Royal Netherlands Institute for Sea Research (NIOZ)

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LICHTKOGEL EXPERIENCE

Seaweeds in the Northsea ecosystem:
the fundamental scientific approach

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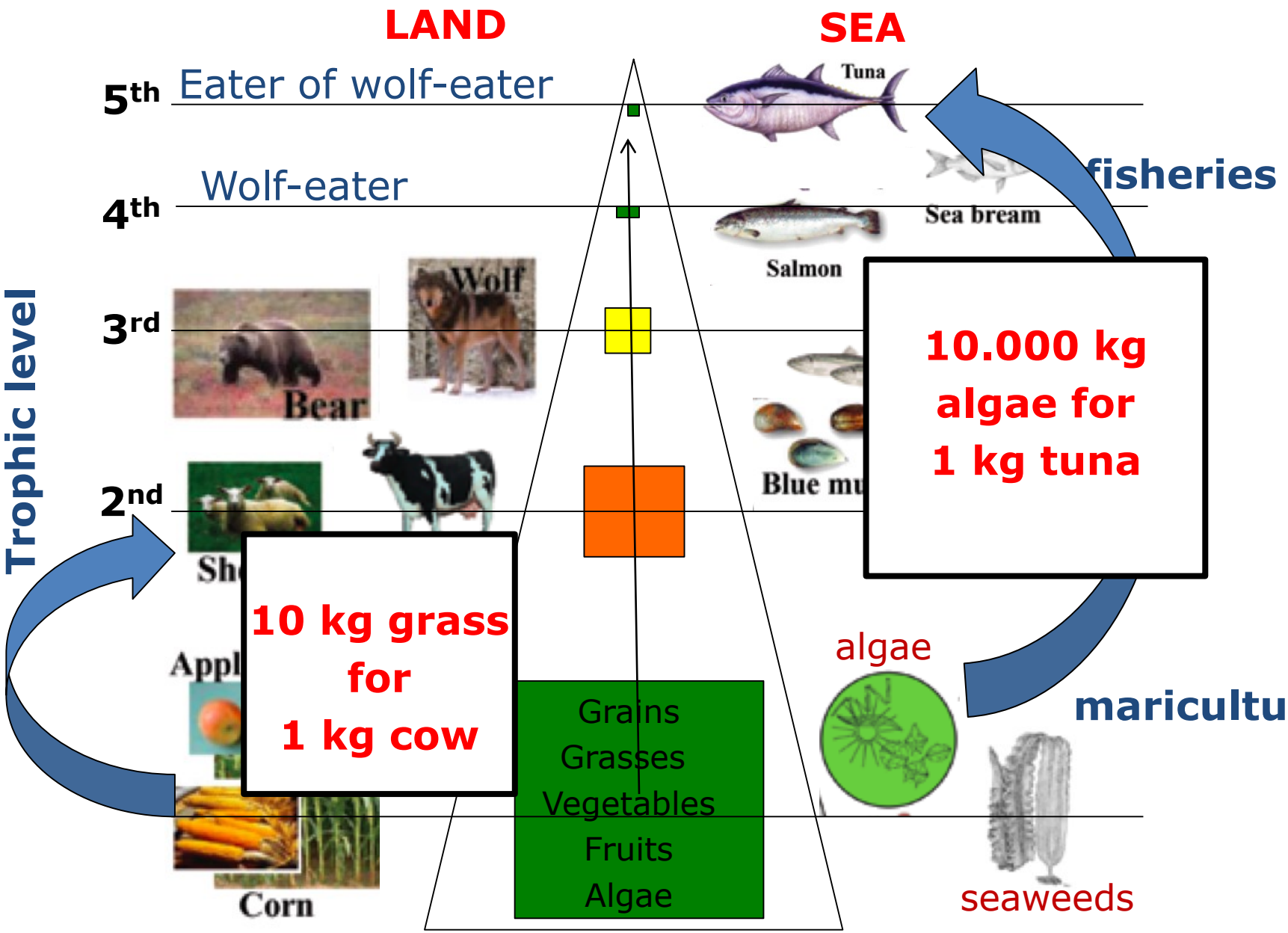
NIOZ an institute of NWO

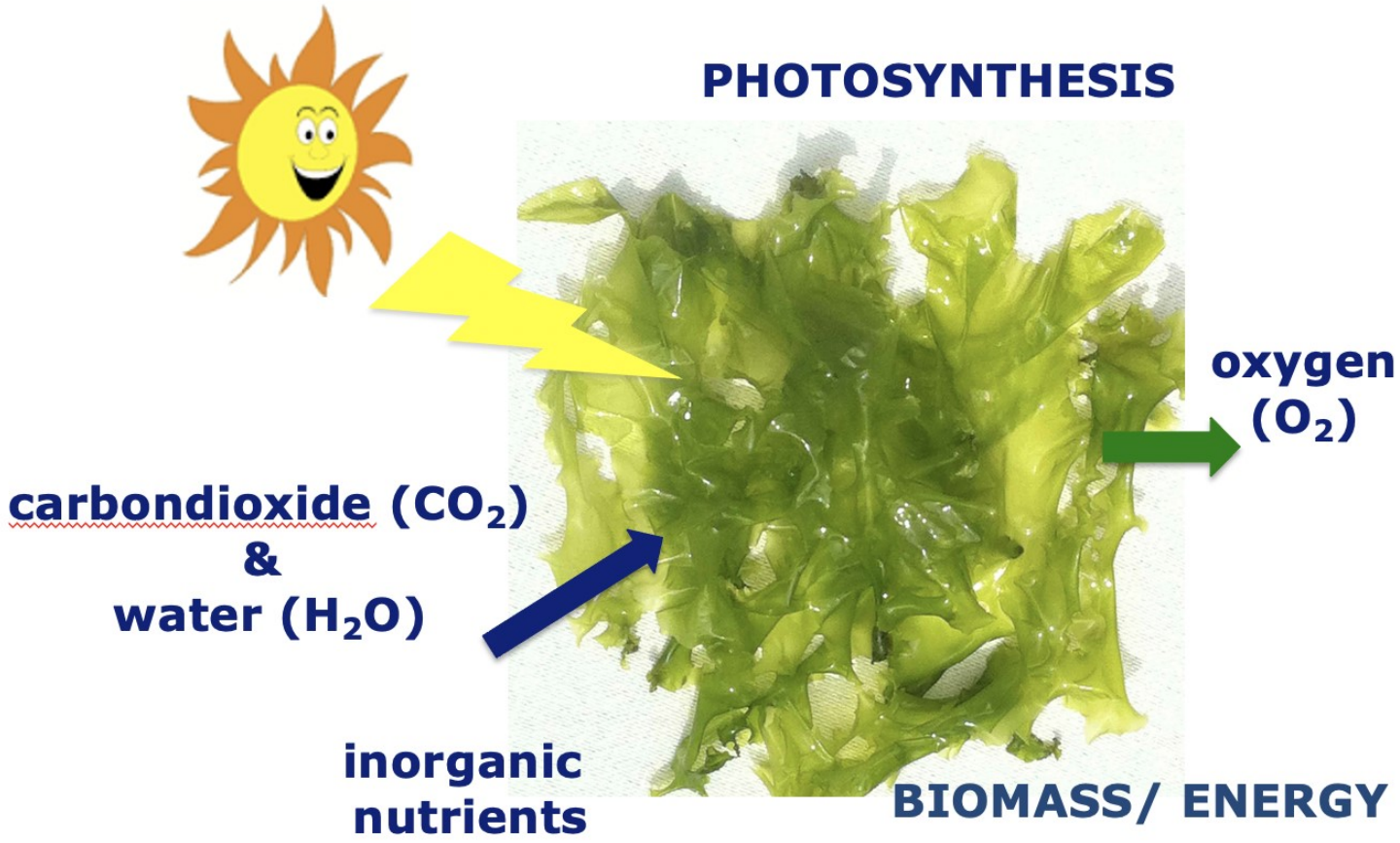
#seaweedopportunities
@KRTimmermans

Trophic chain



use biomass low in the marine ecosystem for food

-> algae, **seaweeds**, shellfish



how to fit it **sustainably** in the Northsea ecosystem ?

Use native Northsea seaweed species

Ulva lactuca

Saccharina latissima

Laminaria digitata

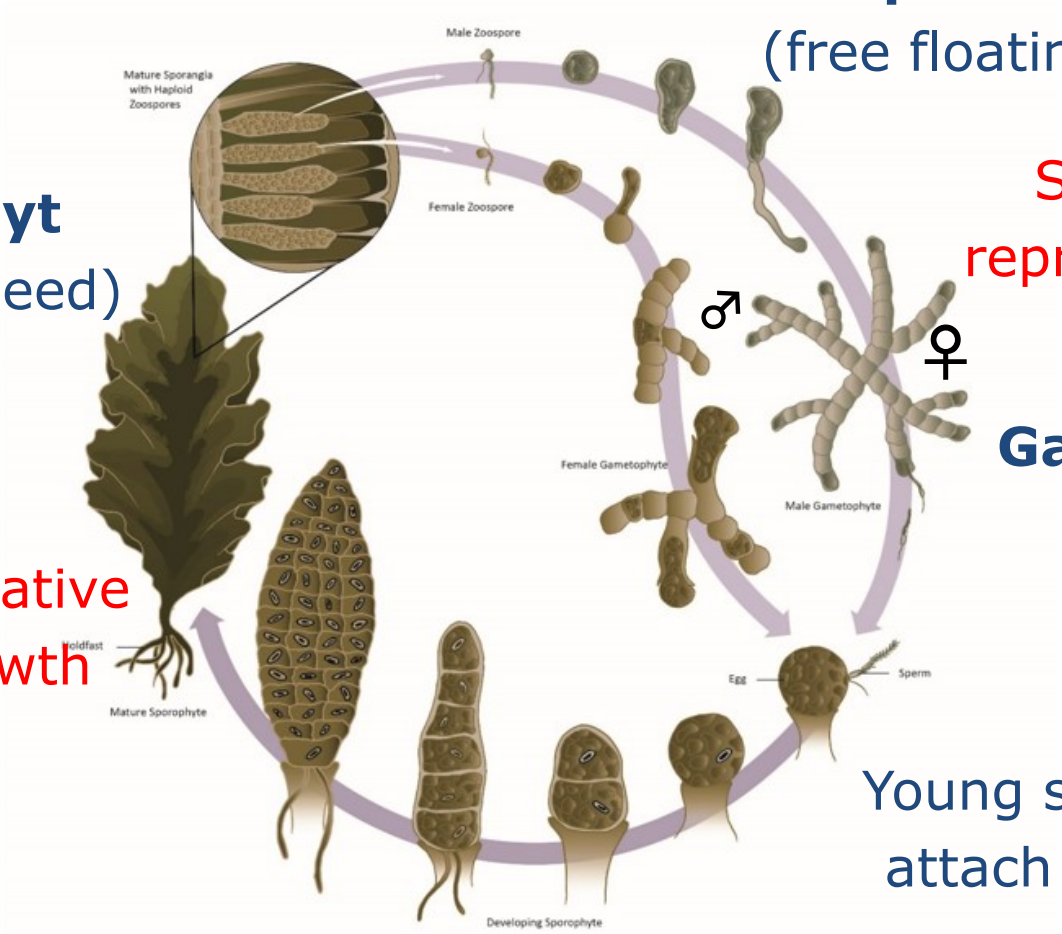
master their lifecycle:
high quality starting material

Lifecycle of brown seaweeds

Spores
(free floating)

Sporophyt
(adult seaweed)

Sexual
reproduction



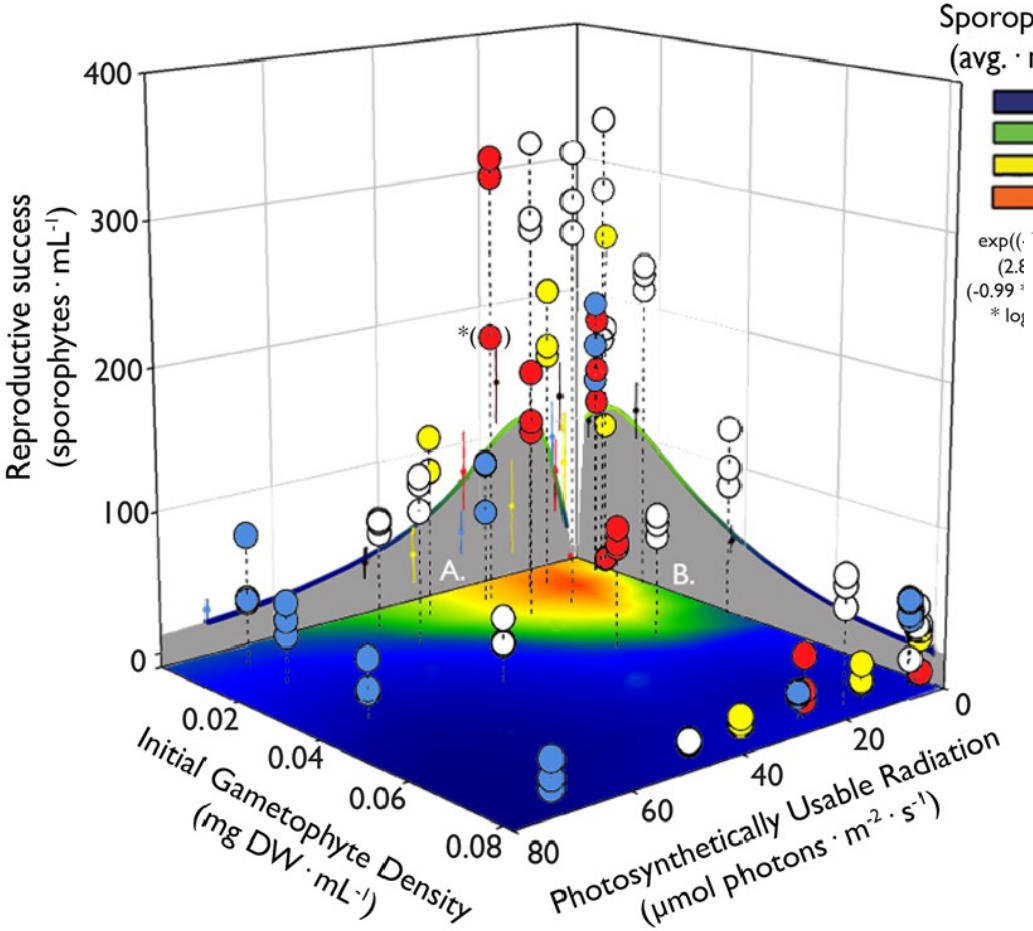
Gametophytes

Vegetative
growth

Young sporophytes
attach to surfaces

What did you do ‘’to make it happen’’ for all of us:

Unravel (a)biotic conditions governing *S. latissima* gametogenesis -> domestication!

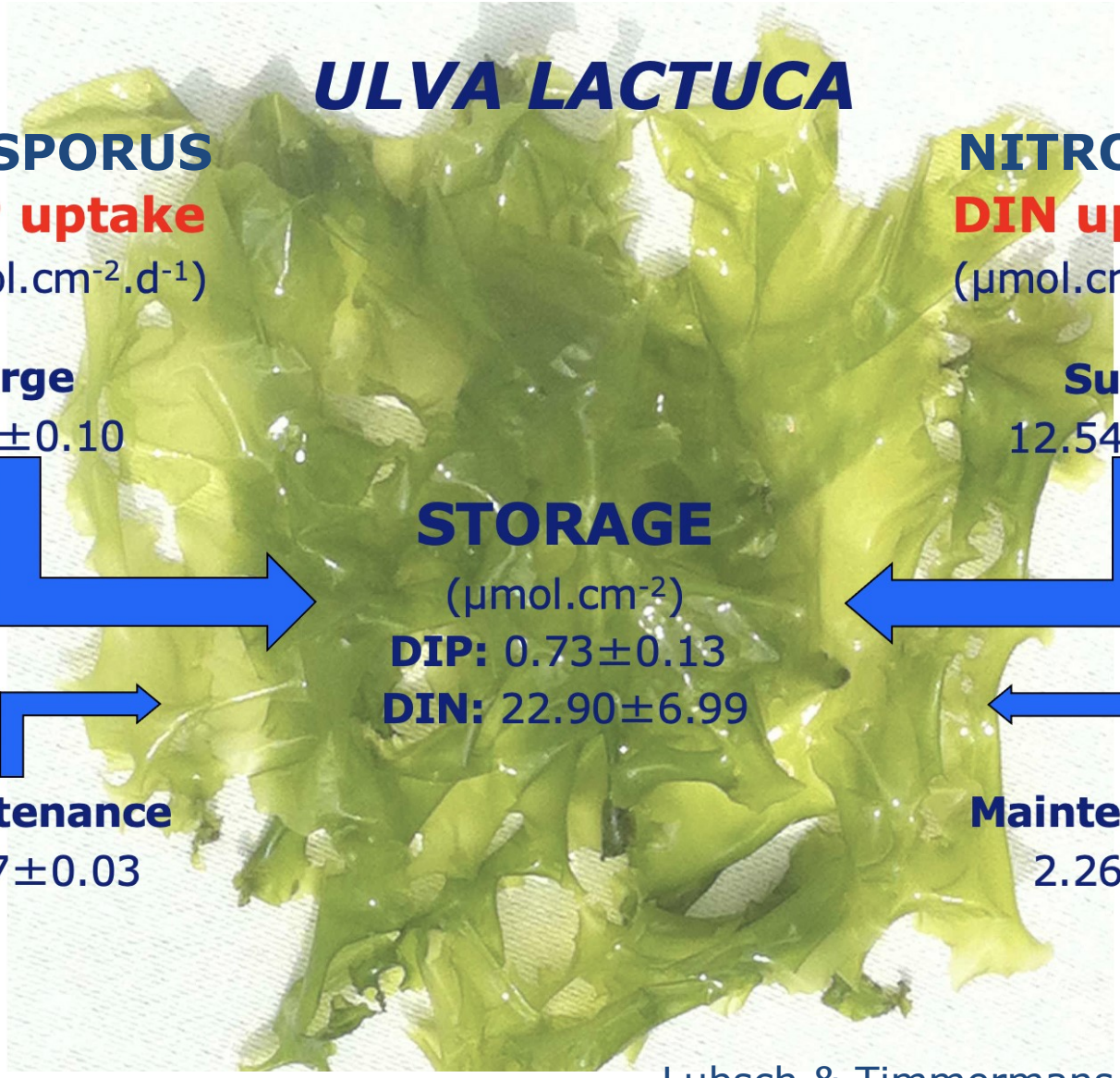


contourplot

- red light
- blue light
- white light
- yellow light

Ebbing et al., J. Phycol. 2020

know their nutrient uptake kinetics

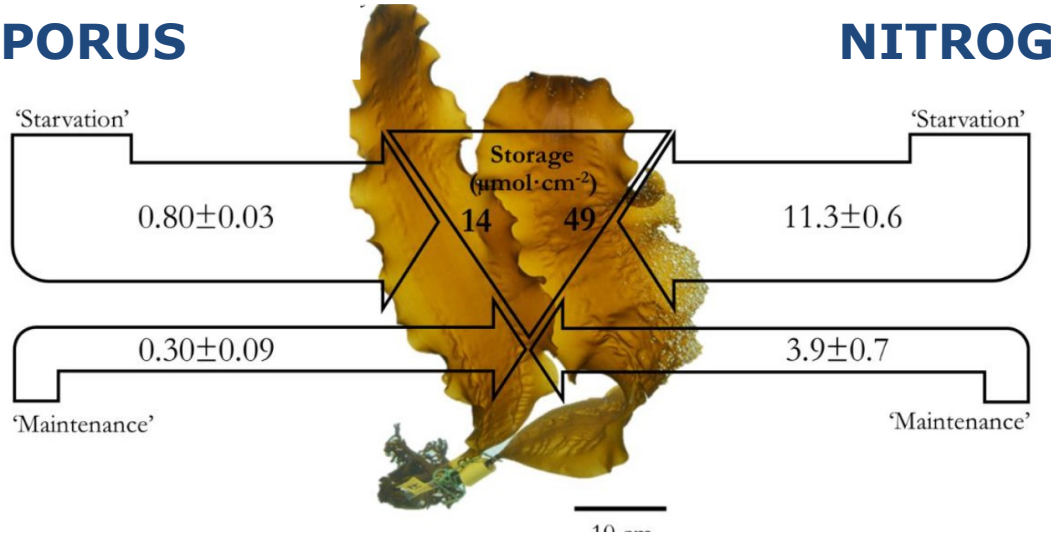


Lubsch & Timmermans, 2018, J. Phycol.

know their nutrient uptake kinetics

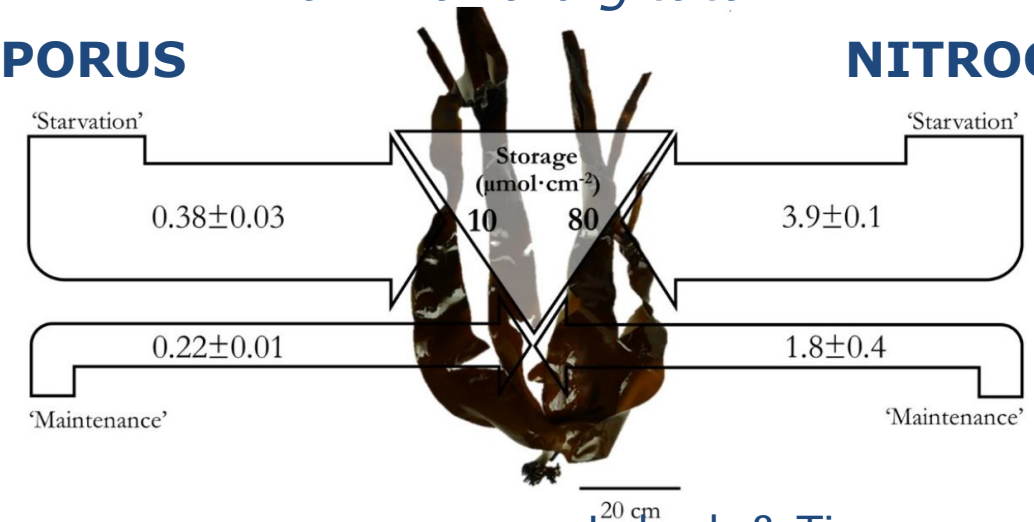
Saccharina latissima

PHOSPORUS **NITROGEN**



Laminaria digitata

PHOSPORUS **NITROGEN**



Lubsch & Timmermans, 2019, J. Phycology

What did you do "to make it happen" for all of us:

Quantify nitrogen and phophorus uptake in *Ulva lactuca*, *Saccharina latissima*, *Laminaria digitata* (and *Palmaria palmate*) standarised per surface area of seaweed front

with this knowledge:

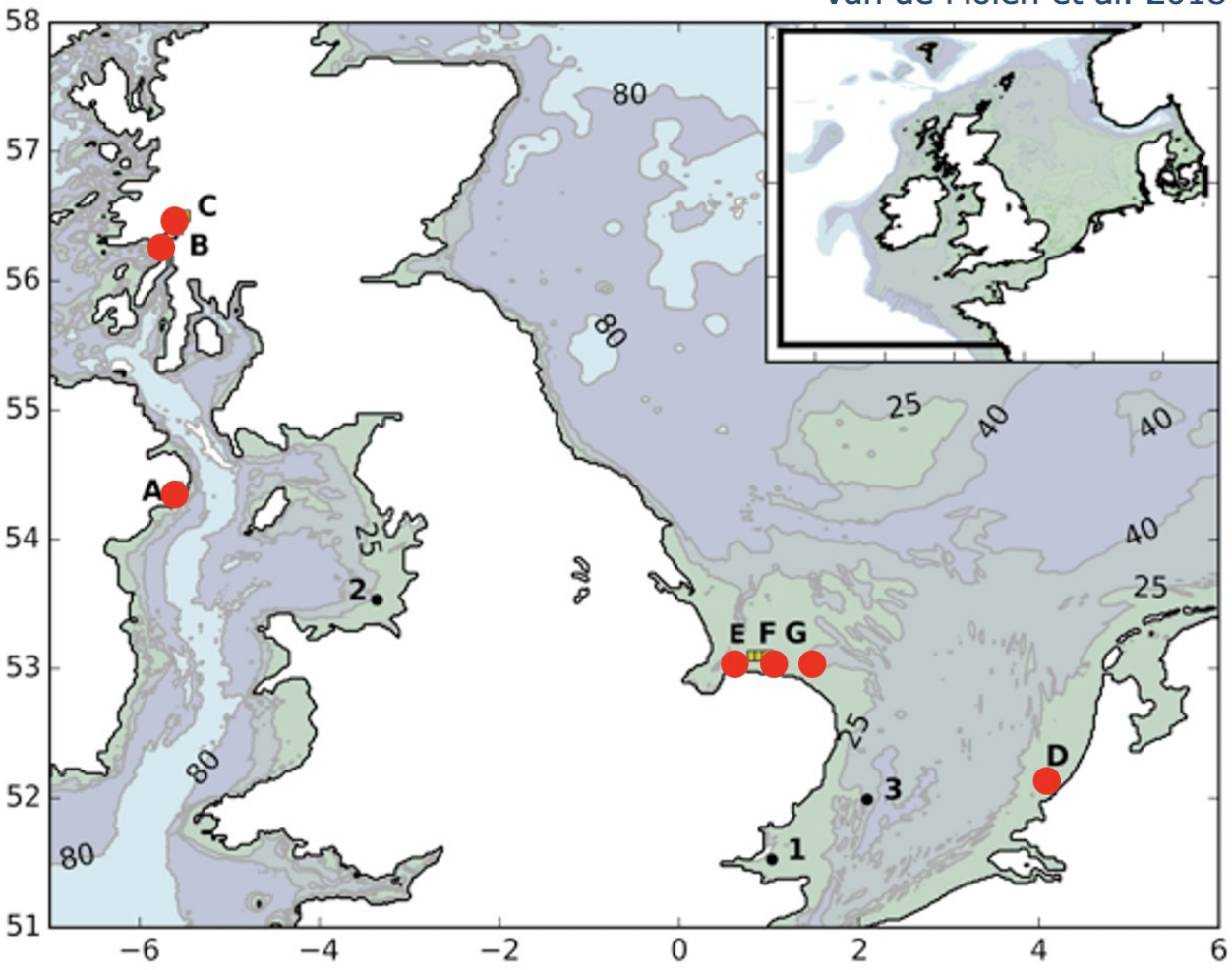
-> seaweed farmers know what yield is possible in their farms

#seaweedopportunities

@KRTimmermans

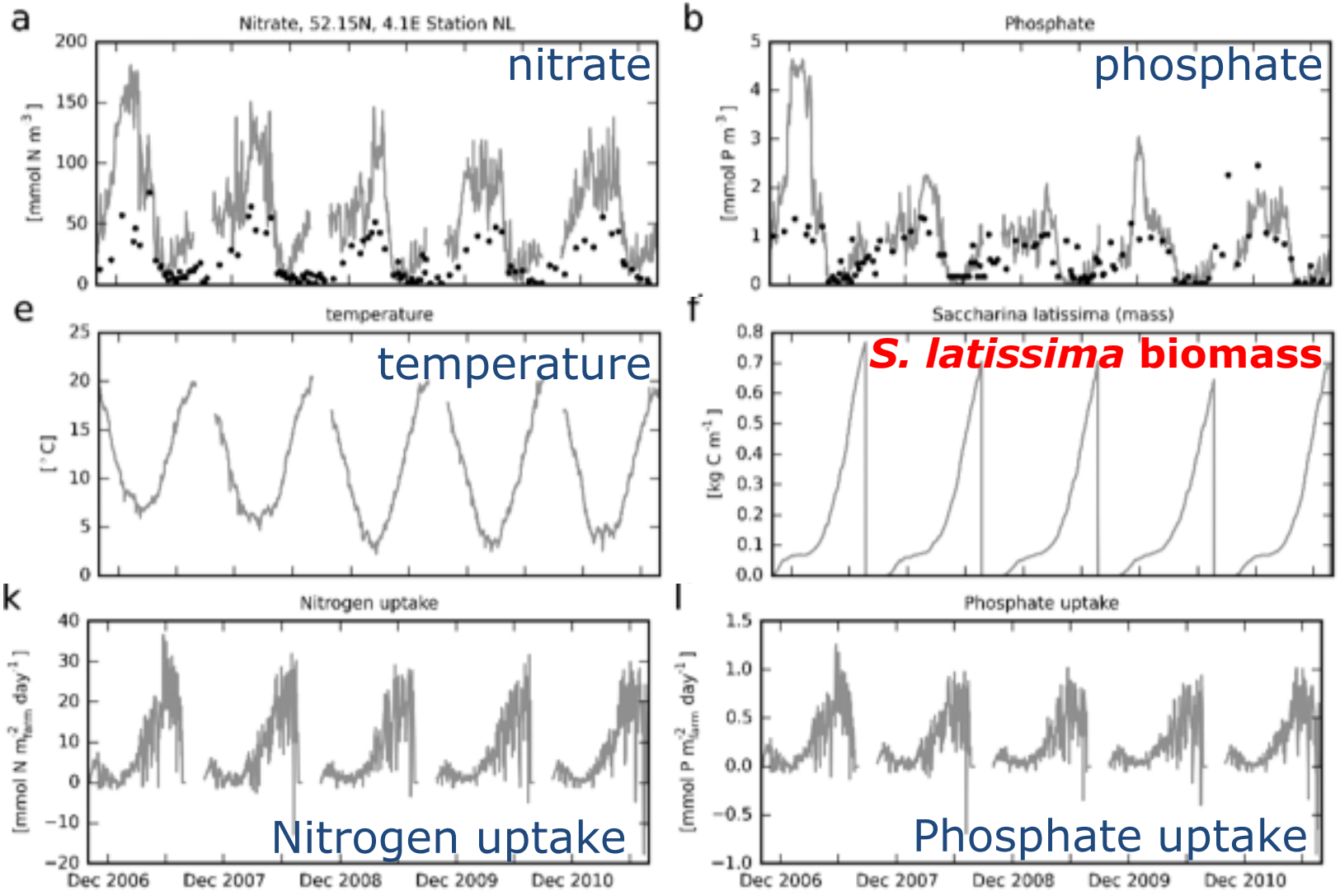
Modelling potential seaweed biomass production

Van de Molen et al. 2018



Modelling potential seaweed biomass production

Northsea farm (Scheveningen)



Modelling potential seaweed biomass production

Seaweed cultivation in the Northsea (and UK) coastal waters is possible, with yields of max
20 ton seaweed DW . ha^{-1}

Marginal (if any) environmental effects, e.g. nutrient concentrations by the (small-scale) seaweed farms

What did you do ‘’to make it happen’’ for all of us:
contribute to a realistic estimate of seaweed production and insight in ecological consequences for the Northsea

Van de Molen et al., 2018, Biogeosciences

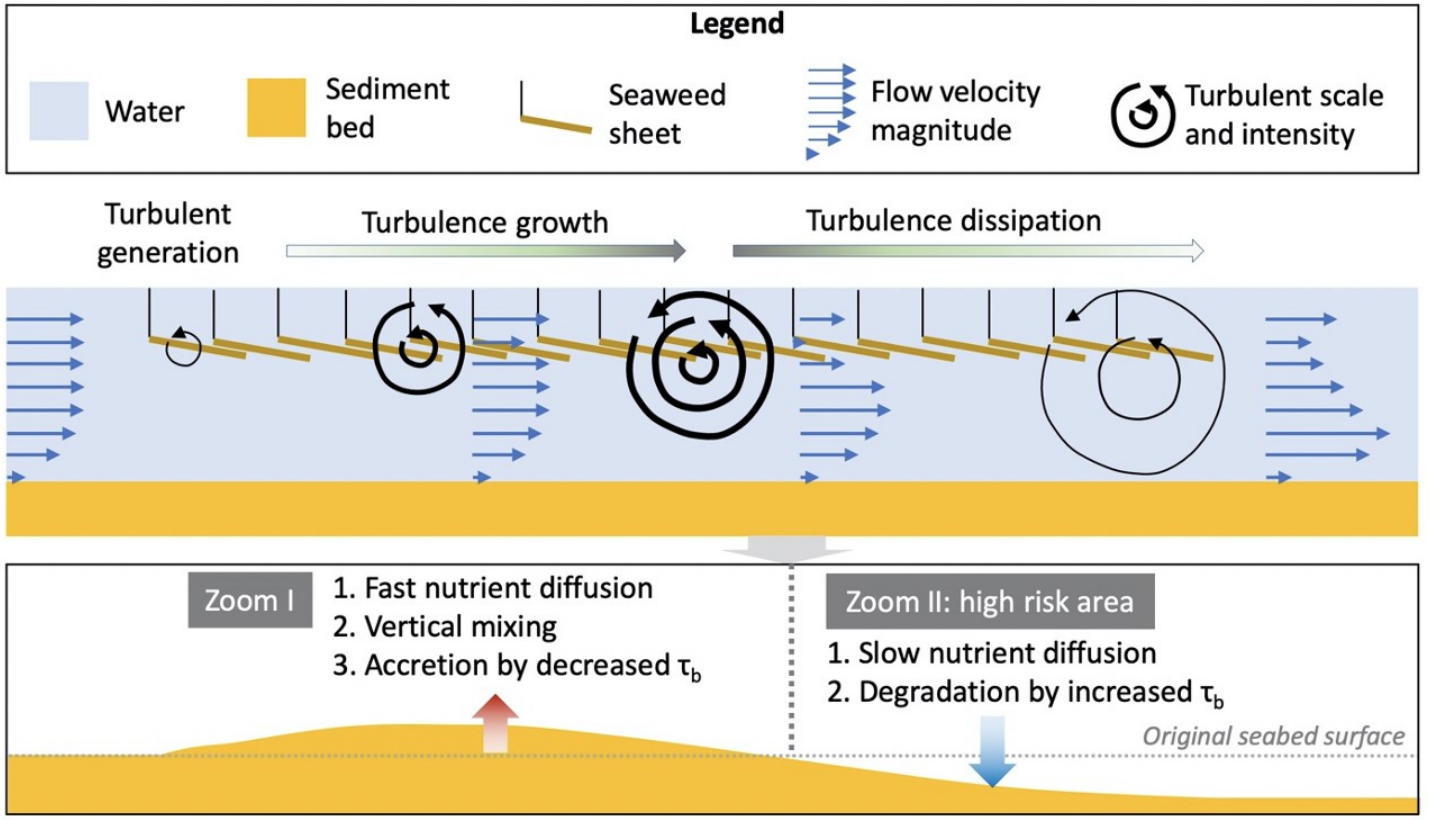
Finding the balance:

preserving the natural marine ecosystem
and
unlocking its potential for food production

14.000 km^2 of seaweed in the Northsea ??

500 km^2 more realistic (without additional measures)
no significant use of nutrients, limiting eutrophication, CO_2 uptake, enhancing biodiversity, and
producing valuable **seaweed biomass**

cultivation offshore easier said than done...



Zhu et al (submitted):

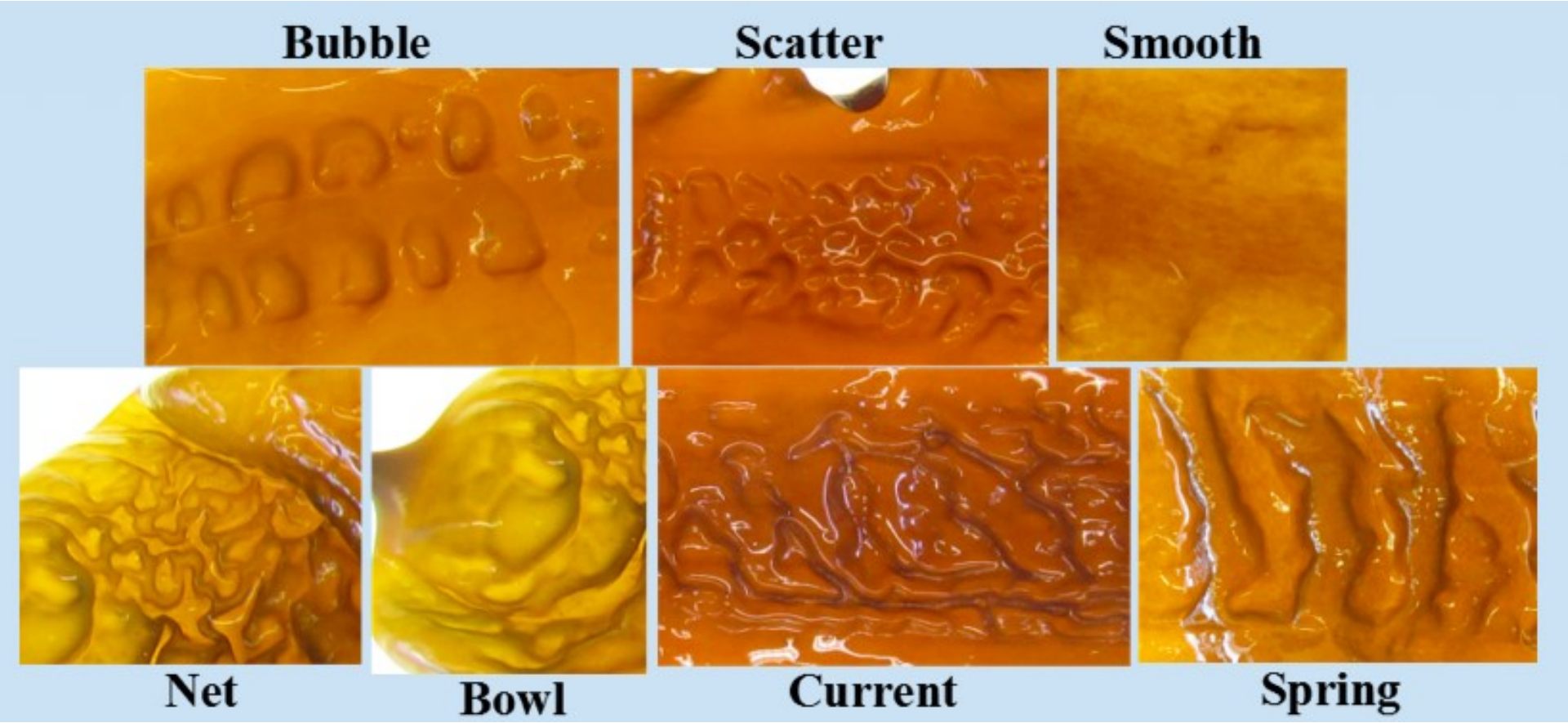
large scale cultivation will cause **reduced current** in the seaweeds (nutrient limitation!), and **enhanced current** below (erosion of sediment, turbulent waters)

cultivation offshore easier said than done...

Saccharina latissima

MORPHOLOGY determined by hydrodynamics

there is no standard seaweed, affecting dragforces (hence anchoring)



Zhu et al., 2021, J Applied Phycol, in press

What did you do ‘’to make it happen’’ for all of us:

a lot of fundamental scientific, experimental work on physiology, ecology, morphology and genetics of native Northsea species

... will continue to do that and extent to research on **taste and texture**, **genetics**, effects of **global warming**, **sensing of growth**, **biorefinery,** etc.

All results publicly available via open access publications...

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Impacts of off-bottom seaweed cultivation on turbulent variation in the hydrodynamic environment Zhu, Q., Z Zhu, R. W. Nauta, Long J., K.R. Timmermans, Y. Cai, Z. Yang, T. Gerkema. Submitted

Is fundamental science enough?
Will Northsea seaweed cultivation happen ?

YES, when we

combine life sciences (physiology, ecology, genetics, chemistry)
with
"soft sciences" - behavioral sciences, ethics of food, governance, socio-economics, etc. -
and
join forces with **applied sciences** (TO2 institutes)

knowing that only

with proper support by companies & consumers this new food production system will be accepted

Northsea Seaweed opportunities;
Fundamental Sciences Making it Happen!

let's do it sustainable, in balance with the natural ecosystem

using domesticated native seaweed species

reducing eutrophication

stimulating biodiversity

don't forget the applied sciences,
processing/biorefinery,
the companies and consumers


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THANK YOU FOR YOUR ATTENTION
thanking my co-workers for their excellent work: Alexander Lubsch, Alexander Ebbing, Guorong Zhu, Qin Zhu, Johan van der Molen, en many others
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@KRTimmermans