

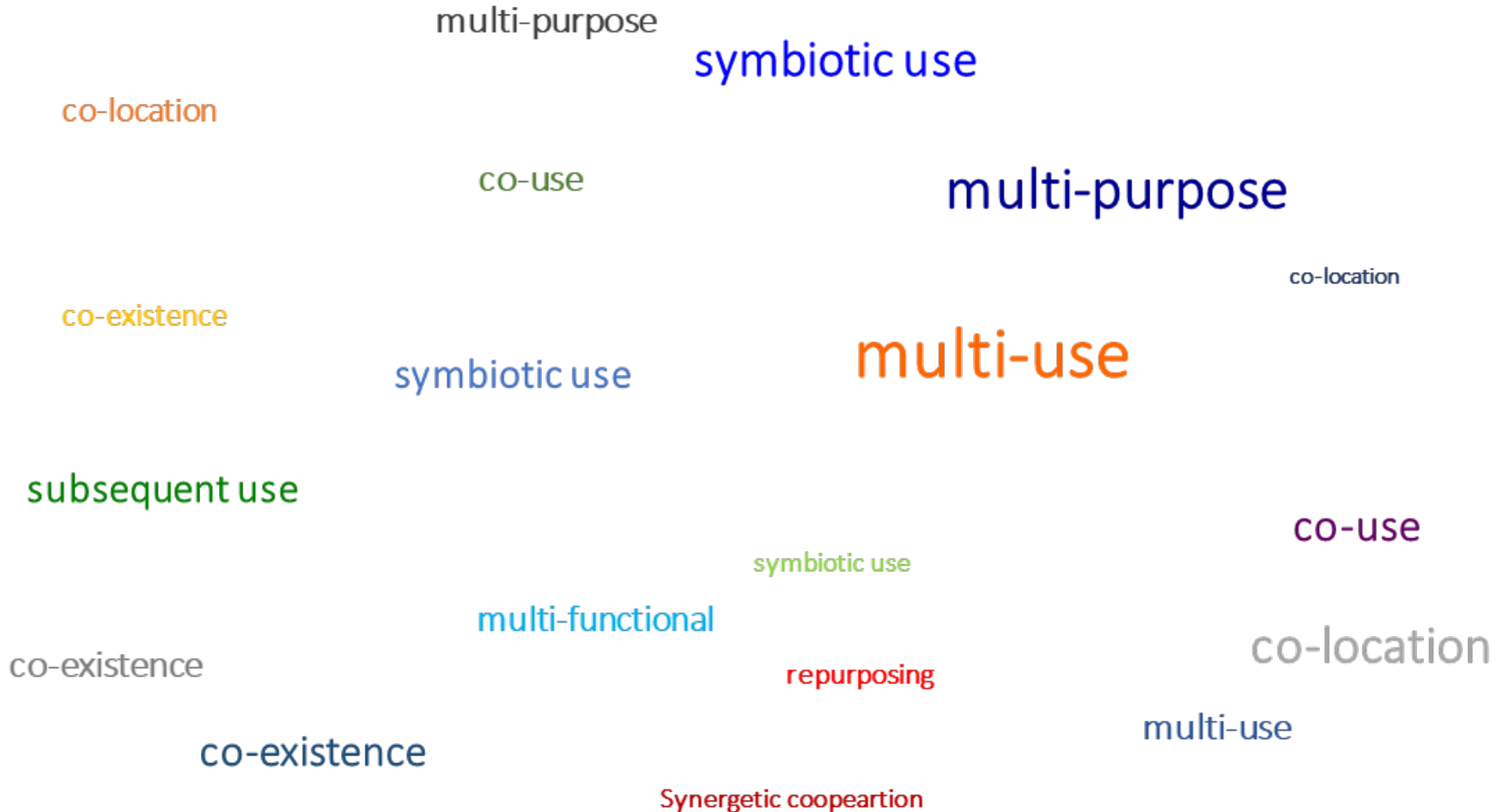
Aquaculture perspective of multi-use sites in the open ocean: The untapped potential for marine resources in the Anthropocene

Prof. Dr. Bela H. Buck

North Atlantic Seafood Forum - NASF - 21st June 2022



What is „Multi-Use“?



offshore wind & fish aquaculture

oil & gas & hydrogen

offshore wind & desalination

offshore wind & floating shipping terminal

offshore wind & seaweed aquaculture

aquaculture & environmental monitoring

offshore wind & MPA

oil & gas & fish aquaculture

offshore wind & shellfish aquaculture

tourism & underwater cultural heritage

tourism & fishing

tourism & MPA

offshore wave & desalination

hydrogen & offshore wind

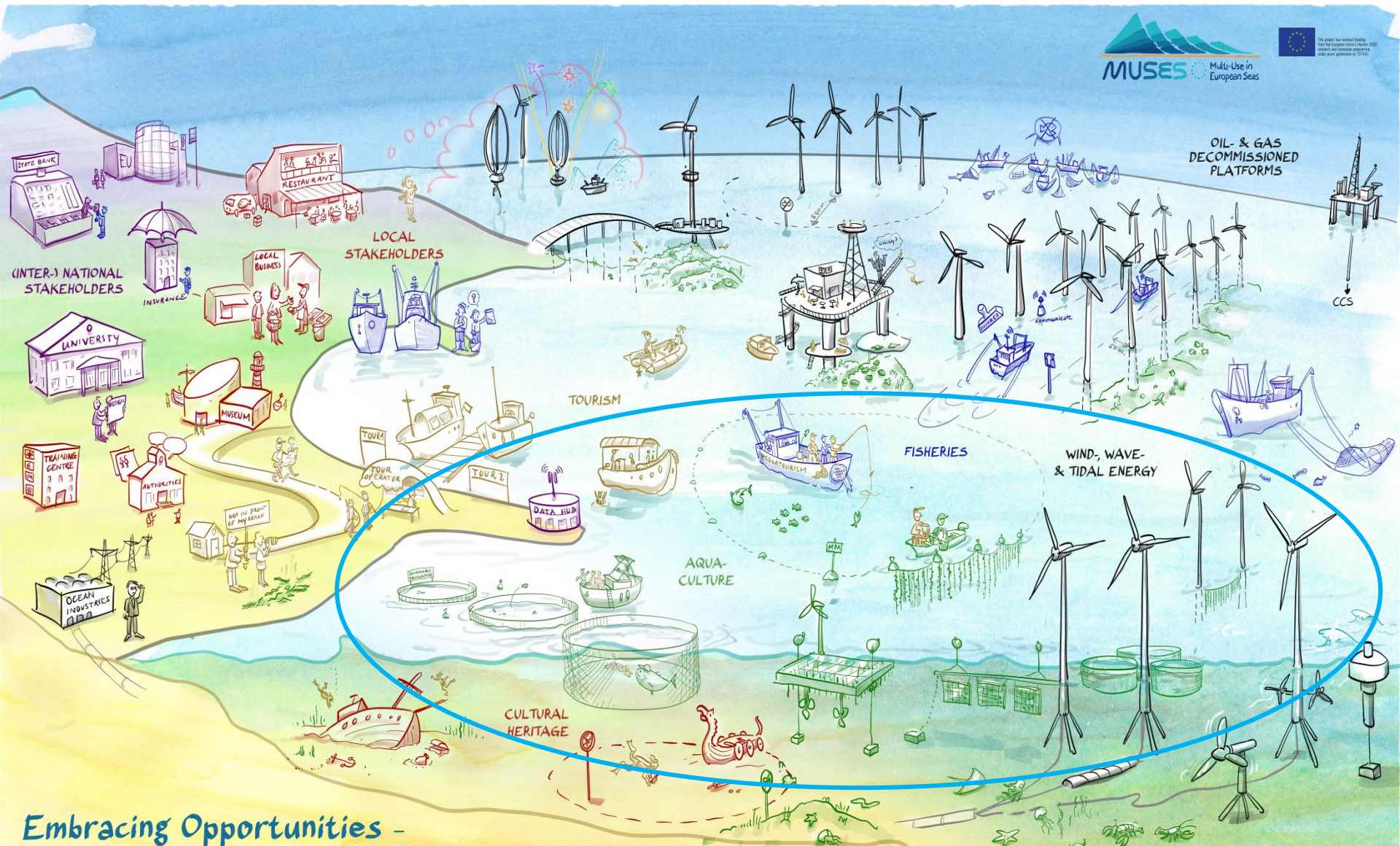
offshore wind & MPA

Floating shipping terminal & shellfish aquaculture

offshore wave & shellfish aquaculture

offshore wind & wave

tourism & wave energy & desalination



Embracing Opportunities - Ocean Multi-Use Action Plan

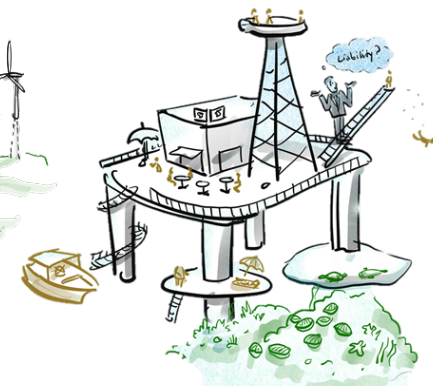
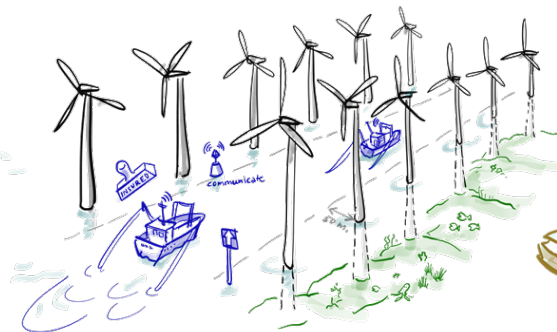
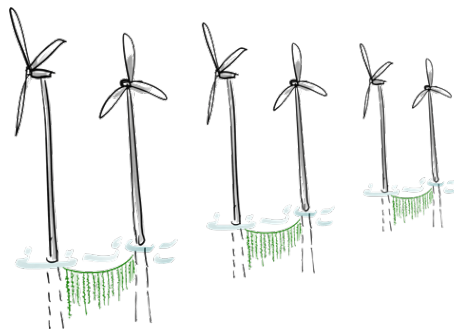
A Common Definition for Marine Multi-Use:

*“Marine multi-use is the **joint use of resources** in **close geographic proximity** by either a single **user** or multiple users.*

The act of exploitation of a resource by one or more users.

A business, company or otherwise legal entity that exploits a given resource.

A good that represents a value to one or more stakeholders.



Type 1

Spatial	✓
Temporal	✓
Provisioning	✓
Functional	✓

Type 2

Spatial	✓
Temporal	✓
Provisioning	✓
Functional	

Type 3

Spatial	✓
Temporal	✓
Provisioning	
Functional	

Type 4

Spatial	✓
Temporal	
Provisioning	
Functional	

German North Sea: 41,436 km²

German EEZ: 28,500 km² (70%)



North Sea: Existing and Perspective Uses and Nature Conservation

Geodetic Datum: ETRS89, Map Projection: Lambertsche Azimutalprojektion

Courtesy of BSH Germany



Offshore Windfarms

- in use
- under construction
- approved
- application submitted
- denied

Platforms

- E-Converter, in use
- E-Converter, under construction
- E-Converter, approved
- E-Converter, application submitted
- E-Transformer, in use
- E-Transformer, under construction
- E-Transformer, approved
- E-Transformer, application submitted
- Measurement Platform, in use
- Measurement Platform, under construction
- Measurement Platform, approved
- Measurement Platform, application submitted
- Petroleum Platform, in use
- Petroleum Platform, out of use
- Natural Gas Platform, in use
- Compressor Platform, in use
- unclassified, in use
- unclassified, approved
- unclassified, out of use

Cable

- High Voltage Cable, in use
- High Voltage Cable, under construction
- High Voltage Cable, approved
- High Voltage Cable, application submitted
- Data Cable, in use
- Data Cable, application submitted
- Data Cable, out of use
- Data Cable, unknown

Pipelines

- Natural Gas Pipeline, in use
- Natural Gas Pipeline, application submitted

Nature Conservation

- Natura2000 SCI
- Natura2000 SPA

Military Practice Area

- Firing Danger
- Air Force Exercise
- Torpedo Exercise
- Mine Hunting Practice
- Submarine Exercise
- unclassified

Boundaries

- Continental Shelf/EEZ
- Territorial Waters/12 nm Zone
- International Boundary

Maritime Features

- Traffic Separation Zone
- Inshore Traffic Zone
- Anchoring Area

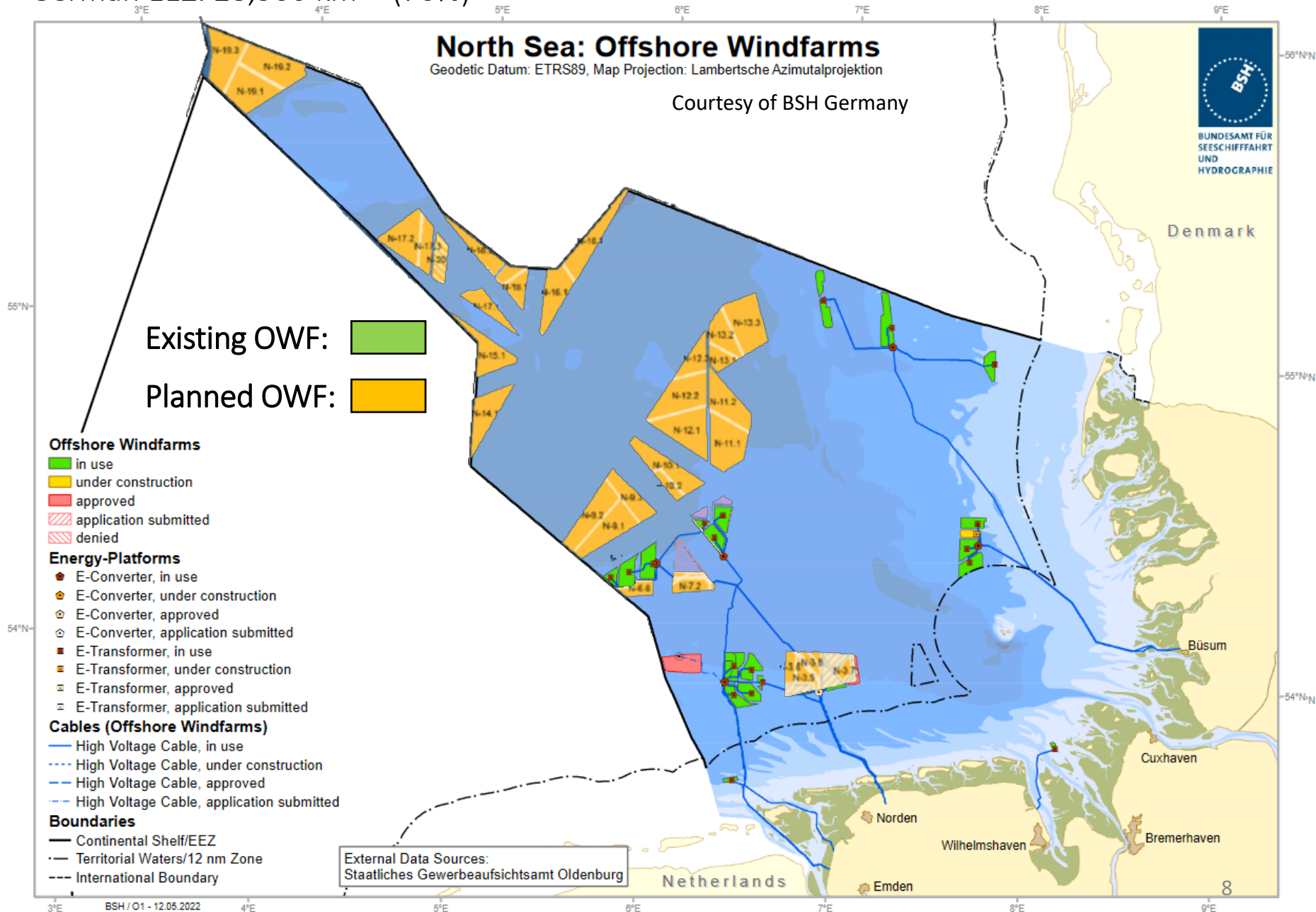
Water Depths

- 50-60 m
- 40-50 m
- 30-40 m
- 20-30 m
- 10-20 m
- 0-10 m
- Tidal Flats

External Data Sources:
Staatliches Gewerbeaufsichtsamt Oldenburg,
European Environment Agency,
Zentrum für Geoinformationswesen der Bundeswehr

German North Sea: 41,436 km²

German EEZ: 28,500 km² (70%)



German North Sea*:

Size Offshore Wind Farms planned: 16 – 195 km²

Capacity Offshore Wind Farms planned: 225 – 2,000 MW

→ Density of Power $\approx 5.7 - 10.6 \text{ MW/km}^2$ (mean = 9.43 MW/km²)

Existing OWF-Area:	704 km ²	Mussel Farming (ha):	$\approx 700 - 1,700 \text{ t}^{**}$
Planned OWF-Area:	3,700 km ²	Mussel Farming (km ²):	$\approx 4,000 - 9,000 \text{ t}$
Subtotal 1:	4,404 km ²	Mussel Farming (EEZ):	overproduction
Security Zone (20%):	880 km ²	Seaweed Farming (ha):	$\approx 20 \text{ t (dry)}^{***}$
Subtotal 2:	3,524 km ²	Seaweed Farming (km ²):	$\approx 103 \text{ t (dry)}$
25% potential use only:	881 km²	Seaweed Farming (EEZ):	overproduction

* = Trümpler & Meyer (2022), BSH

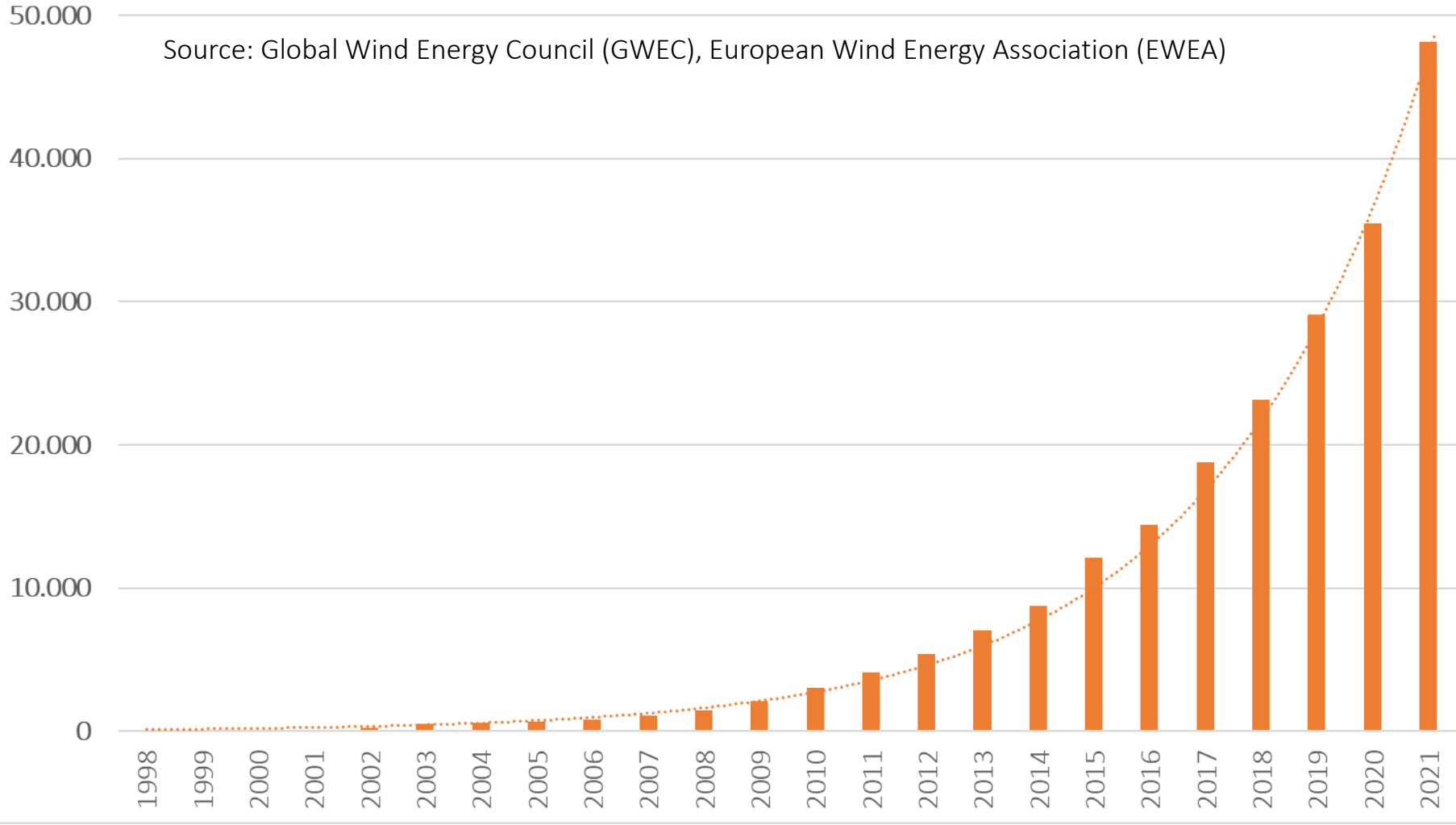
** = Taylor et al. (2019) Front. Mar. Sci. 6:698. doi: 10.3389/fmars.2019.00698

*** = World Bank Group

Global Capacity in MW

Source: Global Wind Energy Council (GWEC), European Wind Energy Association (EWEA)

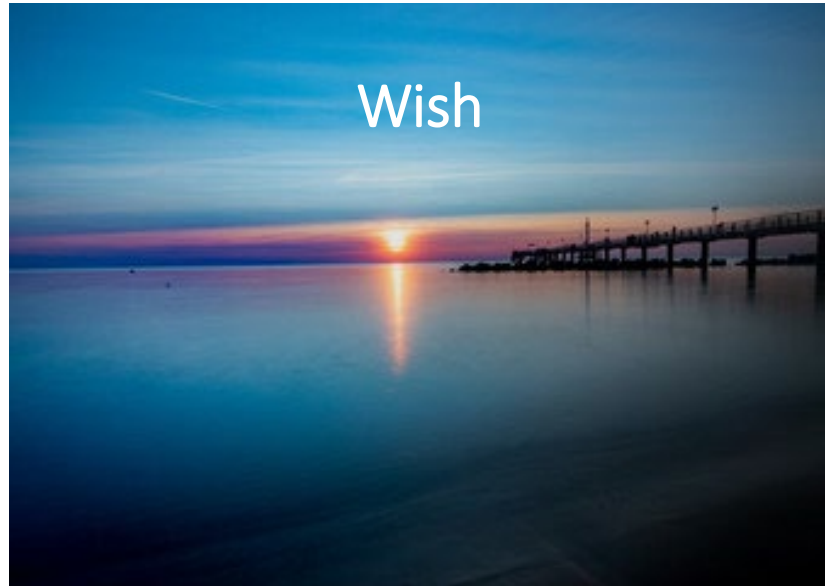
n



- Large potential for aquaculture production
- production can only be realised in the open ocean

Aquaculture off the coast in the open ocean and/or at exposed sites

Wish



Reality



WGOOA

Working Group on Open Ocean Aquaculture

Affiliation: ASG

Chair: Tyler Sclodnick, Bela H. Buck

The Working Group on Open Ocean Aquaculture (WGOOA) seeks answers to questions related to open ocean aquaculture operations.

As the demand for products from aquaculture is constantly increasing and thus the supply of operational space in coastal areas is limited, there are worldwide efforts to move aquaculture more into the open ocean. Central expectations for this transformation is that the culture of aquatic organisms should take place in marine areas where more space is available, stakeholders conflicts are less and better water qualities exist. As a result, new aquaculture production areas have been identified that either lie further out in the open ocean or, on the other hand, in areas that are not far from the mainland but are subject to harsh weather conditions. This leads to a field of research commonly referred to as Open Ocean Aquaculture, Offshore Aquaculture or Exposed Aquaculture.

The central focus of this working group is placed on questions related to open ocean aquaculture, such as:

- the role of potential environmental influences (marine flora and fauna, ecosystems and habitats)
- the technical challenges and specific system design requirements
- the concepts of marine multi-use and site selection
- the economic aspects

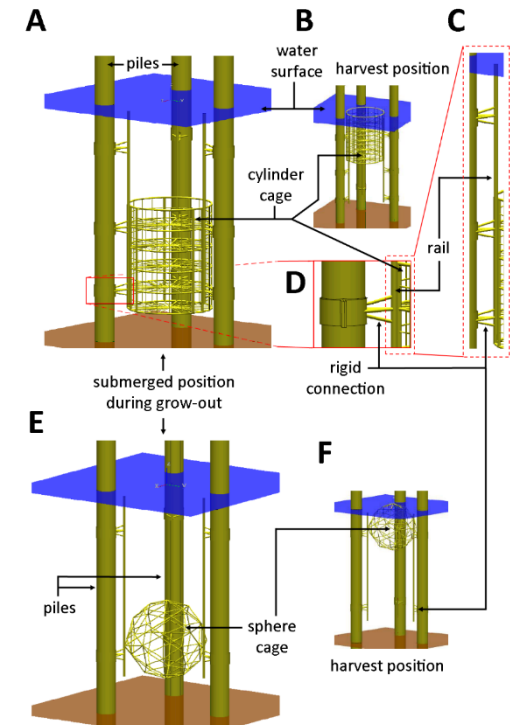
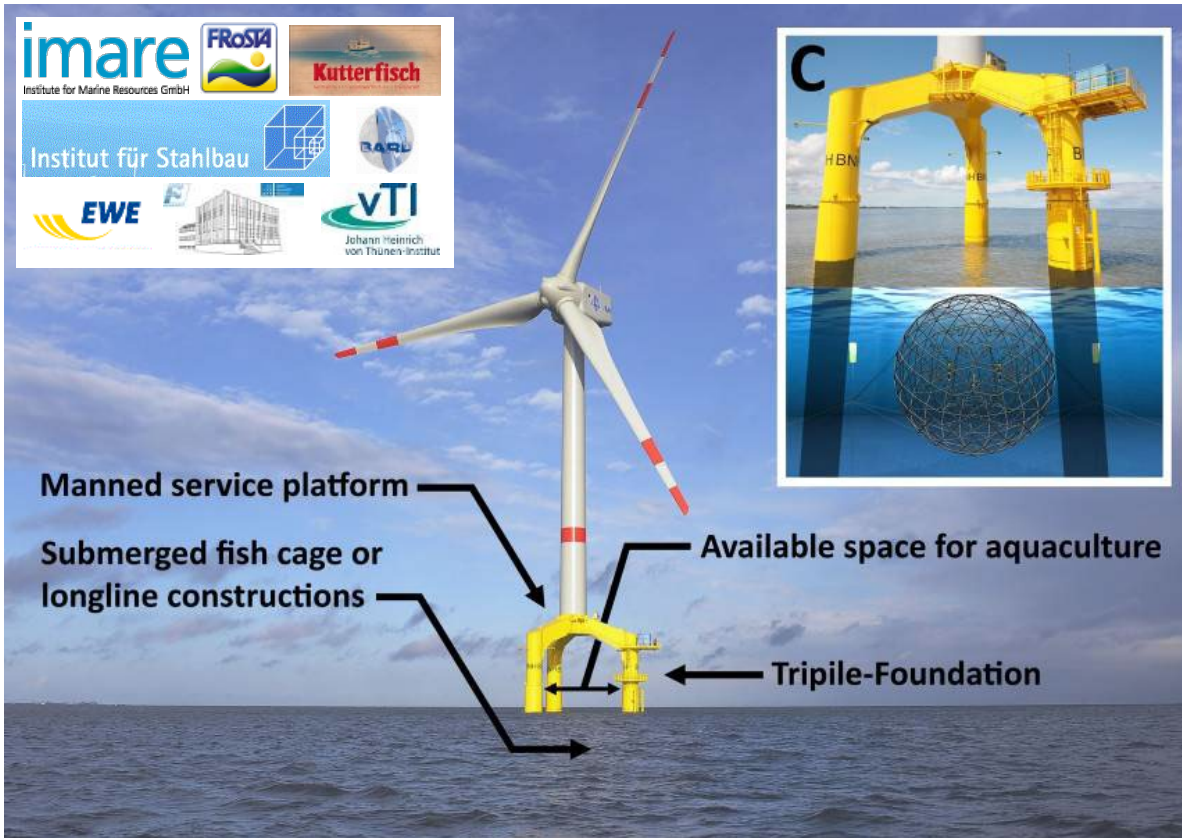
The group will work out concepts for site-specific solutions that will enable the sustainable development of open ocean aquacultures. The goal of WGOOA is to form an inter- and transdisciplinary group of biologists, engineers, economists, spatial planners, managers, people from the industry, administrations and NGOs together, to develop a roadmap for the future of aquaculture at open ocean and/or exposed locations.

Aquaculture in exposed areas need a clear definition.
=> WGOOA (ICES)

Next Meeting: October 2022 Venice/Rimini (after EAS)

Exposed Aquaculture

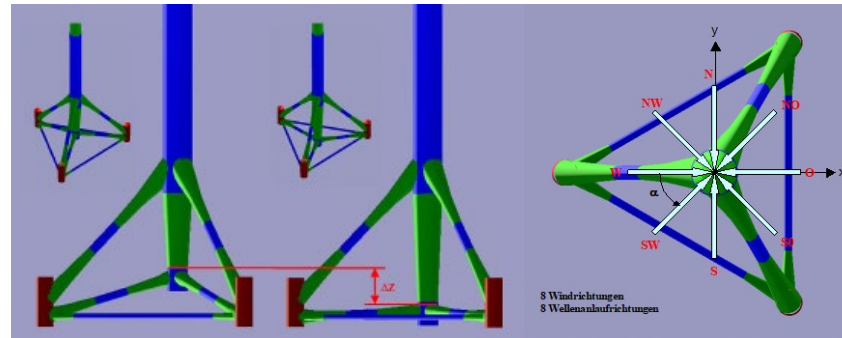
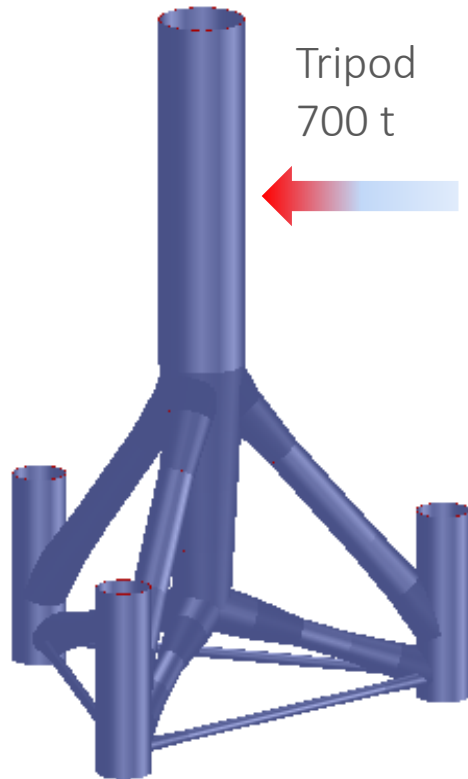
Multi-use to realise OOA



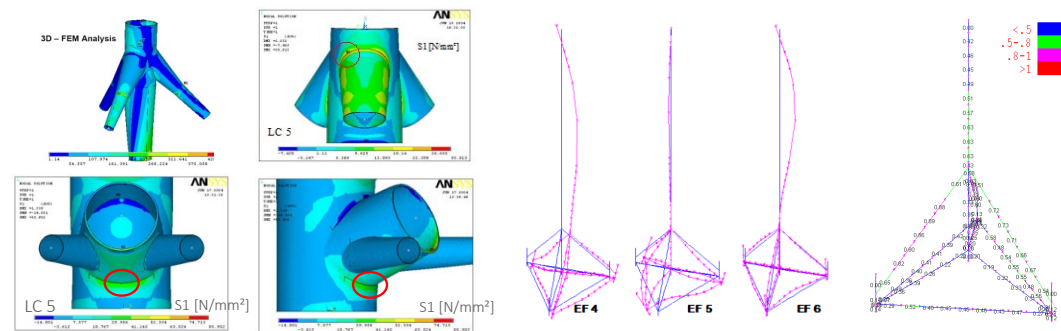
Buck & Langan 2017 - Springer

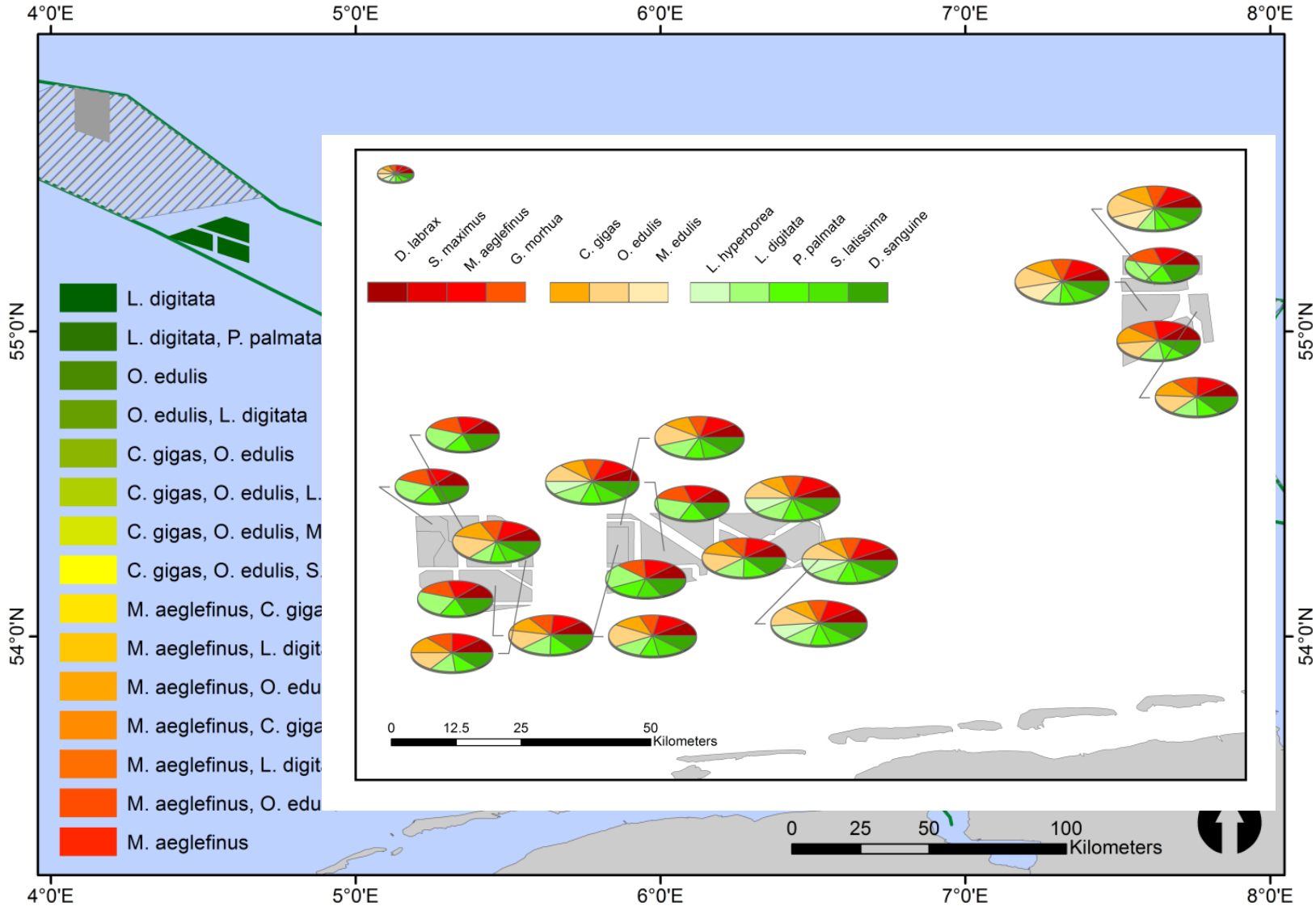
Buck & Krause 2010 - Springer Encyclopedia

Calculation of static models (3-5 MW turbine class)

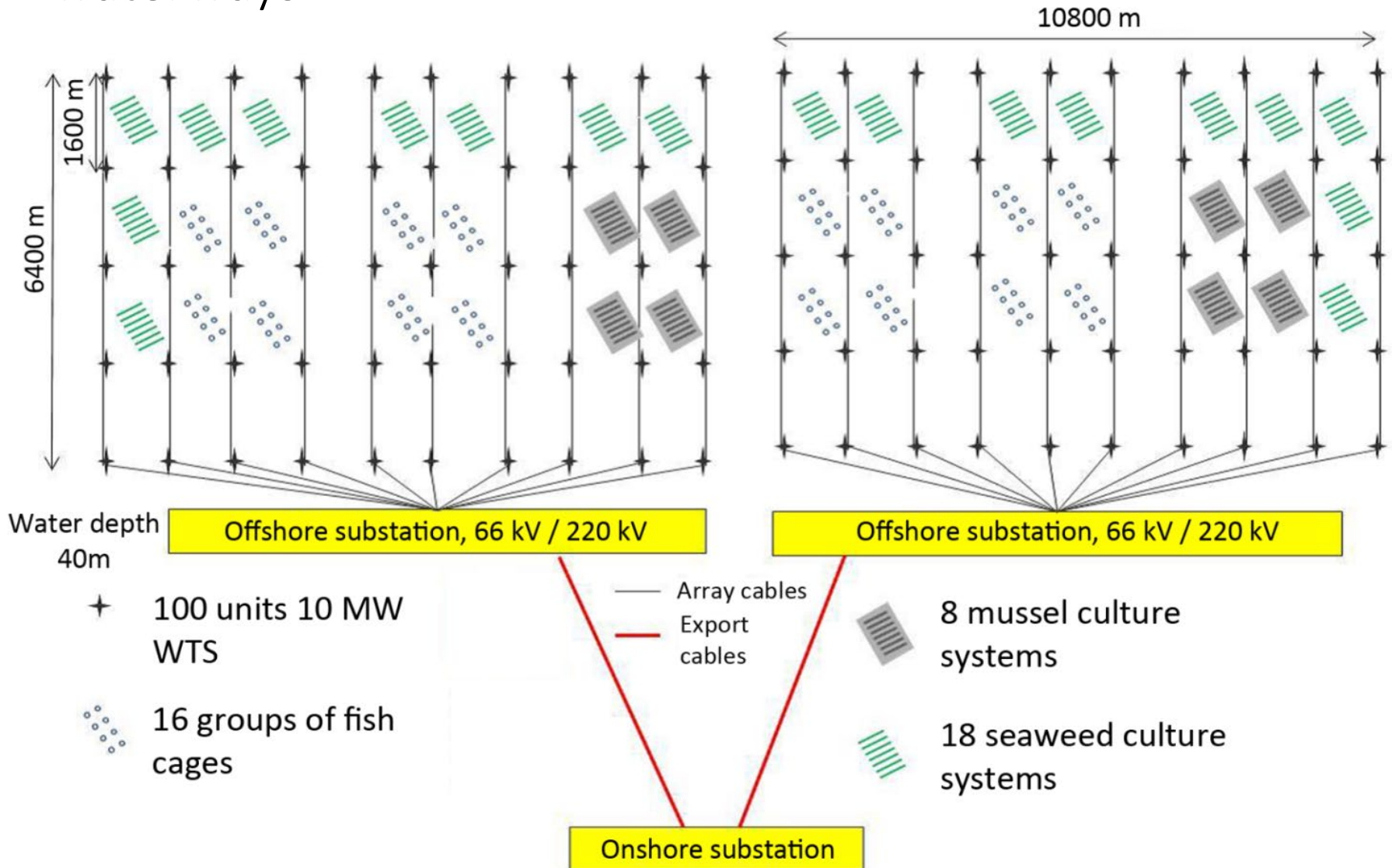


Calculation of alternative attachment points





OWF with IMTA and waterways



BREAKING THROUGH THE BARRIERS FOR SUCCESS

MULTI-USE COMBINATIONS

- Offshore wind & tourism
- Offshore wind & fisheries
- Offshore wind & aquaculture
- Wave energy & aquaculture
- Offshore wind & wave energy
- Tourism & underwater cultural heritage
- Tourism & fisheries
- Tourism & aquaculture
- Oil & gas decommissioning - repurposing



OCEAN MULTI-USE ACTION PLAN



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement no 727451



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Schultz-Zehden et al. (2018) Ocean Multi-Use Action Plan, MUSES project. Edinburgh. 132 p.

Barriers to implement Multi-Use (e.g. in Germany):

- Fights for funds
- Basic assumption that AQ is bad
- Lack of expertise in assessing multi-use
- Space for utilisation is often perceived as "sole right" (Alternative: safety concerns)
- NYMBIs and NATOs

Kölner Stadt-Anzeiger

www.ksta.de

Forschungsgelder „Konkurrenz, Neid und Angst“



Herr Professor Elger, vielversprechende junge Mediziner verlassen Deutschland, weil Unikliniken und Universitäten ihnen keine Perspektive bieten können. Warum?

Christian Elger: Wir wollen ihnen gern eine feste Beschäftigung bieten, aber ein Stellenpool ist an der Universität dafür nicht vorhanden.

Es bedarf eines Antrags beispielsweise bei der Deutschen Forschungsgemeinschaft. Nur 20 Prozent der Anträge werden bewilligt. Bis es zu einer – oft nicht ganz nachvollziehbaren – Bewilligung oder Ablehnung vergeht manchmal ein Jahr oder mehr Zeit. In dieser Zeit hängen die Mediziner sprichwörtlich in der Luft. Bietet sich ihnen woanders eine Chance, dann sind sie weg.

Aquaculture in the German print media

BY THOMAS ROBERT (THOMAS.ROBERT@FHBRM.DE) AND ANDREA BRUNER

Presented at *Aquaculture Europe 2015* and recently published in our *Aquaculture International journal* (February 2017, Volume 25, Issue 1, pp 177-200), the paper on which this article is based sought to identify media coverage of aquaculture and to determine which aspects of aquaculture were highlighted and how they were discussed. The study also focused on the presentation of sustainability issues and of organic aquaculture.

The public perception of production processes is becoming more and more important for the reputation and economic success of the food sector. Negative attitudes held by the public might be reflected in consumers' purchase behavior and further development of the aquaculture sector largely depends on consumer demand for its products on the one hand and on farm-level legislation which allows or establishes new forms of enlarging existing ones on the other.

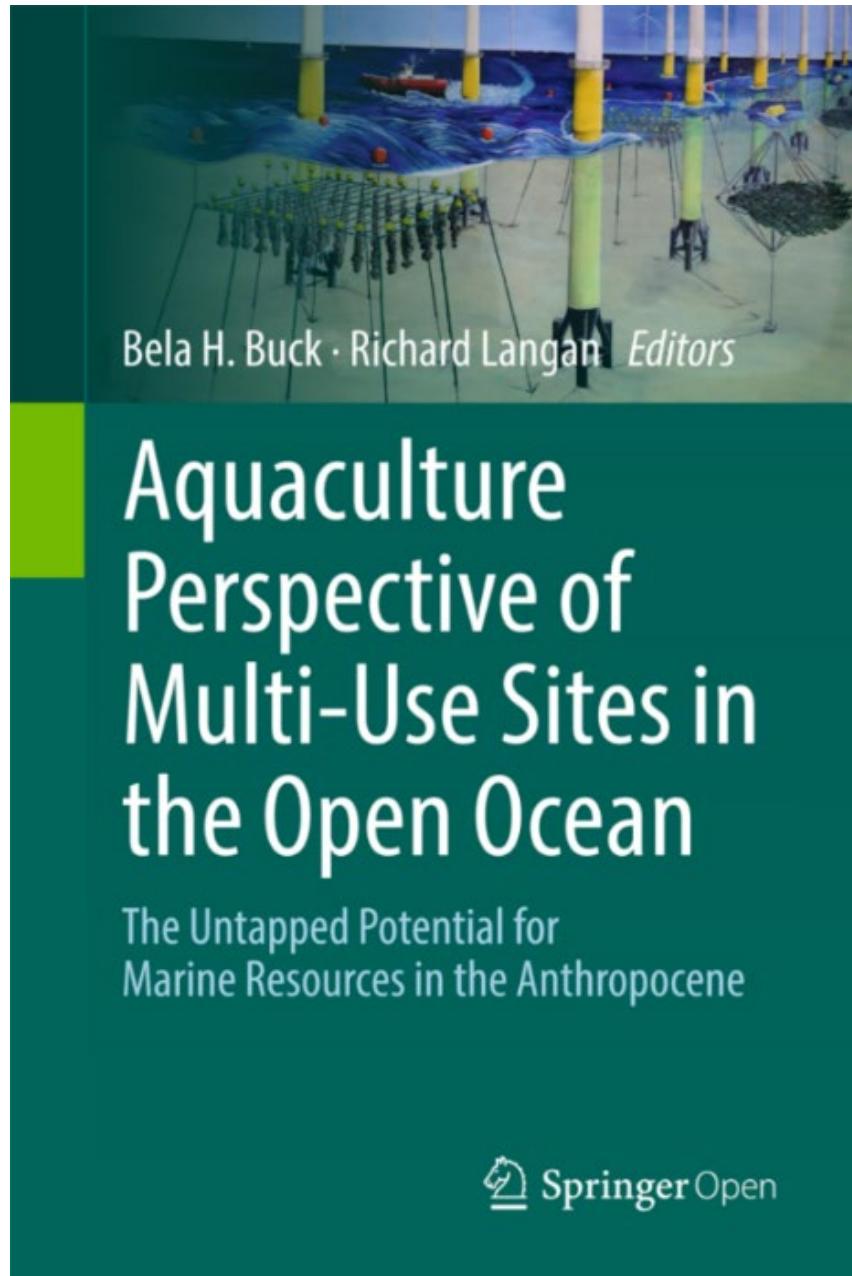
One way to approach and to understand public perception is the analysis of media coverage – especially in the press is an important opinion-former in the public debate. Thus, it is essential for the aquaculture industry to be informed about the presentation of aquaculture in the media and to be able to identify potential factors of influence. However, only a few scientific papers have been published on media coverage of aquaculture and their findings point out that media generally transmitted a negative image of the sector. Risks for human health and for the environment were emphasized, whereas the benefits were less frequently considered.

In contrast, the Bild is a tabloid and the top-selling daily paper in Germany.

All articles containing the following keywords were collected for the sample: "aquaculture, fish farming, fish farms, aquaponics, fish-raising, pond-farming, farmed fish, rearing and fish, rearing and algae, rearing and shrimp, rearing and mussel". The articles were obtained from the online archives of the newspapers and imported into the software MAXQDA 7.5 for further analysis. They were then categorized into seven and four segments were sorted according to different attributes and their aspects. Taxes represented the remaining issue in which an article presented aquaculture. A combination of deductive and inductive category development was used to code the tones, attitudes and their aspects.

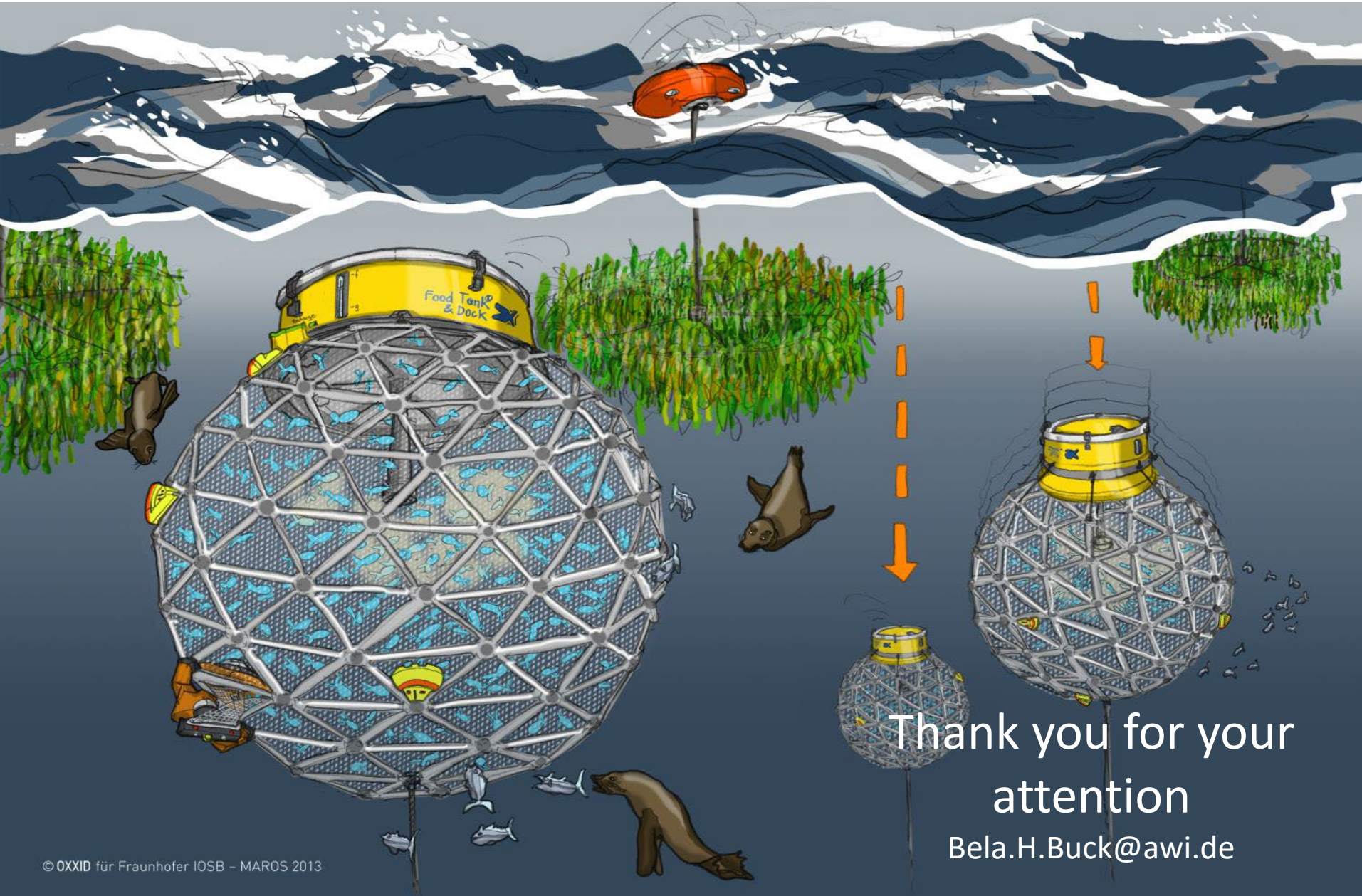
NATO
stands for
No Action Talk Only

Who wants change?



Multi-use in the North Sea:
30 Countries, 48 Authors,
main focus on the North Sea

Open Access



Thank you for your
attention

Bela.H.Buck@awi.de