



Newsletter 4

October 2019



THE LAST DISCLOSE CRUISE

To protect the North Sea, we have to really understand it. The four-year research project DISCLOSE, which runs until March 2020, 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 (UG) and the North Sea Foundation (NSF), 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.



In this newsletter:

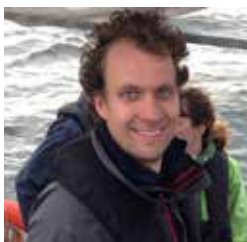
- Science and nature conservation join forces
- Expedition to sand-worm reefs
- Calibrating multibeam backscatter
- Higher Vocational Education program Ocean Technology lends a hand
- Looking for links between the seabed and its marine life



Coproduction science and nature conservation

Scientists and conservation managers work closely together in DISCLOSE. What they have in common is their bond to the North Sea. The division of roles is clear: scientists focus on independent research and the North Sea Foundation targets the general public and policy makers.

DISCLOSE builds bridges. Between the scientists themselves, but also between science and nature conservation. Quite a unique partnership, states Christiaan van Sluis from the North Sea Foundation. "We have always maintained close ties with the science - we even have a scientific advisory board - but within DISCLOSE, we really work intensively together." Van Sluis is dependent on the science. "Being science-based is one of our core values. We are working towards a clean and healthy North Sea. Sustainable solutions demand sound knowledge of the system. For support, it's important that policy decisions are made on the basis of scientific facts."



*Christiaan van Sluis
(North Sea Foundation):
"Being science-based is one of our core values."*

Casting of roles

The division of labour in DISCLOSE is as follows: the North Sea Foundation poses issues of concern to society, after which scientists fill the gaps in knowledge and test solutions in the real world. "Afterwards, we have to share these results. We interpret the findings for the general public and policy makers in The Hague." A notable example, according to Van Sluis: the sand-worm reefs on the Brown Bank.

"DISCLOSE researchers discovered these unique reefs during mapping of the seafloor, after which we did a deep dive into the required level of habitat protection and are now briefing ourselves to get these reefs protected."



Peter Herman (TU Delft):

"Nature organisations and policy makers should listen to the science."

Nurturing discussion

Cooperation is a trend in the academic world. "This is what is explicitly expected of us," tells Peter Herman of TU Delft. "The time when scientists carried out their research in isolation has long past. To receive governmental funding, we have had to work together with industry for a longer time. Since shortly, nature organisations have joined this cooperation. Foundations like the Gieskes-Strijbis Fund request this." Working together offers advantages, he ascertains. "For us, it offers the chance to add our knowledge to the societal debate. It's important that NGOs and policy makers listen to the science. Take the existing monitoring methods. These use point measurements often separated by tens of kilometres. With DISCLOSE, we have shown that this can be improved. We're getting a picture of marine life on the seabed more quickly and over a greater surface area."

Areas of tension

However, there are areas of tension. Academic independence should not be at stake, states Herman. "The danger is that the larger world begins to see scientists as just part of industry and nature organisations. Cooperation can come back to haunt you if people on the outside question the independence of the scientific research. DISCLOSE is very aware of this."



“We can absolutely help each other”

DISCLOSE seeks collaboration. In this section, external people with overlapping interests get to say their piece. How do they view the research? What are the opportunities and the pitfalls? In this section: Rob van Ree, instructor of the Higher Vocational Education program Ocean Technology.



Rob van Ree

Van Ree works at the Maritime Institute Willem Barentsz on Terschelling, a.k.a. the seafaring school. He trains students to be hydrographers. “As operational engineers, they have to be able to work with different types of measuring apparatus, such as the multibeam echo sounder and the side scan sonar,” he explains. Two of his students joined the DISCLOSE expedition last May to the Brown Bank. A stroke of luck, he calls it. “On board, they took measurements with the multi-spectral multibeam echo sounder, the successor to the multibeam echo sounder. A brand-new instrument, really state of the art.” Both parties, Van Ree as well as DISCLOSE, value the contribution of students.

Rob van Ree (instructor Ocean Technology):

“My field of work can profit from the innovations of DISCLOSE.”

Building bridges

Van Ree finds the cooperation special. “DISCLOSE builds a bridge between fundamental science and operational applications, which I value. Universities and higher vocational institutes often exist in separate worlds. Within our field of work -governments and offshore-, dredging- and

surveying companies- I have multiple contacts. With universities, less.” Van Ree would very much like to work more often and more intensively with universities. “We could absolutely help each other. Our institute has its own research vessel, with which we could conduct measurements for projects such as DISCLOSE. Our students would learn a lot from this.”

Secretive world

He applauds the ambitions of DISCLOSE -to come up with better and more efficient ways of mapping marine life on the seafloor through innovation. “We know so little about the seafloor. It remains a secretive world. Surveys are expensive. Yearly, only 1/15th of the North Sea is mapped. For some seabed areas, the most recent data were collected many decades ago. Busy shipping routes receive priority.” Especially the integrative approach of DISCLOSE- the combination of different measurement techniques appeals to him. He finds the coupling between acoustic data and biodiversity interesting. Better, cheaper and more efficient measurement methods: they are very welcome, according to Van Ree. “Through the innovations made by DISCLOSE, we can discover more information about the seafloor. Information about the nature of the sediment, among other things.”

Importance of innovation

Innovation is a fixed part of the curriculum. “In the fourth year, students take inventory of the current state of technology. In groups of ten, they prepare a report on the latest findings. Perhaps I’ll come across DISCLOSE in the coming years. My field of work can profit from the innovations of DISCLOSE. This is why it’s good if students come in contact with it.”





Journey to the Brown Bank



This past May, DISCLOSE headed out on the North Sea. The expedition set - for the third time - a course for the Brown Bank. Goal: a closer look at the sand-worm reefs. Jip Vrooman from the North Sea Foundation tells the story.

North Sea. On Saturday, May 18, 2019, we set out on the RV Pelagia, the research vessel of NIOZ. We're staying at sea for six days. As the expedition leader, I try to manage the communication between the researchers and the ship's crew. In addition, I take photos and write blogs.



"We are visiting multiple locations along the Brown Bank, a natural habitat where sand-worm reefs were found during an earlier expedition in 2017. A noteworthy discovery because these kinds of reefs seem to have disappeared from the Dutch North Sea. We find the reef again, but it's difficult to see if the reef is still the same size."

"We take measurements with four type of instruments. In this photo, for example, we're looking at images made with the multi-frequency multibeam. During the journey, the instrument is used to bounce signals off the seafloor and collect them again. We are mapping the seafloor with this acoustic data."





"We use a special underwater camera. We lower the camera down to just above the seafloor with a sturdy cable. Afterwards, the ship sails in a straight line for two hundred meters. Inside, we look at the - sometimes monotonous - footage. We see a lot of sand and only every once in a while, a bottom-dwelling sea creature or a piece of reef. The footage is later analysed in detail."



"Here, we're lowering a CTD (Conductivity, Temperature and Depth) into the water. From salinity to temperature: this instrument measures many water-quality parameters. The CTD also take water samples at different depths, from which we can deduce, among other things, what species have been around."



"With the so-called boxcore, we take "bites" out of the seafloor. We sieve the sediment sample and rinse away the sand and silt. We save whatever's left for detailed analysis in the laboratory. Sand-worm reefs are known for increasing biodiversity."

"The Brown Bank deserves more protection than it has been getting. The sand-worm reefs, with their rich biodiversity, let us see how special this habitat is. The Dutch part is really not getting much protection. The North Sea Foundation advocates for more research and an appropriate level of protection for the sand-worm reefs. In addition, we nominate the designation of this area as a Natura 2000 site for birds. This habitat is namely very important for sea birds, such as the many northern gannets we see around the ship."





Calibrating multibeam backscatter

A multibeam echo sounder scans the seafloor. The backscatter values make it possible to distinguish different sediments from each other. The problem is that values differ between instruments. The ingenious calibration curve of Alireza Amiri-Simkooei offers a solution. Backscatter can now be calibrated without sediment samples.

During the third DISCLOSE expedition in October 2017, the multibeam was used to collect an immense dataset on the Brown Bank from the RV Pelagia, the research vessel of NIOZ. Amiri-Simkooei, an associate professor at the University of Isfahan in Iran, was flown in to help analyse the data. He also holds a research-position at TU Delft. A multibeam sends ultrasonic signals to the seafloor, he explains. "The strength of the reflected signal -the backscatter- lets us see what the seafloor is made of. A sandy bottom, for example, reflects a stronger signal than one made of mud."



Alireza Amiri-Simkooei (TU Delft):
"We can now compare different measurements of the same multibeam instrument with each other, without having to take sediment samples."

Downside of multibeams

Amiri-Simkooei worked for a year on the dataset. With his revolutionary finding, he solved a well-known shortcoming of the multibeam, namely calibration. "A multibeam instrument is not generally calibrated to a standard for measuring backscatter. Each instrument yields different values. As the variation is large, measurement are often not comparable with each other," he explains. As a rule, calibrations are made using sediment samples. A "bite" taken out of the seafloor indicates what the actual values of the backscatter should be. "On this basis, we adjust the instrument."

Calibration curve

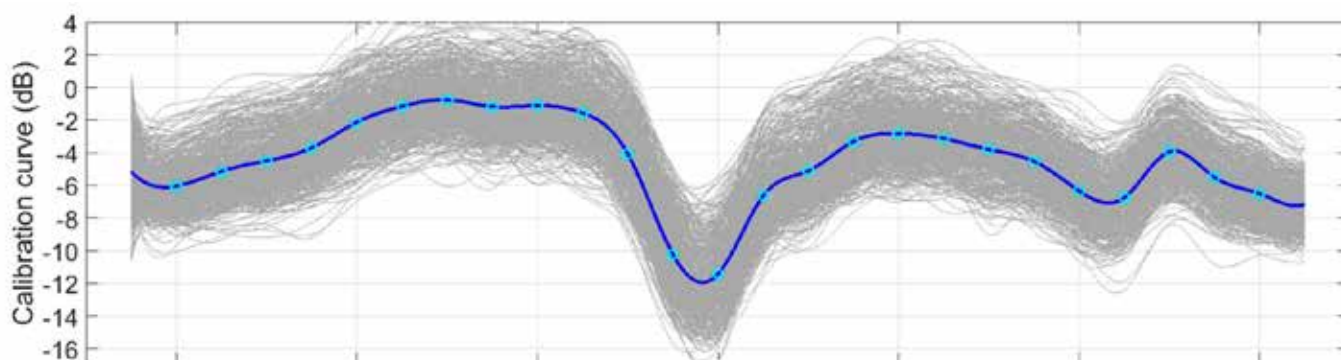
Amiri-Simkooei developed a mathematical alternative. With the DISCLOSE data, he proposed a calibration curve for the multibeam on the Pelagia. "Thousands of measurements make it possible to estimate the curve. The curve is an average, and errors become averaged. With this calibration curve, we can compare the measurements taken with this specific instrument. Also, historical measurements. Another instrument would require a new dataset and calibration curve. Calibration can be done without sediment samples."

More parameters

This method not only makes the comparison of measurements possible, it brings to light more information on the seafloor. Amiri-Simkooei transforms one backscatter value into no less than three parameters. "With one pulse of the multibeam, we now know the particle size, roughness of the surface and the degree of homogeneity of the seabed. This last indicates, for example, if shells are present in the sediment." Amiri-Simkooei published a paper on his results in Geosciences.

Next step

Now that the seafloor has been imaged, DISCLOSE researcher Sebastiaan Mestdagh (see page 7) is taking the next step. He is coupling Amiri-Simkooei's results to the presence of seabed communities. "If this works, then we can use the multibeam to map marine life on the seabed."



The calibration curve (blue line) is the average of thousands of measurements.



Describing patterns in datasets

Multiple researchers are active within DISCLOSE. Working with each other, they are mapping the nature of the North Sea. Each from their own perspective, using their own techniques. This section lets the researchers have their say. This time: Sebastiaan Mestdagh.



Mestdagh is a new member of the DISCLOSE team. He's from Belgium and is replacing Sarah O'Flynn, who has discontinued her research. "Half of the time, I work in DISCLOSE, the other half in Smartsediment, a project in the Schelde area about ecologically responsible re-use of dredged sediment," he explains. The Schelde estuary is well-known territory for him. As a Ph.D. candidate, he researched the influence of changes in the seabed on bottom-dwelling marine life. Last December, he received his doctorate from the University of Gent. "Also within DISCLOSE, I'm looking for patterns between the seabed and its biology," says Mestdagh.

Brown Bank paper

The whole summer, he worked on a publication over the Brown Bank. He combined the available DISCLOSE datasets from this area. "During the North Sea expeditions by DISCLOSE, the Brown Bank was mapped multiple times using different measuring techniques. This includes cameras, the box corer and the multibeam echo sounder." Mestdagh is exploring whether combining the data from these methods delivers extra value. And this seems to be the case. "The measuring techniques are compatible and complementary. Usually, only one method is used during monitoring. Ecologists often take sediment samples. But then you only know what's present in that particular sample. Between the sampling points lie blind spots. Combing acoustic data, videos and sediment samples makes it possible to fill in these blind spots."

Sebastiaan Mestdagh (NIOZ):

"The different measuring techniques are compatible and complementary."

Sketching a rough picture

Mestdagh outlines the Brown Bank as an enormous sandbank, covered with sand waves of about 200 meters wide. "The benthic communities at the top of a sand wave differ from those in the valley. Using acoustic data, we can now sketch a rough picture of the marine life on the seabed. We can do this at the scale of a sand wave." The paper will be sent soon for review at a scientific journal.



Name: Sebastiaan Mestdagh
Age: 28 years
Place of employment: Royal Netherlands Institute for Sea Research (NIOZ) in Yerseke
Research: Describing patterns in datasets of seabed composition and benthic communities

Datasets of the Directorate-General for Public Works and Water Management

This fall, he will pore over the extensive datasets of the Directorate-General for Public Works and Water Management. "The North Sea is monitored under the Marine Strategy Framework Directive. Sediment samples have been collected regularly from the North Sea, starting in 1995. I'm going to look for long-term trends in marine seabed communities. I will try to link these trends to changes in the seafloor."



The last DISCLOSE cruise

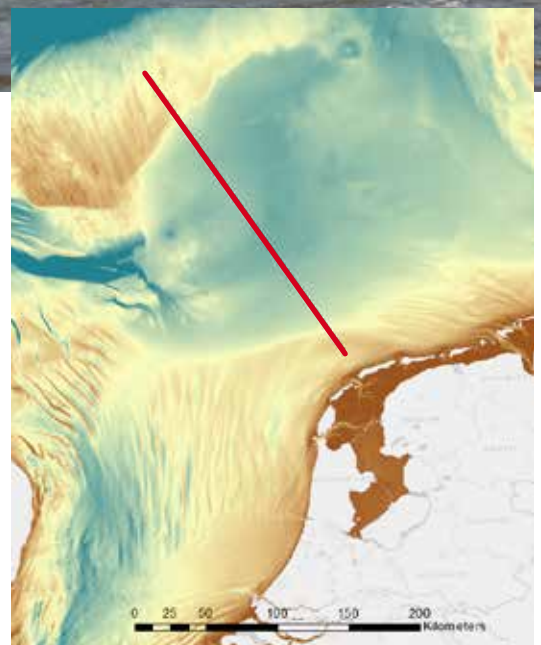


On Monday 7 October, DISCLOSE will take its last cruise on the North Sea. Different measuring instruments, including the brand-new multi-spectral multibeam echo sounder, will be taken on board. Mission: conducting a transect from Doggersbank to Terschelling.

DISCLOSE has visited to the Brown Bank multiple times. "We already have a lot of data from this. And we've been able to combine our measuring techniques (see page 7). It's interesting now to carry out this approach in other habitats," says Karin van der Reijden from the University of Groningen. During the cruise, she wants to sample multiple types of seabeds. "From Doggersbank, we'll sail in a straight line to the coast of Terschelling. A transect of about 250 kilometres. On the way, we'll come across various seafloors. Doggersbank is a shallow sandbank. The seabed is mostly composed of coarse sand. We will pass the Central Oyster Bed with deeper, silty bottoms and the Frisian Front, where the deeper waters 'crash' against the more shallow coastal seabeds. Finally, we will end by Terschelling in the sandy, shallow coastal waters."



*Karin van der Reijden (University of Groningen):
"From Doggersbank, we're sailing in
a straight line to the coast of
Terschelling."*



Taking fingerprints

Van der Reijden wants to create fingerprints of the habitat types. "We will take measurements along the way. I'm bringing my video camera and the fancy multi-spectral multibeam echo sounder. Sediment samples are already available. We're voyaging on the Pelagia (NIOZ). We have one week to take our measurements." There's also a TV crew on board for a BBC documentary about the human effects on oceans. "They're also going to film our research."

Colophon

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More information over the project

www.discloseproject.nl and from the project leader Dick Simons of the TU Delft, email: d.g.simons@tudelft.nl.



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