

Exploring the Saba Bank's Deep Sea

During the fifth leg of the NICO expedition researchers from NIOZ Sea Research, Wageningen Marine Research and Naturalis Biodiversity Center studied the only deep-sea in the entire Dutch Kingdom: the Saba Bank. While a number of research expeditions have explored the shallow parts of the Bank, very little is known about the Bank's deep-sea habitats. Researchers on board investigated the deep-sea environmental conditions and took a first look at what creatures can live at these deep dark depths.

NICO expedition

The research vessel RV Pelagia was in our Dutch Caribbean waters from the end of last year till mid March as part of a 7-month multidisciplinary scientific journey, the "Netherlands Initiative Changing Oceans" (NICO) expedition. The NIOZ Sea Research and NWO Science (ENW) organized the NICO expedition with the aim of obtaining a better understanding of changing seas and oceans (NIOZ, 2018).

After exploring Aruba, Bonaire and Curacao's mesophotic reefs (i.e. reefs below 30 meter depth), cyanobacterial mats and the cause of their proliferation, mapping the sea bottom and sailing from Aruba to St. Maarten investigating eddies and their influence on the distribution of marine mammals and sea birds, the vessel arrived at the Saba Bank for another 13 days of research.

The Saba Bank

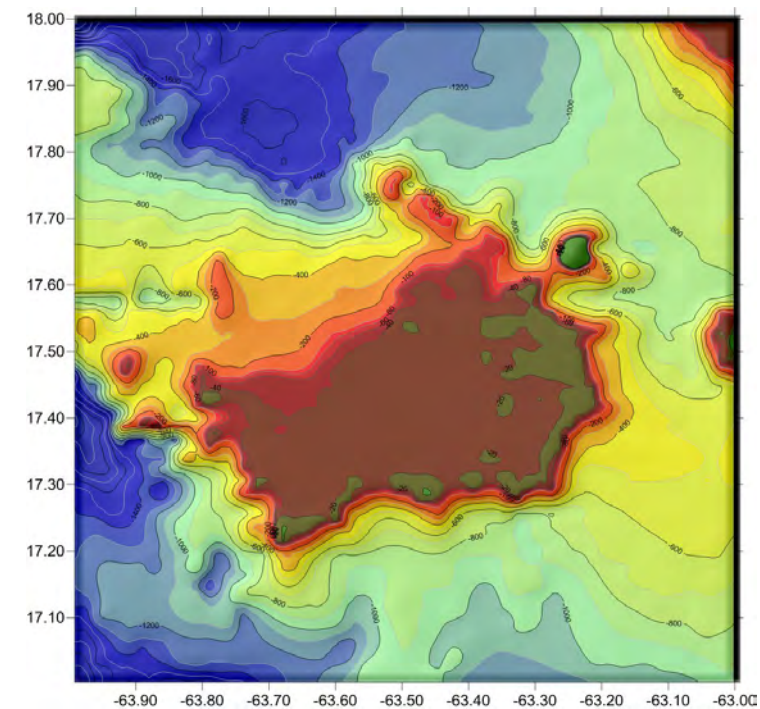
The Saba Bank is a large flat-topped seamount rising from a depth of 1.5 km. The upper area of the Saba Bank covers an area of +/- 268.000 hectares, an area roughly the size of the Dutch part of the Wadden Sea or, more evocatively, about the same size as Luxembourg (DCNA, 2017).

Most of the Bank lies at depths of 20 to 50 meters, but a considerable area to the east lies between 10 and 20 meters and has extensive reef development (Meesters et al., 1996). It reaches a plateau at a depth of about 15 m (Klomp and Kooistra, 2003).

Van der Land was the first who explored the Bank in 1972. In 2010, after the constitutional change, the Saba Bank became the direct responsibility of the Netherlands. Since that time considerable resources have been spent on the Saba Bank including several research expeditions by Wageningen Marine Research and NIOZ Sea Research to assess the state of the fisheries, coral reef health and shark populations (Bos et al., 2016; DCNA, 2017).

Considered to be one of the world's marine biodiversity hotspots (Church and Allison, 2004), the Saba Bank is recognized under the Convention of Biological Diversity (CBD) as an Ecologically and Biologically Significant Area (EBSA). The Saba Bank was listed as a protected area of regional importance under the SPAW-protocol (Protocol Concerning Specially Protected Areas and Wildlife of the Wider Caribbean) and designated as the world's 13th Particularly Sensitive Sea Area (PSSA) by the International Maritime Organisation (IMO) in 2012. In the same year it was officially declared a National Park, making it the largest National Park in the Netherlands (DCNA, 2017; DCNA, n.d.).

More information on the Saba Bank and previous expeditions can be found in the special edition of BioNews: <http://www.dcnanature.org/wp-content/uploads/2018/09/BioNews-SabaBank-2.pdf>



Map of a large submerged carbonate platform: the Saba Bank. The island Saba is the "green dot" on the right. The fifth stage of the NICO expedition focused on the deep-water environments (> 100 meter) north and south of the Bank. Image credit: © Gerard Duineveld (NIOZ Sea Research)

Exploring the deep waters

Dr. Gerard Duineveld and Dr. Furu Mienis of NIOZ Sea Research were the chief-scientists of the fifth leg of the NICO expedition. Their project focused on the Saba Bank's deep-water environments (100 meter and beyond) and their main goal was to determine the biodiversity of the deep slopes and describe how environmental conditions such as turbulence, currents, mixing and food-supply influence life in the deep-sea (Nagelkerke & Duineveld, 2017). Their research area included the northern and southern side of the Bank (van Duin, 2018a).

Moorings

Two thermistor string moorings were placed on the northern and southern side of the Bank, respectively, for hydrodynamic, temperature and turbulence measurements in the first 300 m of the water column above the bottom. Data collected with the thermistors will provide valuable insights on how the topography of the Bank interacts with the currents, creating turbulence and mixing (Duineveld & Mienis, 2018).

Video hopper

Video-transects of two hours each were made between 40 to 1.400 meters with a tethered video frame equipped with one camera directed to the

seabed and one camera directed straight forward. Video footage is displayed live on the ship (van Duin, 2018a; van Duin 2018c) and provided a very first exciting view on what the deep-sea environment looks like and what creatures can live there.

CTD and (core) samples

Along the video transects Conductivity Temperature Depth (CTD) casts were carried out to measure several environmental conditions that are influencing the deep-sea habitats such as salinity and temperature. In addition water samples were taken at different depths throughout the water column. To get a more complete view on biodiversity, geology and chemistry, sediment samples were taken from the seabed with a box-corer (Nagelkerke & Duineveld, 2017).

Baited experiments

A specially designed lander (ALBEX-lander) equipped with bait was dropped on the seabed at depths of 450-1.400 meters. The bait attracted species and two cameras and infrared lights made filming possible whilst not attracting organisms or chasing them away. Also two cages with bait were attached to the frame of the lander to trap scavengers. The number and approach time of species were recorded and this together with (water) flow rate will be used to give a first

glimpse of species richness and density (Rijn et al. 2018a; 2018b).

(e)DNA

An advanced environmental DNA (eDNA) technique is being used to estimate the species diversity and abundance in the water samples (Speksnijder et al. 2015; Duineveld & Mienis, 2018). Fish and other organisms leave behind DNA (so-called eDNA) in their habitat through faeces, gametes, skin cells, etc., and researchers are now able to isolate this DNA from environmental samples (water, soil), amplify and then sequence it to identify the taxonomic identity of the species by their DNA fingerprints (Littlefair et al., 2017).

Bottom trawling and DNA analysis

Lastly, species were collected by bottom trawling. All collected species will be identified, individually DNA fingerprinted and submitted to Naturalis' Biodiversity collection (Beentjes et al. 2015). A DNA fingerprint reference library for the Saba Bank's deep marine habitats will also be made (Speksnijder & Pracht 2018). In addition fauna will be used to analyze the food web of the deep flanks of the Saba Bank.

First findings

Although the large collected dataset is still being analyzed, the researchers kindly shared already

some interesting first findings about the Saba Bank's deep sea.

Seabed

The seabed seems to be dominated by soft sediment suitable for endofauna and epifauna such as sea urchins, sea cucumbers and starfish (Duineveld & Mienis, 2018; van Duin, 2018b). Areas with hard substrates provided also habitat for corals and sponges (van Duin, 2018b).



This image shows Saba Bank's seabed between 400-700 meters depth that was filmed with the video hopper. In the middle you can see two laser lights 30 cm apart that are used to determine the size of species. This photo shows five sea urchins (top left), a fish (middle) and a sponge.

Photo by: © NIOZ Sea Research

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What creatures can live in the deep dark depths?

The researchers recorded shrimps, congers of up to two meters long and sharks. Also impressive were the giant isopods (*Bathynomus*) of more than 10 cm that are related to the woodlouse (pill bug).

Check out this video to see the Saba Bank's deep depths:
<https://www.youtube.com/watch?v=GoLaNmRlJfko>

All collected data are taken to the Netherlands for further analysis and we will know in the coming time which species new to science have been discovered. As the scientists investigated for the first time the only deep-sea habitat of the Kingdom of the Netherlands, many species that they found are likely first records for our country (van Duin, 2018b).

Spatial differences

First observations show spatial differences in fish densities. The baited videos show f.e. larger numbers of snappers in the relative shallows on the southern side. It was also found that the steep southern slopes have a higher biodiversity than the northern slopes especially between 100 and 500 meters depth (van Duin, 2018a).

The water around the Saba Bank seems more productive than the water on top of the Bank concluded from the observed algae densities (van Duin, 2018a). This is an important finding as the deep-sea is dependent on this primary productivity. Future research is needed to reveal the relationship between the top of the Saba Bank and its surrounding deep waters to understand the functioning of the complete ecosystem (van Duin, 2018b).

Even though the NICO expedition has ended, the researchers are still processing all the collected data and we are looking forward sharing their discoveries in future editions of BioNews.

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A giant isopods (*Bathynomus*) of more than 10 cm.

Photo by: © Ulrike Hanz

Check out this video on the fifth leg of the NICO expedition:

<https://www.youtube.com/watch?v=L9tr6X6sJNw>
Produced by The Online Scientist



<https://www.facebook.com/NICO-expedition-370772906669783/>



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