

Examples from the Iliad pilots in Norway  
EMB, 25.04.2024,  
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# DIGITAL TWINS OF THE OCEAN

# Ute Brønner

Ocean Data Enthusiast at SINTEF Ocean  
Member of the UN Decade

Ocean Data Coordination Group  
Leader of the TURTLE project and  
working group 5 under DITTO on  
digital twin interoperability

Work package lead for pilot demonstrators in  
ILIAD, one of the EU Digital Twins  
of the Ocean projects

<https://oceanexpert.org/expert/50093>

[www.linkedin.com/in/utebroenner](https://www.linkedin.com/in/utebroenner)



**Ute Brønner**

Passionate about understanding the ocean  
environment through data from the combina...

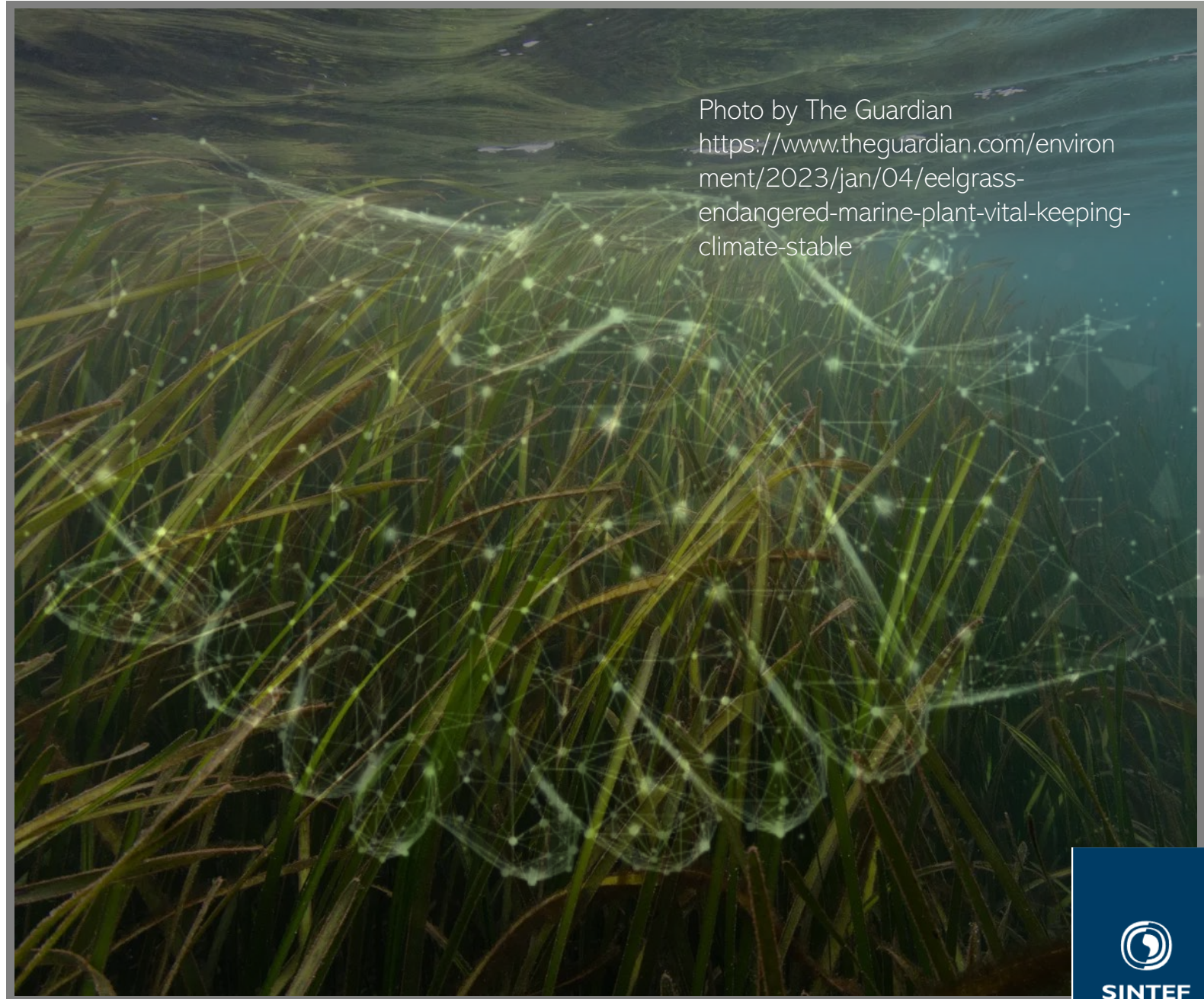


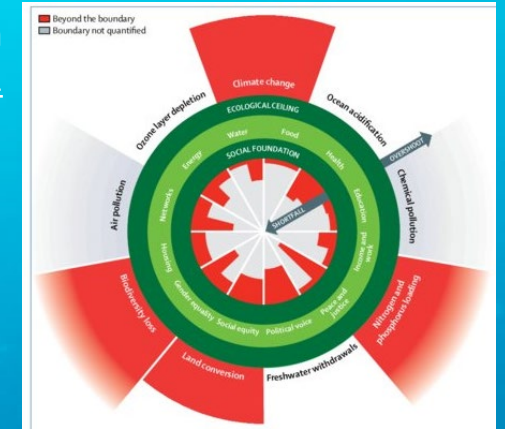
Photo by The Guardian  
<https://www.theguardian.com/environment/2023/jan/04/eelgrass-endangered-marine-plant-vital-keeping-climate-stable>



Protect and restore marine and freshwater ecosystems and biodiversity, in line with the EU Biodiversity Strategy 2030.

Kate Raworth

DOI: [10.1016/S2542-5196\(17\)30028-1](https://doi.org/10.1016/S2542-5196(17)30028-1)



# DIGITAL TWINS IN OCEAN SUSTAINABILITY

# DIGITAL TWINS



Virtual  
representations  
of real-world 'things'

assets (physical twin), processes,  
people, places, systems, and devices

Synchronised  
at specific frequency  
and fidelity  
'reacting' to  
incoming data streams

Observations & model data



Insights through  
predictive capability

Simulate scenarios,  
what if?  
Make decisions

image:  
[https://www.expresscomputer.in/news/  
what-is-a-digital-twin-why-is-it-  
important/45995/](https://www.expresscomputer.in/news/what-is-a-digital-twin-why-is-it-important/45995/)

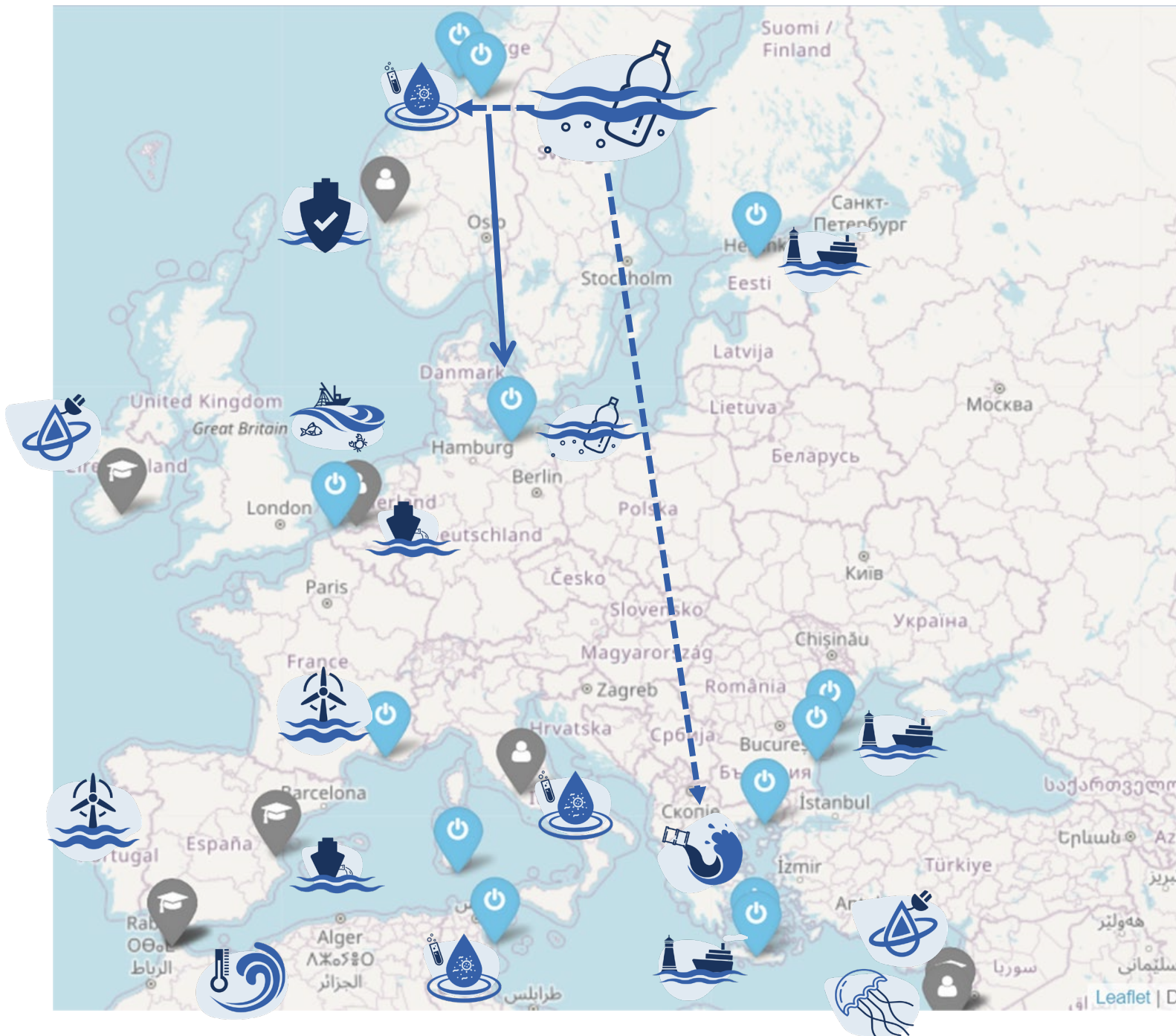


THE SUPERPOWER OF DIGITAL TWINS IS

# CONTEXTUALISATION

Photo by The Guardian  
<https://www.theguardian.com/environment/2021/jan/04/eelgrass-endangers-marine-plant-vital-keeping-climate>





Digital twins of the ocean

Iliad pilot 03:  
Environmental monitoring  
incl. (plastic) pollution,  
or short: water quality pilot



OceanLab



Technology for a better society



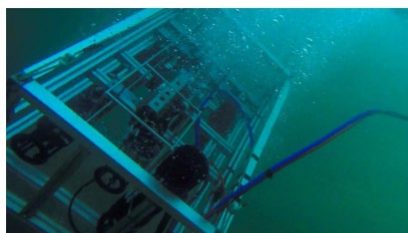
NTNU

Kunnskap for en bedre verden

Iliad pilot 03: Environmental monitoring incl. (plastic) pollution, or short: water quality pilot



OceanLab Node 1: Subsea Facility



OceanLab Node 4: Marine Observatory

NTNU, SINTEF Ocean,  
Fraunhofer,  
LEITAT, BUAS





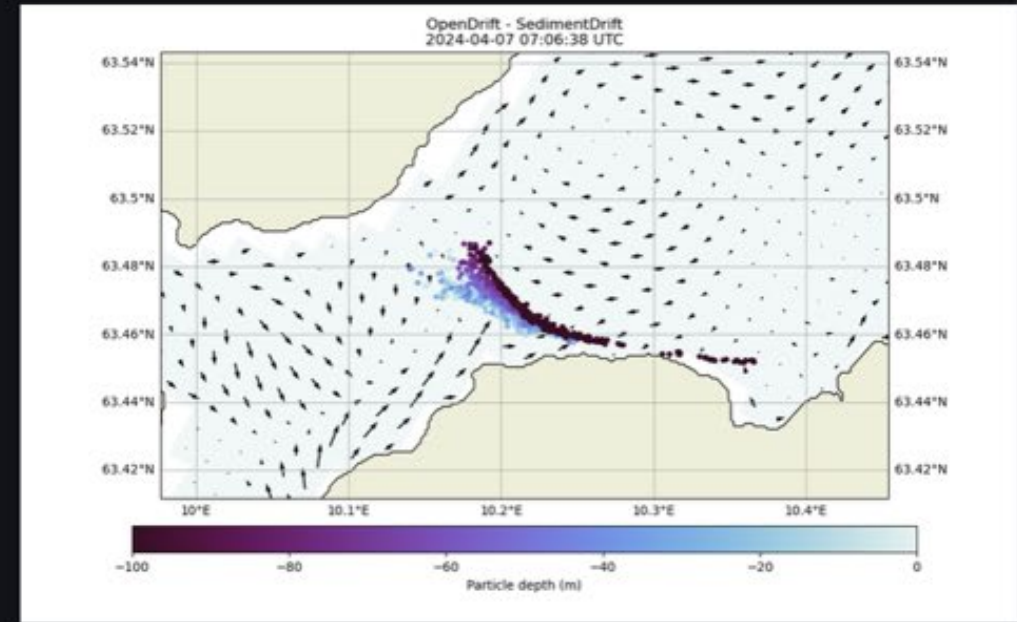
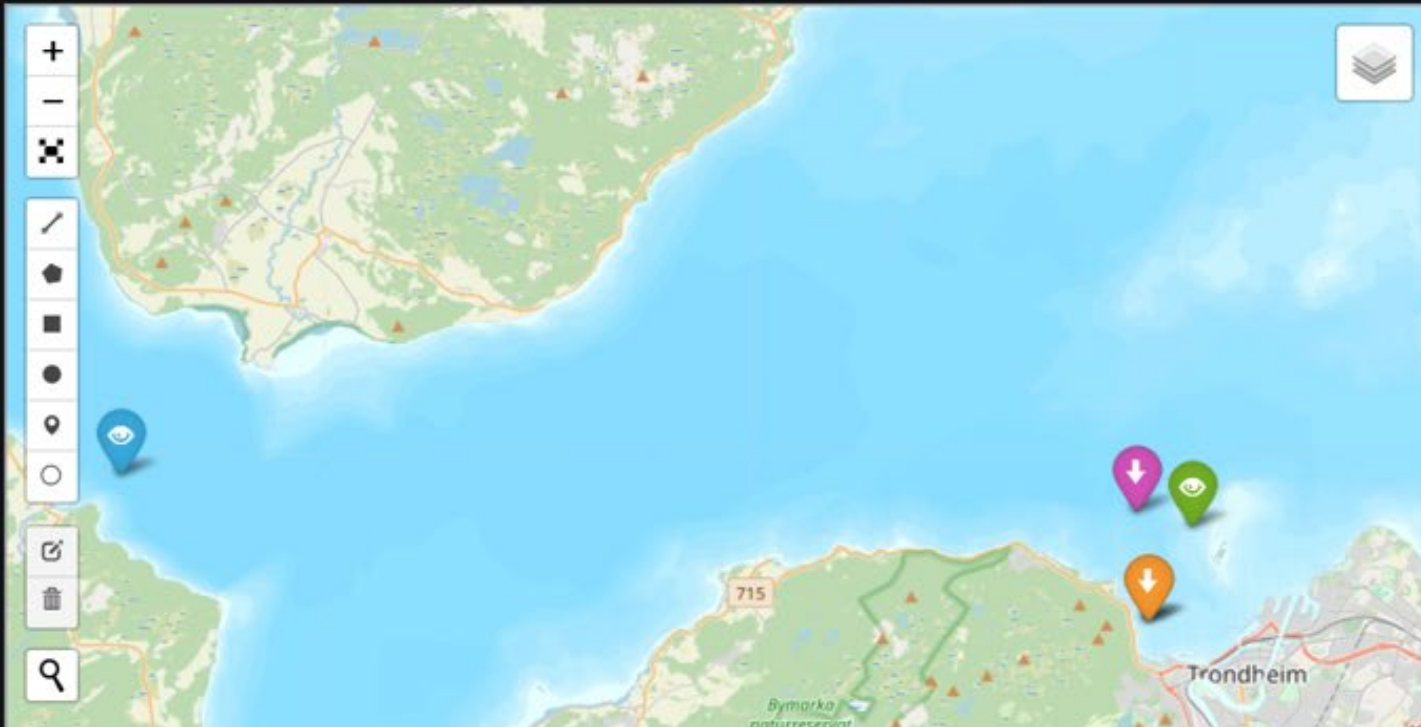
Disclaimer: This page is intended for demonstration purposes only, there may be inaccuracies in datasets and visualizations.

Try it out at [twin.oceanlab.no/](https://twin.oceanlab.no/)!

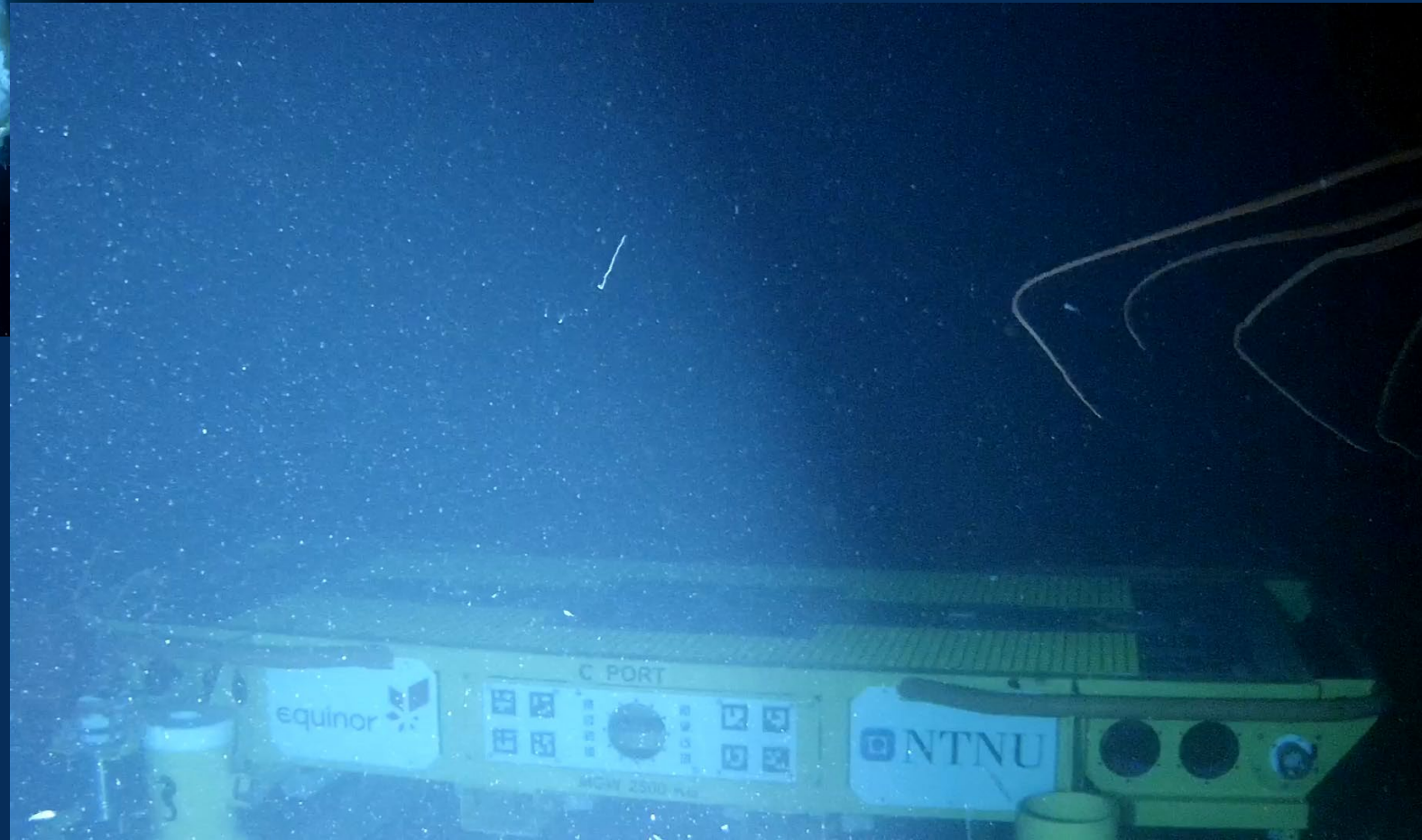


DEMONSTRATION ONLY - SilCam particle transport with Opendrift and NorKyst800/ADCP data

OpenDrift particulates simulation



# Particles?!





Digital twins of the ocean

Iliad pilot 07.01: Smart Monitoring  
for the Norwegian Aquaculture  
Industry,  
or short: aquaculture pilot



# WHY?

While farmed salmon are fundamentally well-adapted to life in sea cages, gill problems, diseases, delousing operations, and the **aquatic environment** contribute to an increased risk of mortality in sea-farmed salmon.

In 2023 farmed salmon lethality was caused by exposure to string jellyfish in the fall of 2023 and preventive measures to contain the spread of pancreatic disease.

These losses of biomass are caused by conditions in the marine environment and a digital twin for smart monitoring can be a solution to increase fish welfare and biomass loss.





SINTEF



**Norwegian fish health**

Filter Map layers Theme

The result of the filtering is sites that meet all the filtering criteria in the selected week

More about filters

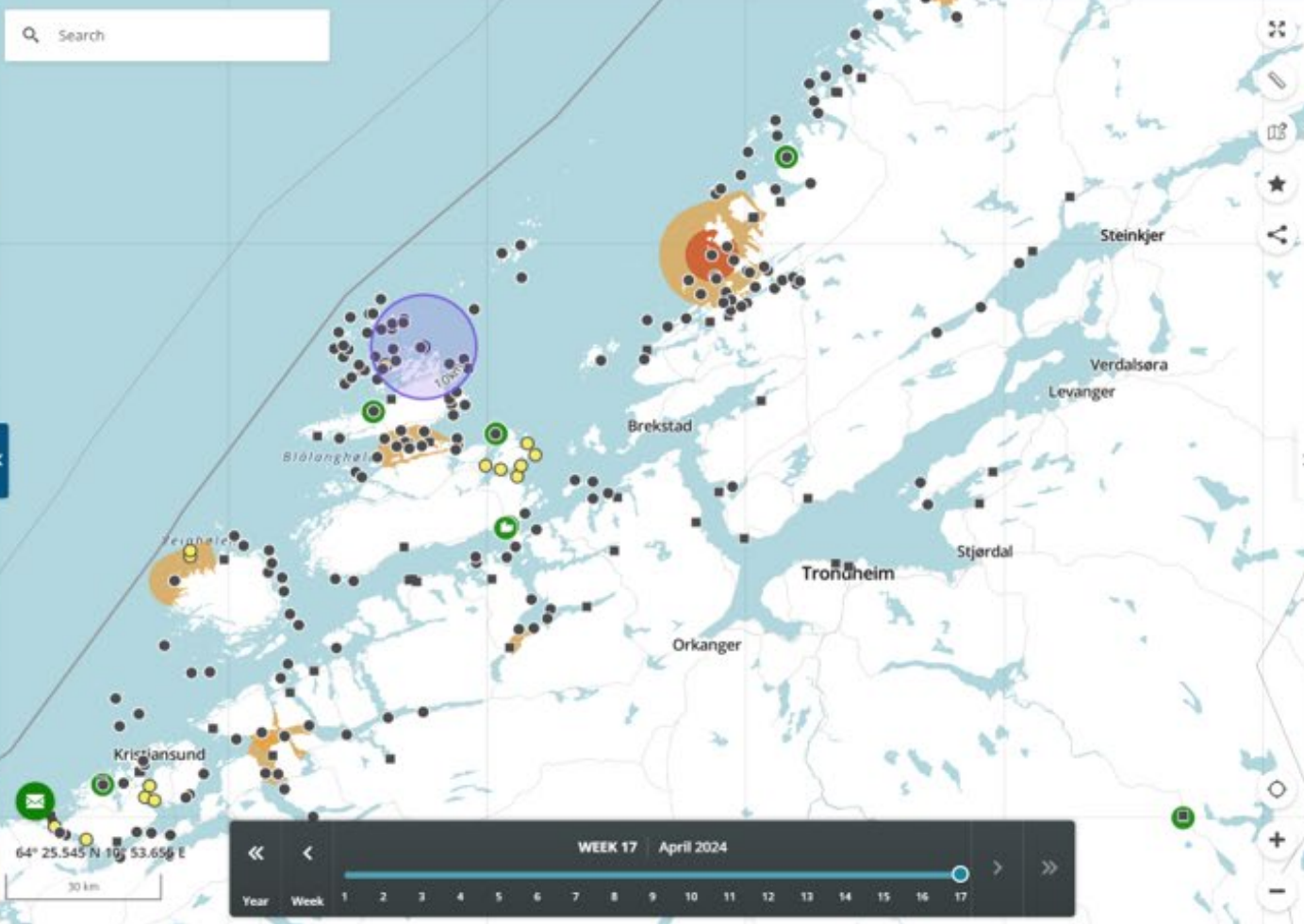
1748 aquaculture sites [Show list](#)

- Salmon lice
- Reporting
- Lice treatments
- Fish disease
- License
- Company
- Placement
- Custom areas

Login

Monday 01:54:47 PM v.24.4.12

BarentsWatch



**Week 17**  
April 22, 2024 - April 29, 2024

WEEK 17  
April 22, 2024 - April 29, 2024

My favorites

You can mark sites, vessels and fish slaughterhouses as favorites, and you will get a shortcut to them here.

The deadline for sending lice reports for this week has not expired.

0	1
Above lice threshold	Below lice threshold
0 % of the aquaculture sites which have reported lice	100 % of the aquaculture sites which have reported lice

More about the lice threshold

40	9
40 of the aquaculture sites have pancreatic disease (PD) or are suspected of having PD	9 of the aquaculture sites have infectious salmon anemia (ISA) or are suspected of having ISA

Amount of aquaculture sites above lice threshold

During week 16-26, the lice threshold for certain parts of the country is lowered

ILIAD Aquaculture Pilot

Intended for demonstration only: There may be errors and inaccuracies present in the datasets and visualizations

**Filters**

Year: 2024

Week: 5

Show follow:

Owner organization:  
Select...

**Data Layers**

- > Weather warnings:
- > Sea temperature:
- > Trajectory simulations:
- > Municipalities:
- > Production areas:



Deler av Øst-Finnmark  
Alert: Det er ventet lokalt moderat ising på skip i utsatte kyst- og fjordstrøk.



LOGO <


Home Measurements **Map** Alerts Settings

Brekstad Leksvik

### Munkholmen Buoy

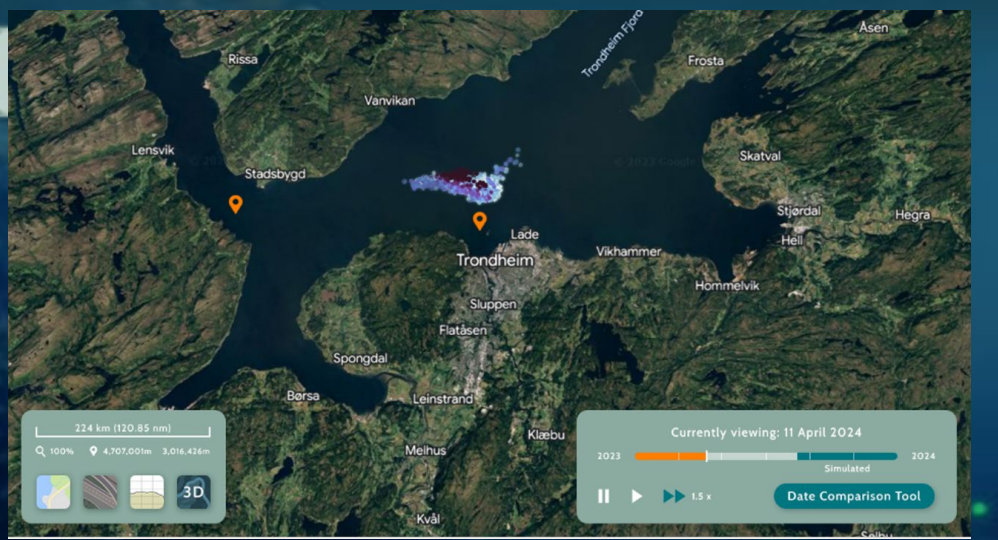
Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliqua. Quis ipsum suspendisse ultrices gravida. Risus commodo viverra maecenas accumsan lacus vel facilisis.

ATON MMSI: 992581014  
 Lat: 63° 27.45'  
 Lon: 010° 22.33'  
 Depth: 80 m



Orkanger Melhus Klæbu Tamra  
 Fannrem Kvål Selbusjøen Innbygda Seibu

## Measurements



224 km (120.85 nm)  
 Q 100% 4,707,001m 3,016,426m

Currently viewing: 11 April 2024  
 2023 Simulated 2024  
 1.5 x Date Comparison Tool

colliad

Home Measurements **Map** Alerts Settings

Brekstad Leksvik

Hasselvika Rissa Vanvikan Frosta Asen  
 Lensvik Stadsbygd Skatval Hegra  
 Vikhammer  
 Flatåsen  
 Spongdal Leinstrand  
 Borså Melhus Klæbu  
 Kvål Seibu

> Buoy

> Particle Type

- Copepods i
- Eggs i
- Plastics i
- Oil i

> Particle Size

> Density

> Prop. Speed

> Mov. Speed

> Depth

External Data

- Wind i
- Weather i
- Waves i

Add New Data Source

Currently viewing: 11 April 2024

2023 2024

1.5 x Date Comparison Tool



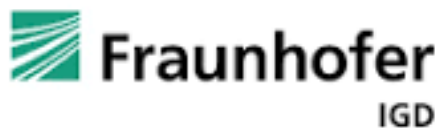
# DTO visualisation

# Procedural Ocean

Procedural Ocean transforms geo-data into detailed 3D oceanic landscapes, offering a vivid simulation of interactions between the environment, natural species, and human activities. It enables exploration, learning, and the testing of various scenarios, thereby enriching our understanding and improving decision-making in marine ecosystems.



DTO visualisation



Fraunhofer Institute for Computer Graphics Research IGD



# European Digital Twin of the Ocean

A leap in ocean knowledge and sustainable action





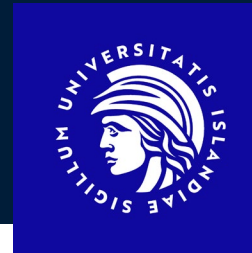
**HORIZON-MISS-2023-OCEAN-01-08**

*Integration of socio-ecological models into the Digital Twin Ocean  
Research and Innovation Action*



Logo generated by Dall-E

# Socio-Ecological Ocean Management Applications using Digital Ocean Twins



netcompany  
intrasoft



Stockholms  
universitet

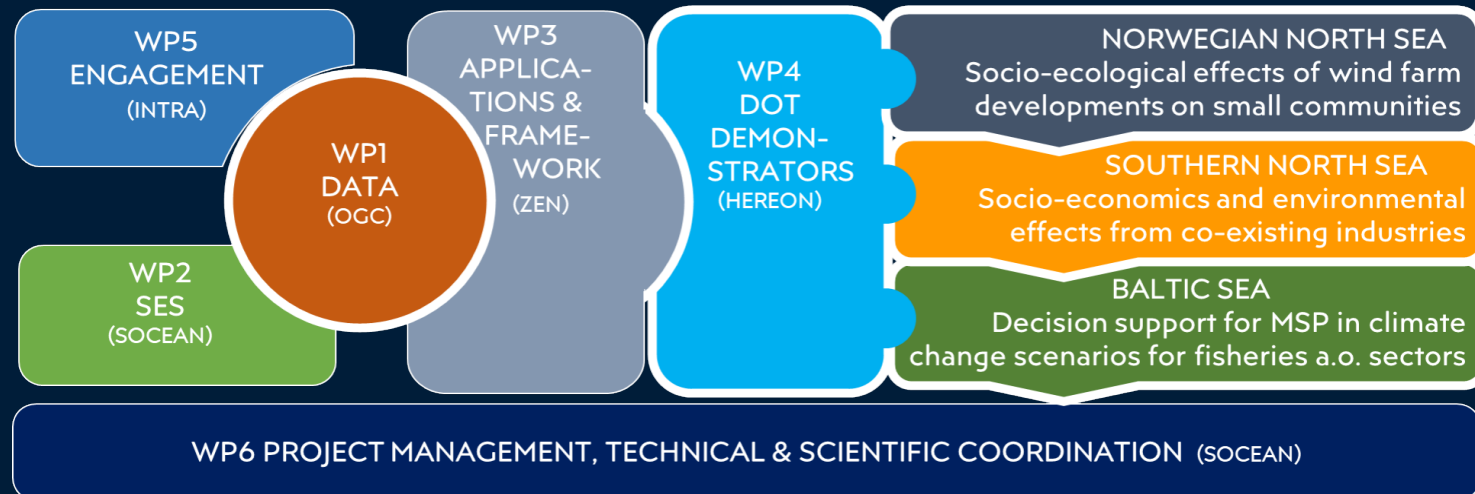


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GEOMAR

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Research&Innovation





**SOUTHERN NORTH SEA**  
Socio-economics and environmental effects from co-existing industries



Credit: [Nicolas Job / Ocean Image Bank](#)



**BALTIC SEA**  
Decision support for MSP in climate change scenarios for fisheries a.o. sectors



Image courtesy: <https://utsira-nord.nve.com/>

**NORWEGIAN NORTH SEA**  
Socio-ecological effects of wind farm developments on small communities



Image courtesy: <https://www.baltictimes.com/>