

SAIL4OXYGEN

A Citizen Science Project for
Yacht Crews

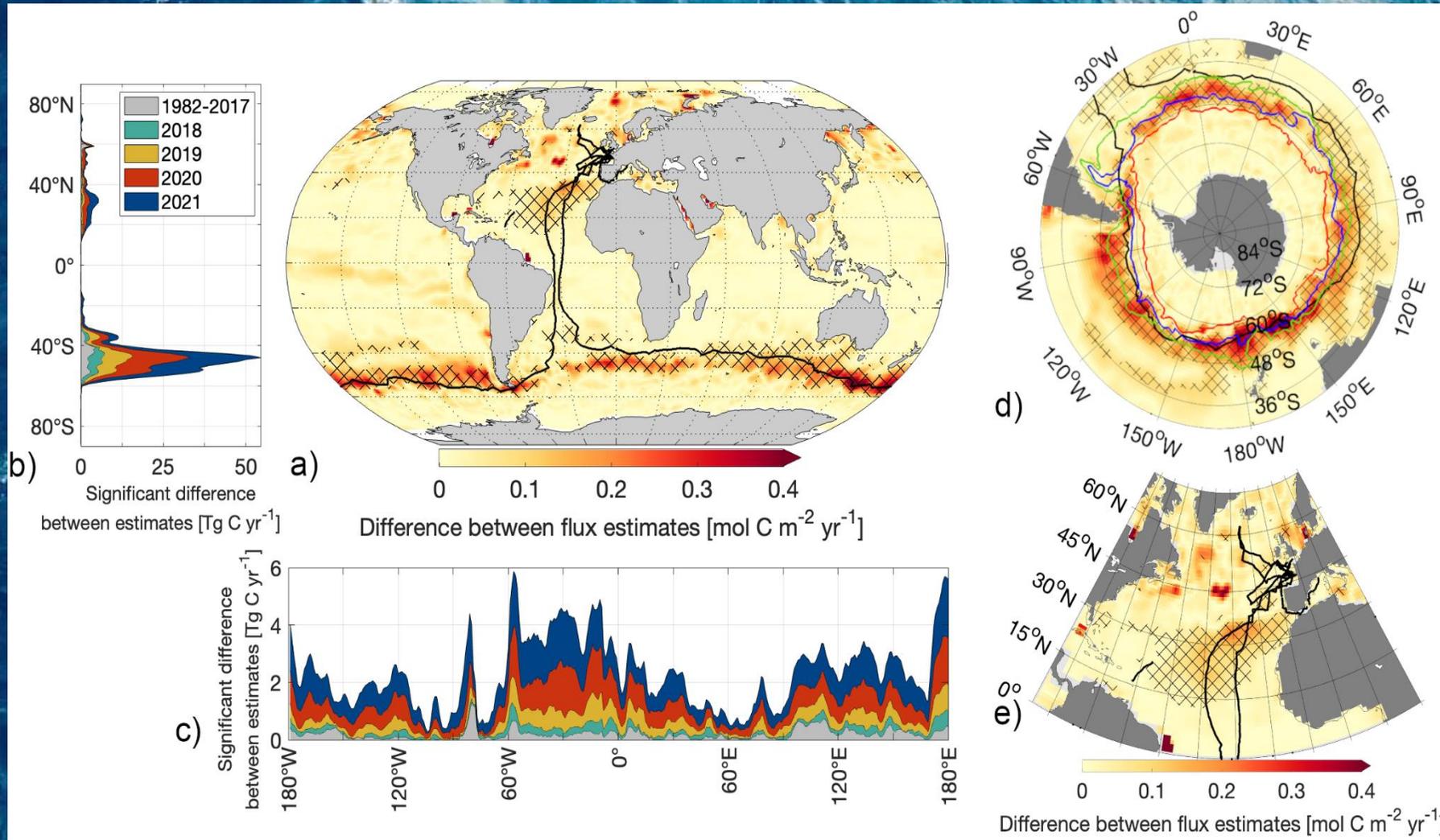
Toste Tanhua Chemical Oceanographer



A history of working with sailors



Can the data from one boat make a difference?



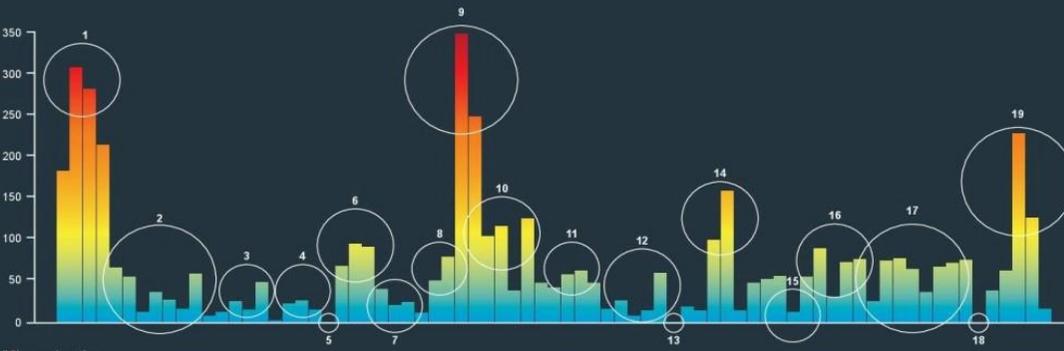
Behncke et al., in preparation

Microplastic sampling during the Volvo Ocean Race

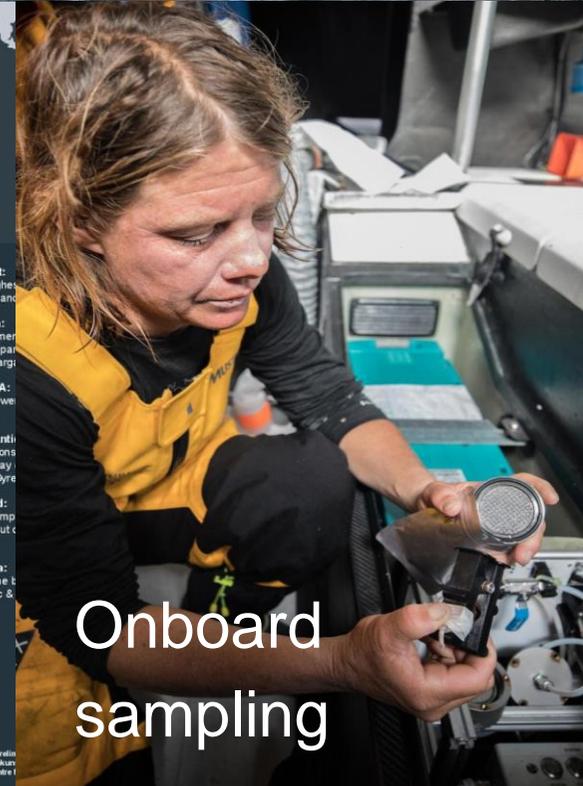


Volvo Ocean Race 2017-18

Microplastics Data



- North Atlantic Ocean and Mediterranean Sea:** High microplastics levels may be attributed to the proximity to the coast, strong ocean currents and busy shipping routes.
- Atlantic Ocean:** Progressing south, levels decreased with distance from land, with a relative increase closer to South America, an area with strong surface currents.
- South African coast:** Microplastic pollution near Cape Town may partly originate further north due to the strong Agulhas current, which flows from the northern Indian Ocean.
- Indian Ocean:** Relatively high microplastic content in these remote areas are likely due to currents originating further north.
- South of Great Australian Bight:** One of only 3 sample areas where no microplastics were found.
- Australian coast:** Microplastic concentrations will be affected by currents coming from the northern Indian Ocean & Indonesian archipelago.
- From Melbourne to Hong Kong:** Recorded levels were lower in the open water of the Equatorial Pacific.
- Philippine Sea:** The measurement of 75 particles/m³ may be due in part to patchiness of particle distribution as higher levels were recorded in a more inshore sample from this area.
- South China and North Philippine Sea:** High levels were measured in an area coinciding with the Kuroshio current which feeds into the North Pacific Subtropical Gyre.
- Equatorial Pacific:** Average levels in this region were higher than recorded on the previous leg. Prevailing currents have a significant impact on microplastic distribution in this area.
- Approach to New Zealand:** Progressing south through the Coral Sea the concentration increased steadily to a level of 60 particles/m³ in the sample closest to Auckland.
- Remote Pacific near Point Nemo:** Microplastic levels of 9-26 particles/m³ in an area further from land than anywhere else on Earth, & a level of 57 particles/m³ off Cape Horn.
- South America east coast:** One of only 3 samples along the race route with 0 microplastic particles recorded.
- Brazilian coast:** Levels were highest close to mainland.
- Caribbean Sea:** A low measurement have been due part blockages by sargassum.
- East of the USA:** Measurements were 89 particles/m³.
- North Mid-Atlantic:** The relatively open Atlantic may be North Atlantic Gyre.
- West of Ireland:** One of the 3 samples.
- Skagerrak area:** High levels in the Baltic & North Sea.

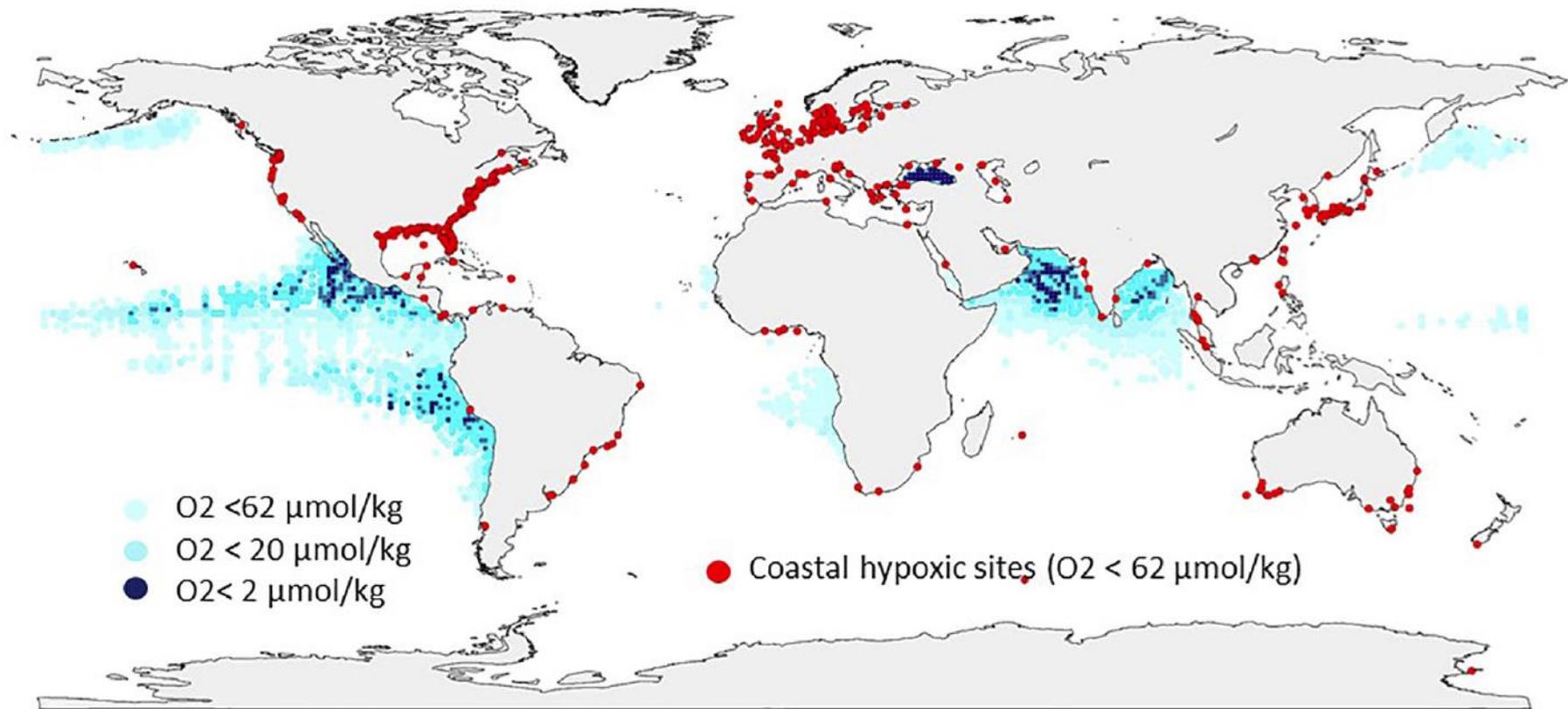


Onboard sampling

Prof. Dr.-Ing. Sören Gulderson
GEOMAR Helmholtz Centre

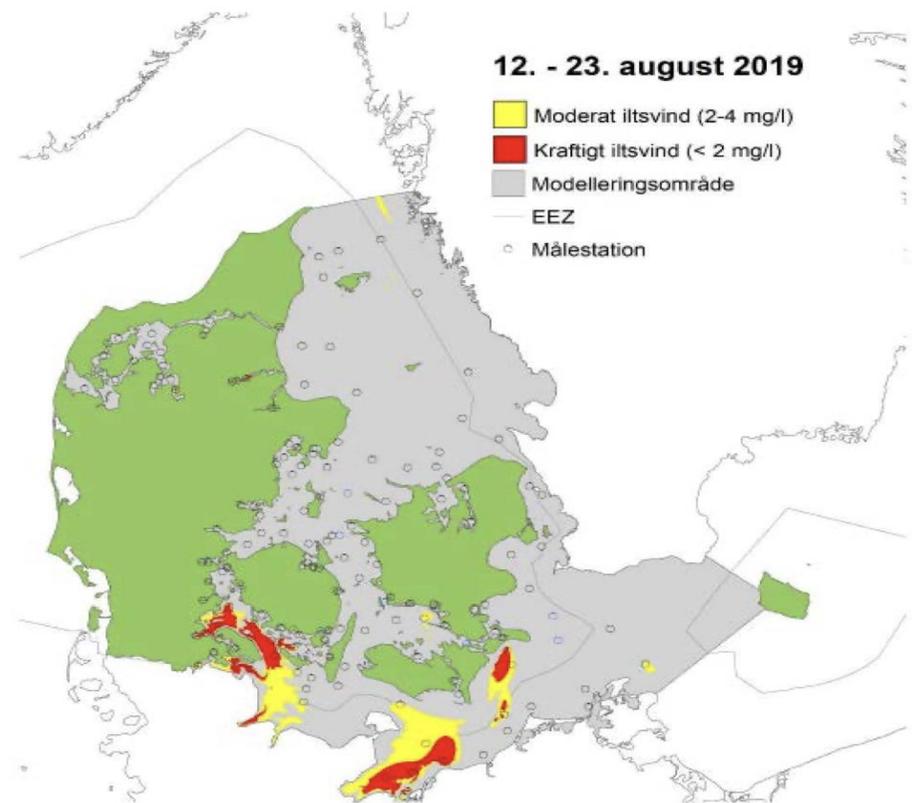
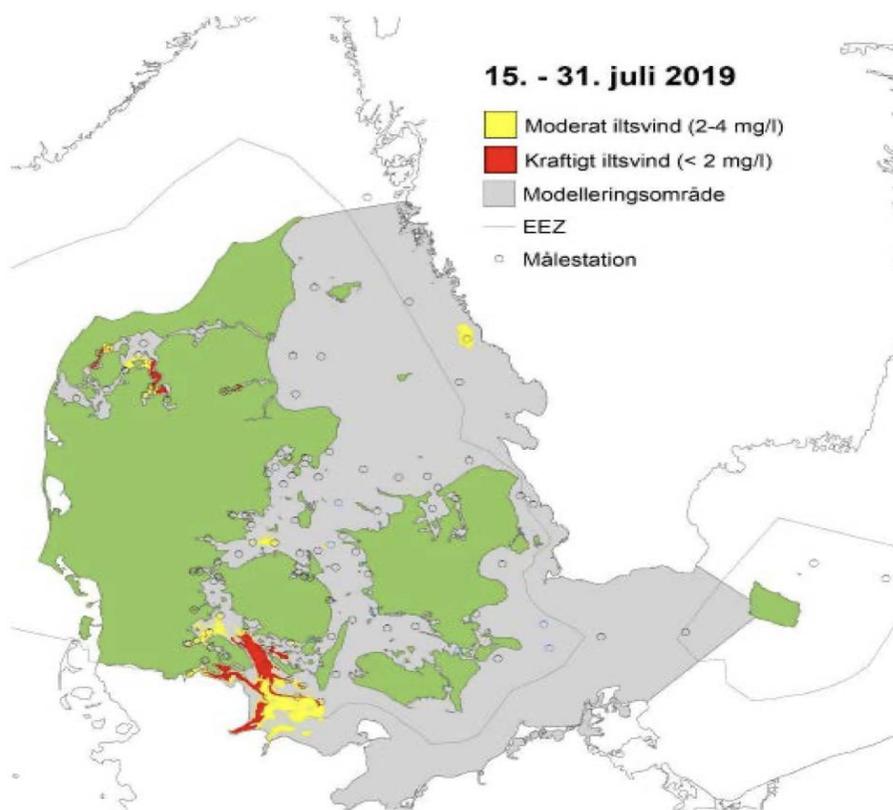
BACKGROUND

- The ocean is loosing oxygen –more coastal hypoxic sites



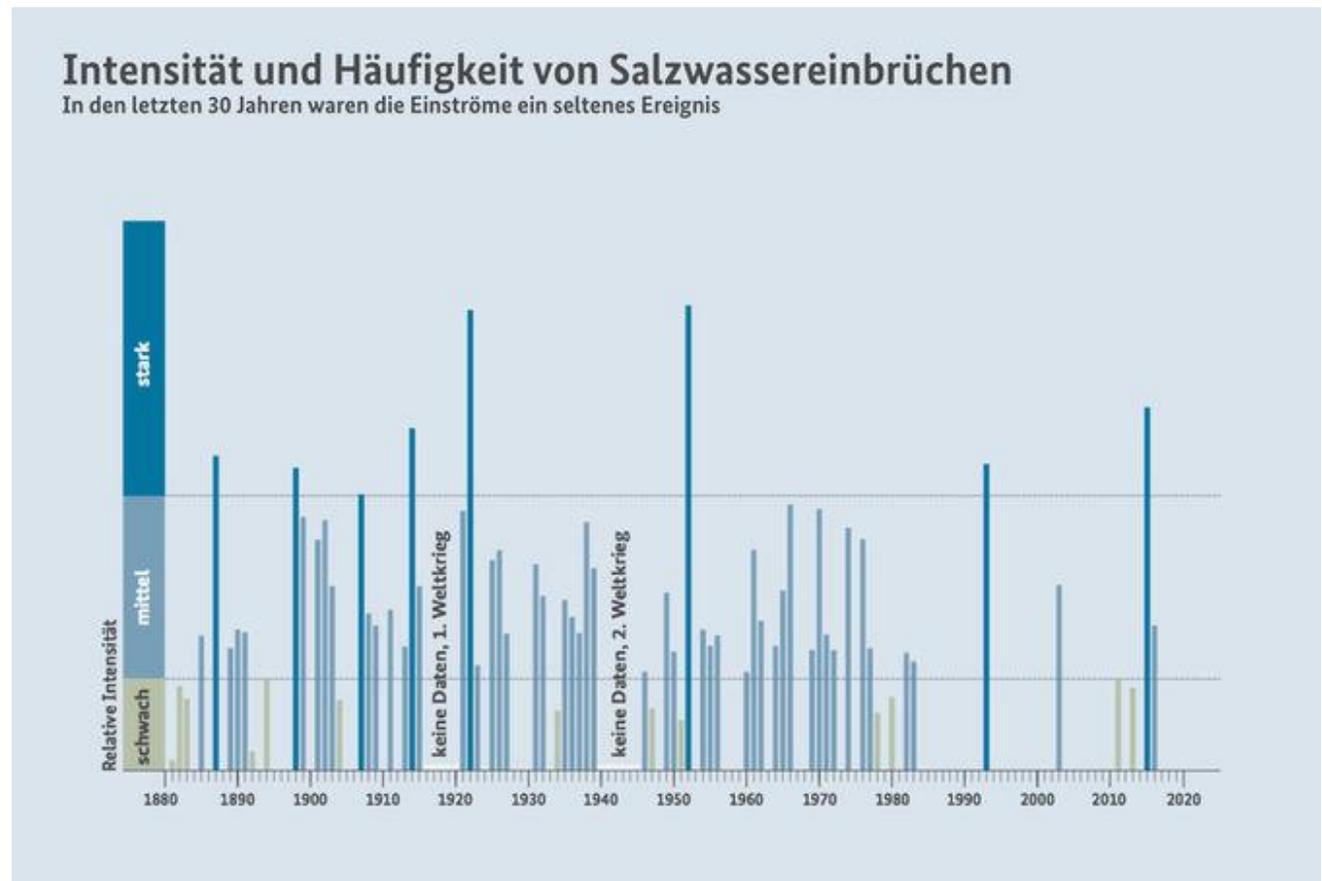
BACKGROUND

- High nutrient loads lead to strong algal blooms in the Baltic
- Decomposing organic material consume oxygen
- The strong stratification prevents re-oxygenation

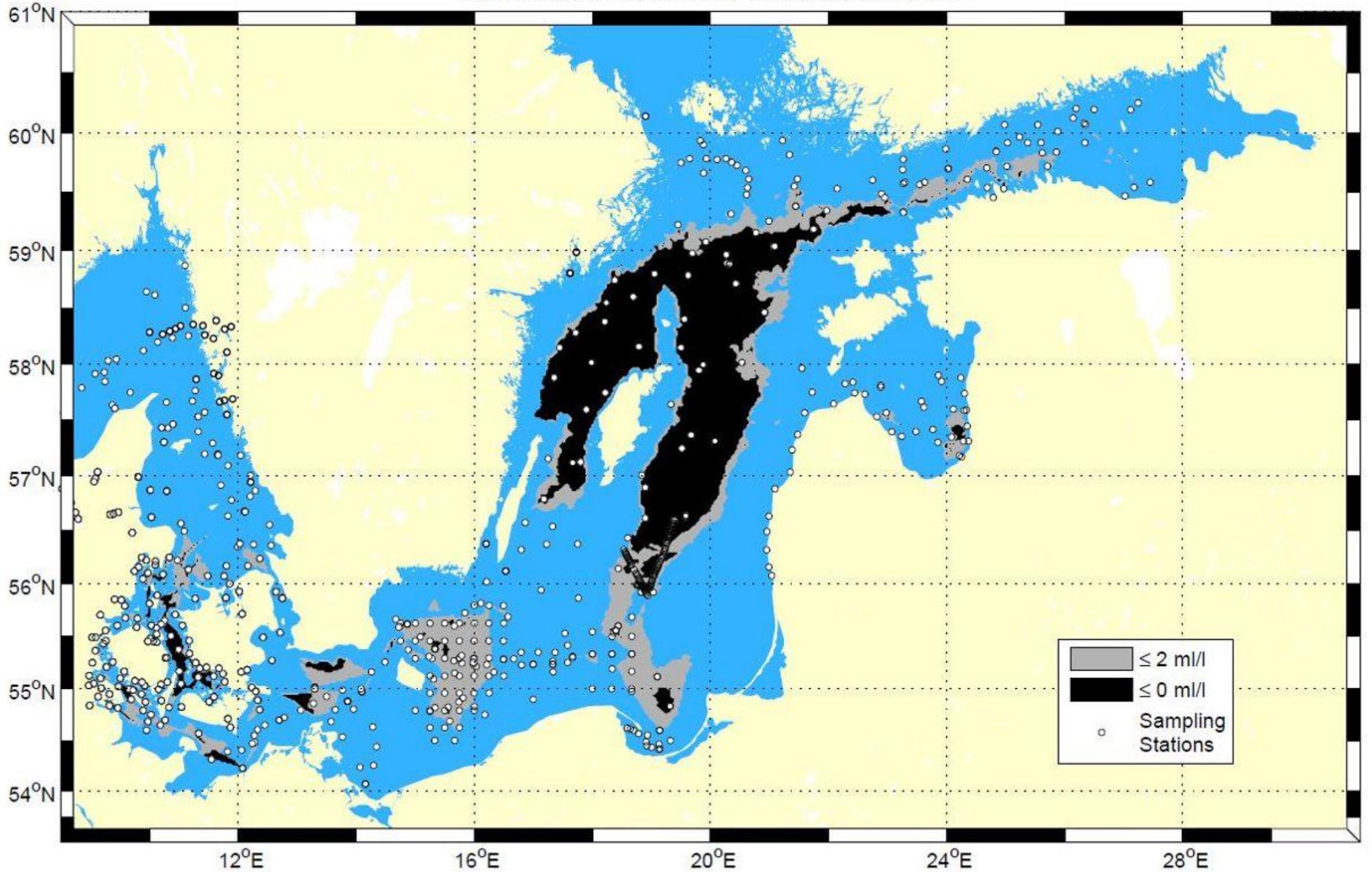


BACKGROUND

- Lack of, or little deep-water exchange with the North Sea leads to increased areas of anoxia

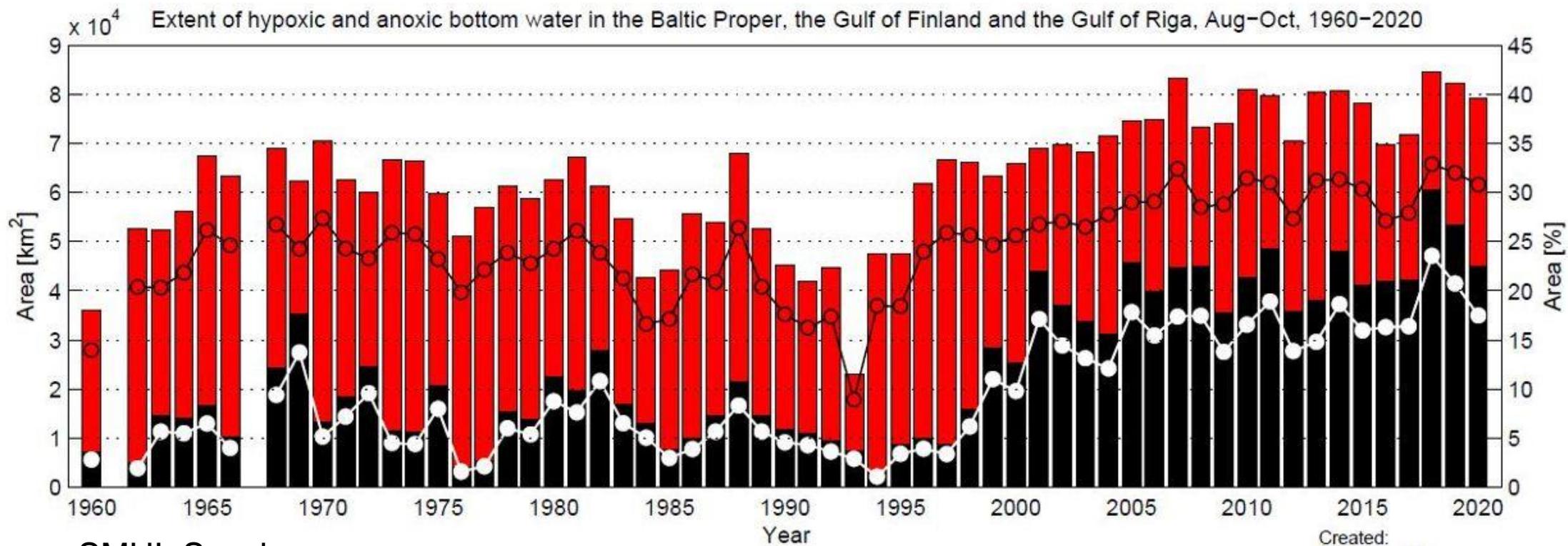
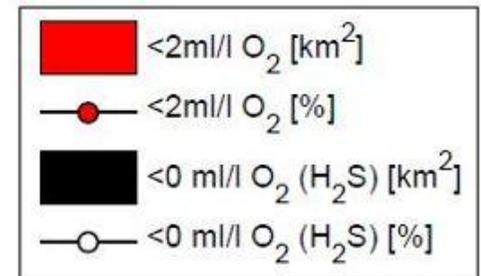


Extent of hypoxic & anoxic bottom water, Autumn 2020



SMHI, Sweden

Created:
February 2021

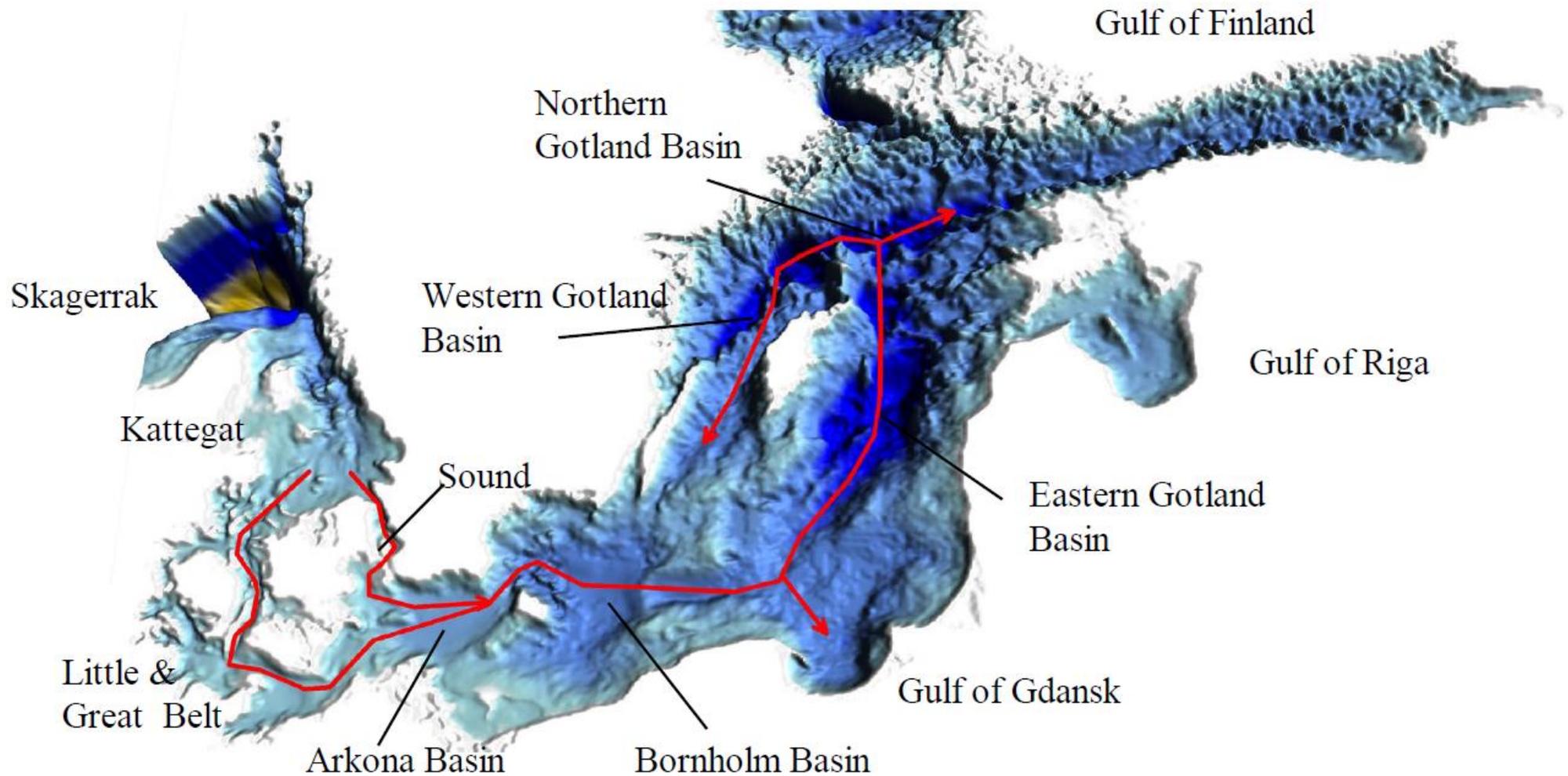


SMHI, Sweden

Created:
February 2021



Oxygen supply partly driven by topography



BACKGROUND

The United Nations Decade of Ocean Science for Sustainable Development



Declining Oxygen in
the World's Ocean and
Coastal Waters





MOTIVATION Trans Ocean

- > 4.800 members, > 2.200 Yachts in Trans Ocean e.V., thereof > 500 on long-distance cruising
- Ocean and climate protection as top-3 themes by members
 - Let's do something about that

Connections between GEOMAR and TransOcean

Guiding Question:

What research theme could benefit from engaging sailors as citizenb scientists?

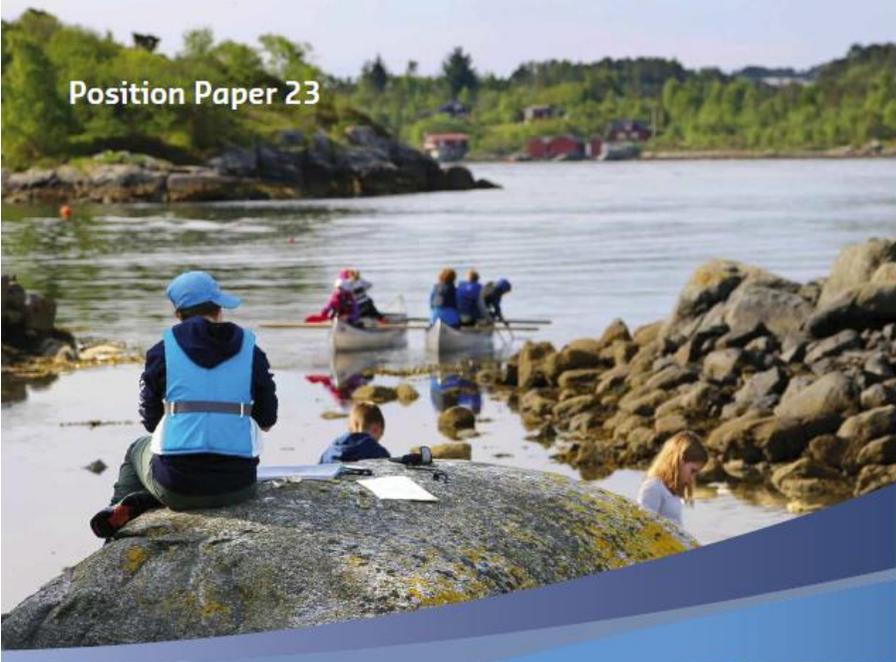


Marine Citizen Science

Advancing Citizen Science

for Coastal and Ocean Research

Position Paper 23



Citizen Science is the collaboration between scientists, and the general public as volunteers, to gather and/or analyse data relating to the natural world.

The Citizen Science formula is simple: to give people a structured way to record their observations and share them with scientists

Citizen Science is a process where citizens can become an integral part of the sharing of results and findings within the wider community and the interaction is very much a two-way process.

Marine Citizen Science

KEY CHALLENGES AND OPPORTUNITIES PROVIDED BY CITIZEN SCIENCE	
Challenges	Opportunities
Recognition of scientific value	Timely data from disperse sources
Maintaining scientific rigour and data quality	Power to address large knowledge and funding deficits
Involvement of Citizen Scientists representing a broad spectrum of society	Educating public about environmental policy issues such as biodiversity
Political and financial guarantees for action on findings	Participatory democracy

The value of Citizen Science lies in its ability to contribute to scientific knowledge, the benefits for education, its societal value and its value for policy making.



The 10 Principles of Citizen Science

- 1. Citizen Science projects actively involve citizens in a scientific endeavour that generates new knowledge or understanding;**
- 2. Citizen Science projects have a genuine science outcome;**
- 3. Both the professional scientists and the Citizen Scientists benefit from taking part;**
- 4. Citizen Scientists may, if they wish, participate in multiple stages of the scientific process;**
- 5. Citizen Scientists receive feedback from the project;**
- 6. Citizen Science is considered a research approach like any other, with limitations and biases that should be considered and controlled for;**
- 7. Citizen, Science project data and meta-data are made publically available and where possible, results are published in an open access format;**
- 8. Citizen Scientists are acknowledged in project results and publications;**
- 9. Citizen Science programmes are evaluated for their scientific output, data quality, participant experience and wider societal or policy impact;**
- 10. The leaders of Citizen Science projects take into consideration legal and ethical issues surrounding copyright, intellectual property, data sharing agreements, confidentiality, attribution, and the environmental impact of any activity.**



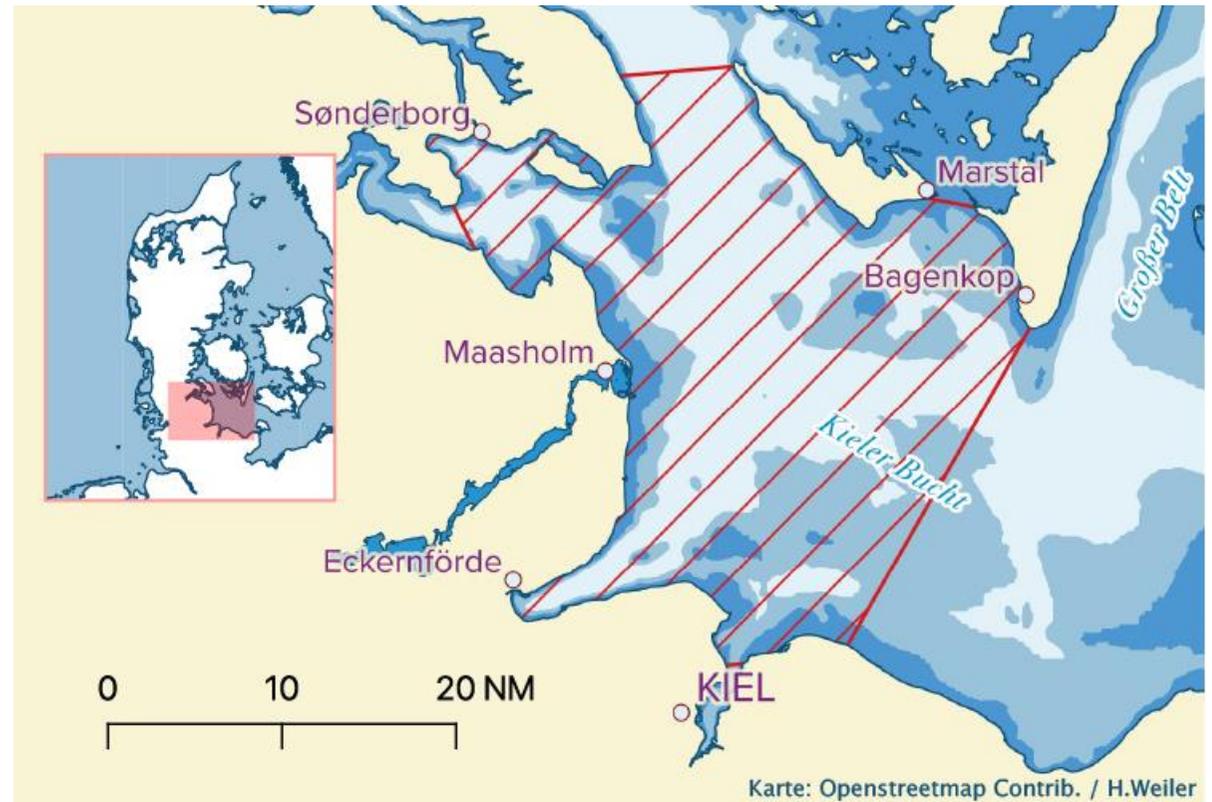
SAIL⁴OXYGEN

- Sailing for Oxygen is a cooperation between TransOcean and GEOMAR, i.e. between a large cruising association and a large research organization
 - The project enable yacht crews to become active in marine research and to collect important data about the Baltic Sea
 - The project is funded by the German ministry of science and education (BMBF)
 - Time-line of the project is 2023-2025
- 

SAIL₄OXYGEN

Area

- For 2023 we concentrated on a relative small area in the South West Baltic – the Kieler Bay
- For 2024 we will expand the area to the Belt bridges in the north, and to Warnemünde in the east





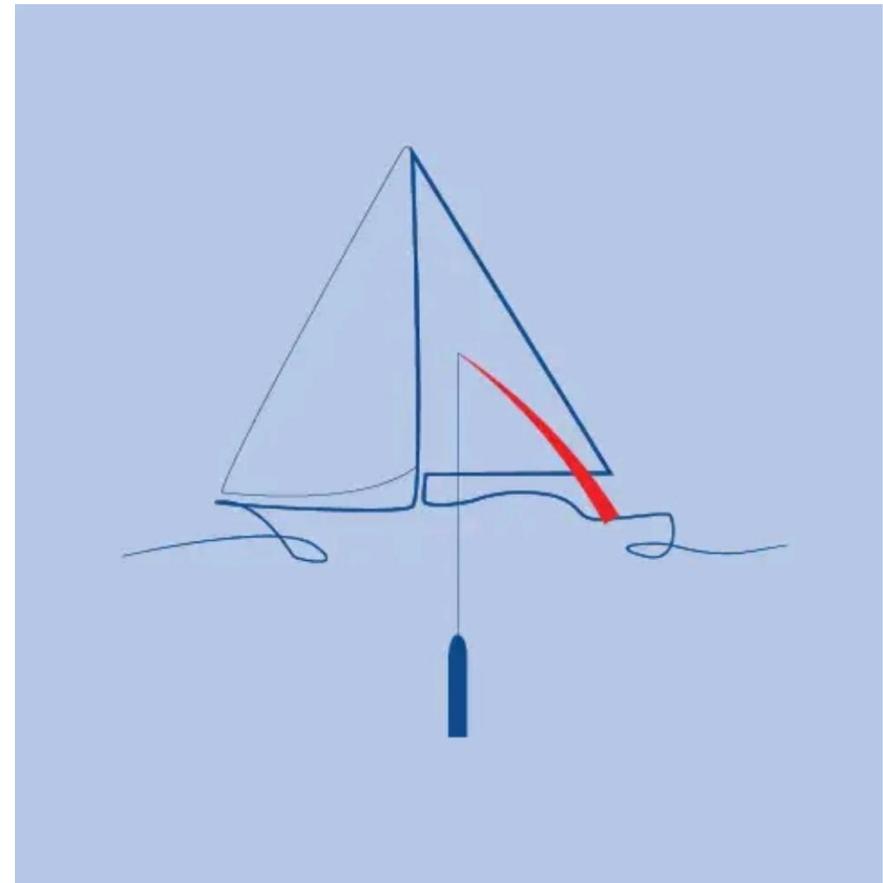
SAIL⁴OXYGEN

What are we doing?

- Yacht crews are measuring depth profiles temperature, salinity, pressure and oxygen in areas at least 10 meter deep in the southwest Baltic
 - The data are published on our data portal in near-Real Time, and submitted to data portals as quality controlled data by the end of the season
 - All the data are made freely available for agencies and other users
 - We are gathering experience with citizen science projects
- 

SAIL4OXYGEN

- The data are being transmitted together with the position by two mobile apps
- We have partners in marinas and ports that serve as distributors of the instruments



Logo Sail4Oxygen-App

IMPRESSIONS





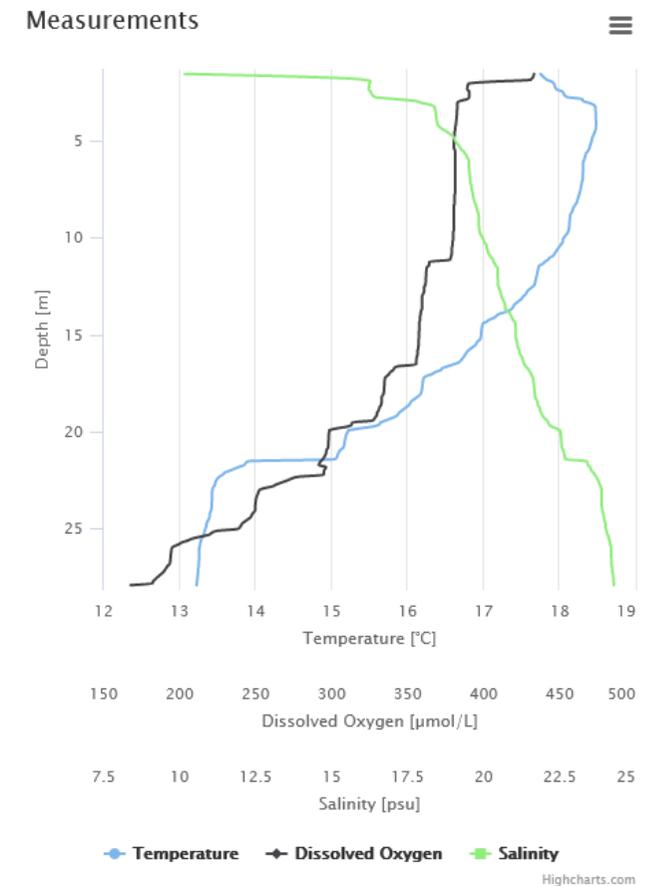
HOW ARE WE FISHING FOR DATA?

- Register on www.sail4oxygen.org
- Check the availability of instruments, get one in a port, and off you go
- When the conditions are right, lay by, activate the sonde and get the rod and reel ready.
- Make the profile
- Send the data over the app
- When you are done, return the instrument in a participating port



SAIL4OXYGEN 2023

- February
 - A kick-off meeting, and then a virtual meeting every 3-4 weeks
- April
 - Project formally started
- May
 - The first information material and a website with registration
- June
 - Official start of the project during the fly-by of the Ocean Race in Kiel
 - Initial contacts with ports and partners
- July
 - First Version of the Sail4Oxygen-App ready
- August
 - First measurements of a citizen scienc crew
 - First trial port is Kiel-Schilksee

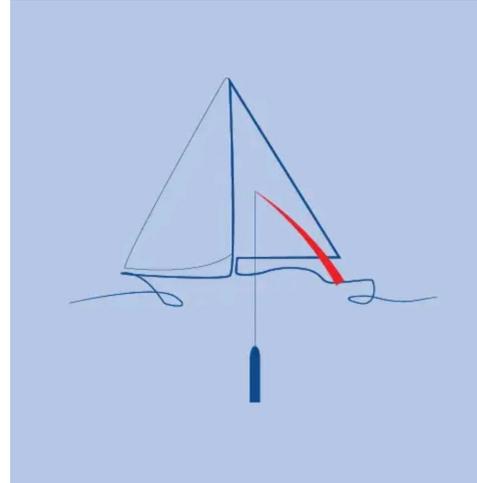


Data collected on 2023-08-30 10:54:25
At Position 54° 31.763' N, 10° 02.533' E
Device: Sonde EXO3 23A105105
Boat: Valentina

Beispielhafte Messergebnisse, Quelle: Beluga Portal

Outlook

- 8-10 Sondes will be available in 2024
- We will activate more (~10) ports
- Improvements of the app for transmitting data
- Dedicated mobile phones for the instruments



WHERE TO FIND THE DATA?

BELUGA Navigator Beta Dashboard Status Data Admin Tools About Last build: 2023-10-16 Login

Campaign: Sail4Oxygen [Website](#) Organization: GEOMAR, Trans-Ocean e.V. · Chief scientist: Toste Tanhua · Start: Aug 01 2023 Close feed

Platforms 2 All times in your local time

- Sonde EXO3 23A105105** Sonde a month ago
ID: 23105105 Length: 0.2 m Width: 0.2 m Height: 1.3 m Draught: 0.0 m
[Dashboard](#) [Data](#)

54° 21.505' N 10° 10.462' E
Current position

- EXO3 -104** Sonde 14 days ago

Feed 3 Filter by tag...

- Wir sind jetzt ein Forschungsschiff!**
Die ersten Yachten sind mit ihren Messwerten zurück und der erste Tester fasste die Erfahrung ganz vorzüglich zusammen: „Wir haben Wissenschaft gemacht. Wir sind jetzt ein Forschungsschiff!“. Dabei haben wir auch einige Erkenntnisse gewonnen,...
Trans-Ocean e.V.
August 29 2023 News
- sail4oxygen - Erste Crews mit Häfen rund um Kiel legen los**
Die ersten sail4oxygen-Sonden sind da und ausgiebig getestet. Zeit, in die produktive Phase zu wechseln! Dafür starten wir mit ersten Seglern in der Region Kiel. Ein kleiner Überblick zum Stand beim Projekt "Citizen Science: Sailing for Oxygen"
Trans-Ocean e.V.
August 04 2023 News
- Citizen Science: Sailing for Oxygen**
Wir machen Wissenschaft. Citizen Science: Sailing for Oxygen ist ein gemeinsames Forschungsprojekt mit dem GEOMAR Forschungszentrum in Kiel. Dabei helfen wir Meeresforscher, wichtige Informationen in

These raw data have not been subjected to our quality control or quality ×

**THE
BELUGA-
Portal OF
GEOMAR**

The crews
can check
their own
data

Thank you!



sail4oxygen.org