Conference Digital Twins @WUR: Bringing Digital Twins to Life

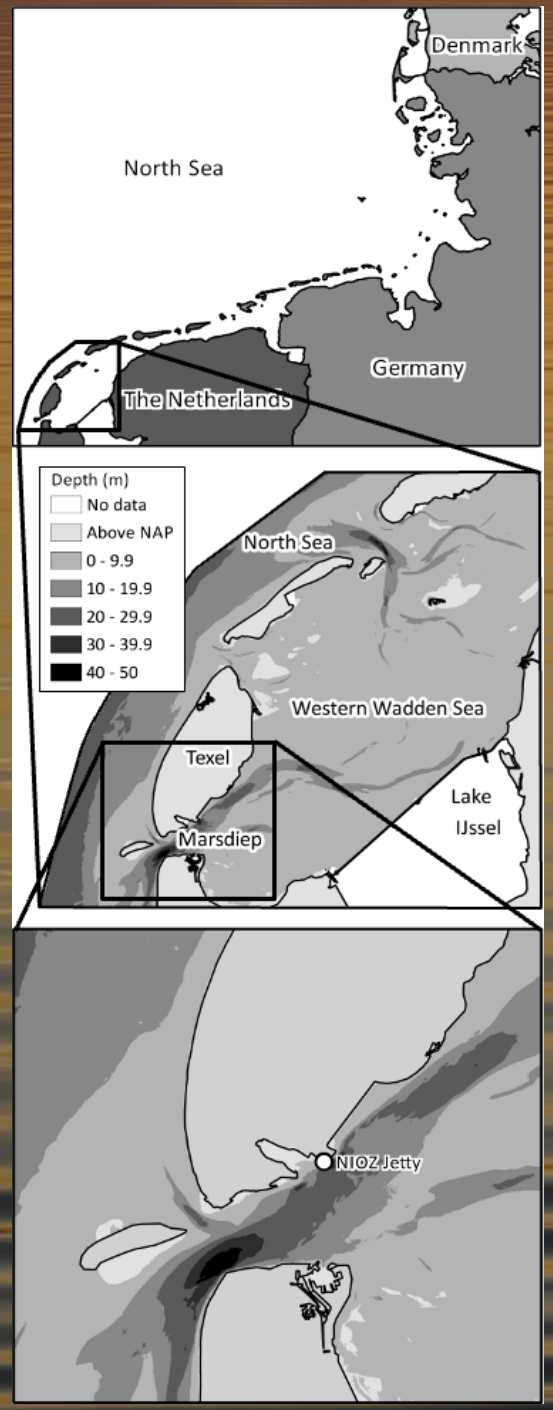
Session ‘Digital Twin for living environment & biodiversity: State of the art’

14 December 2022

Wadden Sea Long-Term Ecosystem Research

Katja Philippart (Waddenacademie, NIOZ & UU)

Rick Hoeksema (RWS Noord-Nederland)



long-term dynamics phytoplankton

(50 years in 2023)

NIOZ jetty series (ca. 40 times/ year)

Started by Gerhard Cadée (NIOZ) in 1974 inspired by results of the ‘International Biological Programme’ cruises in 1970-’71

Handed over to Katja Philippart in 2004

Phytoplankton in the Marsdiep at the end of the 20th century; 30 years monitoring biomass, primary production, and *Phaeocystis* blooms

Gerhard C. Cadée*, Jan Hegeman

Long-term phytoplankton–nutrient interactions in a shallow coastal sea: Algal community structure, nutrient budgets, and denitrification potential

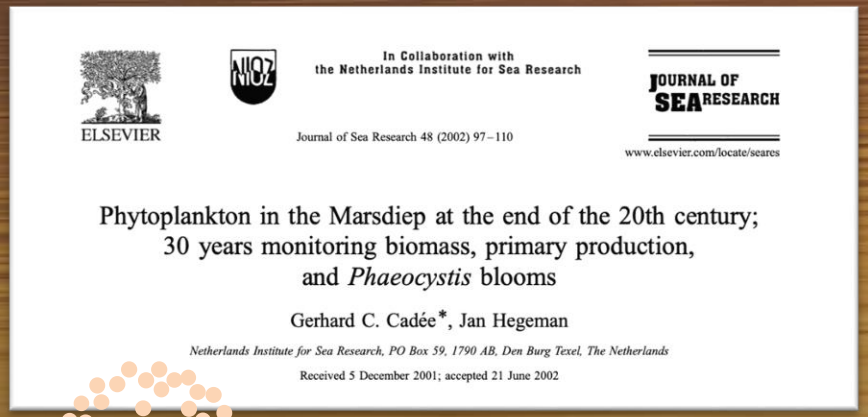
Catharina J. M. Philippart, Gerhard C. Cadée, Wim van Raaphorst, and Roel Riegman

Impacts of Nutrient Reduction on Coastal Communities

Phosphorus limitation during a phytoplankton spring bloom in the western Dutch Wadden Sea

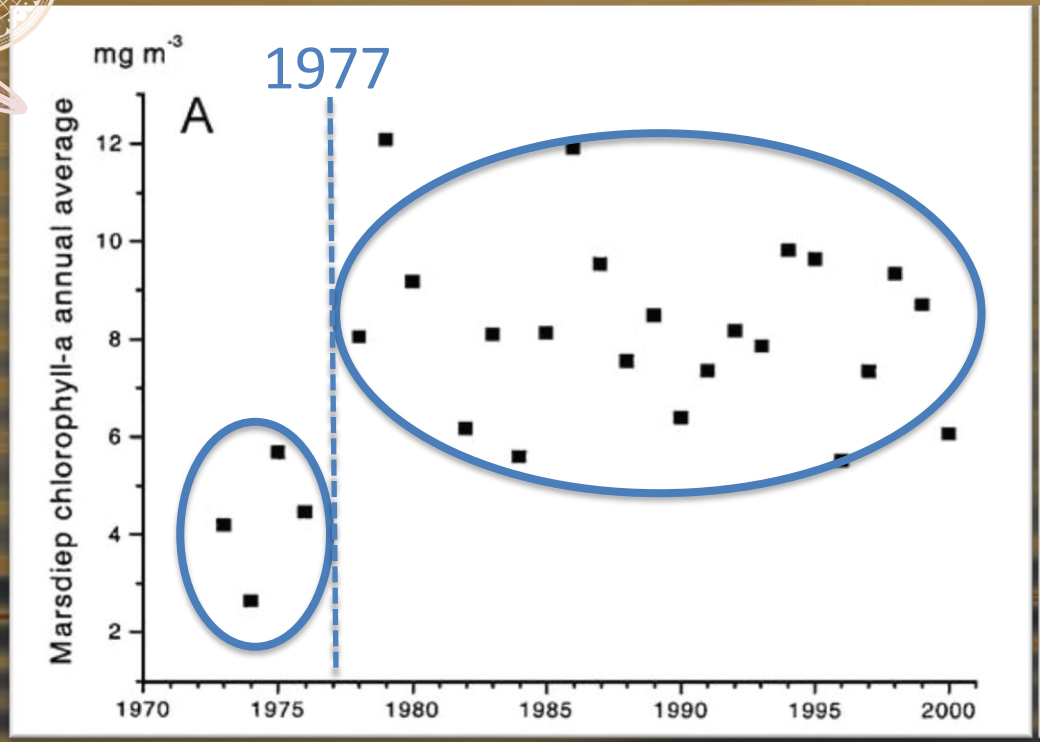
Four decades of variability in turbidity in the western Wadden Sea as derived from corrected Secchi disk readings

Long-term Field Observations on Seasonality in Chlorophyll-*a* Concentrations in a Shallow Coastal Marine Ecosystem, the Wadden Sea

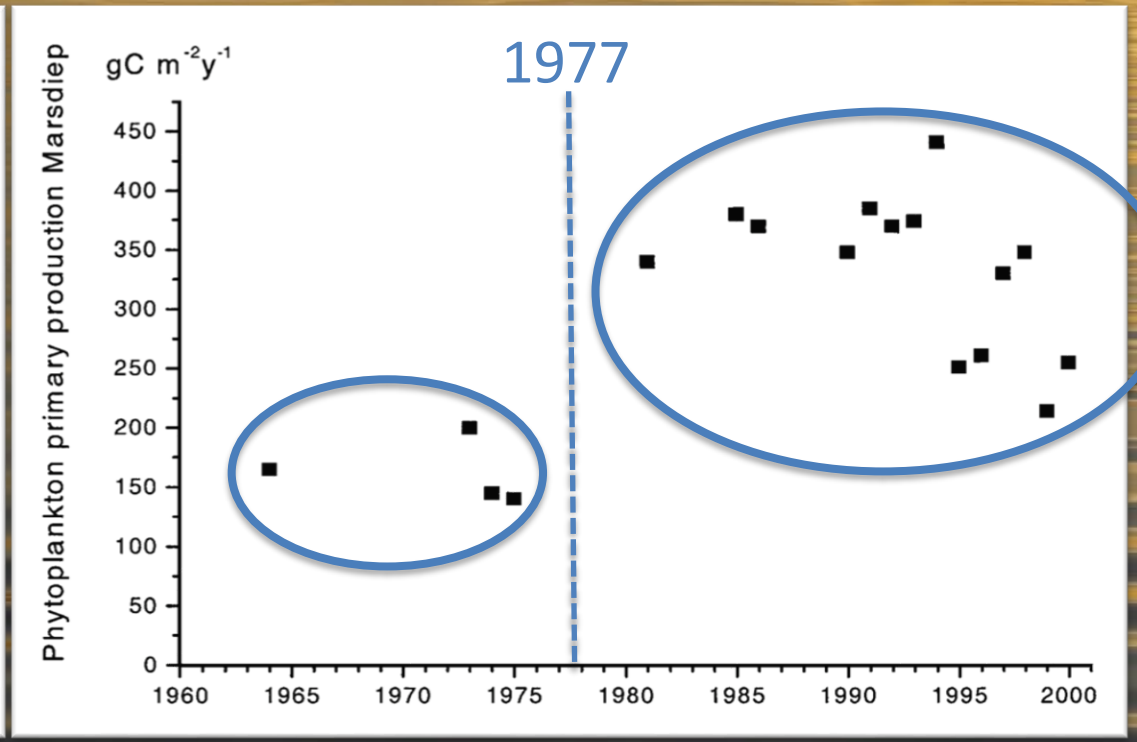


Long-term trends and shifts

Chlorophyll-a (mg m^{-3})



Pelagic production (gC m^{-2} y^{-1})



Long-term trends and shifts

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https://doi.org/10.3354/meps13267

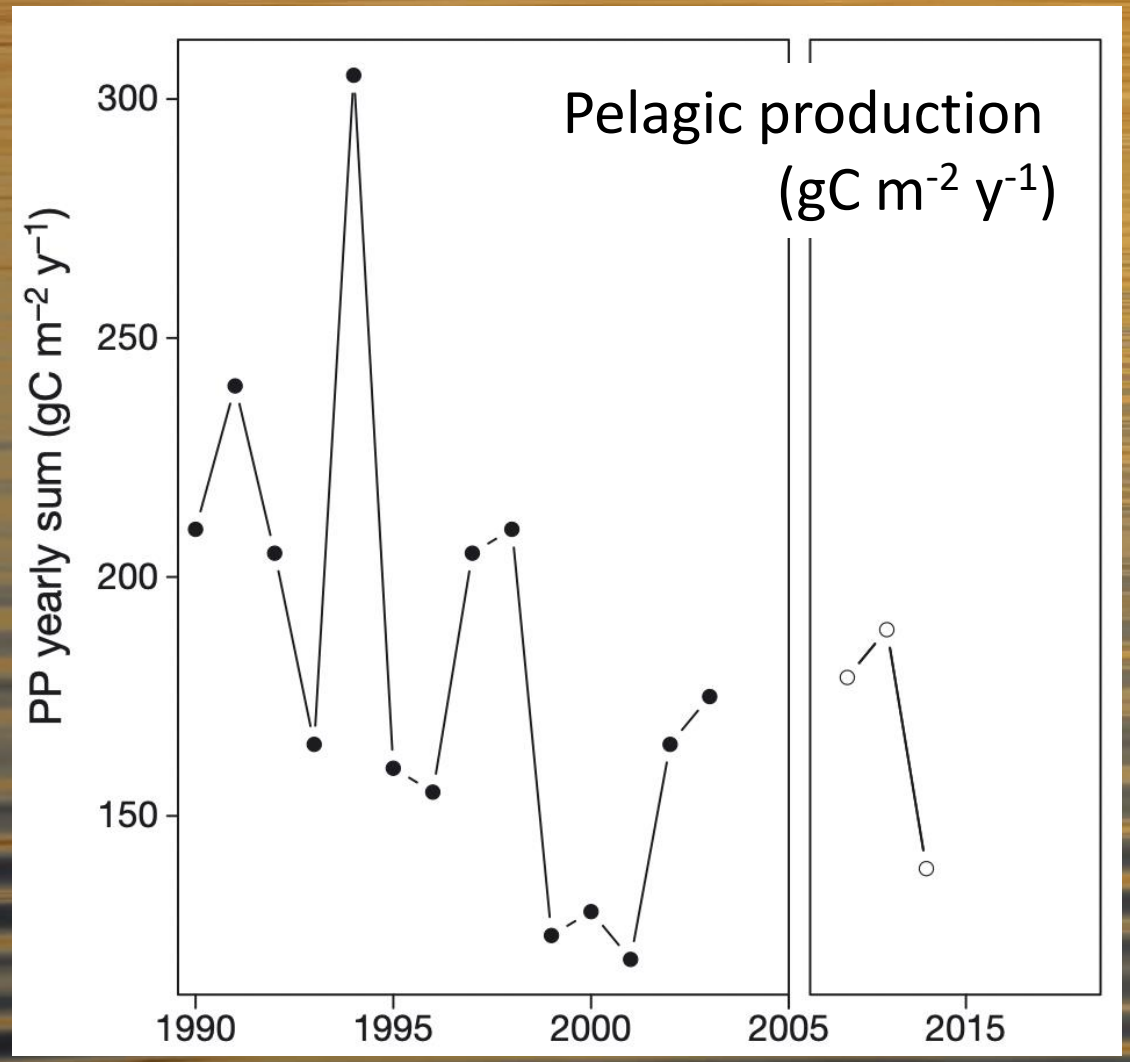
MARINE ECOLOGY PROGRESS SERIES
Mar Ecol Prog Ser

Published April 2

Planktonic primary production in the western Dutch Wadden Sea

P. Jacobs[1,*], J. C. Kromkamp[2], S. M. van Leeuwen[1], C. J. M. Philippart[1,3]

[1]NIOZ Royal Netherlands Institute for Sea Research, Department of Coastal Systems, and Utrecht University, PO Box 59, 1790 AB Den Burg, Texel, the Netherlands
[2]NIOZ Royal Netherlands Institute for Sea Research, Department of Estuarine and Delta Systems, and Utrecht University, PO Box 140, 4400 AC Yerseke, the Netherlands
[3]University of Utrecht, Department of Physical Geography, PO Box 80.115, 3508 TC Utrecht, the Netherlands

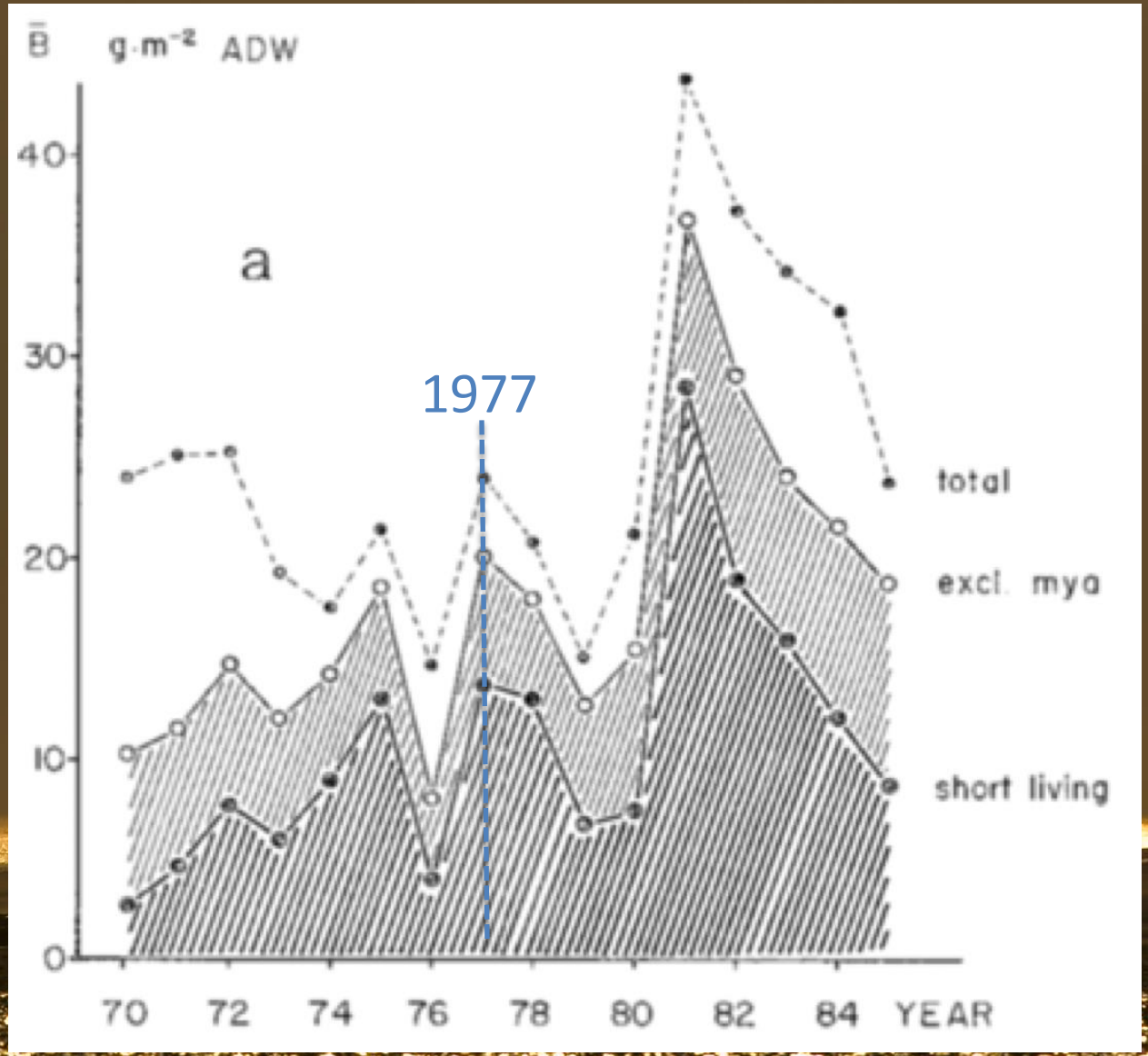


Biomass macrozoobenthos (gAFDW m^{-2})

OPHELIA, 26: 55-64 (December 1986)

ZOOBENTHOS RESPONSES TO EUTROPHICATION OF THE DUTCH WADDEN SEA

J.J. Beukema & G.C. Cadée
Netherlands Institute for Sea Research, P.O. Box 59, NL-1790 AB Den Burg, The Netherlands



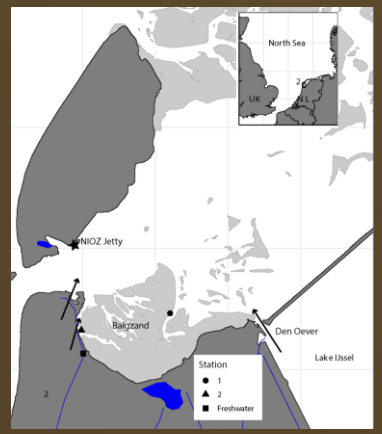
PLOS ONE

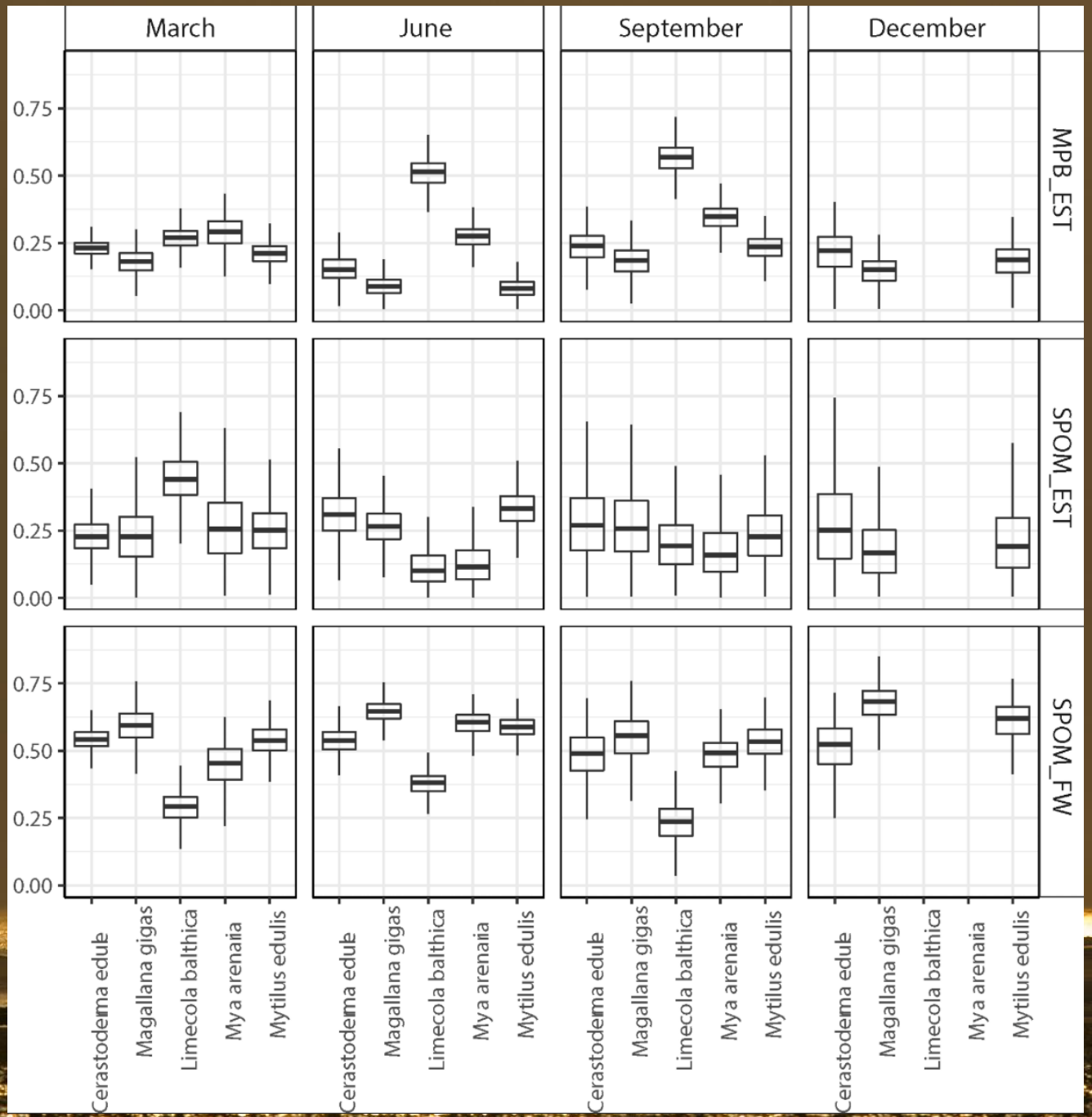
RESEARCH ARTICLE

Seasonal variation in the diet of estuarine bivalves

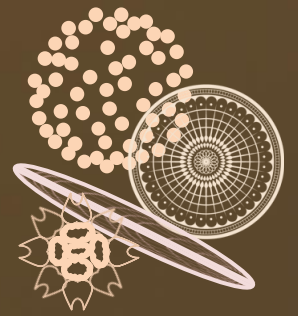
Alexa Sarina Jung[1]*, Henk W. van der Veer[1], Marcel T. J. van der Meer[2], Catharina J. M. Philippart[1,3]

1 NIOZ Royal Netherlands Institute for Sea Research, Department of Coastal Systems, Utrecht University, AB Den Burg, Texel, The Netherlands, 2 NIOZ Royal Netherlands Institute for Sea Research, Department of Microbiology & Biogeochemistry, Utrecht University, AB Den Burg, Texel, The Netherlands, 3 University of Utrecht, Department of Physical Geography, TC Utrecht, The Netherlands



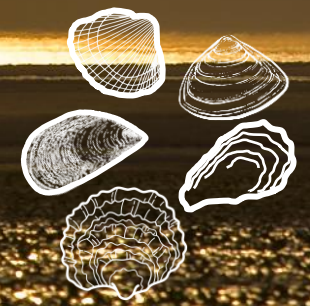


marine pelagic algae
(ca. 25%)

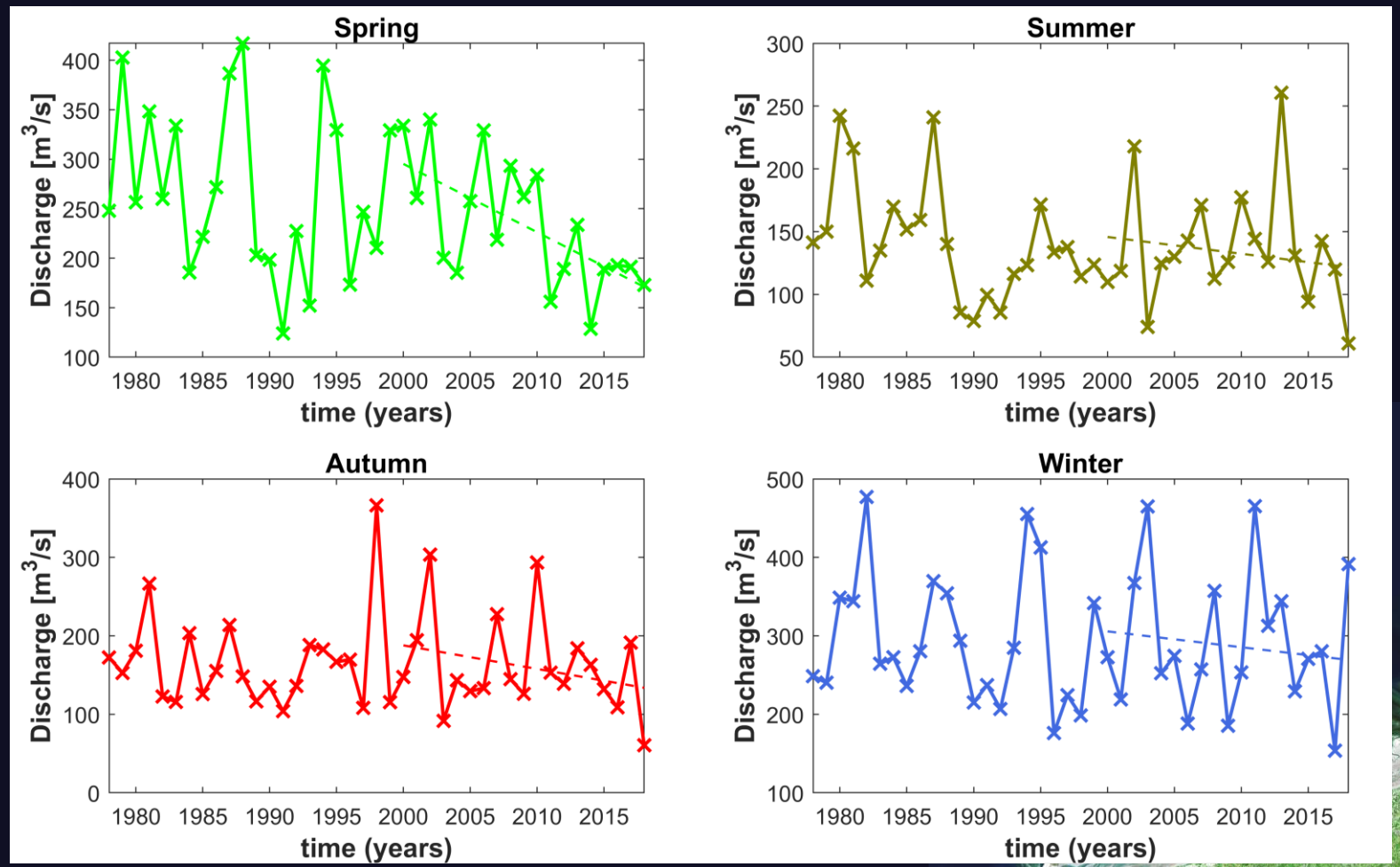


marine benthic algae
(ca. 25%)

freshwater algae
(ca. 50%)



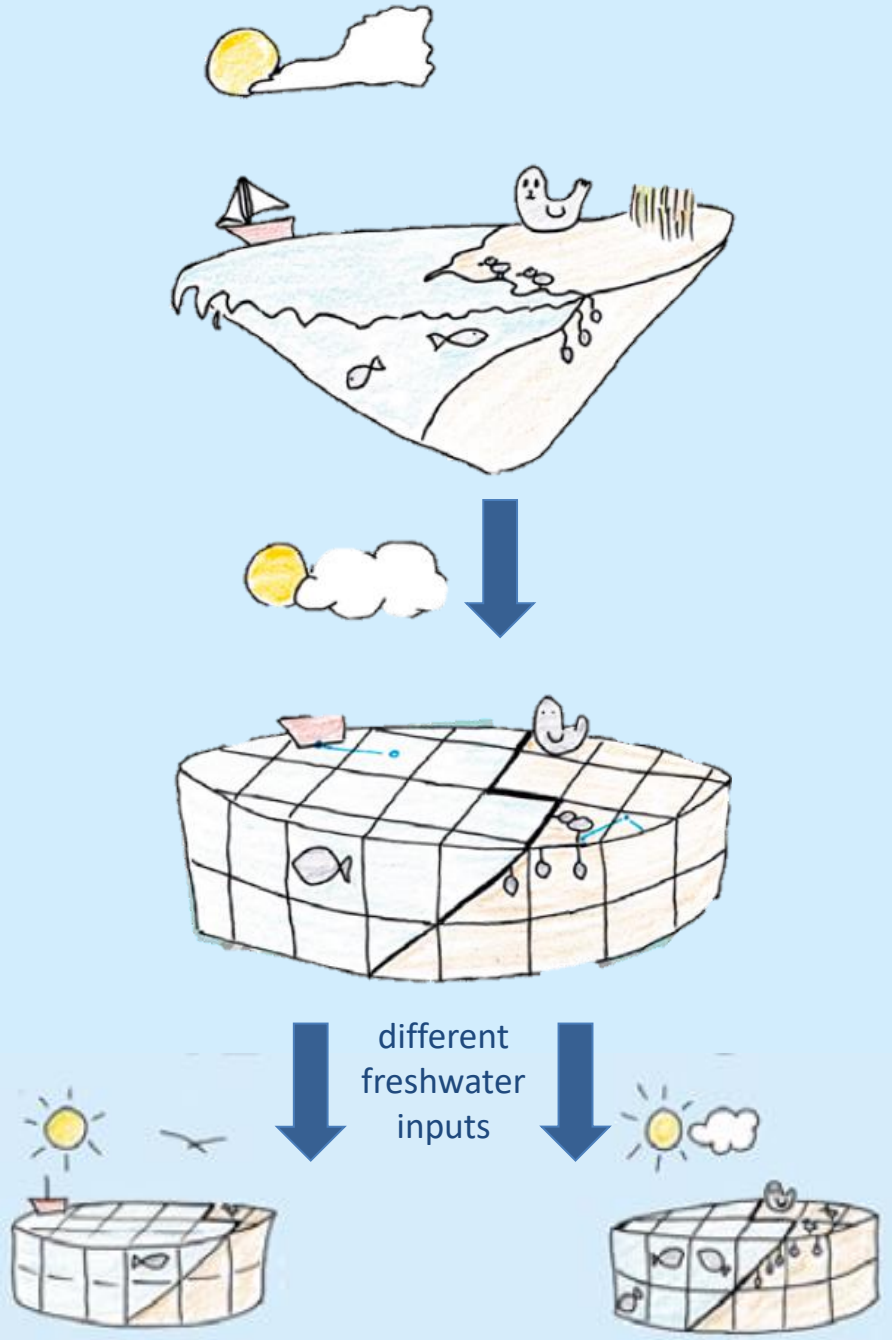
Mean seasonal signals of the combined freshwater discharge (m3/s) of the larger freshwater entrance points into the trilateral Wadden Sea (1978-2018)



OSPAR ICG-EMO riverine database
(Sonja van Leeuwen, NIOZ)

building scenario's using digital twins

LTER LIFE proposal
Marcel Visser (NIOO)
14:00-16:00



building scenario's using digital twins

LTER LIFE proposal
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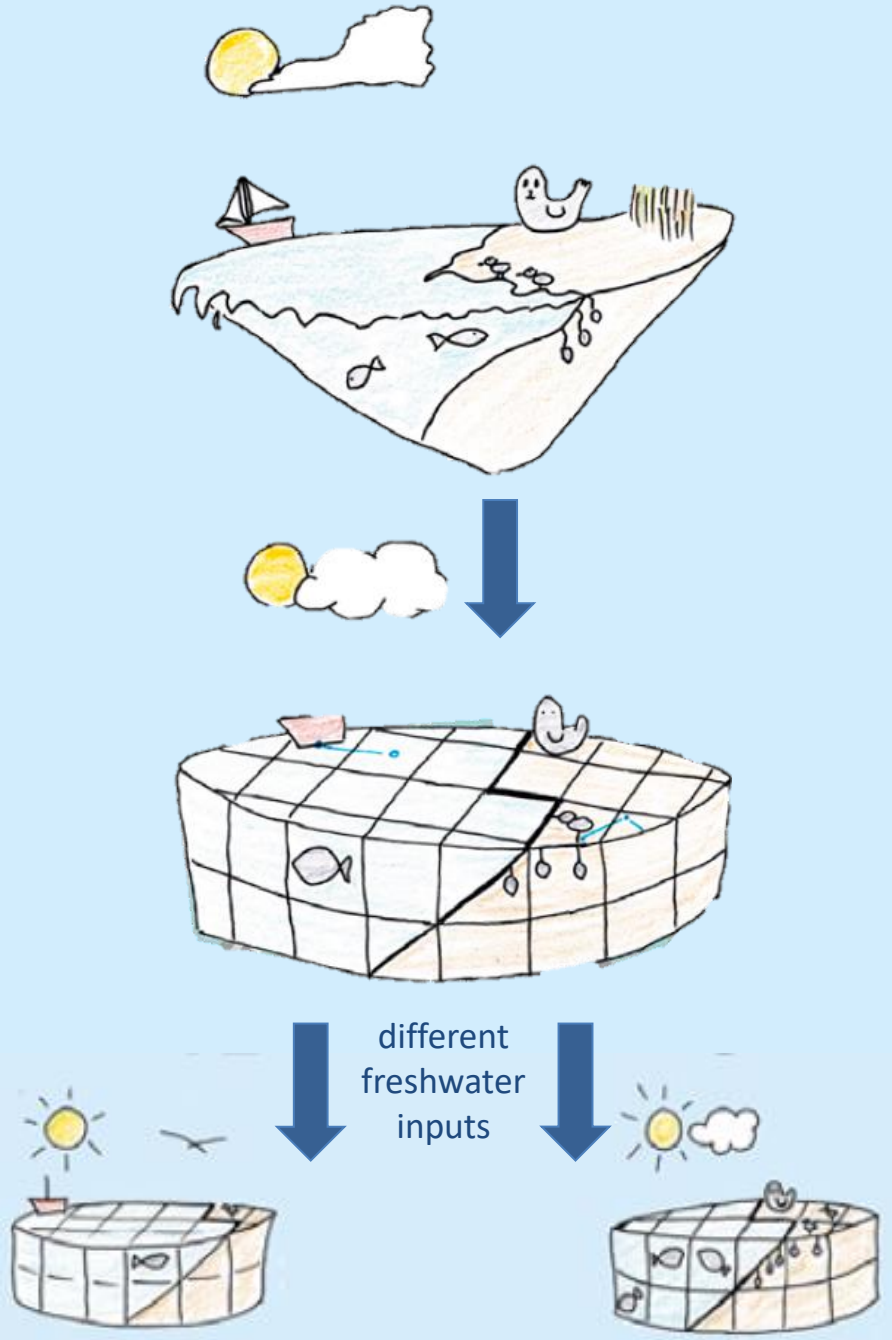


Scientific Consortium
2008-2015

Societal Consortium
since 2015

Scientific Consortium
2008-2015

Societal Consortium
since 2015

WaLTER
wadden sea
LONG-TERM ECOSYSTEM RESEARCH

BASISMONITORING
Wadden

WaLTER
wadden sea
LONG-TERM ECOSYSTEM RESEARCH

Gedegen, innovatieve en verbindende monitoring van het waddengebied

MEETPROGRAMMA'S WADDENGEBIED

WaLTER projectteam

VERSIE 2019-10-23

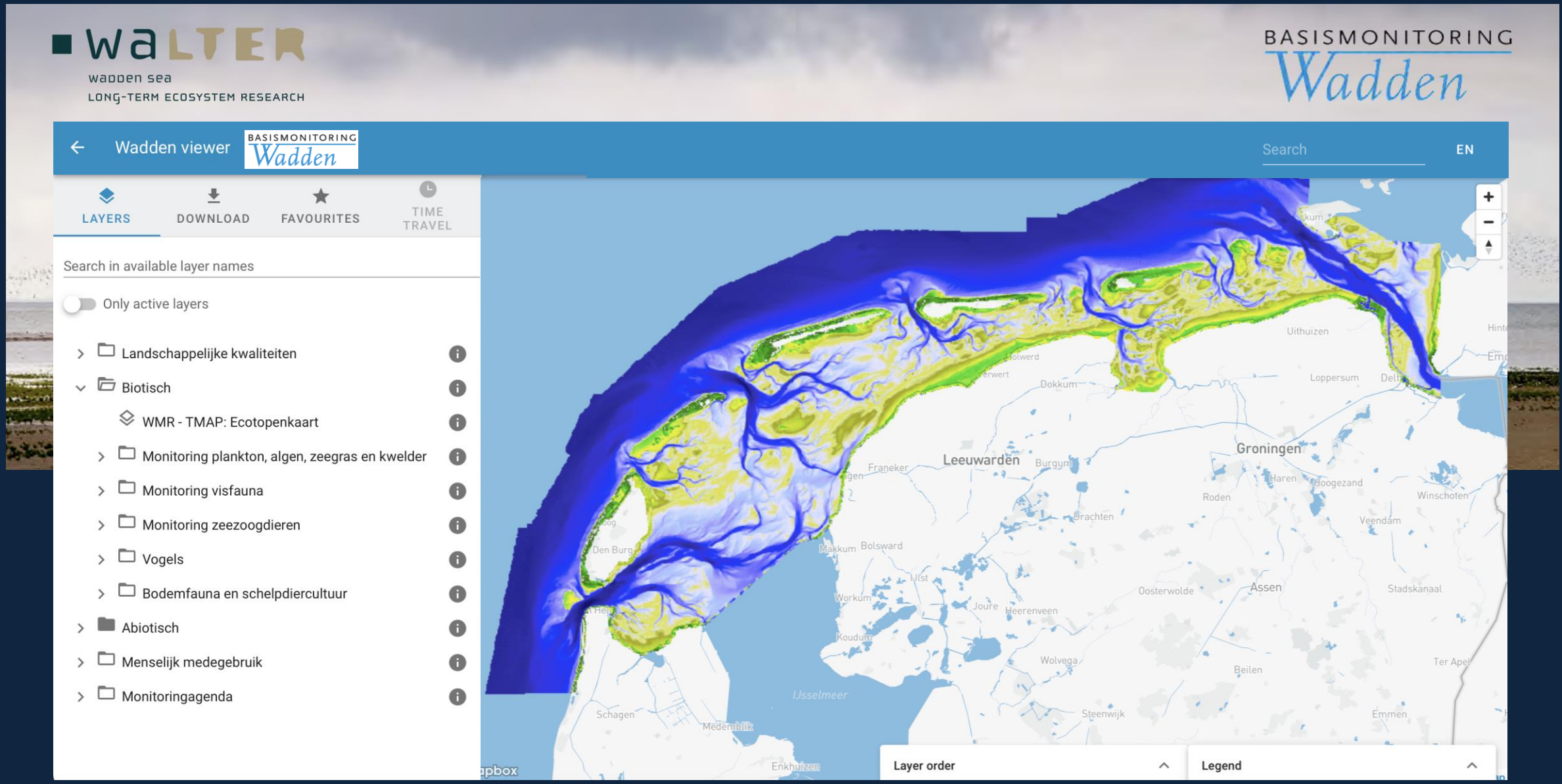
OKT 19

MEETPROGRAMMA'S

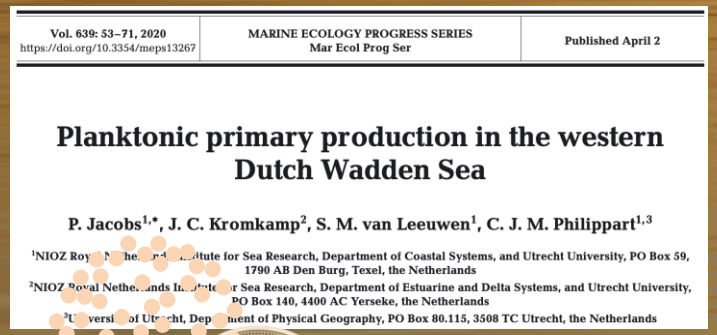
INHOUDSOPGAVE

Scientific Consortium
2008-2015

Societal Consortium
since 2015



Strong annual and seasonal variability



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Planktonic primary production in the western Dutch Wadden Sea

P. Jacobs[1,*], J. C. Kromkamp[2], S. M. van Leeuwen[1], C. J. M. Philippart[1,3]

[1]NIOZ Royal Netherlands Institute for Sea Research, Department of Coastal Systems, and Utrecht University, PO Box 59, 1790 AB Den Burg, Texel, the Netherlands

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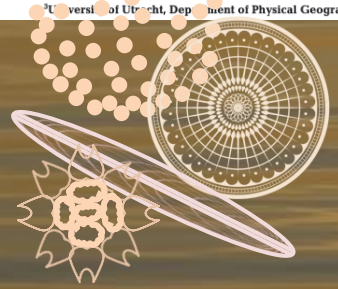
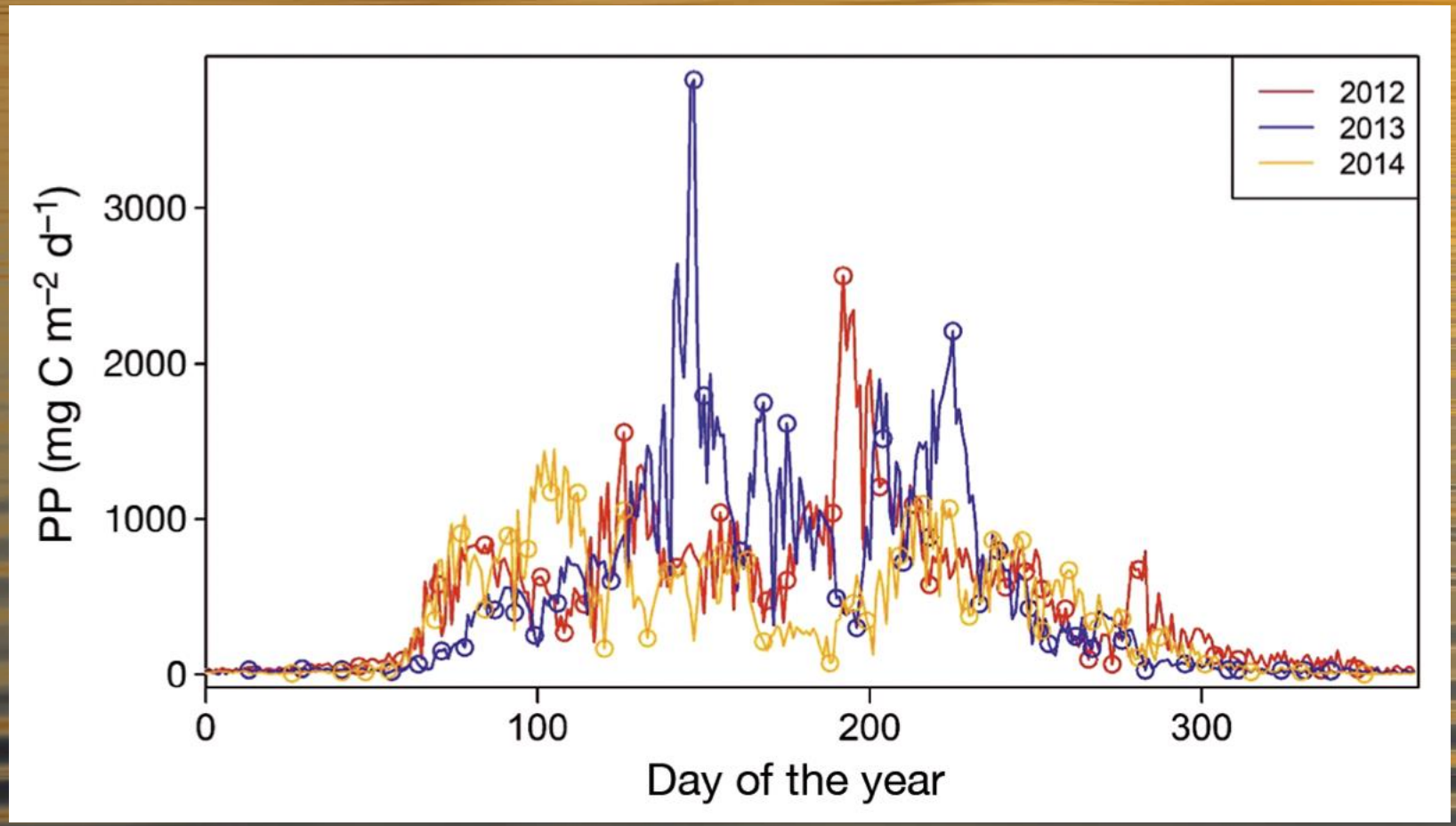




Pelagic production (gC m^{-2} y^{-1})

Strong spatial variability

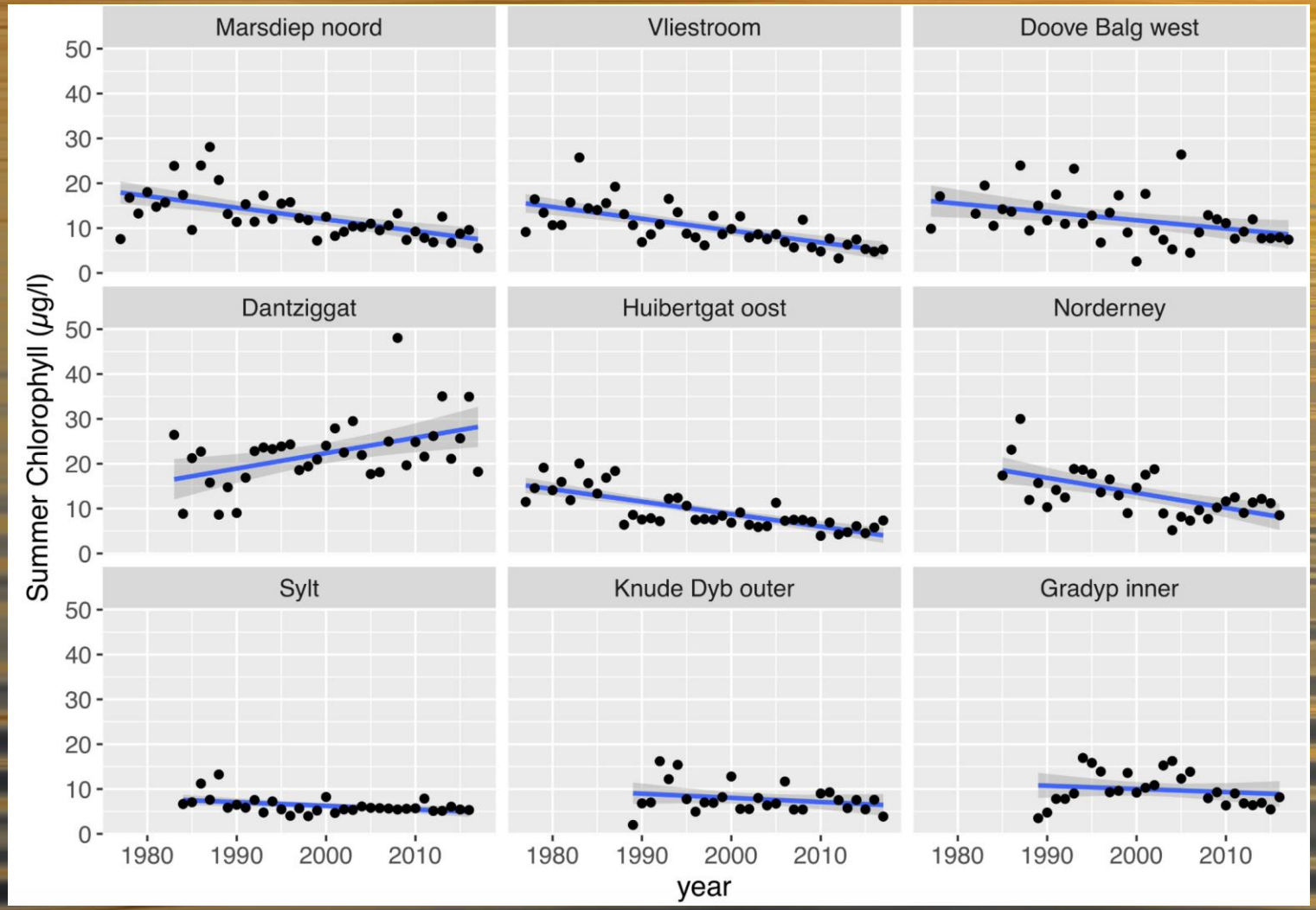

frontiers in Marine Science

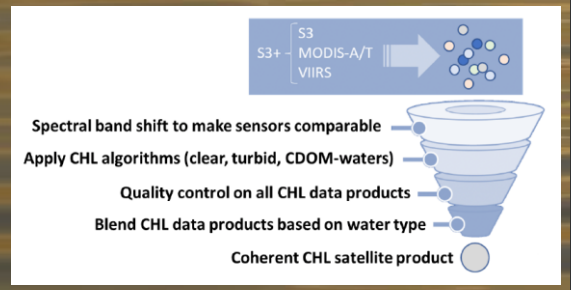
ORIGINAL RESEARCH
published: 04 July 2019
doi: 10.3389/fmars.2019.00370

Wadden Sea Eutrophication: Long-Term Trends and Regional Differences

Justus E. E. van Beusekom[1], Jacob Carstensen[2], Tobias Dolch[3], Annika Grage[4], Richard Hofmeister[1], Hermann Lenhart[5], Onur Kerimoglu[1], Kerstin Kolbe[6], Johannes Pätsch[7], Johannes Rick[3], Lena Rönn[6] and Hans Ruiter[8]*

[1] Institut für Küstenforschung, Helmholtz-Zentrum Geesthacht, Geesthacht, Germany, [2] Department of Bioscience, Aarhus University, Roskilde, Denmark, [3] Wadden Sea Station Sylt, Alfred-Wegener-Institut, Helmholtz-Zentrum für Polar-und Meeresforschung, Bremerhaven, Germany, [4] Bundesamt für Seeschifffahrt und Hydrographie, Hamburg, Germany, [5] Department of Informatics, University of Hamburg, Hamburg, Germany, [6] Niedersächsischer Landesbetrieb für Wasserwirtschaft, Küsten- und Naturschutz, Betriebsstelle Brake-Oldenburg, Oldenburg, Germany, [7] Institute of Oceanography, University of Hamburg, Hamburg, Germany, [8] Rijkswaterstaat, Utrecht, Netherlands

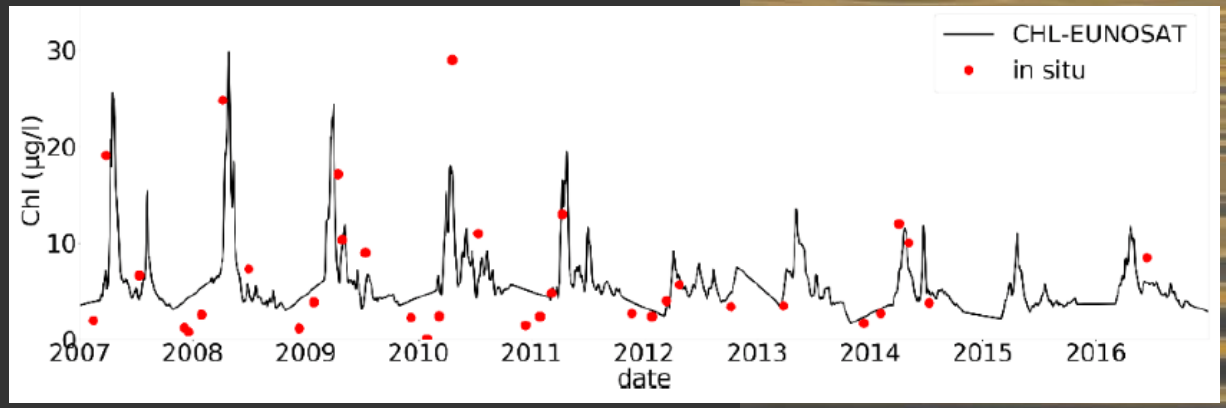


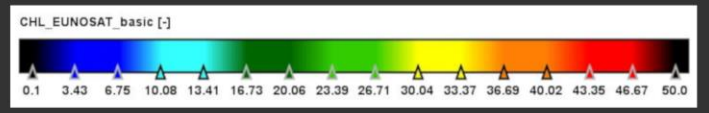


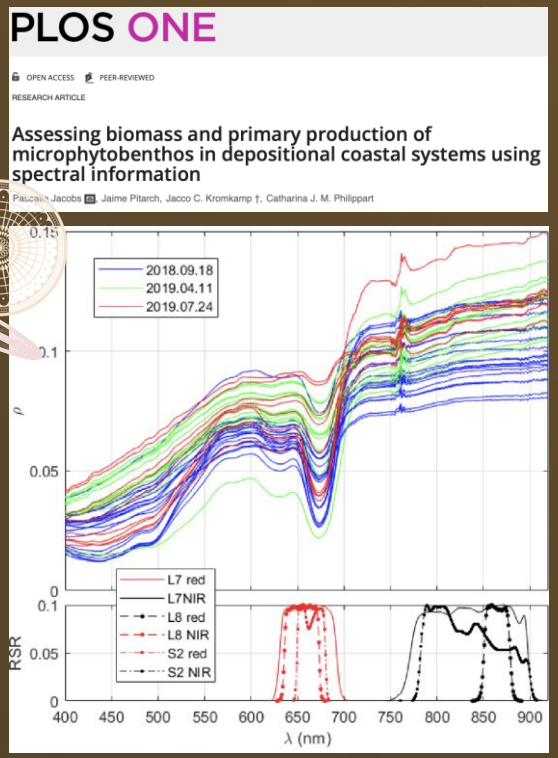
combined satellite information

Phytoplankton

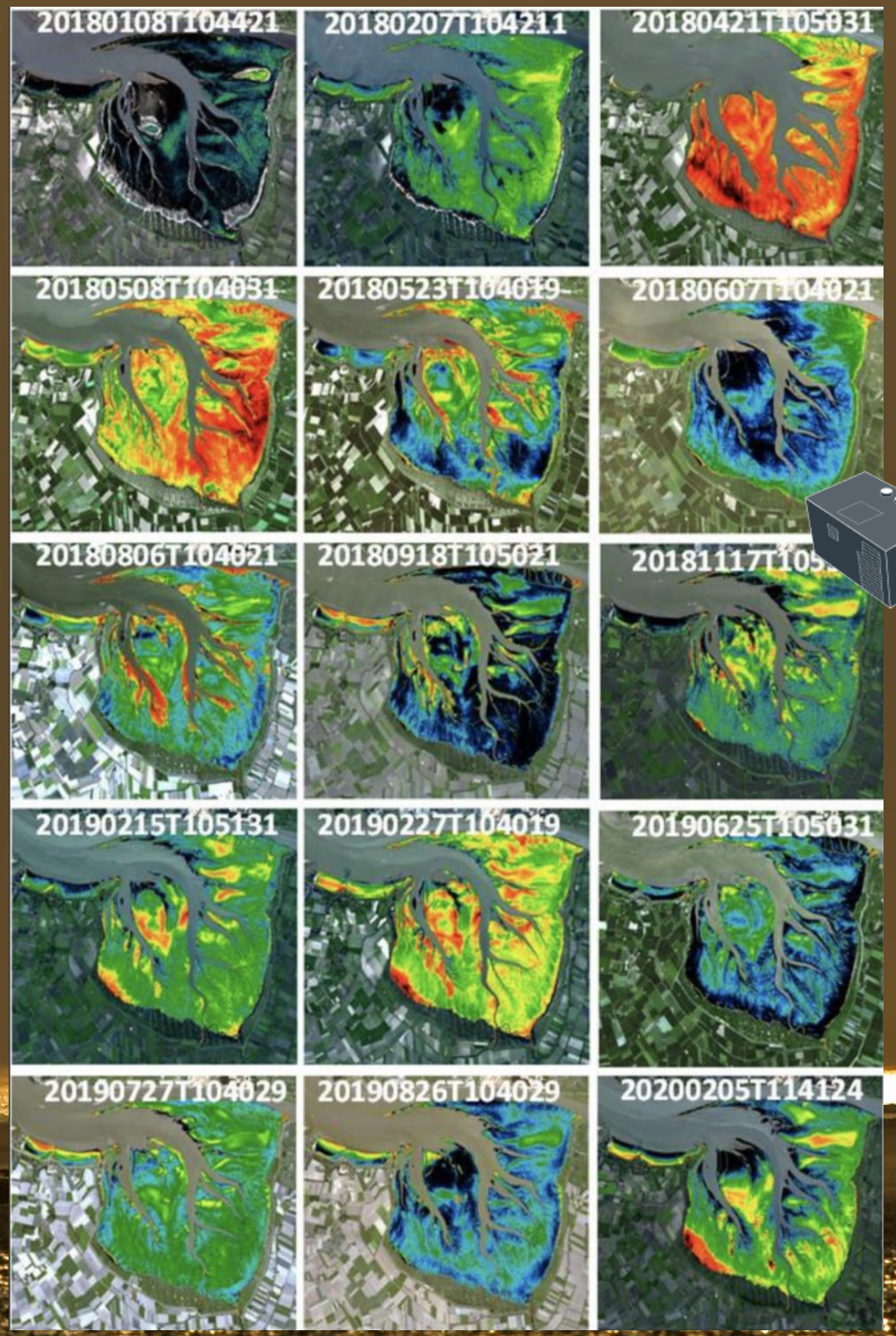
Chlorophyll-a ($mg\ m^{-3}$)
7 May 2020





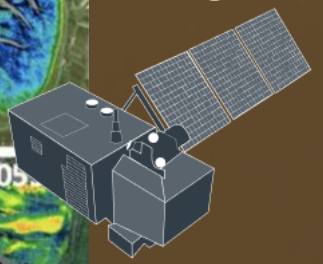


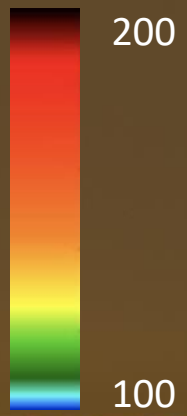
information from satellites & hyperspectral sensors (3 campaigns)



Microphytobenthos

sum of chlorophyll-a & phaeophytin (mg m^{-2})





Enhancing the predictive performance of remote sensing for ecological variables of tidal flats using encoded features from a deep learning model

Logambal Madhuanand[1,*], C. J. M. Philippart[1,2], Jiong Wang[1,3], Wiebe Nijland[1], Steven M.de Jong[1], Allert I. Bijleveld[2], Elisabeth A. Addink[1]

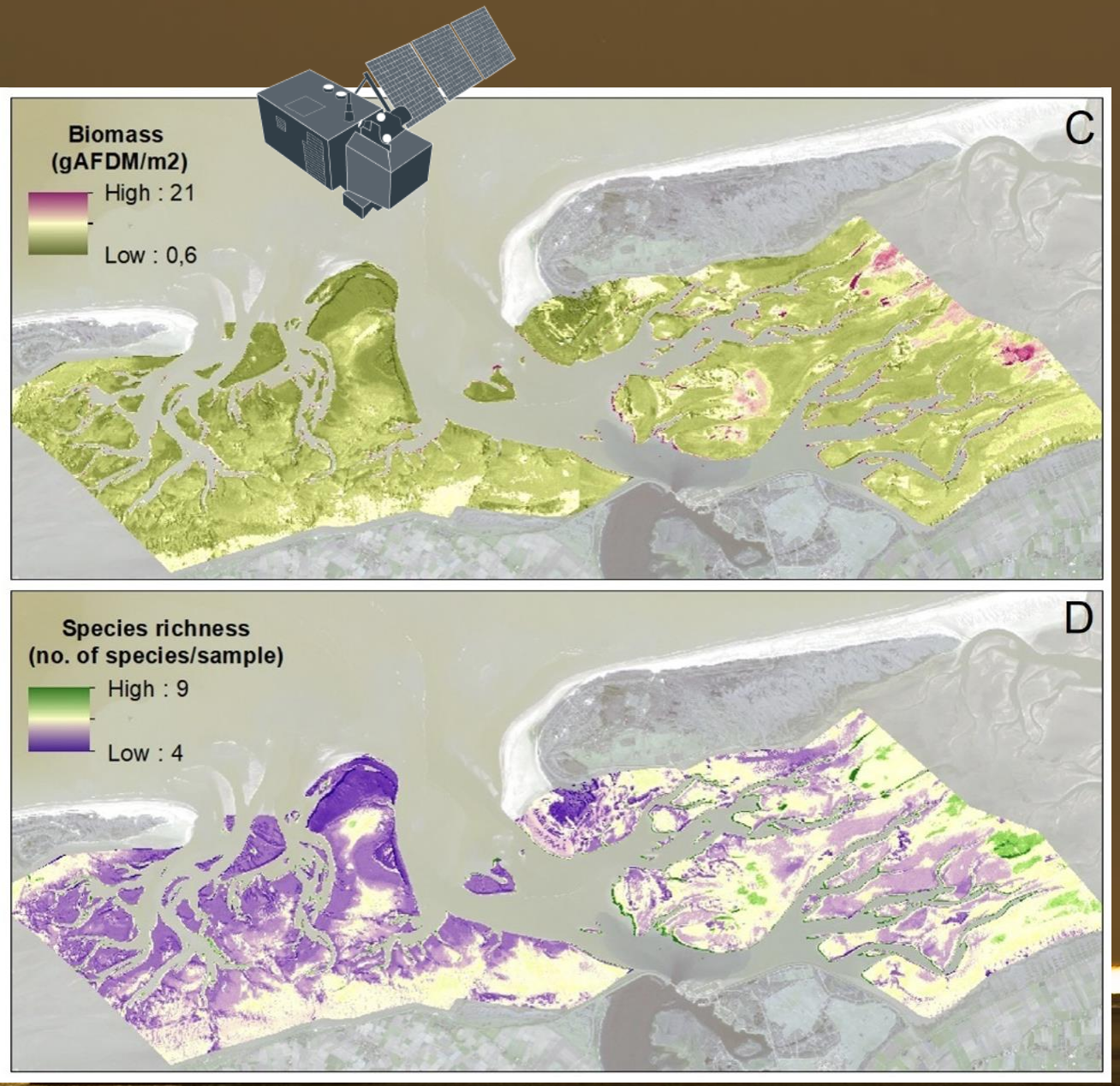
[1]University of Utrecht, Department of Physical Geography, PO Box 80.115, 3508 TC Utrecht, the Netherlands

[2]NIOZ Royal Netherlands Institute for Sea Research, Department of Coastal Systems, PO Box 59, 1790 AB Den Burg, Texel, the Netherlands

[3]University of Twente, Geo-Information Science and Earth Observation (ITC), 7514 AE Enschede, The Netherlands

information from satellite (S2: B, G, R , NIR) & machine learning

(from 462 field observations to 1.534.889 pixel values)

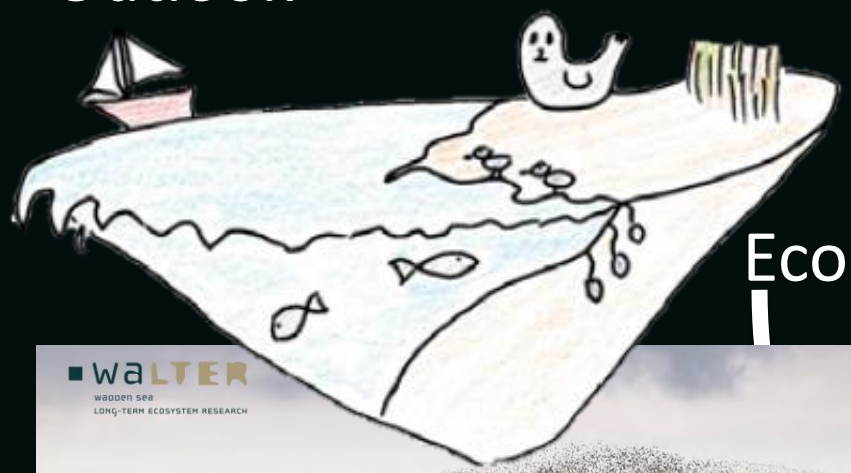


Macrozoobenthos

Biomass (gAFDW m^{-2})

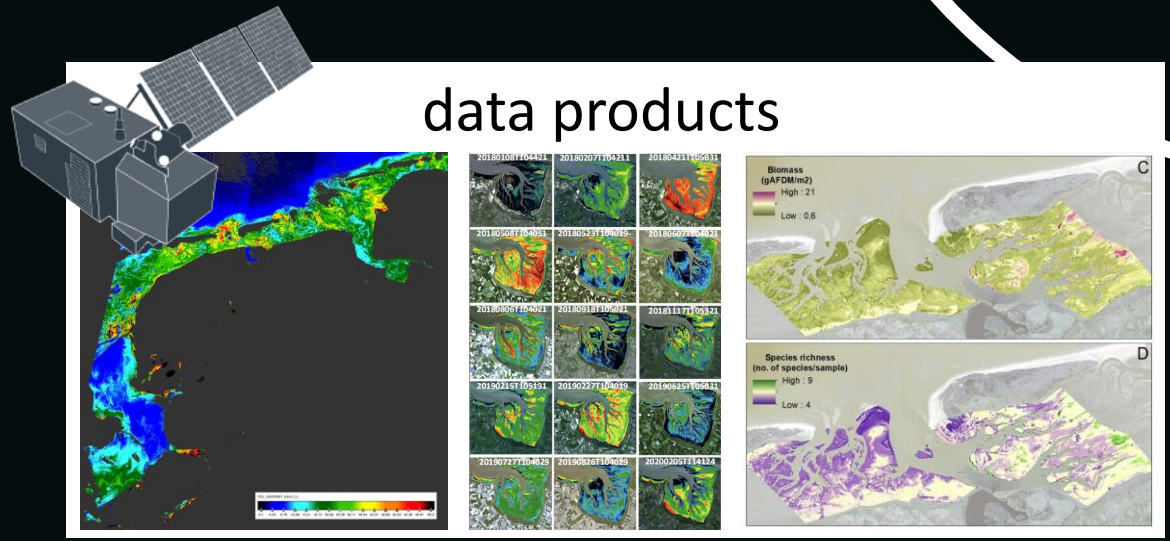
Species richness (#species $sample^{-1}$)

Outlook



Ecosystem

data products



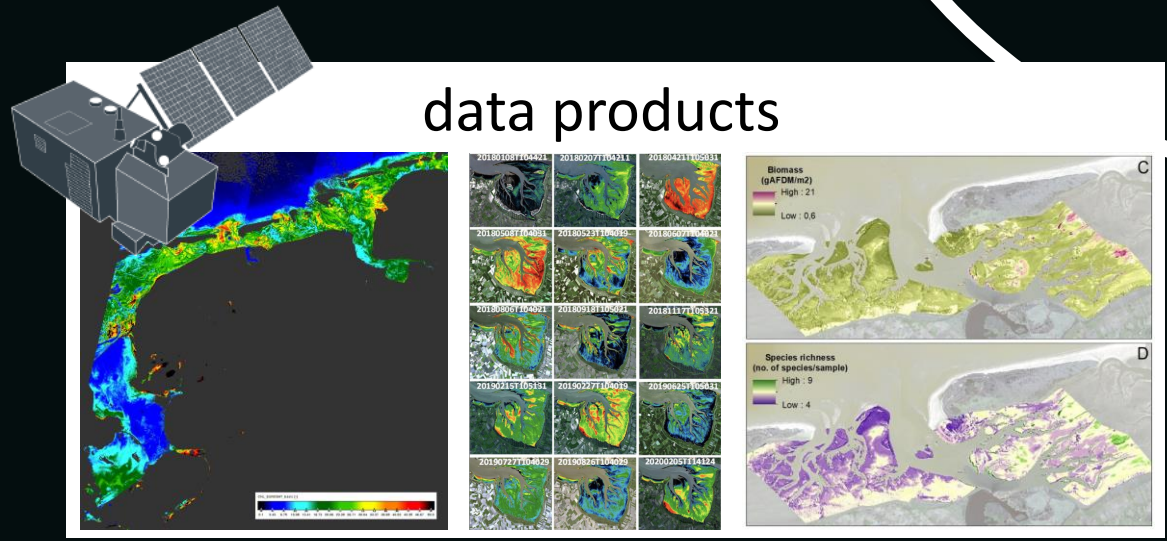
Digital Twin

Tool for Wadden Sea
Long-term Ecosystem Research

Outlook

Ecosystem

data products



Digital Twin

Tool for Wadden Sea
Long-term Ecosystem Research

Thank you!