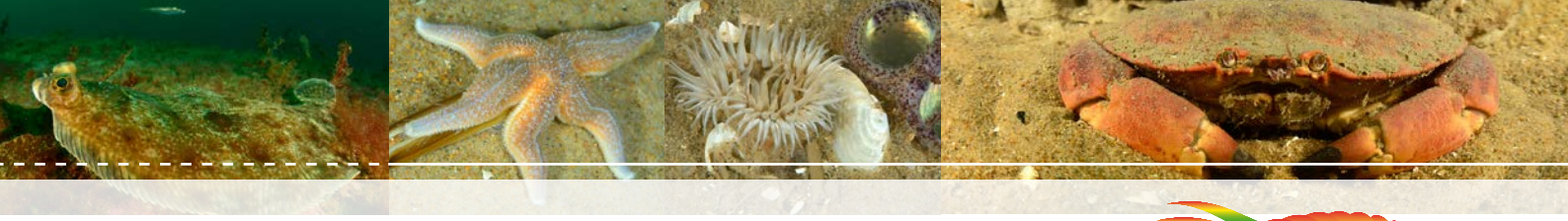


Newsletter 2

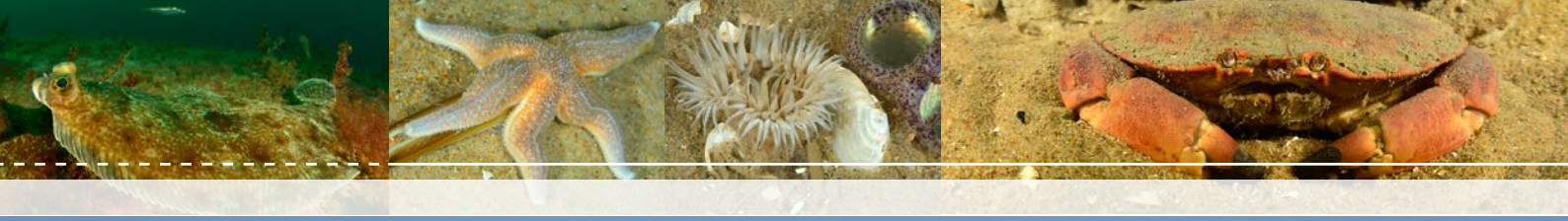
October 2018

DISCLOSE

DISCLOSE is an acronym for DIstribution, StruCture and functioning of LOw-resilience benthic communities and habitats of the Dutch North SEa; a four-year research project wrapping up in March 2020. DISCLOSE aims to map the habitats of the Dutch North Sea using a combination of techniques. The project – a collaboration between the Delft University of Technology, the Royal Netherlands Institute for Sea Research (NIOZ), the University of Groningen, and the North Sea Foundation – is funded by the Gieskes-Strijbis Fonds.

Mapping habitats of the North Sea

In this newsletter:



Tracking down nature hotspots

Fisheries in the Brown Bank

Bottom-trawling fisheries, dredging, shipping, sand and gravel mining: the North Sea is not at peace. "It's one of the most intensively used seas in the world," tells Han Olff, full professor of ecology at the University of Groningen. Human activities have irrevocably impacted marine life. But to what extent? And how quickly can marine life on the seabed recover?

Han Olff (University of Groningen):

"People keep increasing their impact on the bottom of the North Sea."

Since the beginning of human recollection, the North Sea has been used. And now more effectively and intensively at constantly larger scales. Resulting in impacts on the seabed. "People keep increasing their influence on the bottom of the North Sea," observes Olff. As the root cause, he points in particular at the bottom-trawling fisheries, which drag their nets over the seabed. "Within DISCLOSE, we study how the biology on the seafloor has been changed by fishing activities."

Metamorphosis

Olff suspects a worrying shift underwater. His hypothesis: the seabed has undergone metamorphosis in the deeper parts, whereby vulnerable organisms have given way to less susceptible ones. Olff calls the ability of a community to recover after disturbance 'resilience'. "Some communities have low resilience. They recover extremely slowly," explains Olff. He is particularly referring to coral-like structures, such as oyster or sand-worm reefs. "In the past, an enormous area was covered by reefs in the North Sea. Reefs are formed by long-lived species and have high biodiversity."

Benefitting from disturbance

Olff points out strong indications that most of the reefs have disappeared because of fisheries. "First, the fishermen stayed close to the coast. Later, with the increase in engine power, they could fish more often and to greater depths," according to Olff. Through constant stirring up of the sediments, the seabed is now sandy and occupied mostly by crabs. "This habitat type with high resilience is often found in coastal zones, where the natural dynamics are high because of waves and currents. Crabs thrive under disturbance. They are opportunistic scavengers. They actually profit from the bycatch of fisheries and a disturbed seabed."

Hotspots

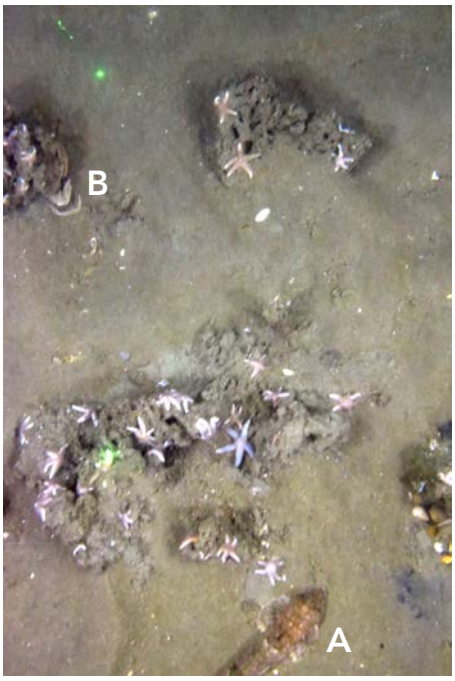
With the DISCLOSE project, Olff wants to track down hotspots. Such as the best locations where vulnerable habitats can still be found, or locations with high potential for recovery. The map that the researchers are working on will hopefully point out where these hotspots lie. Olff: "We are drawing up a habitat map of the North Sea based on abiotic factors, looking at which species live where and what the fishing intensity is. With all this data, we want to compare intensively fished locations, for example, with less fished areas. If long-lived species don't occur in intensively fished areas but do occur in comparable habitats, then we have a smoking gun." Olff finds protection of these 'top' locations very important. "We are going to propose protection measures to safeguard these hotspots."

The preliminary results in pictures

DISCLOSE studies the seabed with diverse methods. The three North Sea expeditions have delivered thus far a huge pile of raw data, which the research team is now examining. Multiple scientific articles are in progress. The researchers declare their findings here.

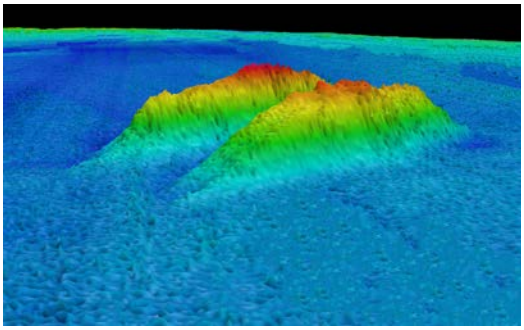
"The left photo is of a sediment sample from the Brown Bank, collected with a Box Corer. This heavy instrument cores a round disc from the seabed. The photo on the right shows the results after sieving. You see two sea potatoes and many broken shells. In total we sampled 22 places, three samples per location. The jars containing preserved soil organisms are in our laboratory at the moment. We are determining which species are present." **Sarah O'Flynn from the Royal Netherlands Institute for Sea Research (NIOZ)**

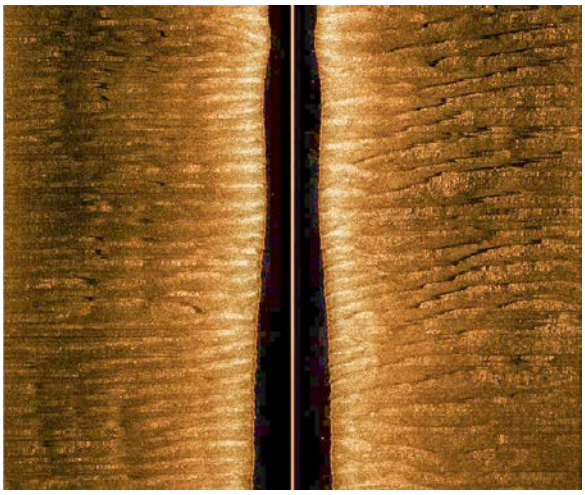
"This is a soil profile, but then taken from the bottom of a the sea. We used Sediment Profile Imagery (SPI) to take this photo in the Central Oyster Grounds. The camera can penetrate twenty centimetres into the sediment. What attracts attention is the greyish lower layer. This indicates anaerobic conditions. The hole in the middle was made by a soil organism, possibly a mud shrimp, also called the Callianassa shrimp." **Sarah O'Flynn from the Royal Netherlands Institute for Sea Research (NIOZ)**



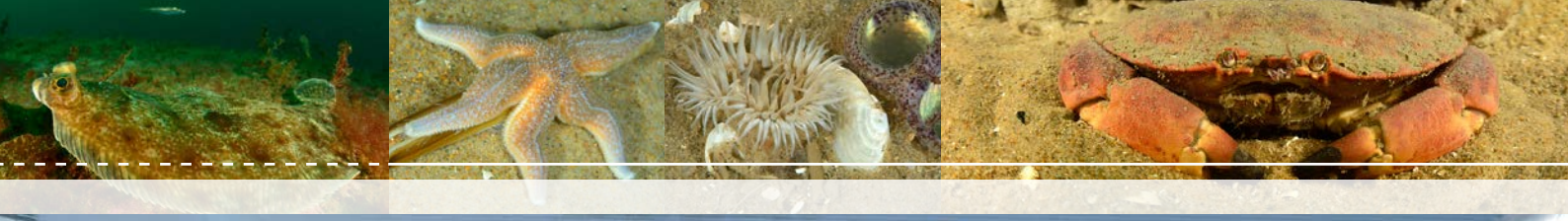
"This photo was taken with the single-lens reflex camera on Bruce, my camera frame that we tow over the seabed. The camera makes a photo every ten seconds. Many photos appeared to be out of focus, but not this one. In it, you see a sand-worm reef with starfish. At the bottom is a dragonet (A), and at the upper left corner, a crab (B) is sticking out of the reef. The two laser points in the photo are at a set distance from each other. That's how we scale the photo. I haven't yet looked at all the photos - really gruelling labour - but I've looked at the videos taken by Bruce."
Karin van der Reijden from the University of Groningen

"We saw these two curious underwater mountains with our multibeam echo sounder. This device sends out sound waves and receives back the echoes. Blue indicates greater depth than red. Later, it appeared that we had sailed over a sunken platform."
Leo Koop from TU Delft





"What you see here is an image from a Side Scan Sonar. The sonar, a sort of torpedo hangs out the back of the ship into the water. The torpedo can't 'see' directly underneath, thus the black band in the middle. Left and right - a hundred meters to each side - you can see clear differences in relief. The striped pattern shows waves in the sand that lie perpendicular to the direction of navigation."
Leo Koop from TU Delft



TU Delft wins a next-generation echo sounder

Exciting news. DISCLOSE has an ultramodern device at their disposal: a multispectral multibeam echo sounder. It's a prize, won by a team of researchers from TU Delft. Mirjam Snellen, an Associate Professor from the winning team, is happy with the acquisition. "With this, we can better distinguish sediment types from each other."

Progress never stops. The multibeam echo sounder that DISCLOSE worked with over the last years has already been surpassed. The state-of-the-art successor has just rolled out of the factory: the multispectral multibeam echo sounder. The prefix, multispectral, indicates its added value. "The traditional multibeam echo sounder, which has already been in existence for thirty years, sends out a sound wave at one particular frequency. After reflecting off the seabed, the received acoustic data deliver information on water depth and sediment type," explains Snellen. The sediment type, that is what is at stake here. Mud, rock, coarse sand, fine sand: the multibeam 'hears' it, but not perfectly. Some sediments sound almost identical. For example, Snellen brings up coarse sand and gravel. The limitation appears to lie in the frequency. "An echo sounder sends out a pulse at one frequency, such as 300 or 12 kiloHertz. The multispectral echo sounder can emit at multiple frequencies consecutively. This has yielded multiple times more acoustic data."

The challenge

To promote the brand-new product, the supplier R2Sonic put out a challenge. Six teams took part. The assignment was not easy. "We received three datasets from a location, each using a different frequency. The task was to make a classification based on this. Our team developed an algorithm, in which we optimally combined data from the three frequencies. The discrimination in the detections was increased. We could distinguish more sediment types from one-an-other. Not five but eight." This algorithm appeared to be the winning entry. This past spring, researcher Timo C. Gaida accepted the trophy in California on behalf of the whole group. A trophy case has been purchased, states Snellen.

Mirjam Snellen (TU Delft): *"With the multispectral echo sounder, the discrimination in the detections has increased."*

Better insight

The Dutch Maritime Institute Willem Barentsz on Terschelling and the marine construction company Boskalis will conduct the maiden voyage. The device will be tested in September. DISCLOSE cannot wait to get started. "We really want to take the device to the Brown Bank, where we've already done measurements. With this system, we'll get much better insight into the sediment types in the North Sea. This would deliver a more accurate habitat map."

DISCLOSE creates awareness

DISCLOSE seeks collaboration. In this section, external people with overlapping interests get to speak their piece. How do they view the research? What are the opportunities and the pitfalls? In this episode: Willem Remena from Naturalis Biodiversity Center.

Willem Renema

Naturalis is the national research institute in the area of biodiversity. Renema's group Marine Biodiversity focuses on marine life. Especially in the tropics, but recently the North Sea has been receiving more attention. Renema follows DISCLOSE with interest. Just like DISCLOSE, he works on innovative techniques to map biodiversity. "Our group is busy with DNA meta-barcoding. Through this, we determine what sorts of DNA are present in a water sample. Within Naturalis, this technique was developed for freshwater. There have been some snags applying this technique in seawater." One of these research questions: at which scale does a DNA sample give an adequate picture? The DISCLOSE habitat map can offer solace. "With the map, we can better target our search for locations, for example a DNA sample per habitat type. I'm curious if our DNA results correspond to the observations of DISCLOSE.

Willem Renema (Naturalis Biodiversity Center):

"The North Sea is so close yet faraway; there is still so much undiscovered biodiversity."

Better representation

People often have a wrong and limited image of the North Sea, notices Renema. "They see the sea as a body of water, with the seafloor as a monotonous sandpit. I hear this even from researchers: it doesn't really matter where you take a sample. Actually, the opposite is true. The variation in the ecosystems and biodiversity is enormous. In many places, a mosaic of habitat types lies hidden under the water." According to Renema, DISCLOSE contributes to a better picture. "DISCLOSE will reveal the actual situation - I expect - so that the variation can be seen. The work of the researchers has delivered fantastic images: accurate habitat maps and cool photos and videos of sand-worm reefs and sharks."
Renema finds a habitat map of the North Sea of obvious importance. "It's so close by, but there is still so much undiscovered biodiversity. Really crazy. It's possible that the habitat map will lead to new legally protected nature areas."

Multidisciplinary

The collaboration within DISCLOSE is inspirational. The multidisciplinary approach, whereby three worlds - marine biology, ecology and acoustic remote sensing - combine their powers was an eye opener for Renema. The unique coalition has bred imitation. "After the setup of DISCLOSE, we sought contact with TU Delft. We're working together on a project. I find it exciting to broaden my horizons. It offers such scope for the imagination. We don't all have to reinvent the wheel."

Datamining with North Sea data

Within DISCLOSE, three Ph.D. candidates are active. Together, they are mapping the expanse of nature in the North Sea. Each from their own perspective, with their own techniques. This section lets the researchers have their say. Second episode: Karin van der Reijden.

Whoever clicks on a random point of the digital North Sea map will receive an adequate image of the present habitat. This is how Van der Reijden envisions the habitat map of DISCLOSE. They haven't come so far yet. Till now, she has collected and analysed publically available data on the North Sea. At first, only environmental factors, such as water temperature, depth, sediment and current. "Not marine life on the seabed. That'll come later," she explains. EMODnet appears to be a large source of data, a habitat mapping by the European Union of all European seas, including the North Sea. However, EMODnet is still not adequate. "For one thing, the classification is not specifically for the North Sea; furthermore, the map is based on a limited number of environmental factors. I put in additional biologically relevant factors, including water temperature and salinity. I get this data from other sources."

Name:	Karin van der Reijden
Age:	28 years old
Employment:	the University of Groningen, Groningen Institute for volutionary Life Sciences (GELIFES)
Research:	drafting a habitat map and video monitoring

Karin van der Reijden looks at live feed from the seabed

Relative depth

Meanwhile, Van der Reijden has a gigantic dataset at her disposal. By cleverly combining factors, she creates new ones. She cites relative depth as an example. "Relative depth indicates where a point is found: on top of a peak, along a slope or in a valley. For marine life on the seabed, relative depth is important. This past summer, we added this factor as a layer." The challenge for this fall: determining the classification. This is the clustering of factors in such a way that an overview legend of the habitats manifests itself. Van der Reijden does not want to stipulate the classes beforehand herself. With datamining, she lets the computer find clusters in the dataset. A computer program divides the data objectively into relatively homogenous classes, in which there is as much similarity as possible. She calls this datamining technique the unsupervised clustering method. "I've tested the technique on a small dataset. I've mastered the programming. I expect a legend of about ten to twenty habitats."

Karin van der Reijden (University of Groningen):

"I want to be able to explain why my research is important."

Bruce from Finding Nemo

The next step: determining the biology of the seabed per habitat. This will happen with the available datasets, including those from Rijkswaterstaat, supplemented with her own observations. Van der Reijden uses Bruce for this, her video installation named after the friendly shark in the animated film Finding Nemo. Bruce was built using an English model, but with the needed modifications. "He is two times bigger than the original and has not one but two cameras: a video camera that we can control remotely and a digital single-lens reflex camera that makes

time-lapse photos. Meanwhile, Bruce is already in use. During our third expedition, I was able to make several usable video transects." This coming spring, Van der Reijden wants to head to sea. With the preliminary habitat map in hand, she can carry out targeted filming of the seabed with Bruce.

Bottom-trawling fishery

When the habitats with their marine life are established, Van der Reijden wants to assess how vulnerable they are to human disturbance. She is focused on the bottom-trawling fishery, which drags nets over the seabed. "Satellite images give the locations of the fishing vessels every two hours. If I lay this data over the habitat map, then I can hopefully determine the effect of the fishery on the biology of the seafloor. We will know the fishing intensity, the habitats, the environmental factors and which species live where. I will look for differences between fished and unfished locations, among other things."

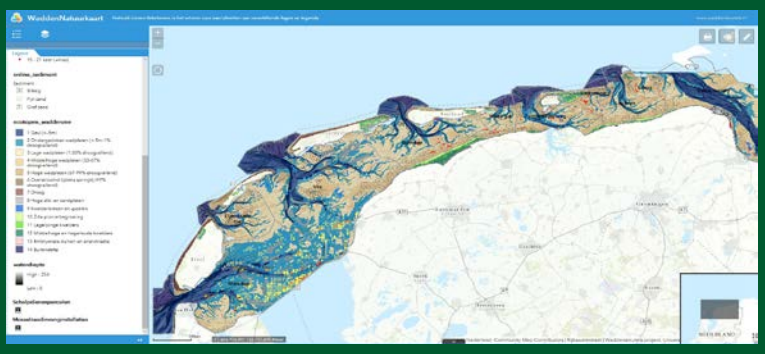
Academic freedom

The bottom-trawling fishery is familiar territory for Van der Reijden. Before DISCLOSE, she worked happily for two years at Wageningen Marine Research, where she also undertook an internship. She tallied the discards - the unwanted by - catch that was thrown overboard. In Groningen, where she studied marine biology, she's come back to her old stomping grounds. Life under the salt water surface fascinates her. "I'm always busy with the sea. As a fanatic diver, as a student and as a researcher." The academic freedom suits her, but pure fundamental research isn't her thing. "I want to be able to explain why my research is important. This is the essential thing for me. Not knowledge purely for its own sake. DISCLOSE will hopefully really contribute to the protection of nature in the North Sea."

Bruce is launched

Habitat map of the Wadden Sea

The habitat map of the North Sea will eventually be available for everyone online. Karin van der Reijden uses an application that was used earlier for the Dutch Wadden Sea. The project Waddensleutels (www.waddensleutels.nl), a research project in which the University of Groningen was involved and developed the Wadden Nature Map, amongst other things. You can find this map at www.waddennatuurkaart.nl. The map is used in many ways for research and management.



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Translation: Esther Chang (eScribe)

More information over the project
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