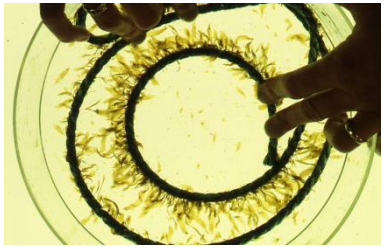


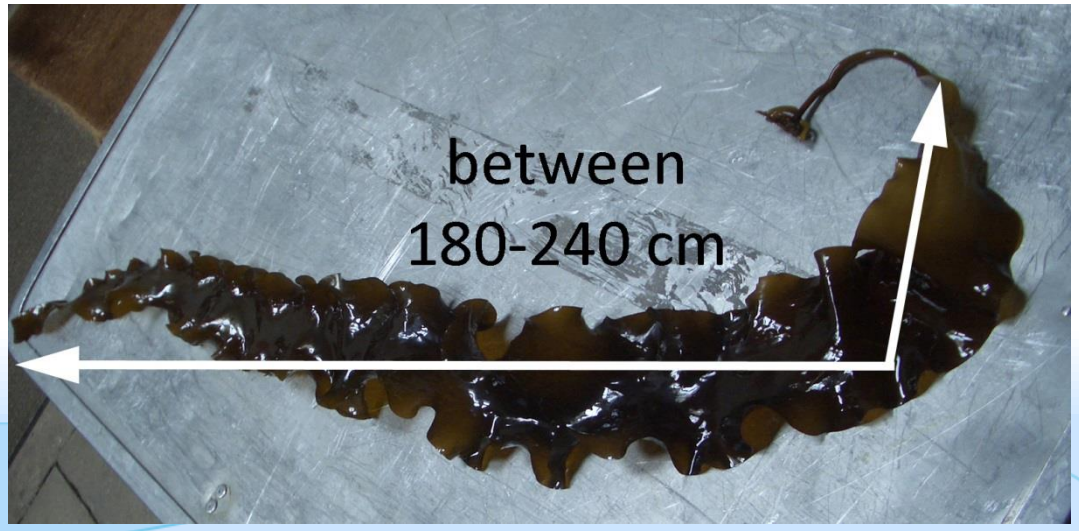

Energy from Offshore Kelp Farms: Technologies and Production of *Laminarian* Species

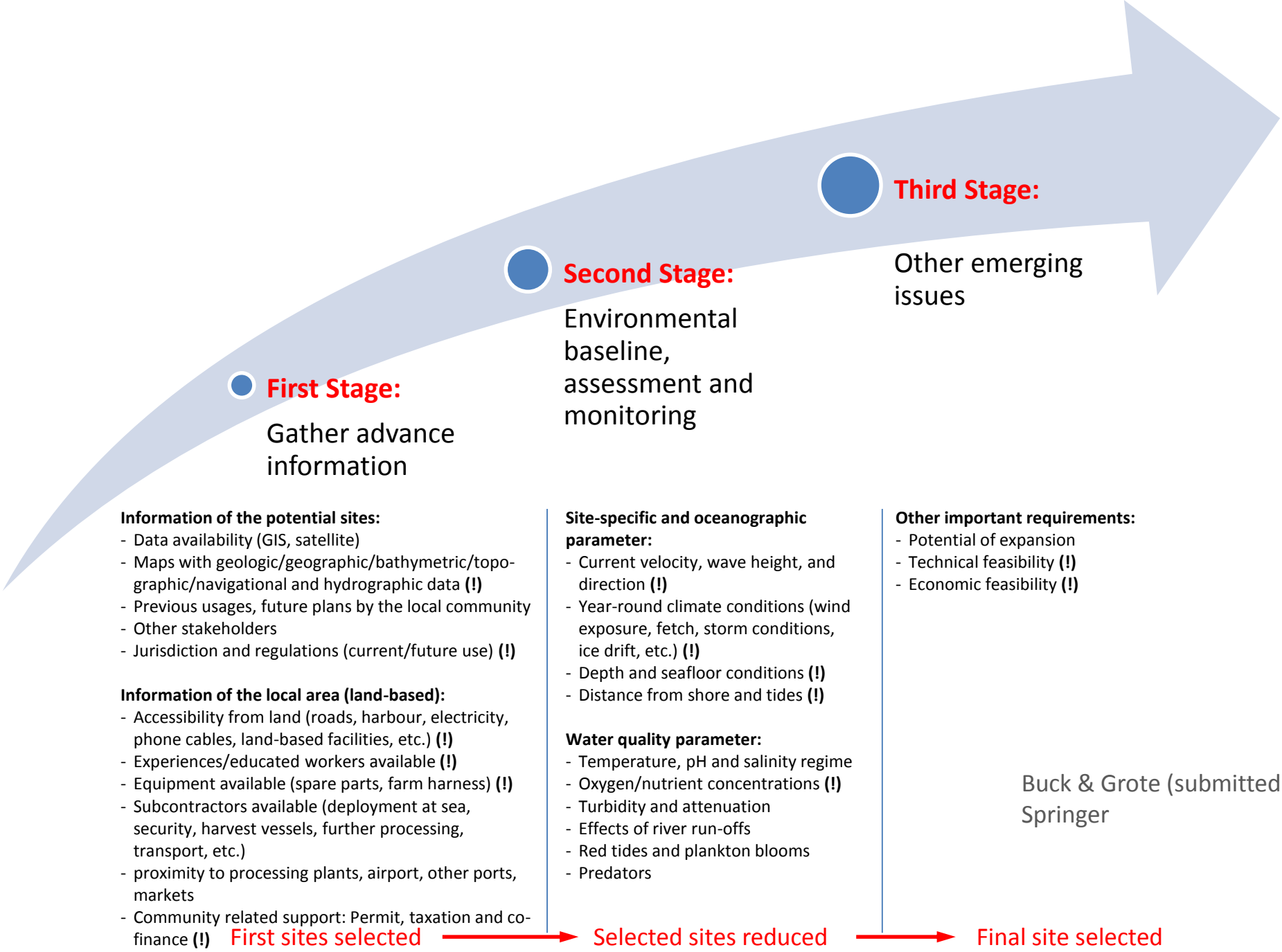
Prof. Dr. Bela H. Buck

Marine Offshore Biorefinery Workshop in Israel - Tel Aviv-Jaffa 24th May 2017

Production of seaweed offshore

1. What are the drivers?
2. Is there an withstanding technique and how can we avoid failures?
3. How is the economic potential depending on target product?
4. Is experienced personal available?
5. Who is willing to conduct this enterprise?

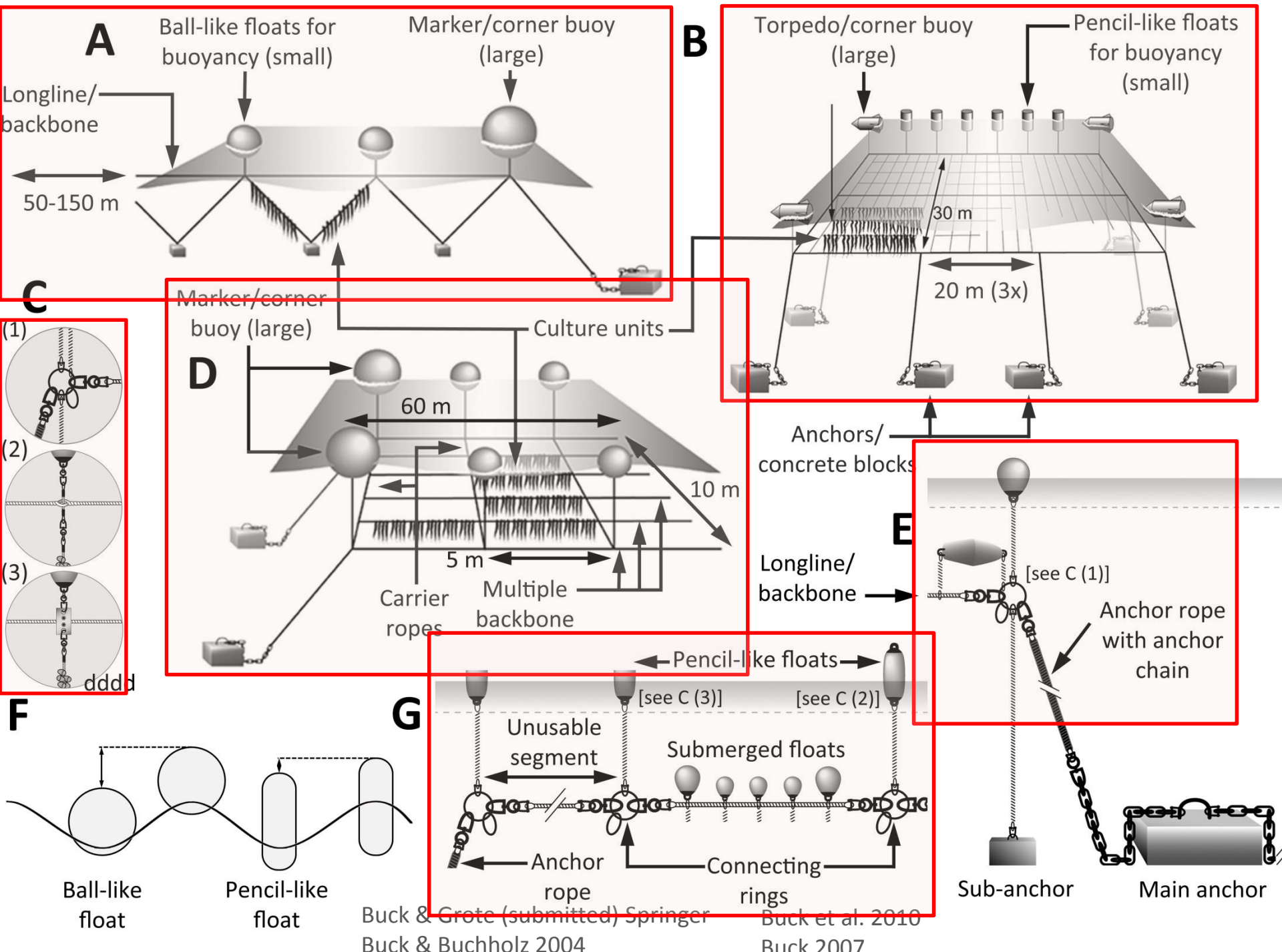




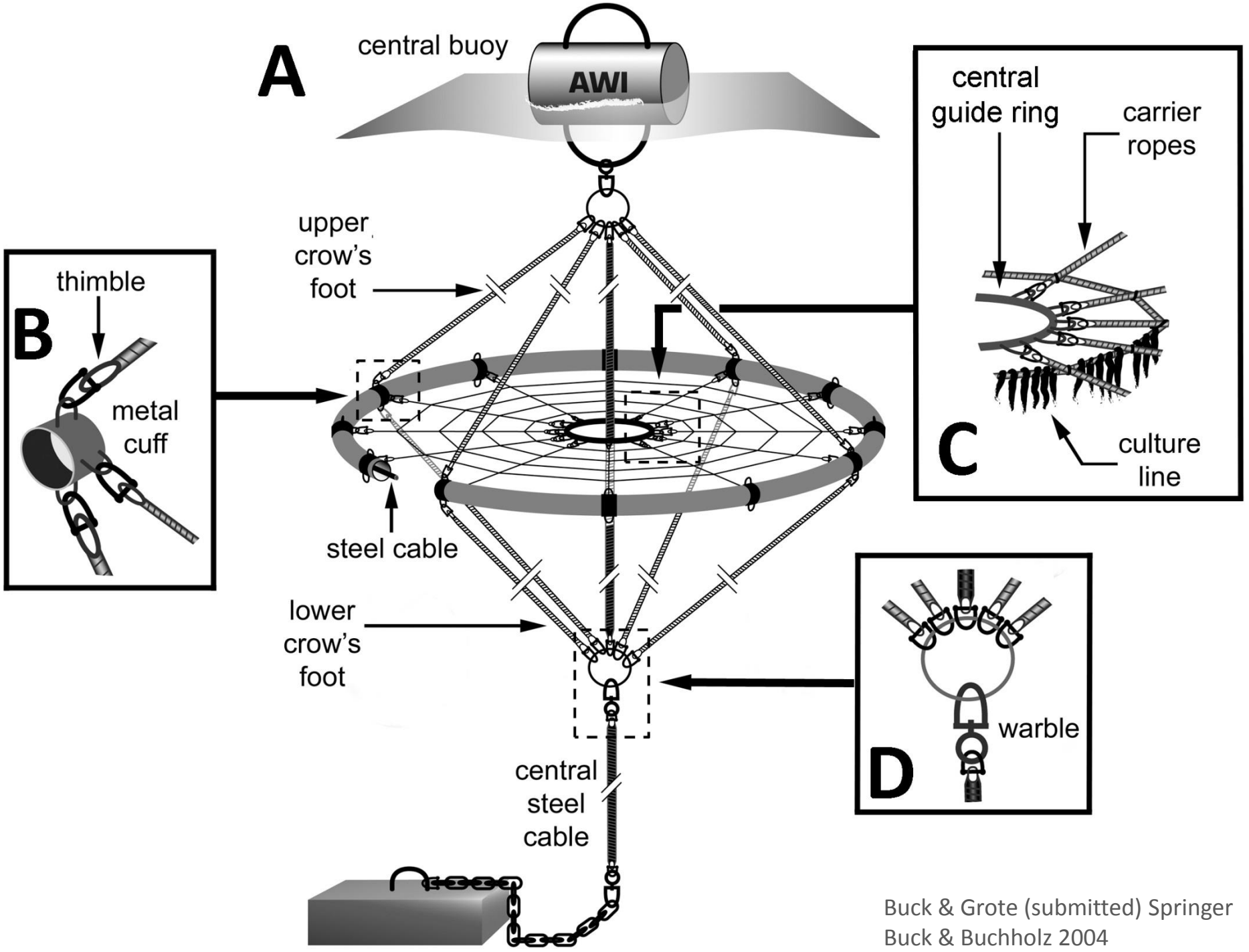
Buck & Grote (submitted)
Springer

Technology and System Design

→ Offshore Resistant Techniques



Buck & Grote (submitted) Springer
Buck & Buchholz 2004
Buck et al. 2010
Buck 2007



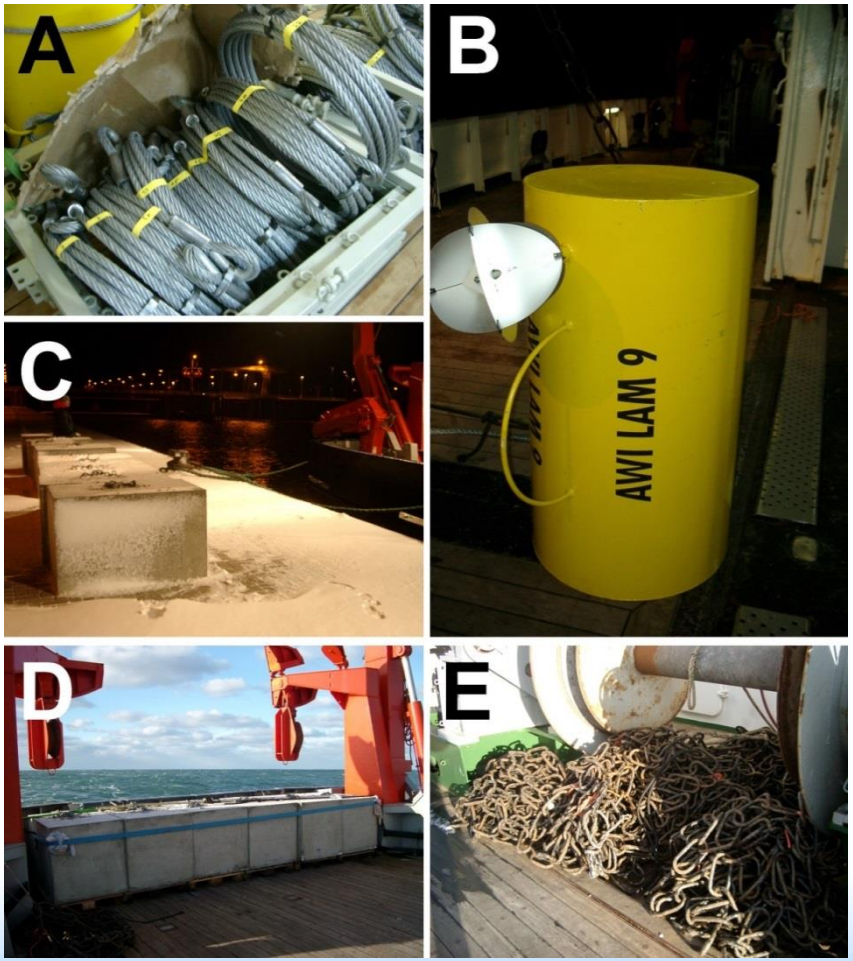
Buck & Grote (submitted) Springer
Buck & Buchholz 2004

First version from 1994-1997

Modified version from 2001-2006

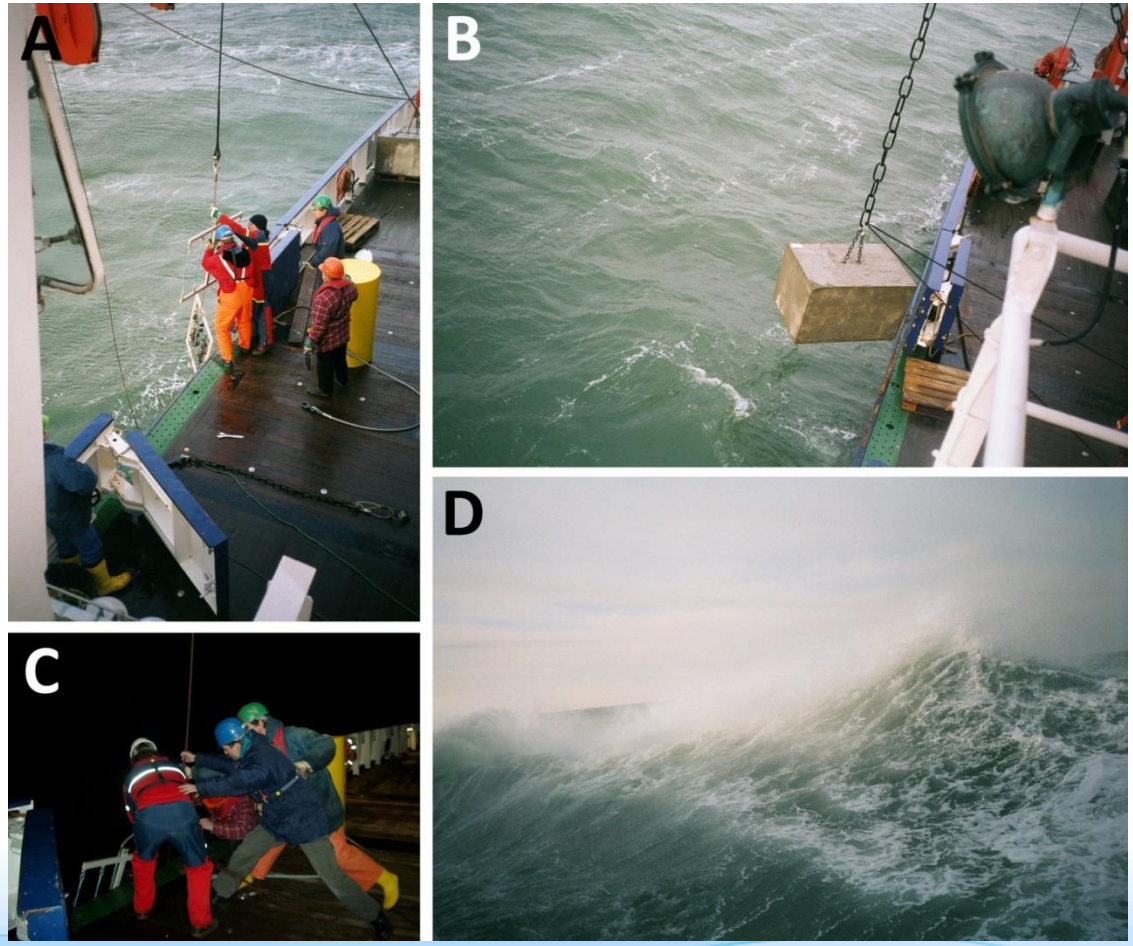
Buck et al 2017a/b
Buck & Grote (submitted) Springer

Resistant equipment:



Buck et al 2017a/b
Buck & Grote (submitted) Springer

Preparation at sea:

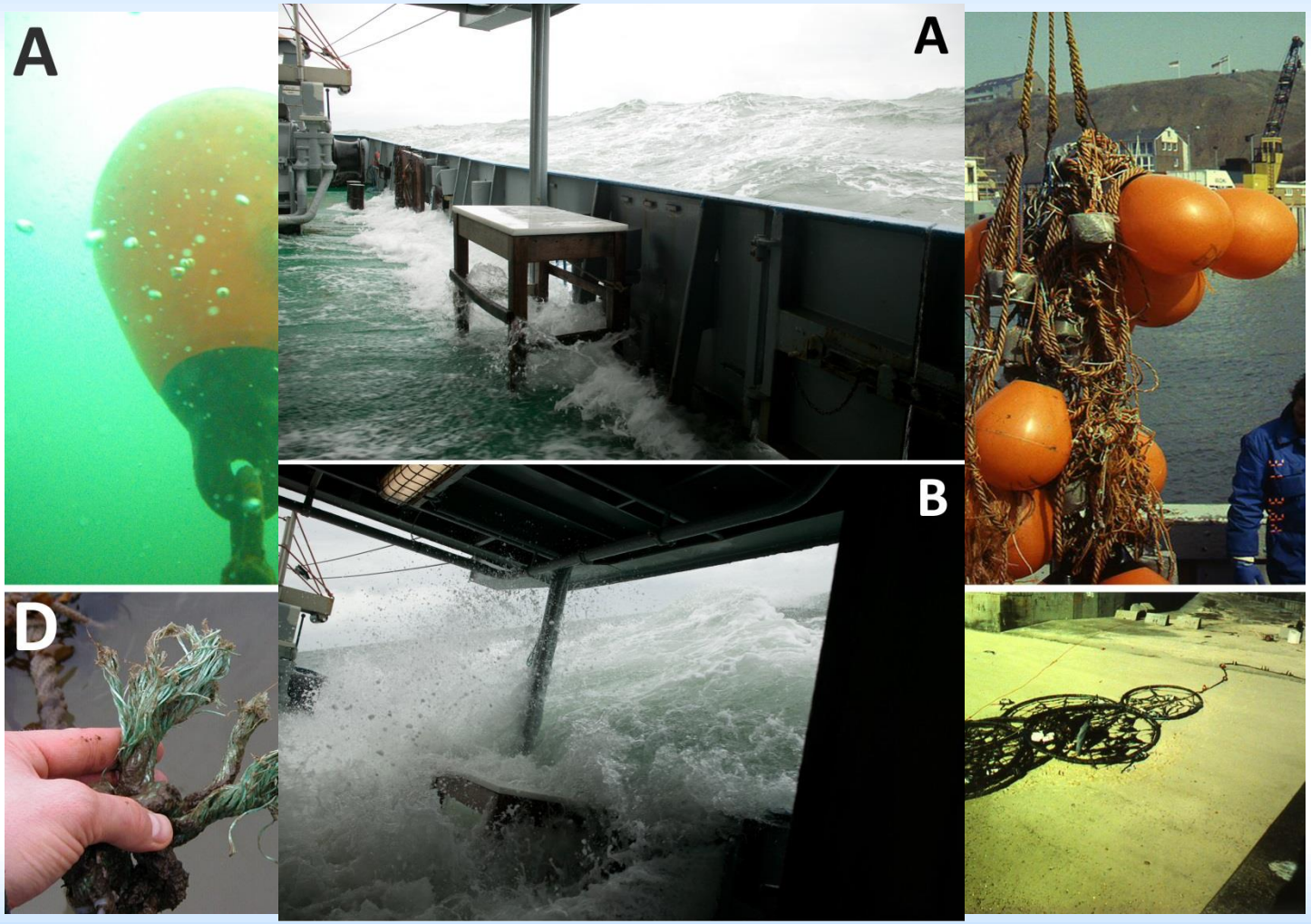


Buck et al 2017a/b
Buck & Grote (submitted) Springer

AWI SeaKult sustainable futures in the marine realm Bundesverband Aquakultur Hochschule Bremerhaven

Buck et al 2017a/b
Buck & Grote (submitted) Springer

Wrong Calculations and failures:



Buck et al 2017a/b
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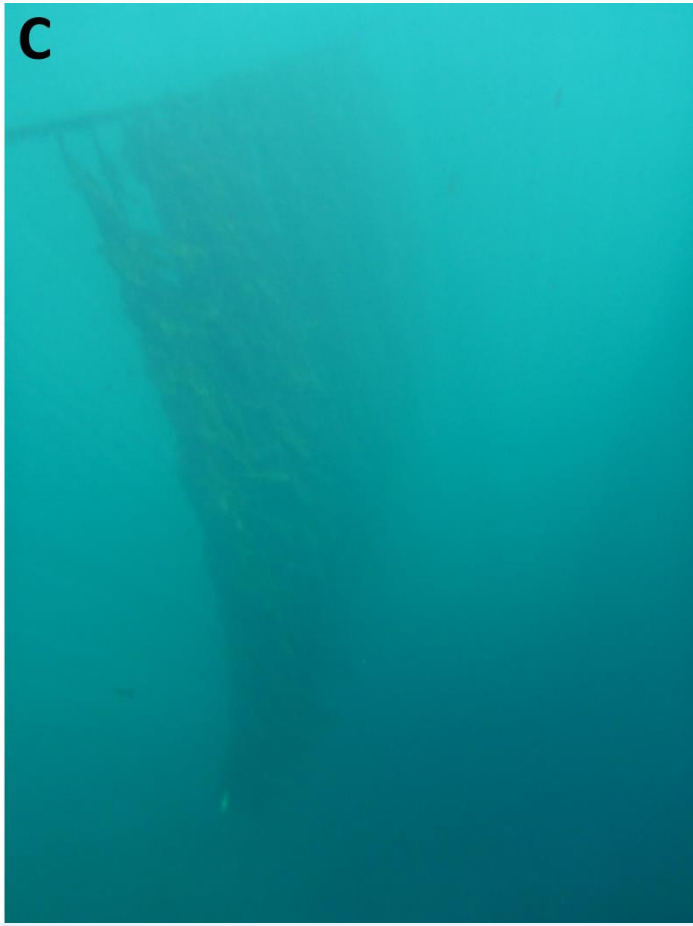
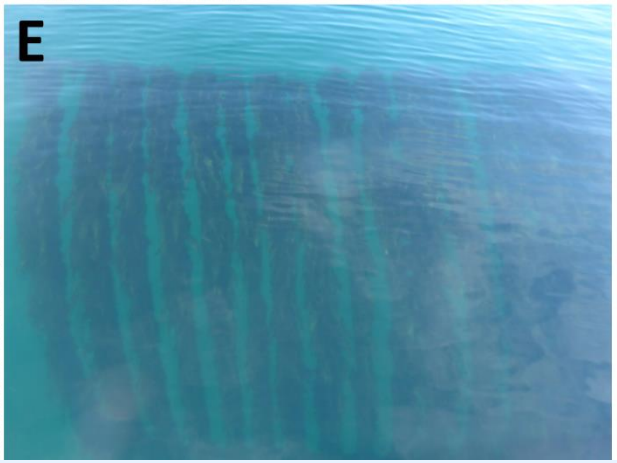
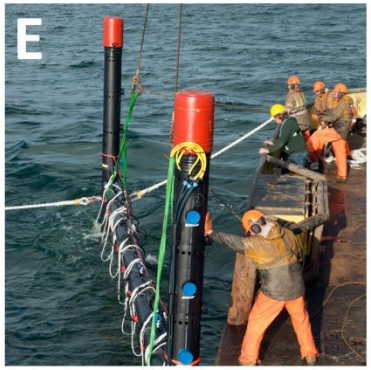




Curtain system from Sweden

AWI SeaKult sustainable futures in the marine realm Bundesverband Aquakultur Hochschule Bremerhaven



H-frame from the Netherlands

Data Collection on *Saccharina latissima* Cultivation: other costs

Other cost data

1	License costs, only paid one time [€]	1.000
2	motor overhaul (every 10 years) [€]	0
3	labour costs	
4	fuel	72.000

Labour:	Boss (owner and captain)	1x
	employee	2x

Working days at sea: 120 days

deployment of longlines	30 days	full staff
harvest of longlines	30 days	full staff
maintenence	60 days	full staff

Working days on land: 100 days

lab work	40 days	employee only
store/handle of biomass	20 days	full staff
other work	40 days	boss only

fuel costs:

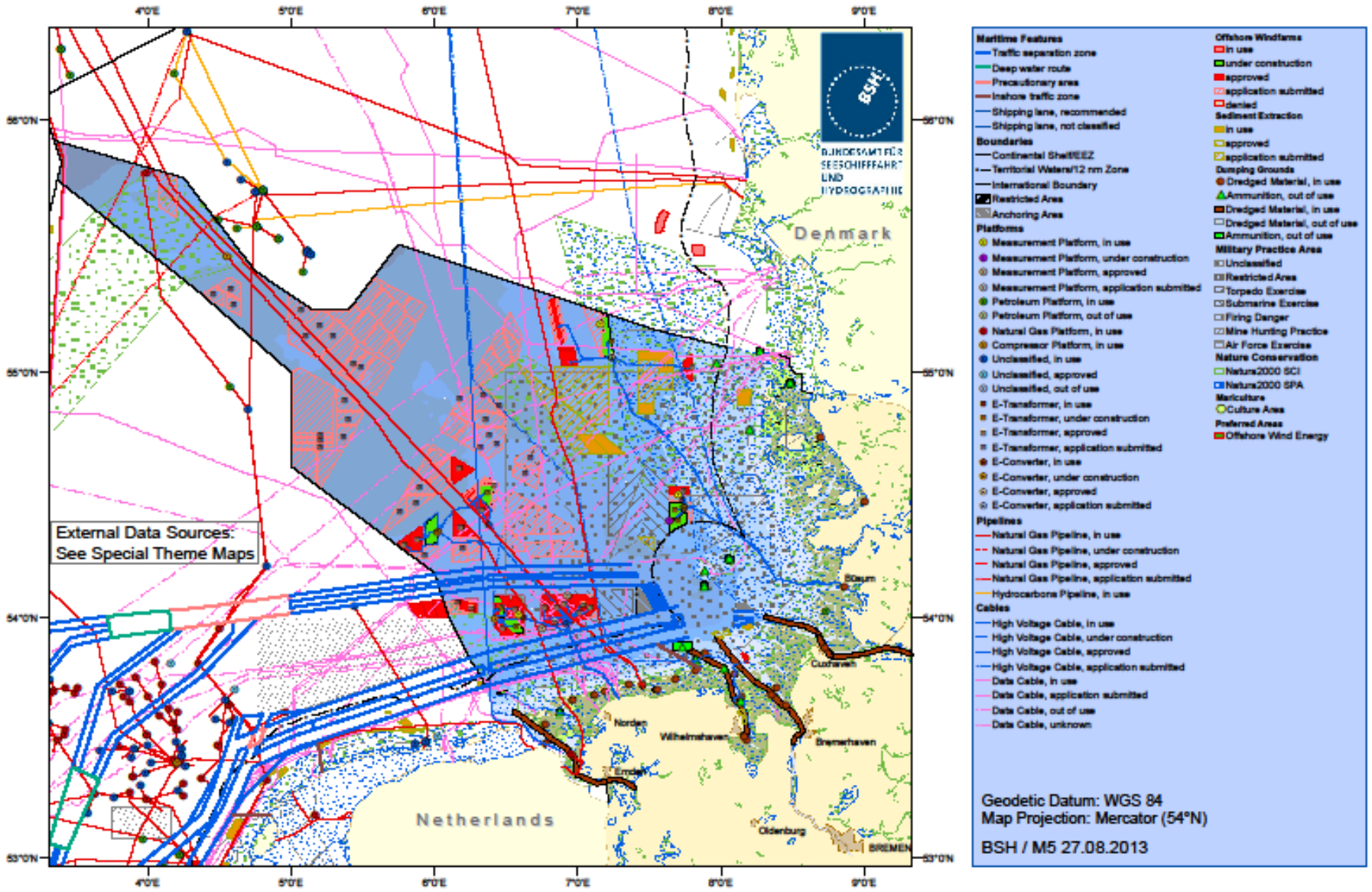
one day price [€]	600	120 days price [€]	72.000

production data | data infrastructure | data other costs

Special Case

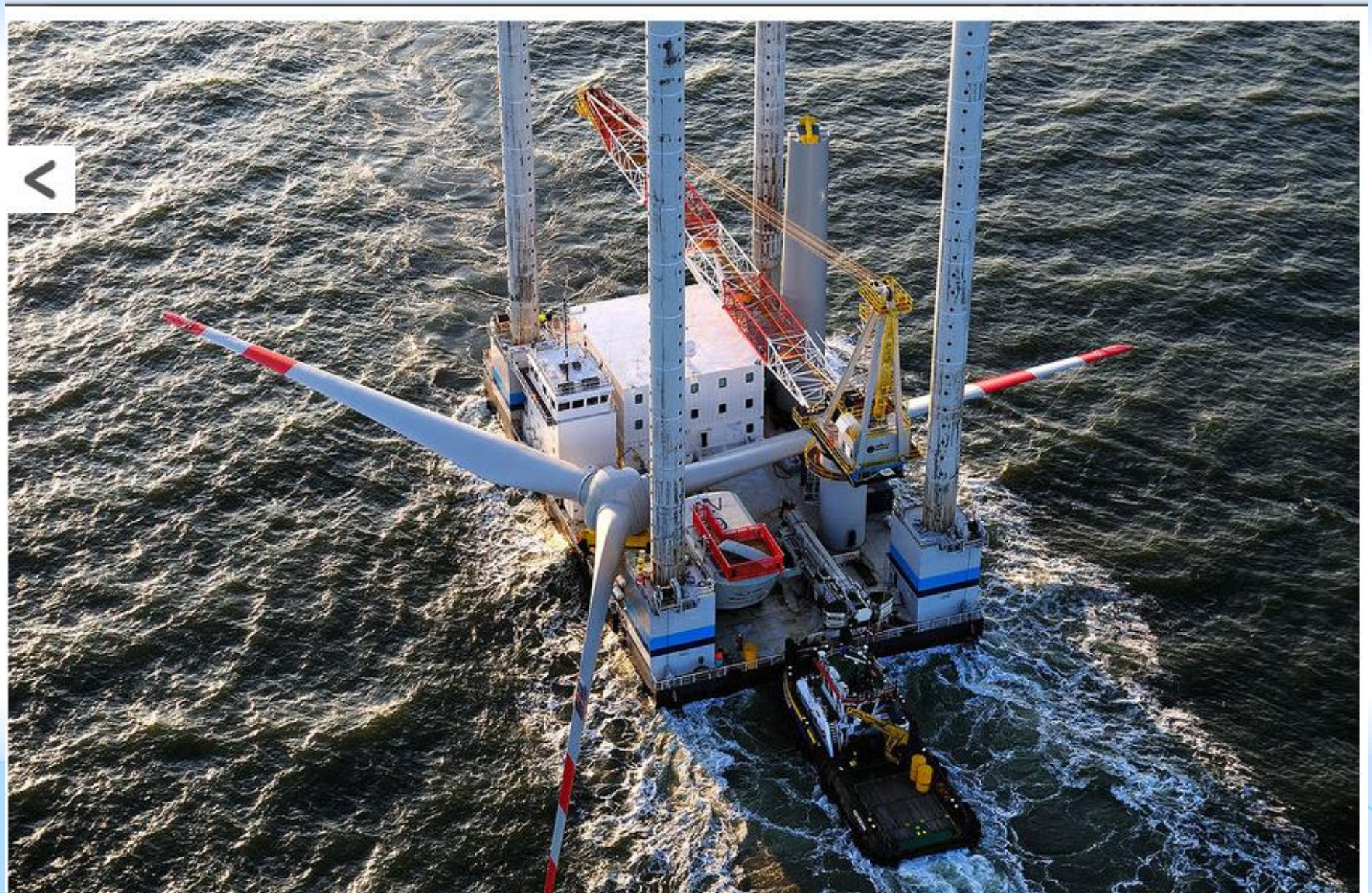
→ Multi-use as Solution

North Sea: Existing and Perspective Uses and Nature Conservation



http://www.bsh.de/en/Marine_uses/Industry/CONTIS_maps/index.jsp

Buck et al. 2004, Courtesy of the Federal Maritime and Hydrographic Agency (BSH)



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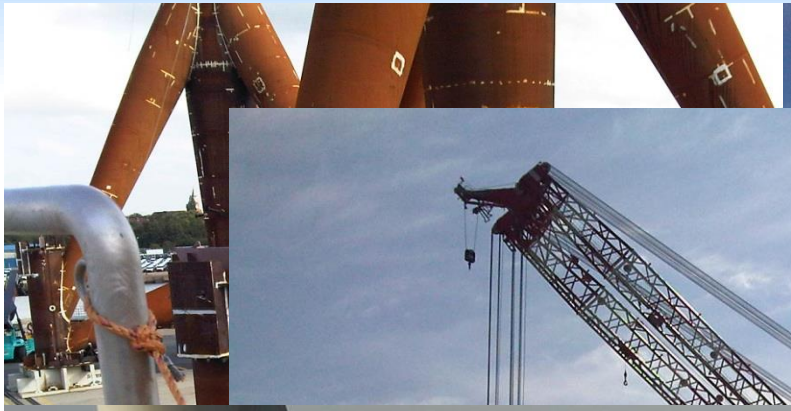

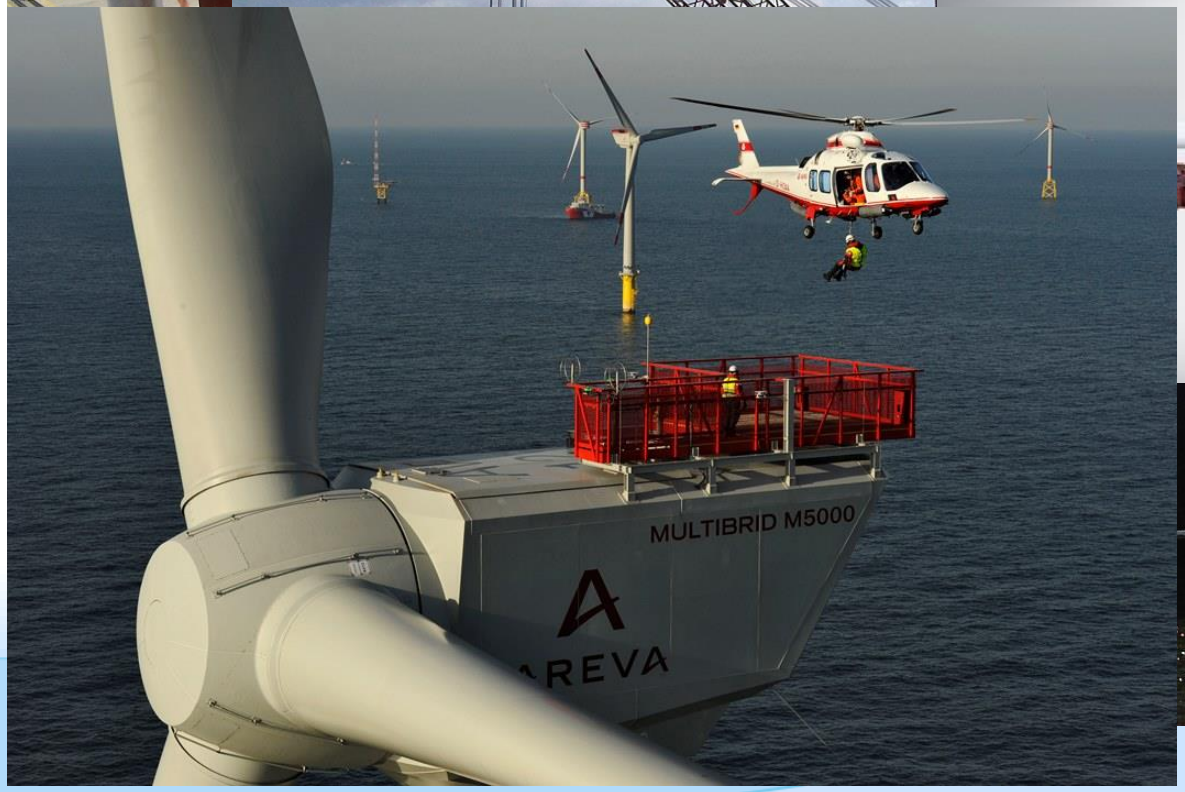

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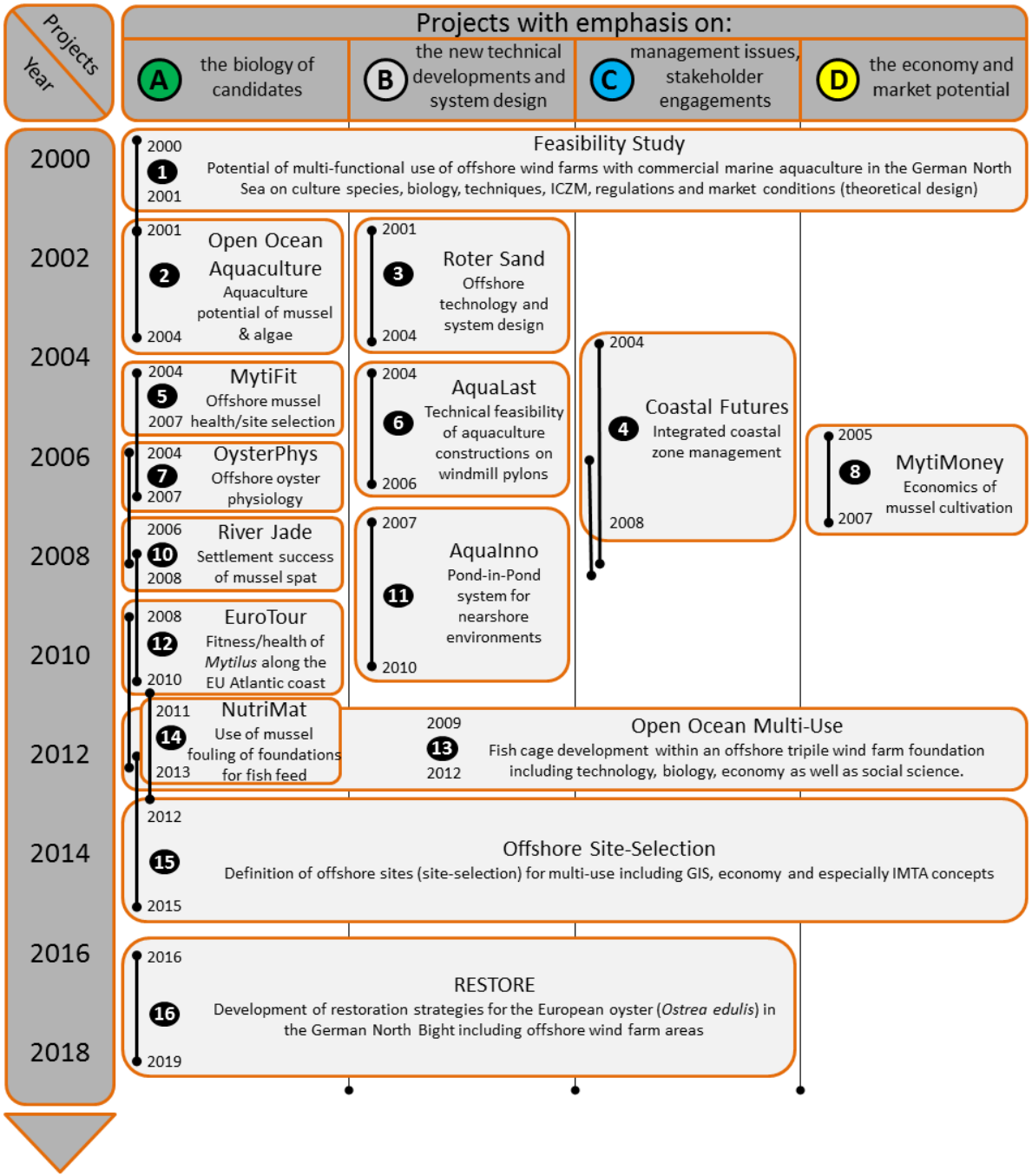
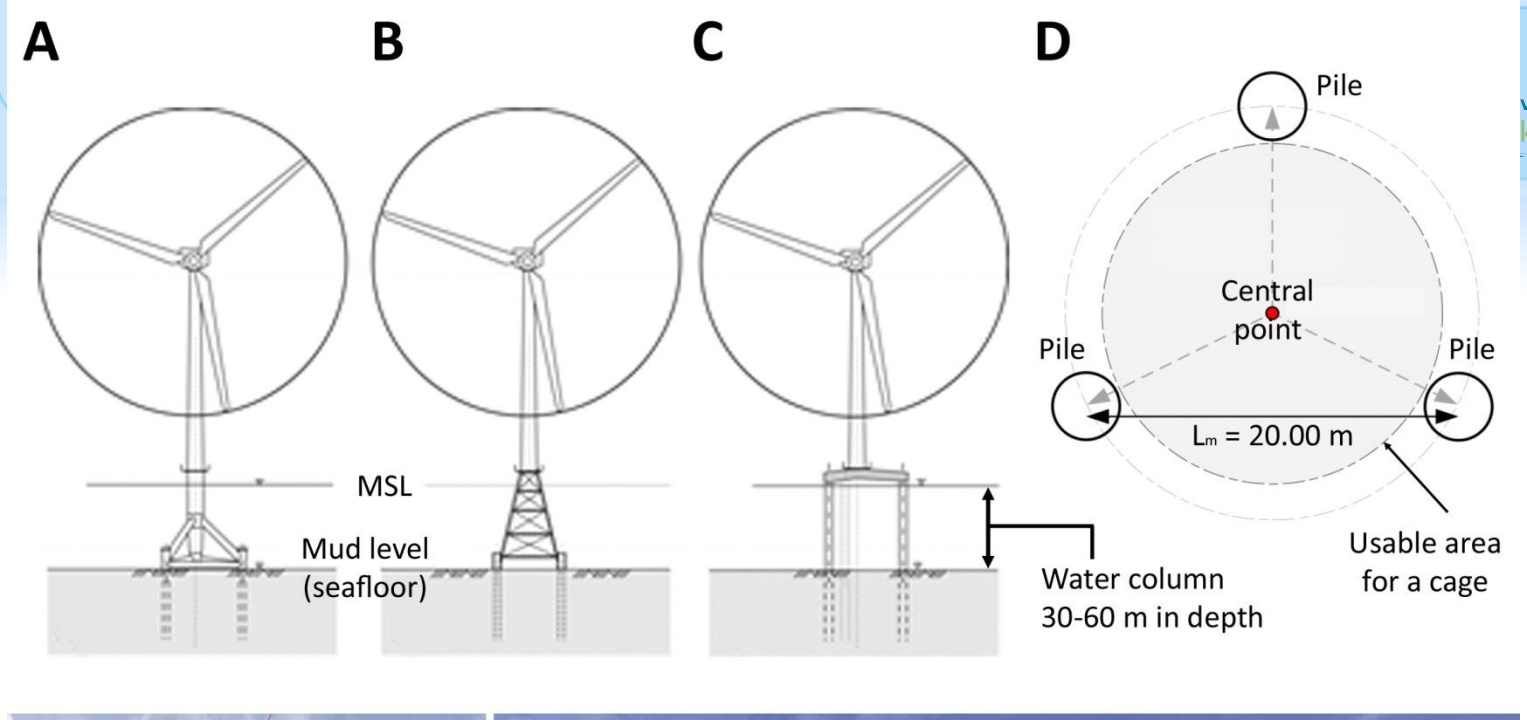
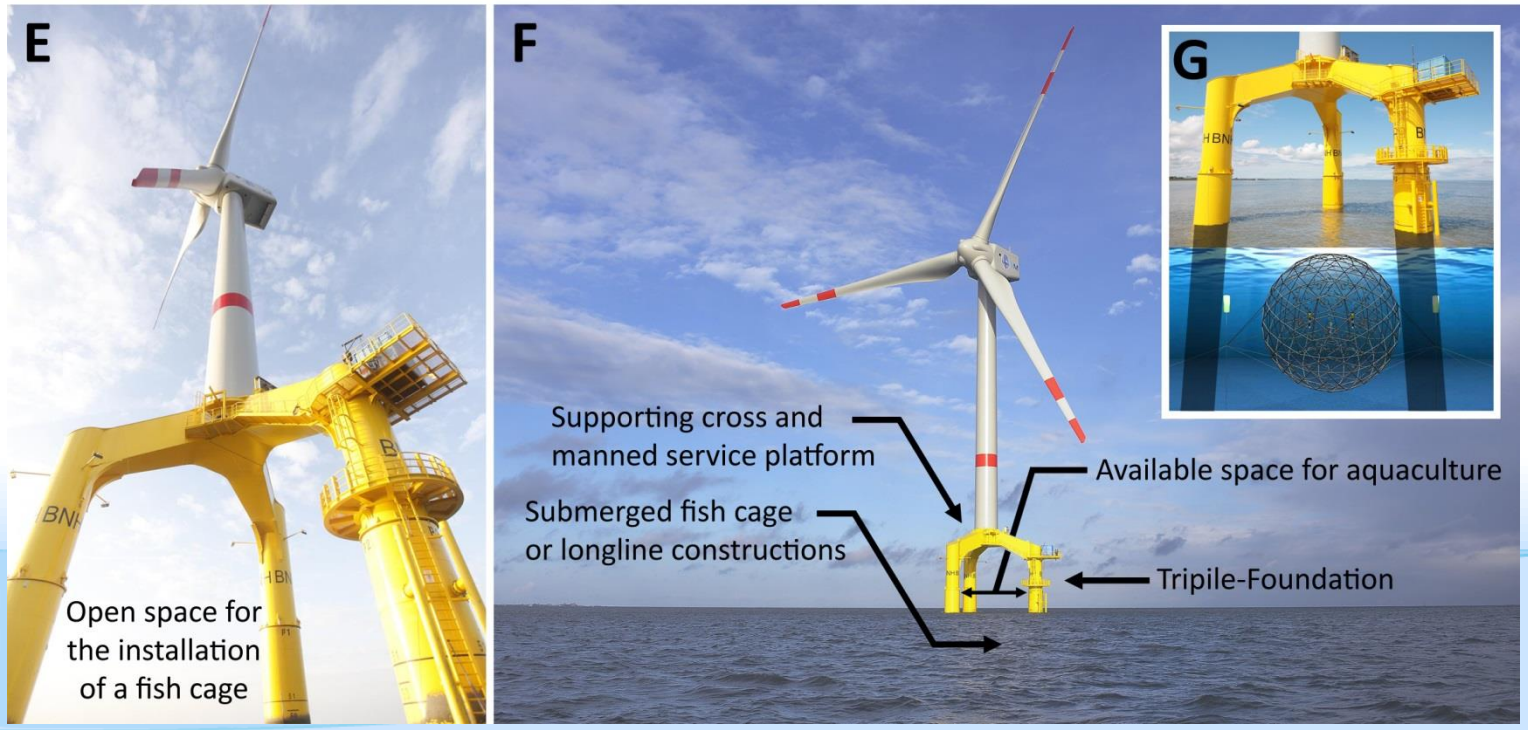


Buck et al 2017

Offshore-Site-Selection

→ IMTA in OWF

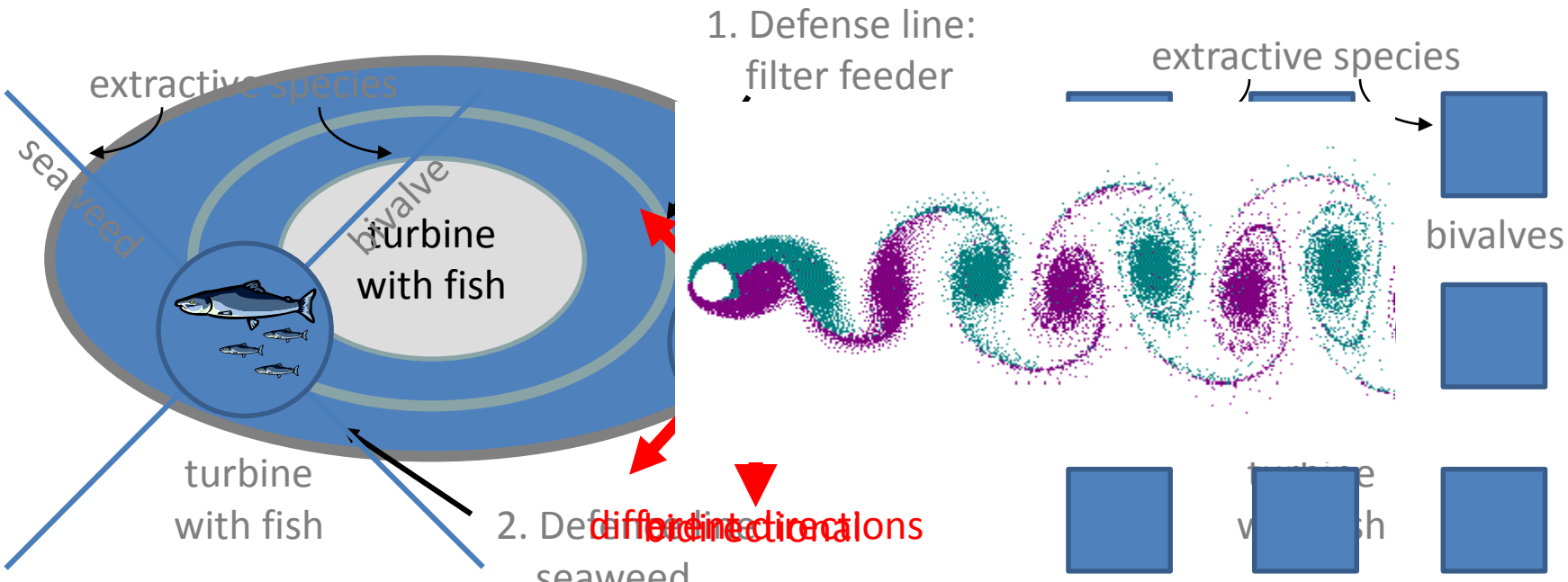




Buck et al 2017

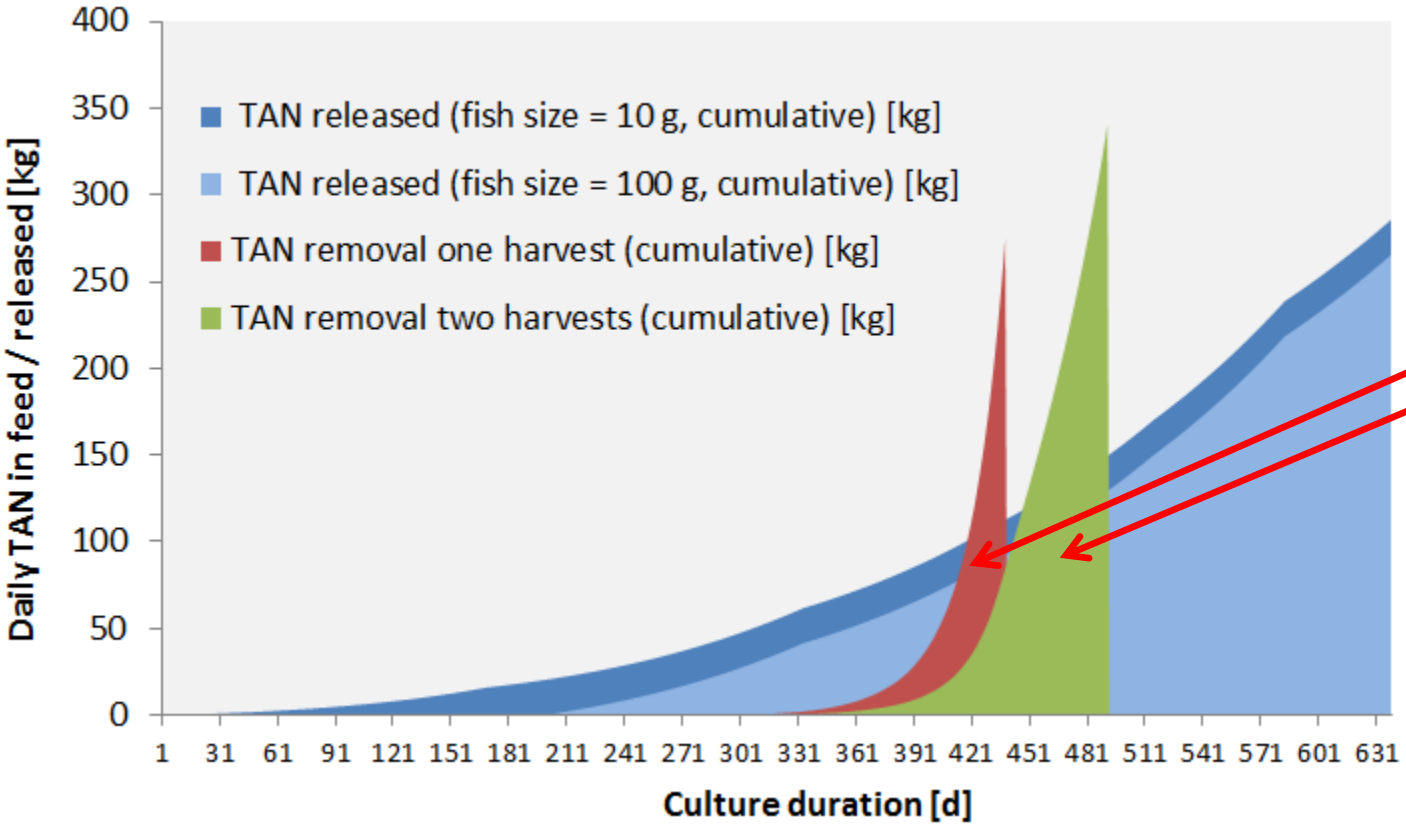
IMTA

(Integrated multi-trophic aquaculture)



McVey & Buck (2008), WAS

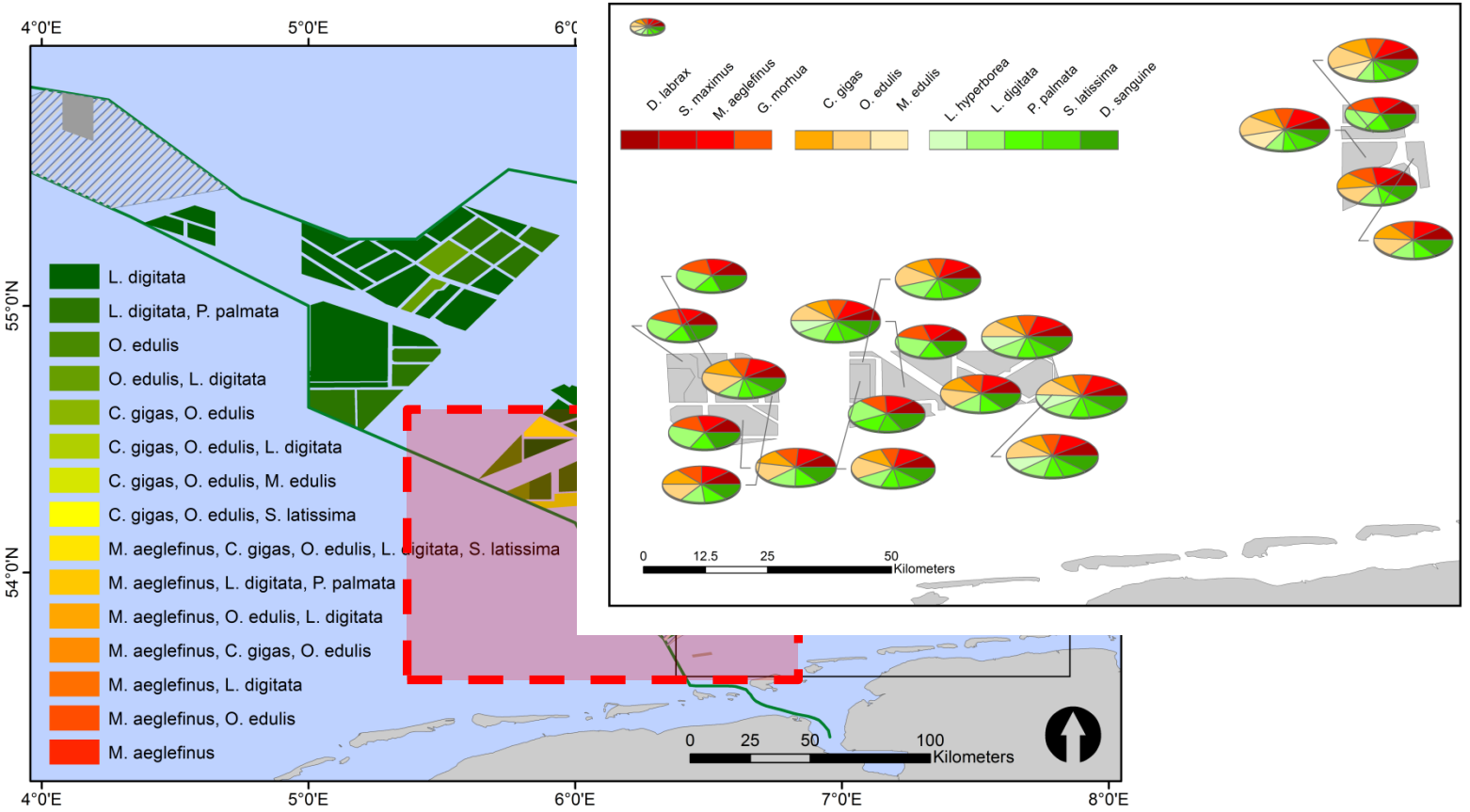
Basic Data 07: Fish & seaweed



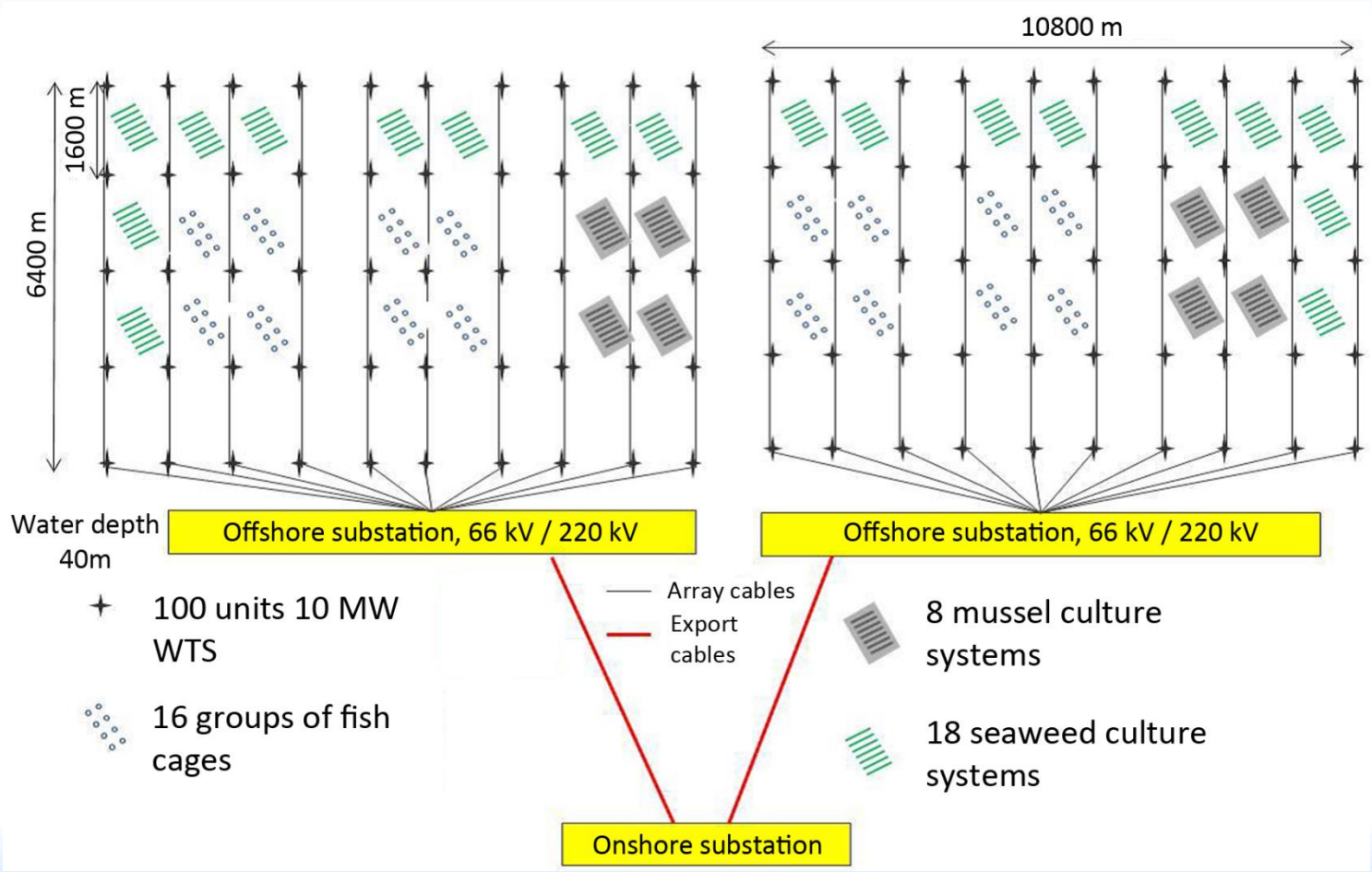
264.52 kg

- two harvests within one year
- Enlarge seaweed farm size and reduce costs (675 €·t^{-1})
- Emission concept with regard to credits/tax reduction

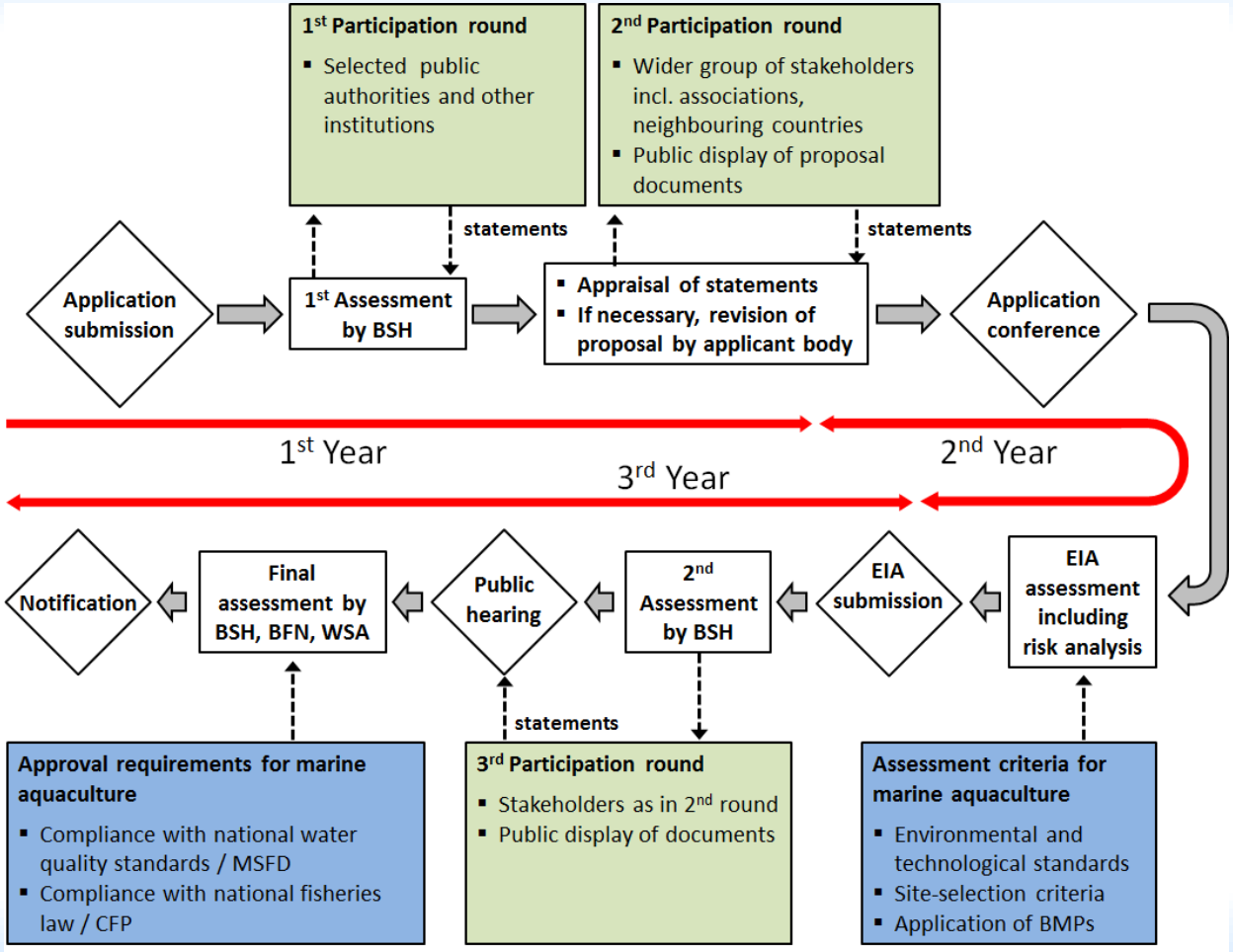
Buck & Grote, submitted



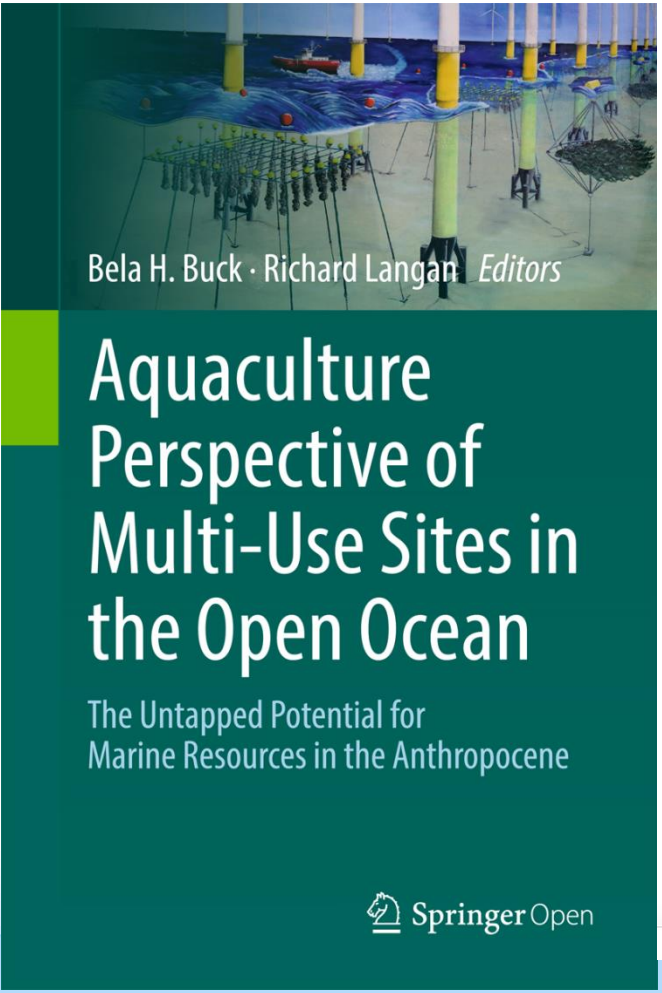
Courtesy of Vanessa Stelzenmüller – Thünen Institute Germany



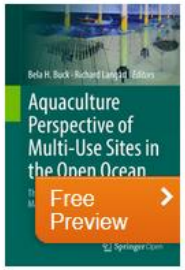
He et al. 2015 modified in Buck et al 2017



Buck et al 2017



» Environmental Sciences » Aquatic Sciences



Open Access

Aquaculture Perspective of Multi-Use Sites in the Open Ocean

The Untapped Potential for Marine Resources in the Anthropocene

Editors: **Buck**, Bela H., **Langan**, Richard (Eds.)

The first-of-its-kind compilation that comprehensively explores the scientific, engineering, economic and policy aspects of marine aquaculture multi-use of offshore platforms

A timely analysis of the rapid development of offshore energy production platforms and the massive projected global seafood deficit

Individual chapters written contemporaneously with EU "Oceans of Tomorrow" developments as well as proposals by the Food and Agriculture Organization (FAO), authored by highly-respected, international experts in the field

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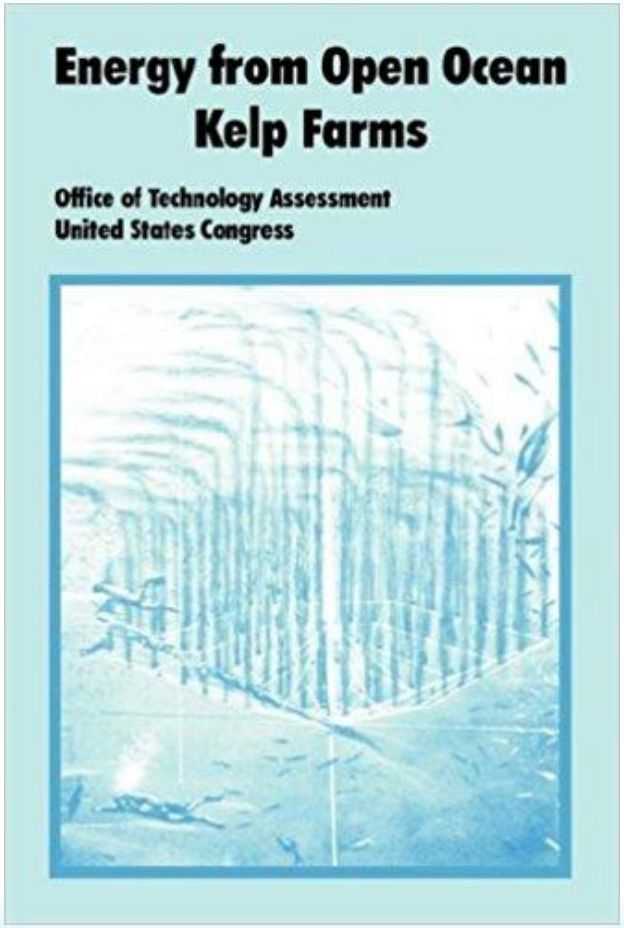
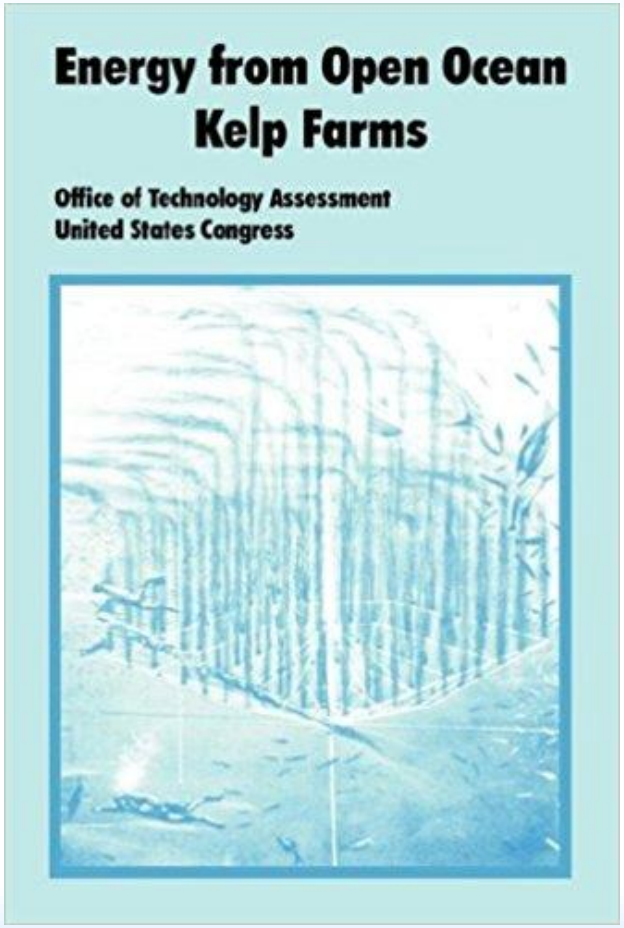
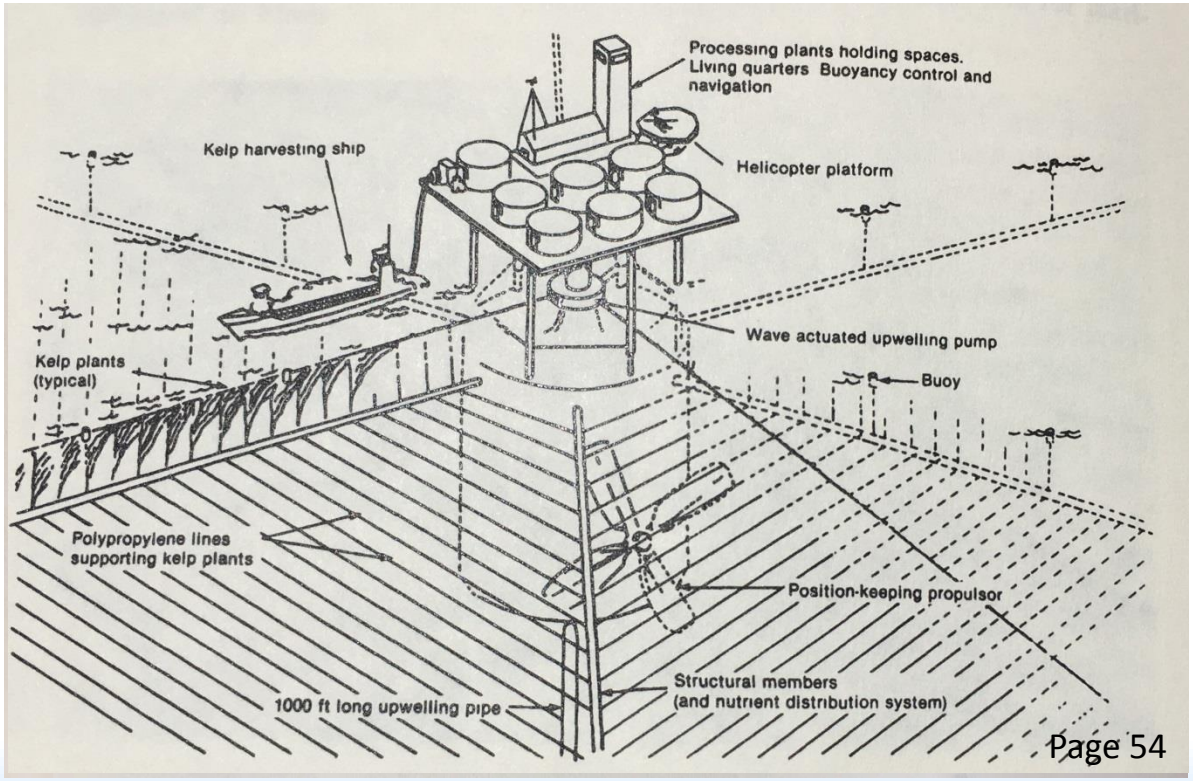


Large ocean energy farms may one day prove to be an alternative source of synthetic natural gas for homes and businesses. Research into new ocean biomass energy systems has been reviewed here by the Office of Technology Assessment of the United States Congress, with the assistance of specialists in the research and development aspects of ocean farming. This report presents the status of ocean energy farm developments and evaluates their potential. While ocean energy farms are now in the early stages of development and much research remains to be done, the prospects are encouraging. This book contains descriptive and analytic material concerning ocean biomass resources; potential for future ocean farms; technologies of ocean farming; existing government and private efforts; energy and economic data; environmental effects and legal aspects; and future research needs.

Examples: Farm Designs





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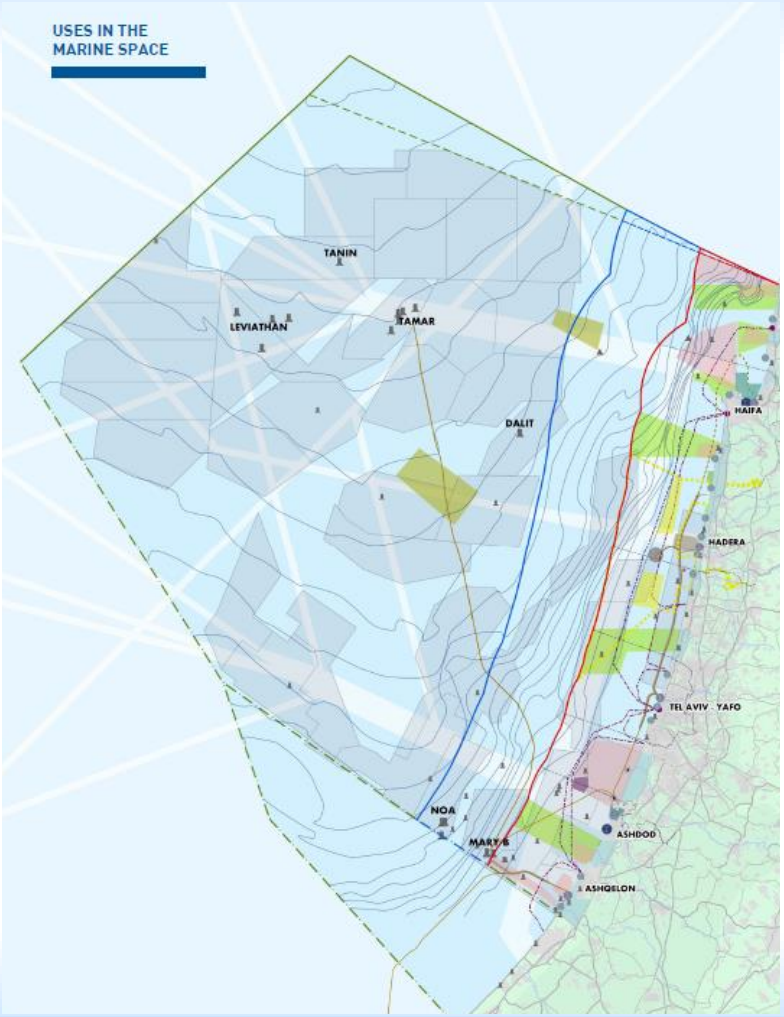
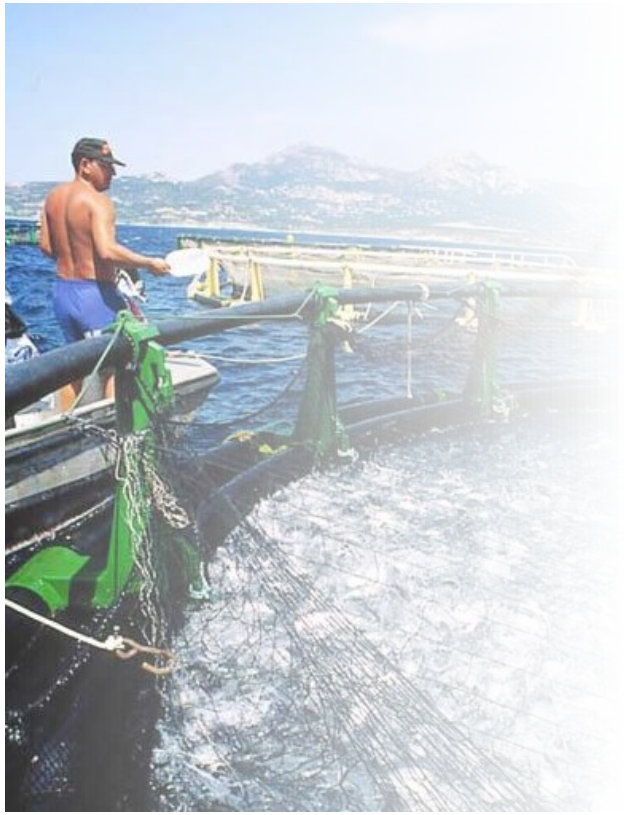
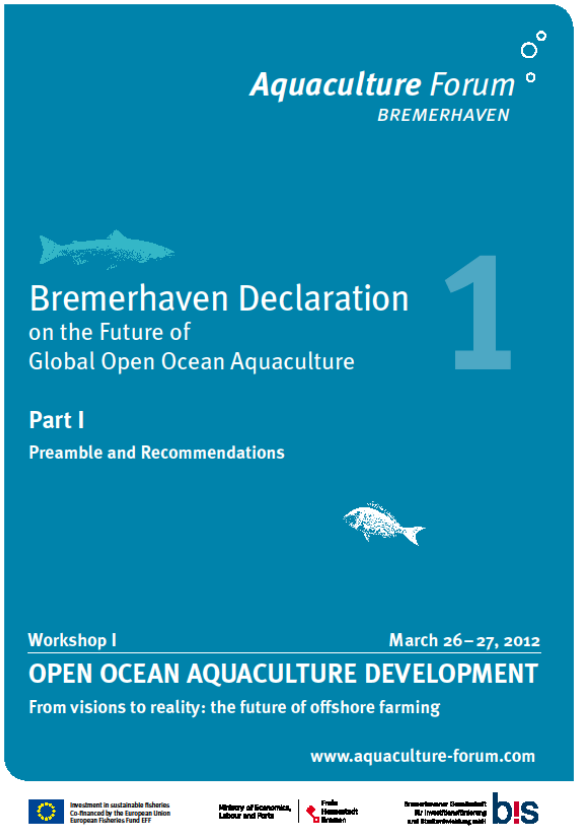


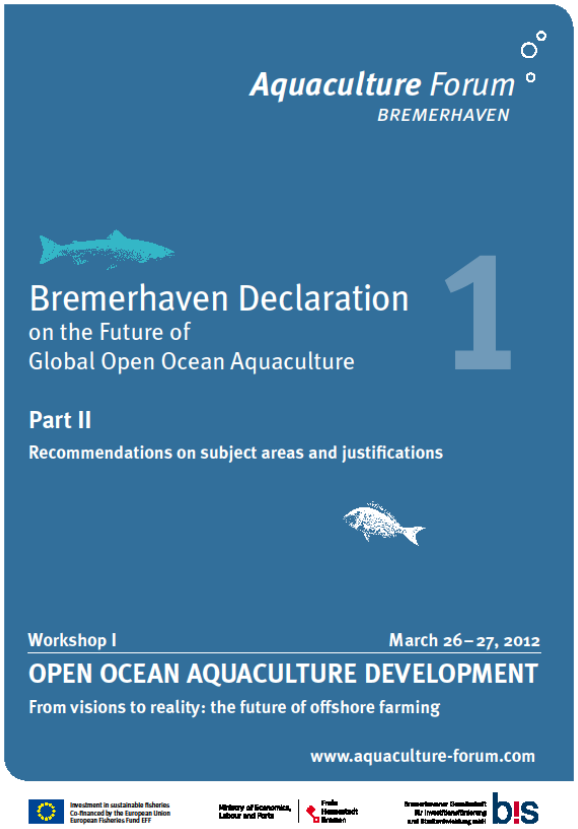
First challenge: find an appropriate space in the marine real,



Future Production of Food from the Oceans:

- Do net reinvent the wheel
- Follow guidelines defined by the FAO
- Foster cooperation with experts within the EU + X
- Develop innovative technologies to allow co-use concepts
- Set-up an inter. offshore test facility





Bremerhaven Declaration

on the Future of Global Open Ocean Aquaculture

Authors:

Buck
Krause
Rosenthal
Shpigel
Cost-Pierce
Langan
Fredheim
and others…

Rosenthal et al 2010a/b

Thank you for your attention!