. For her, research should not result in delays or cancellation. "The current knowledge already enables us to make decisions and carry out conservation measures." The research performed by DISCLOSE is applicable not only to basic monitoring but also for gauging the effects of measures. "Measures in the North Sea, such as the closing of habitats to fisheries, must always be linked to reliable research. Thus, with a reference point and long-term measurements afterwards. Otherwise, it will remain unclear if the protection measures and nature restoration efforts are actually successful."

Reference habitats

During the DISCLOSE symposium last year in Utrecht, multiple speakers spoke about the lack of reference habitats. Reuchlin-Hugenholtz agrees with this. "In the North Sea, there is a lack of areas that have been undisturbed for a long time. In the busiest sea in the world with centuries of exploitation, such areas are crucial to determine the potential for nature development." She herself works on the active restoration of oyster banks. North of Schiermonnikoog, she is carrying out a field experiment with oysters and 3D-printed reef structures. "The oysters we re-introduced are doing well", she says. To estimate the effect of the measures, she uses multiple monitoring techniques, just like DISCLOSE.

Long-term perspective

Reuchlin-Hugenholtz is curious if DISCLOSE will have a successor. "I find it beneficial for the research to continue." Monitoring and protection require, according to her, much patience and a long-term perspective. As an example, she brings up the Dogger Bank, a Natura 2000 habitat without protection. "For more than ten years, we've been talking in vain about protection measures. The Dutch government has abdicated their responsibility for the nature conservation of the Dogger Bank. We've filed a complaint about this with the European Commission.

‘Monitoring the North Sea floor at the small scale’

Multiple researchers are active within DISCLOSE. Working with each other, they are mapping the expanse of nature in the North Sea. Each from their own perspective, with their own techniques. This column lets the researchers have their say. This episode: Olivier Beauchard.

Darwinian processes are at the foundation of Beachard’s work. Adaptation to habitats determines the chance of survival. “Lifespan, size, mobility, fertility,” Beauchard summarizes a few characteristics. He names these biological species characteristics ‘*traits*’. Since 2012, he has worked at NIOZ searching for the relationships between species traits and habitats. After working for two years at the Flanders Marine Institute, he returned last year. “I’m specialized in the analysis of complex datasets and have put together a large database on species and their species traits.”

Name: Olivier Beauchard
Age: 44 years
Employer: Royal Netherlands Institute for Sea Research (NIOZ) in Yerseke
Research: Vulnerability of benthic communities

Fantastic contrast

Until mid-May 2020, Beauchard is working on two articles for DISCLOSE. For one article, he’s linking three databases: those of benthic organisms (benthos) in the North Sea, the environmental conditions where they are found, and species traits. He found many correlations. “The Dutch North Sea appears to be a fantastic experiment. The area is made up of two contrasting parts: on one side the deep, muddy and relatively quiet northern part, and on the other side, the dynamic southern part with strong currents and sandy sediments.” The north is more species-rich, he says. “The species that live there tell us that this habitat is vulnerable. The benthic organisms are mostly large, live longer and take longer to mature. These traits indicate relatively low disturbance.” Survival in the southern North Sea requires more resilience. “Species there are more stress-resilient. After a disturbance, communities are able to recover faster, for example, because these species mature faster and also reach sexual maturation faster.”

Olivier Beauchard (NIOZ):

‘Species tell us about the vulnerability and resilience of a habitat.’

Small-scale monitoring

Still, the southern part contains high variation, both in geomorphology and species, as indicated by DISCLOSE research. “In highly dynamic areas, life is not limited to opportunistic, short-lived species. In the troughs between sand waves, for example, we also find vulnerable, long-lived species. Even the same species as found in the northern part.” His advice: zoom in and map the seafloor of the North Sea at a high resolution. “Otherwise we risk destroying the local, fragile communities that we did not even encounter using coarse monitoring methods.” For the second article, Beauchard lays out the relationship between *traits* and the demersal fisheries. “I do research, according to *traits*, on how sensitive communities and habitats are to the impact of seabed disturbance.”

Nature in the North Sea requires collaboration

The closing argument of DISCLOSE is drawing near. March 2021, the four-year research project reaches its end. The researchers are writing their scientific articles and dissertations as we speak. It is now time for the nature conservation agencies to step up and put DISCLOSE findings into practice. Irene Kingma from the North Sea Foundation joined the DISCLOSE team in September 2019.

What is your role in DISCLOSE?

'I'm taking over the role of my colleague Christiaan van Sluis. For DISCLOSE, I keep myself busy with the internal and external communication. We were planning to organize a public colloquium for the summer. Because of the corona measures, we had to postpone this of course.'

Irene Kingma (North Sea Foundation):

'The protection of nature in the North Sea falls far short of the target.'

What could DISCLOSE mean for nature protection in the North Sea?

'I'm impressed by the work of DISCLOSE. The multidisciplinary approach, with which they looked at the seafloor of the North Sea with a combination of measuring techniques, is really valuable. It can mean a lot for future monitoring and protection of nature in the North Sea.'

What is the status of protection in the North Sea?

'The protection measures fall far short of the target. The Dutch government assigned Natura 2000 habitats in the North Sea, but then neglect bringing forth protection measures. The government wants to have the Brown Bank also designated as a Natura 2000 habitat, but solely to protect common murres and auks. Even though DISCLOSE has demonstrated that rare ross worm reefs are present there. These reefs were not disclosed to Brussels by The Hague. Thus, they are not taken into consideration.'

Are you positive about the North Sea agreement?

'The proposed agreement was recently put on the table, but the final voting and signing round was postponed because of the corona crisis. The proposed text leaves room for optimism. The percentage of the North Sea floor that would become fully protected by 2030 would increase to 12.5 percent. The agreement acknowledges that there is not enough knowledge about the functioning of the ecosystem, especially in relation to the significant (future) changes in the North Sea. Fifty-five million euros is reserved for monitoring, scientific research and nature conservation. The big question is whether all the parties will sign the proposed agreement. Subsequently, success will depend on the execution of the plans.'

What do you see as the power of the agreement?

'That many parties are joining in. The agreement is dominantly initiated by the current developments in offshore wind energy. Large new offshore wind parks will change the North Sea. Inspired by the Energy agreement, the government also wanted a similar broadly supported agreement for the North Sea. Cooperation is important, or else everyone will just stay on their own islands. This holds for the North Sea agreement, but also for DISCLOSE, where diverse disciplines join together in collaboration.'

Colophon
Text: Addo van der Eijk
Translation: Escribe, Esther Chang
Lay-out: Greetje Bijleveld. Design: Sense Visuele communicatie
Photography: NIOZ (p. 1 big photo, p. 3 en 4), Jip Vrooman (p. 3 en 4, sediment samples), OCEANA/Carlos Minguell (photo's in the banner), OCEANA/Juan Cuetos (p. 1 small photo), Cor Kuyvenhoven (p. 6 portrait), Udo van Dongen (p. 6 sea anemone), Hans Hillewaert (benthic organisms p. 7), Karin van der Reijden (p. 2 illustration).

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.

rijksuniversiteit groningen
TU Delft
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