

Marine Aquakultur – aber gerne: Chancen und Risiken einer nachhaltigen Produktion von Fisch & Co.


Bela H. Buck

Wissenschaftstagung «Erschliessung neuer Ernährungsquellen»

ETH Zürich, 15.09.2016

FAO 2007

1. Aquakultur ist die Zucht aquatischer Organismen.
2. Kontrolle des Aufzuchtsprozess und Bereitstellung von optimalen Bedingungen.
3. Kandidaten: Fisch, Mollusken, Crustaceen und Algen.

Dramatischer Druck auf Fischbestände

FAO 2015

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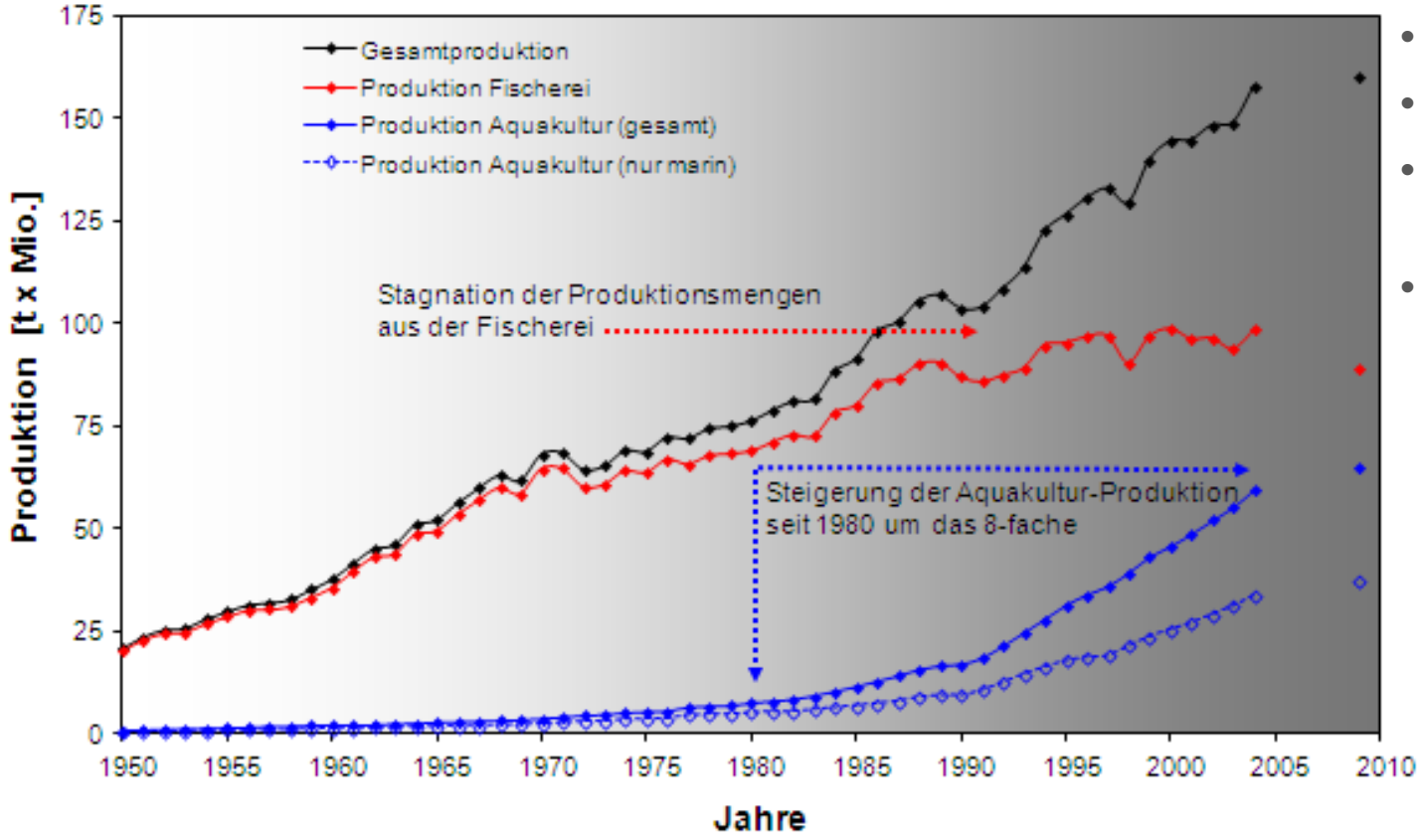
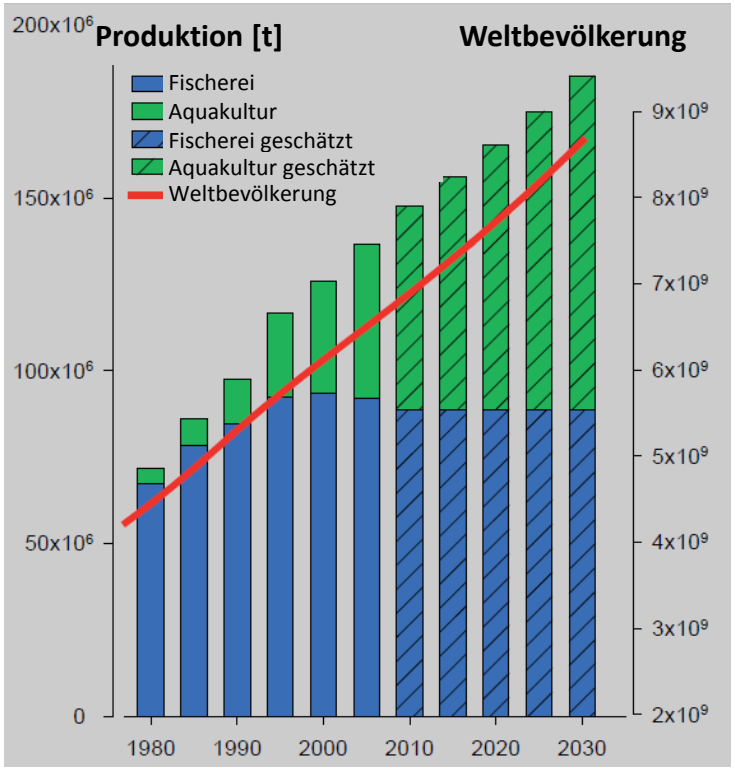


- ≈ 200 Mrd. US $
- 21 kg/Kopf/Jahr
- 50 Mio. Angestellte, Sek. => 180 Mio. => 540 Mio.
- 172 t/Person (Norwegen) ↔ 6 t/Person (China) o. 2 t/Person (Indien)

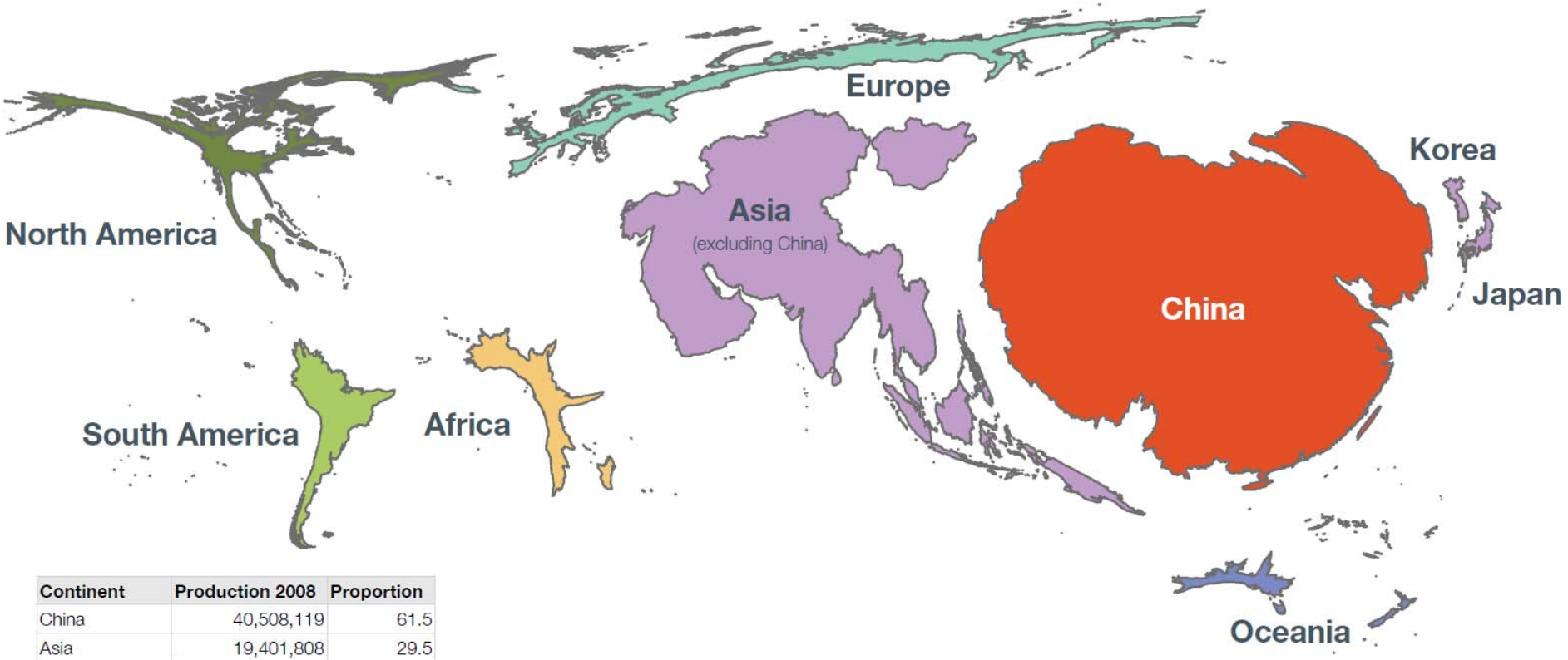


Waller 2012

Aquatische Produktion

aus Fischerei und Aquakultur

- Weltbevölkerung steigt
- Nachfrage setig
- Mehr Platz ist erforderlich
- Produktion muss zur Entlastung der Umwelt nachhaltig sein



Continent	Production 2008	Proportion
China	40,508,119	61.5
Asia	19,401,808	29.5
Europe	2,341,646	3.6
South America	1,461,061	2.2
North America	965,792	1.5
Africa	952,133	1.4
Oceania	176,181	0.3

Blue Frontiers Report 2014

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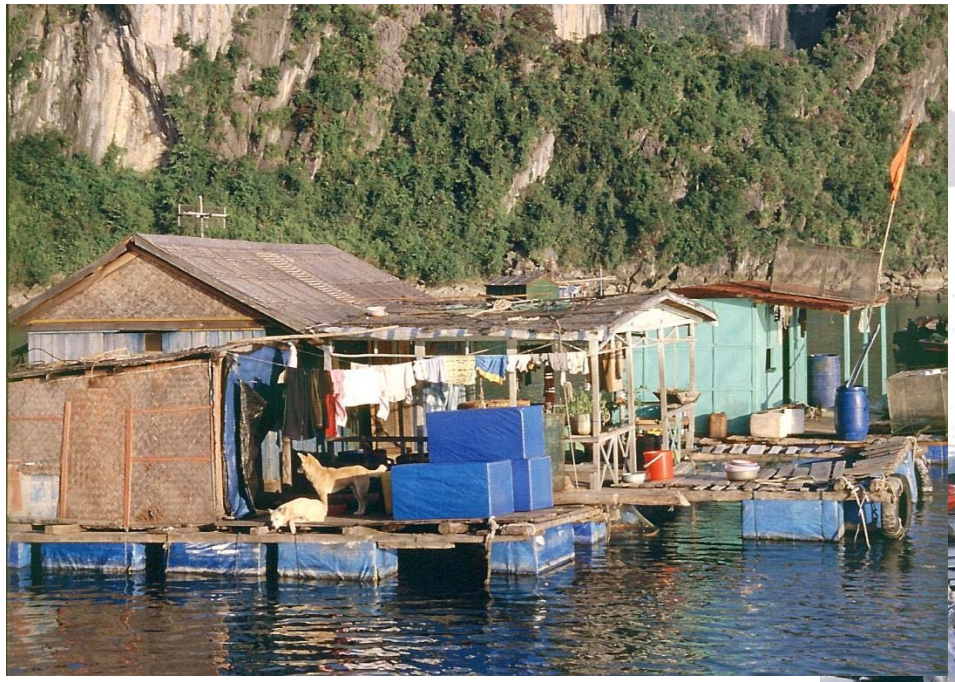

Mintenbeck K (2016)

Aquakulturtechnologien und Systemdesign

→ im Meer (Freiwasser)

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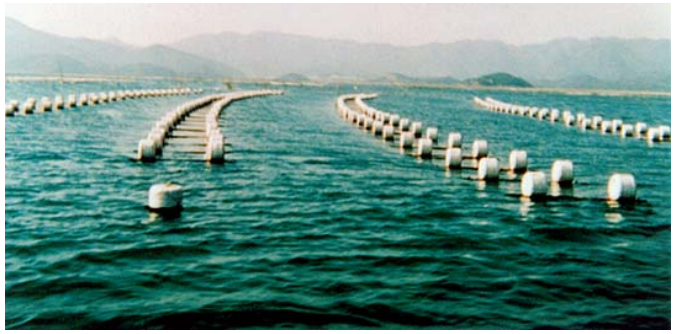
Muschelkulturtechnik



Algenkulturtechnik


Bridgestone (Norway)


Dunlop (Scotland)


NN (Norway)

Aquakulturtechnologien und Systemdesign

→ Teichwirtschaft

Landgestützte Systeme:

Mintenbeck (2016)


Raceways


Abgedeckte Raceways


Teiche (4.000-40.000 m^2)

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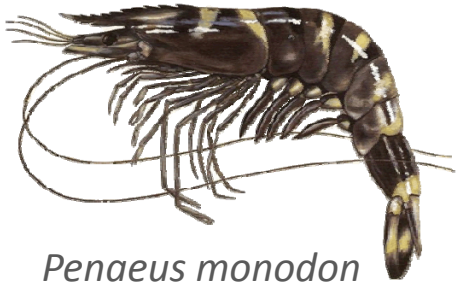
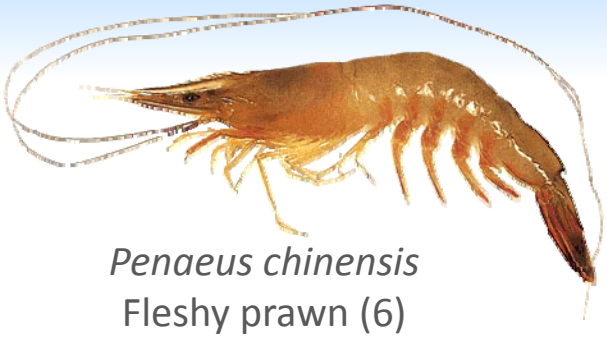
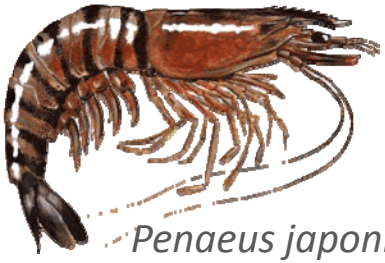


Penaeus monodon
Giant tiger prawn (1)

Penaeus vannamei
Whiteleg shrimp (2)

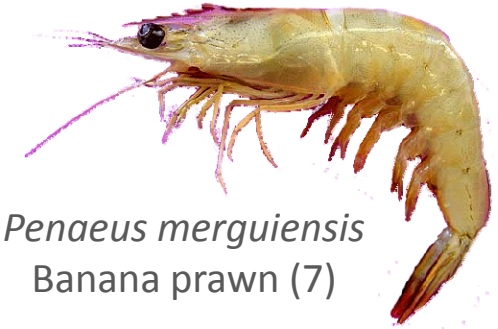


Penaeus chinensis
Fleshy prawn (6)

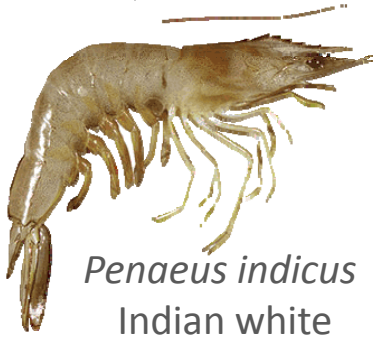


Penaeus japonicus
Kuruma prawn (4)

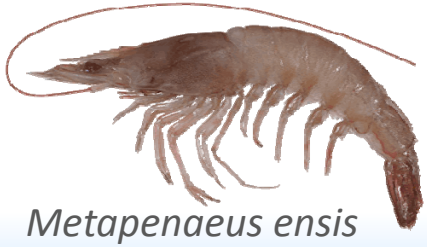
Penaeus stylirostris
Blue shrimp (5)



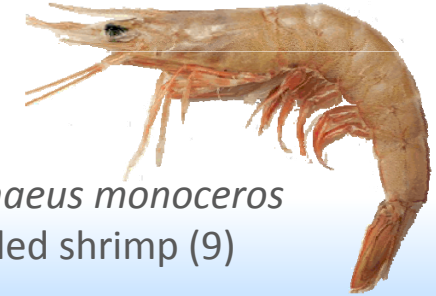
Penaeus merguiensis
Banana prawn (7)



Penaeus indicus
Indian white prawn (3)



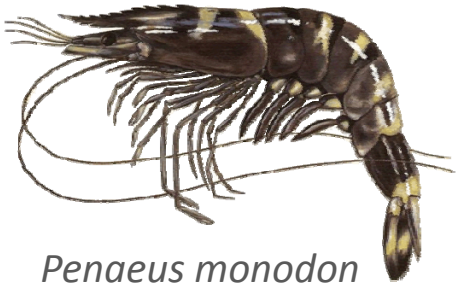
Metapenaeus ensis
Endeavour Prawn / Greasyback shrimp (8)



Metapenaeus monoceros
Speckled shrimp (9)

1 = Google Inc (2016), 2 = Ictioterm (2016), 3 = Alphaimpex (2016), 4 = Balik Vadisi (2016), 5 = Naked Finn (2016), 6 = Weblio (2016), 7 = Food University (2016), 8 = Fish Gov (2016), 9 = Himasper (2016)

Garnelen aus Thailand



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natürlich

künstlich

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1995

USA

1998

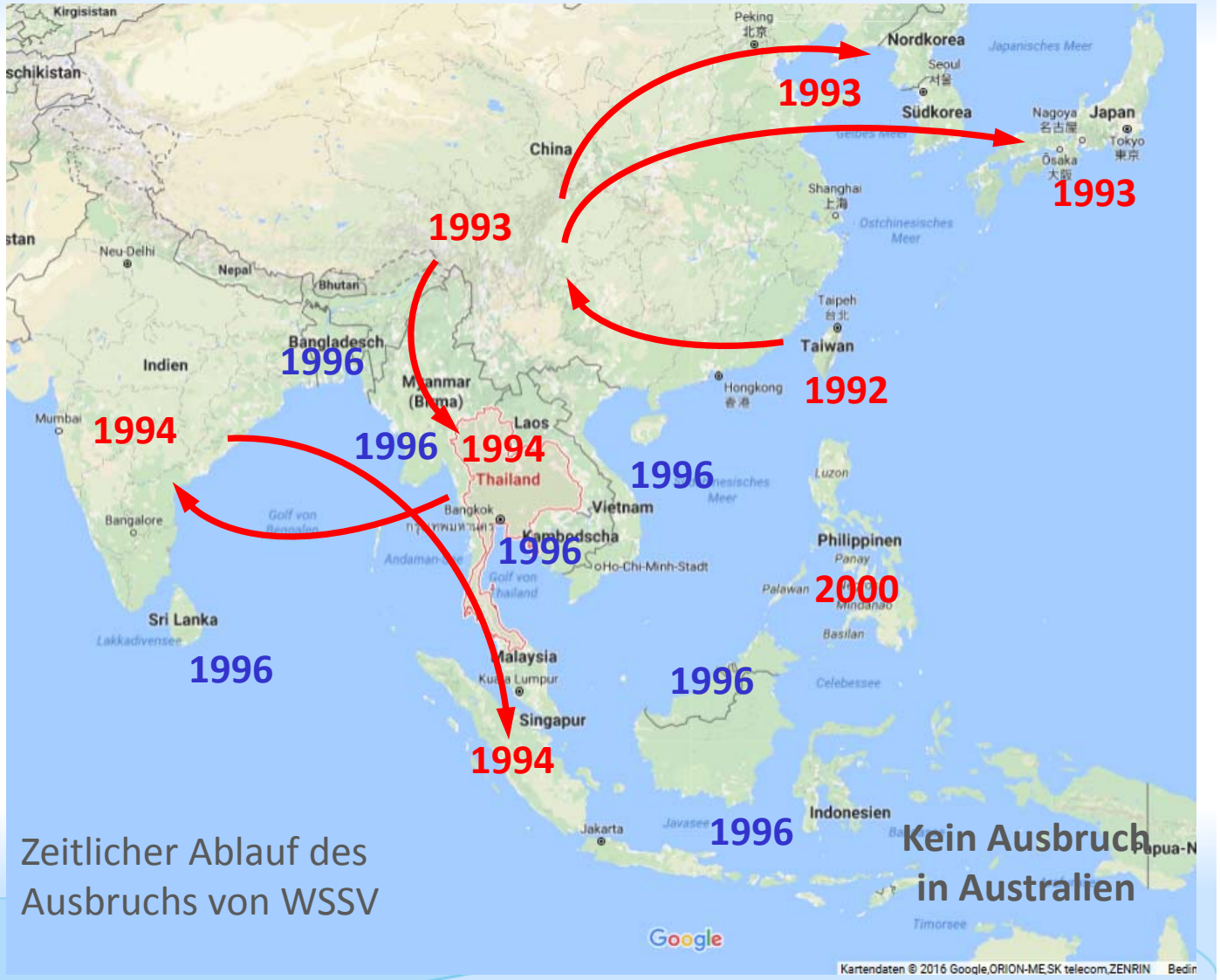
Mittel-/Südamerika

1999

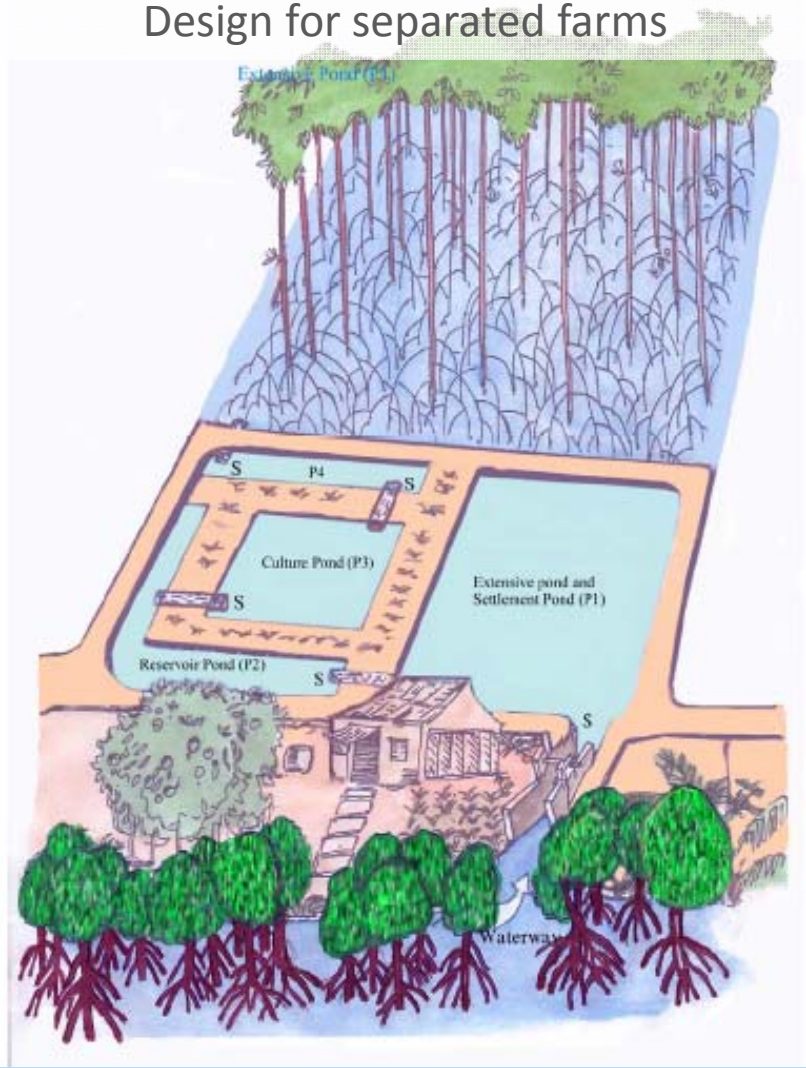
Mexiko

2011

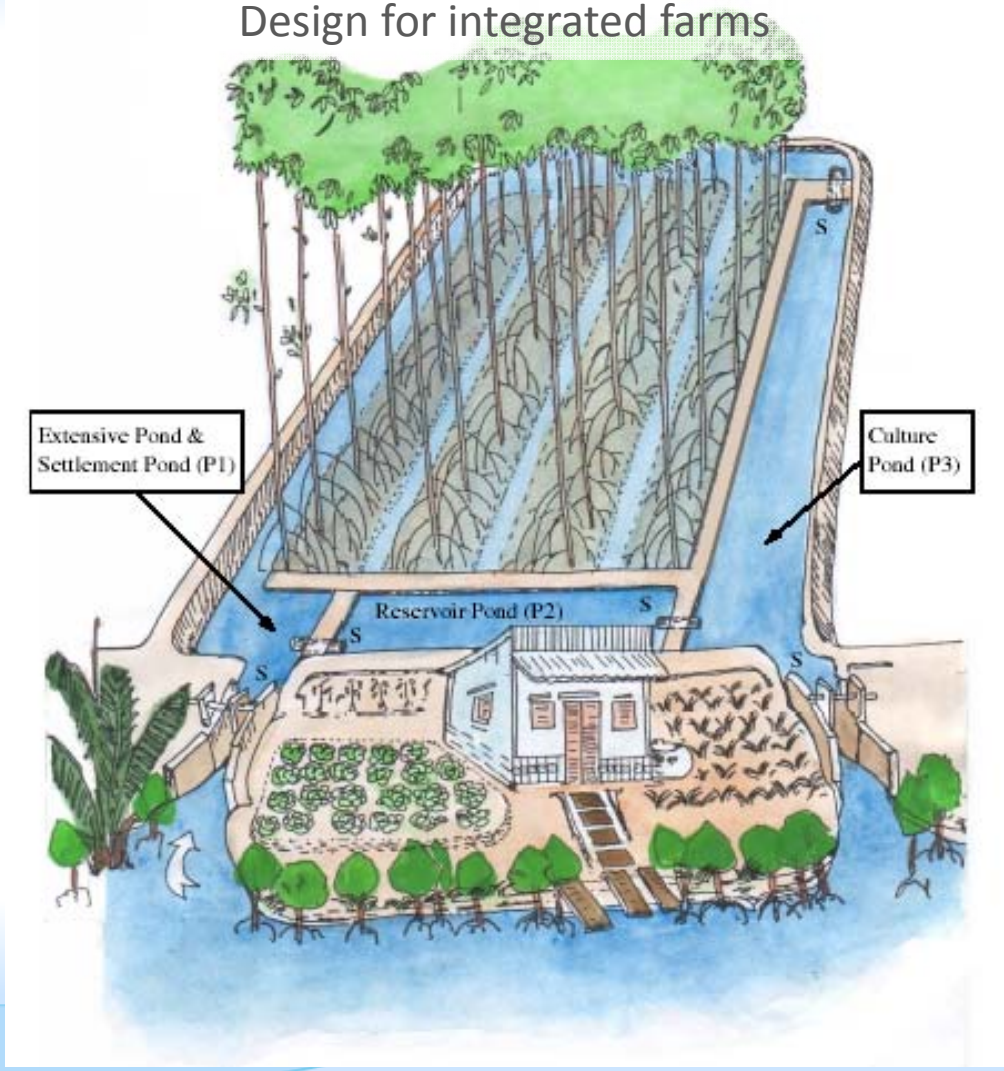
Saudi Arabien



Design for separated farms



Design for integrated farms



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Aquakulturtechnologien und Systemdesign

→ Recirculating Aquaculture Systems (RAS)

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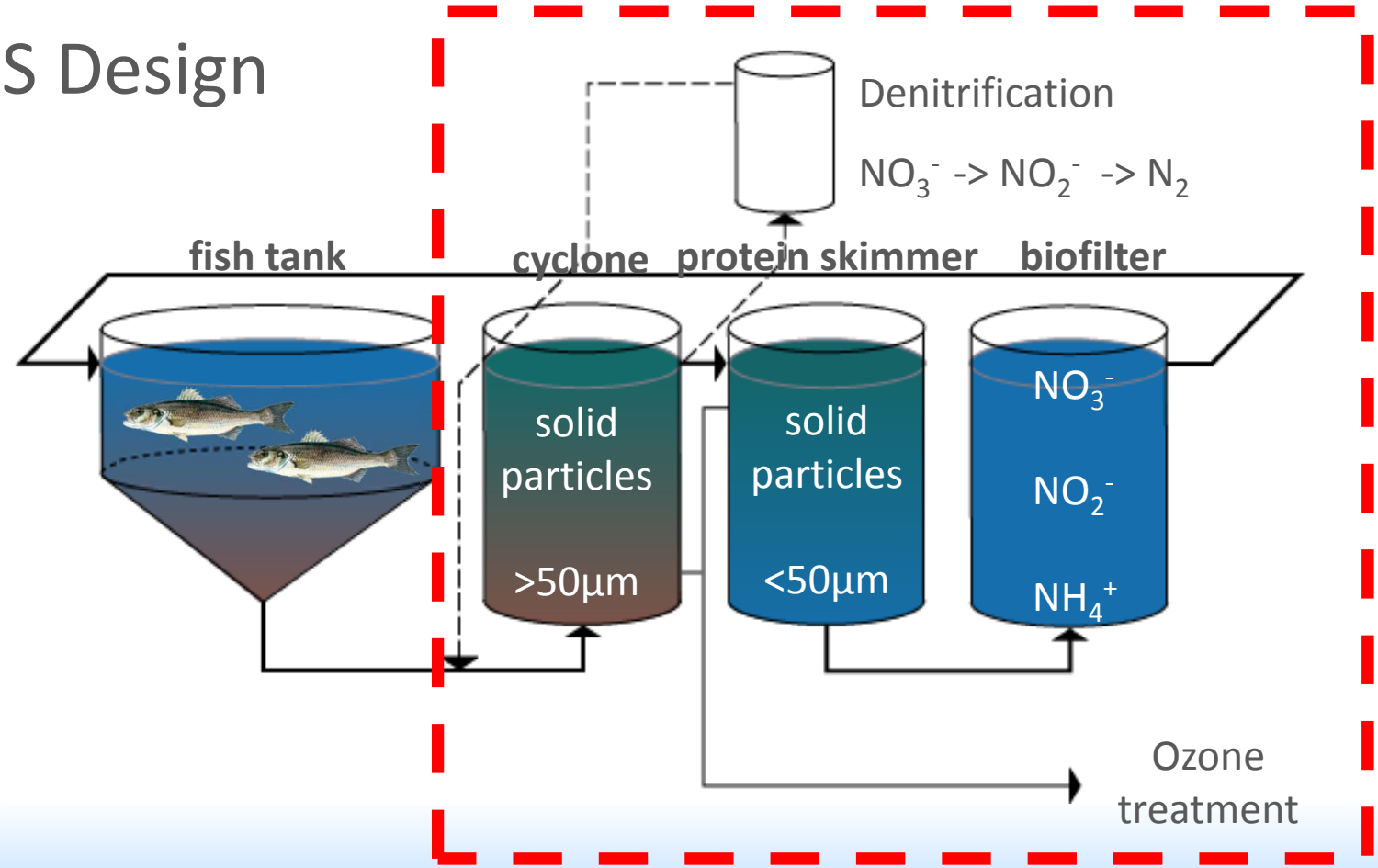
Daily water exchange < 0,3 %

RAS Design



Bischoff A (2011)

Aktueller Besatz: Steinbutt, Wolfsbarsch, Dorade, div. Garnelen, Seegurken

Aktuelle Projekte: Verbesserung des System-Designs, Futtermittel, Stress Response

Aquakulturtechnologien und Systemdesign

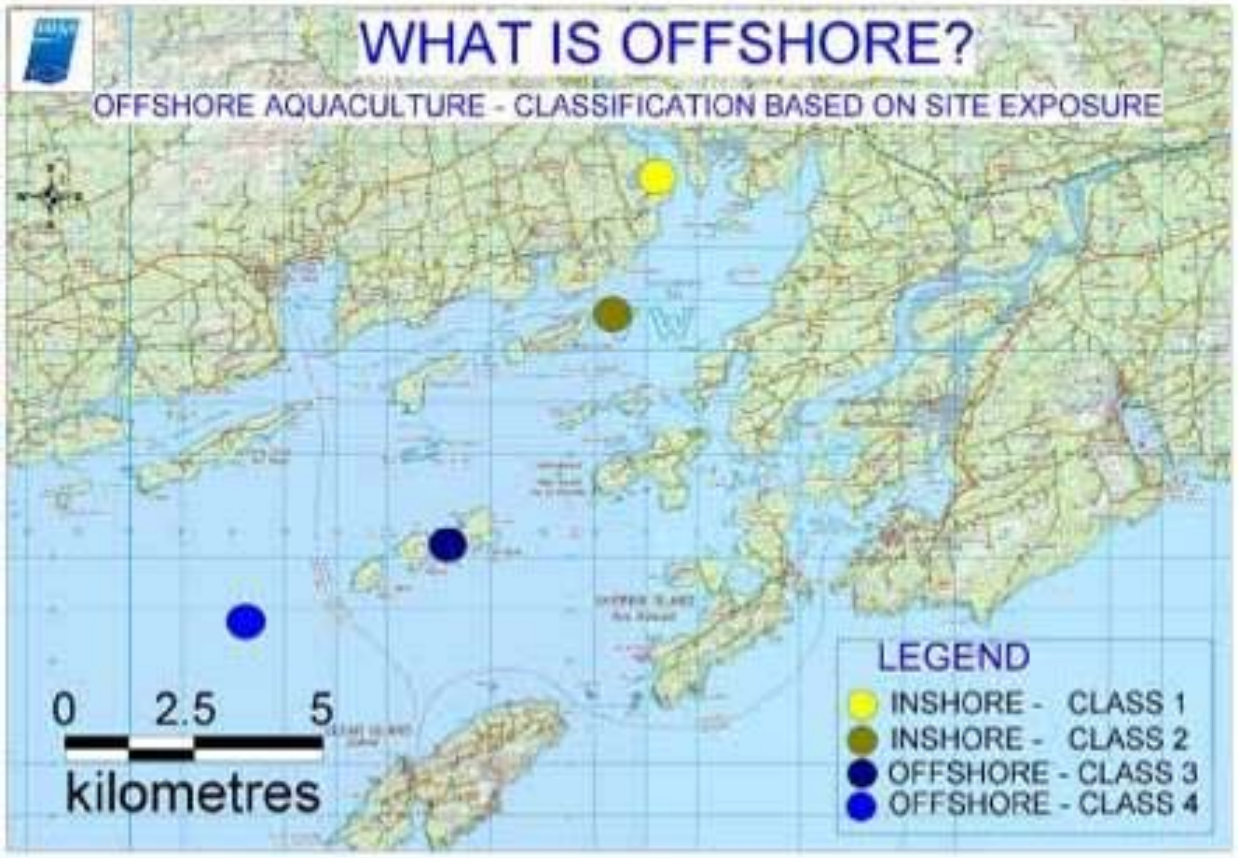
→ Aquaponics

Firma: Ecco-Jäger (Bad Ragaz)

Dachfarm 1000m²
Gemüse/Kräuter
untere Etage 200m²
Buntbarsch

Aquakulturtechnologien und Systemdesign

→ Offshore AQ (OOA)



Ryan (2005)

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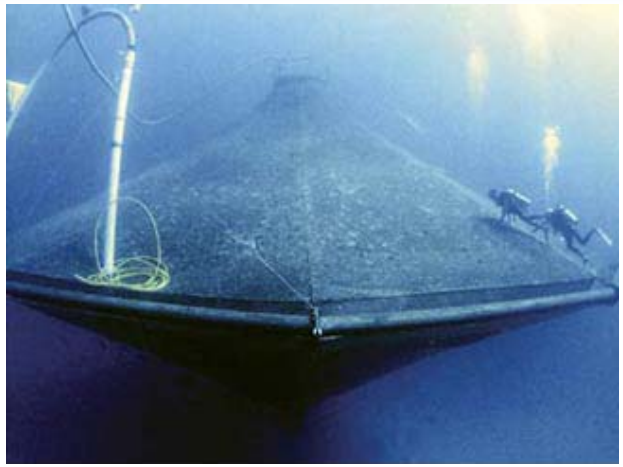
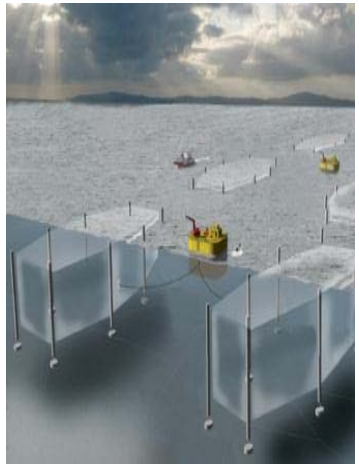
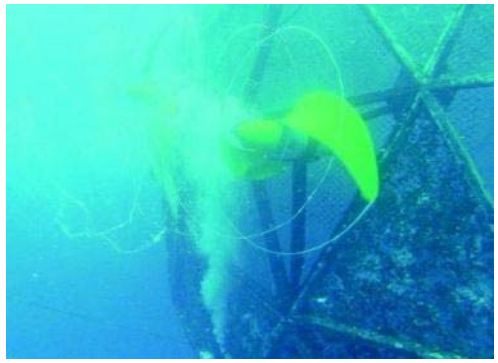


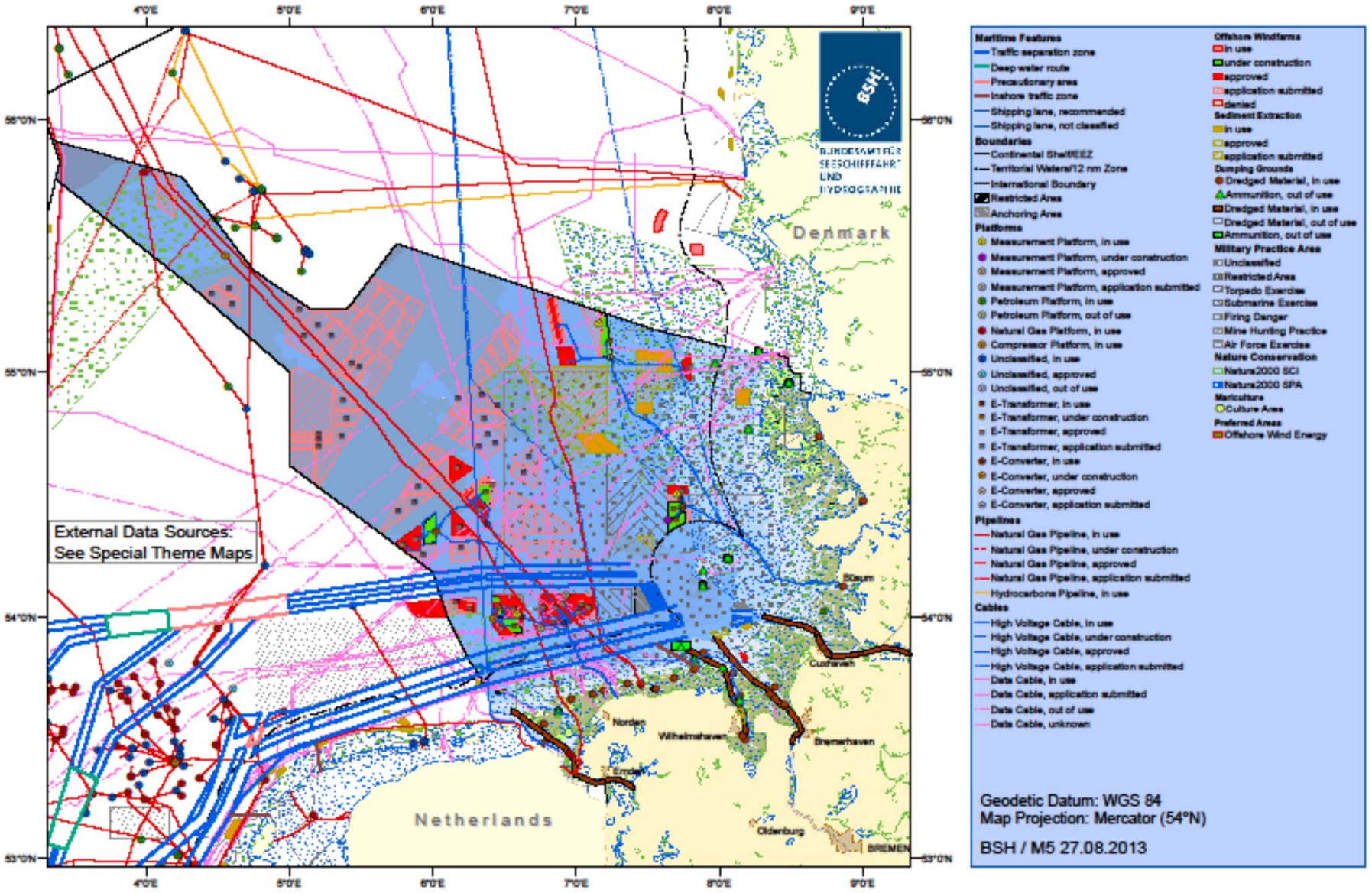
Offshore-Aquakultur

Mintenbeck K (2016)

Kombinationen Offshore

→ Der Multi-Use-Ansatz

North Sea: Existing and Perspective Uses and Nature Conservation



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

Courtesy of the Federal Maritime and Hydrographic Agency (BSH)

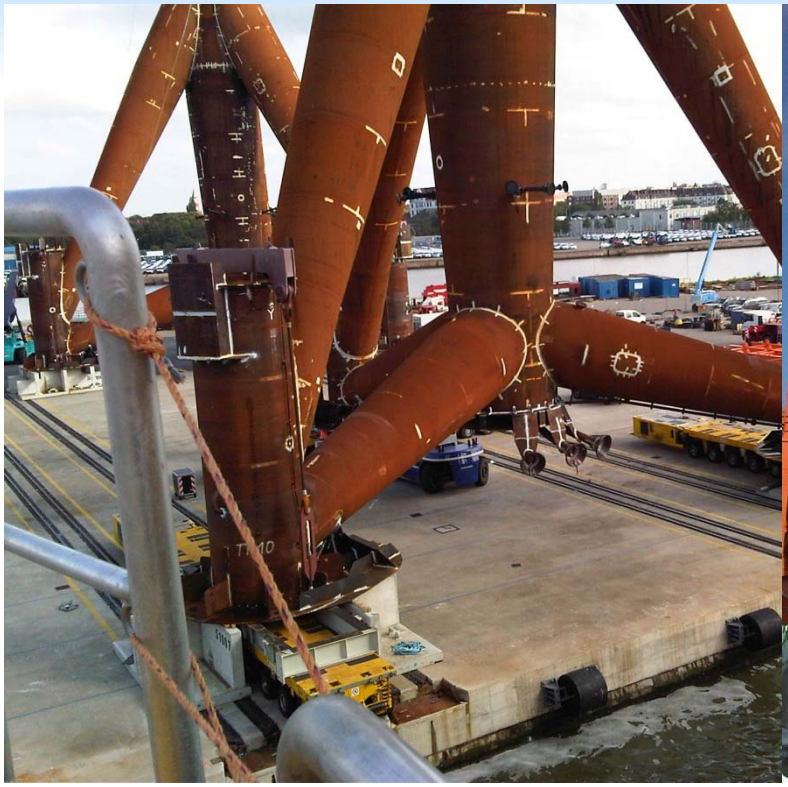
Construction of the *Alpha Ventus* wind farm in the EEZ 60 km off the coast of Germany.

5 MW class turbines:

65 MWh·day^{-1}·windmill^{-1}

8,000 €·day^{-1}·windmill^{-1}

70% of companies SME



PNE 2012 (2005)

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PNE 2012 (2005)

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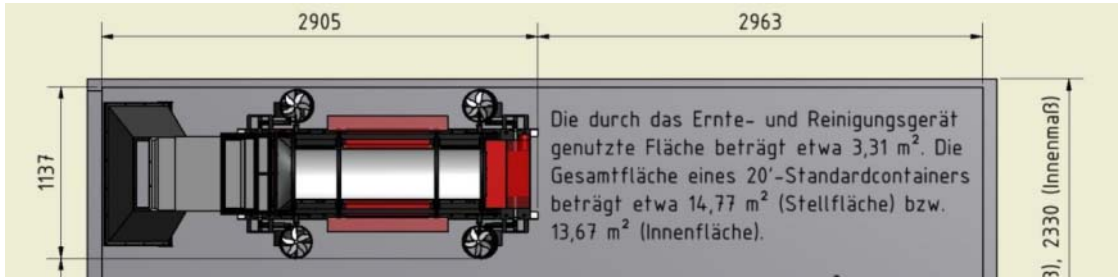
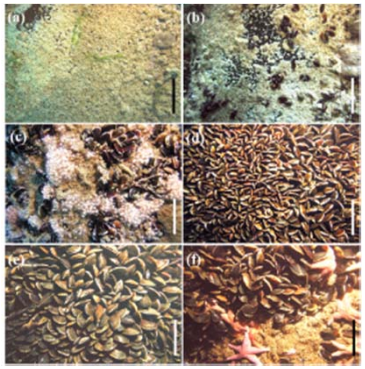
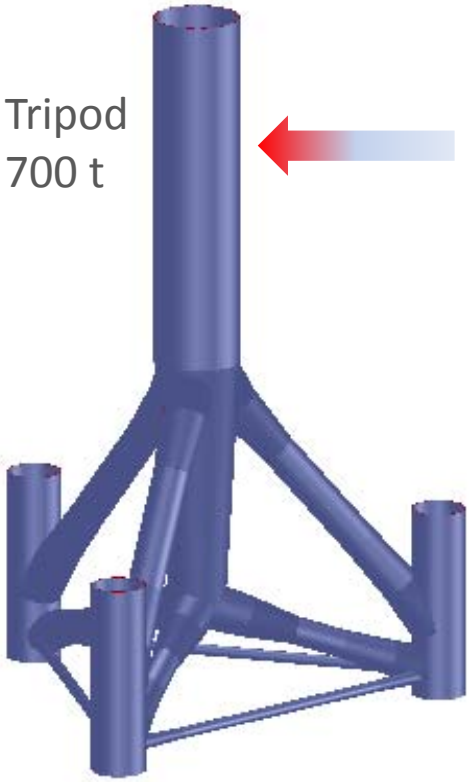
imare GmbH



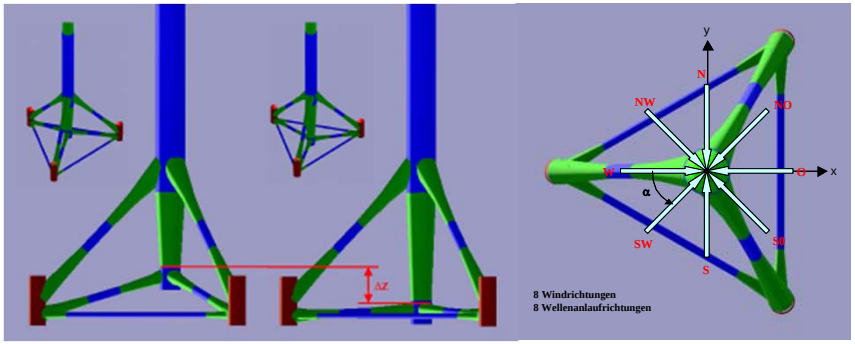


Berechnung der mechanischen Lasten

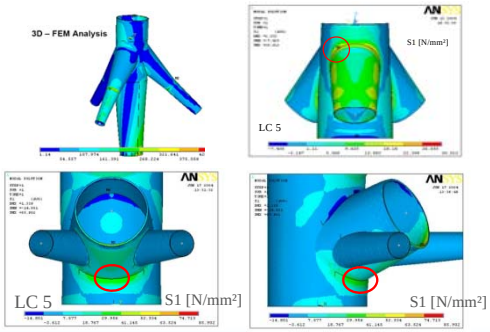
Tripod
700 t

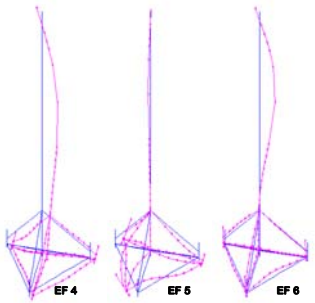


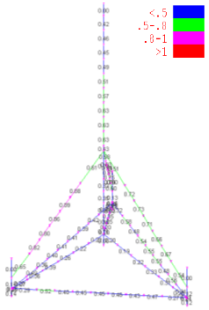
Berechnung eines statischen Modells (3-5 MW Turbinenklasse)

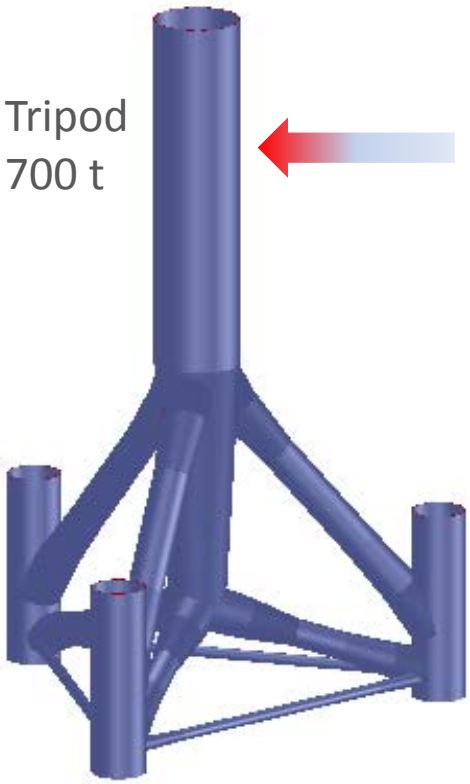


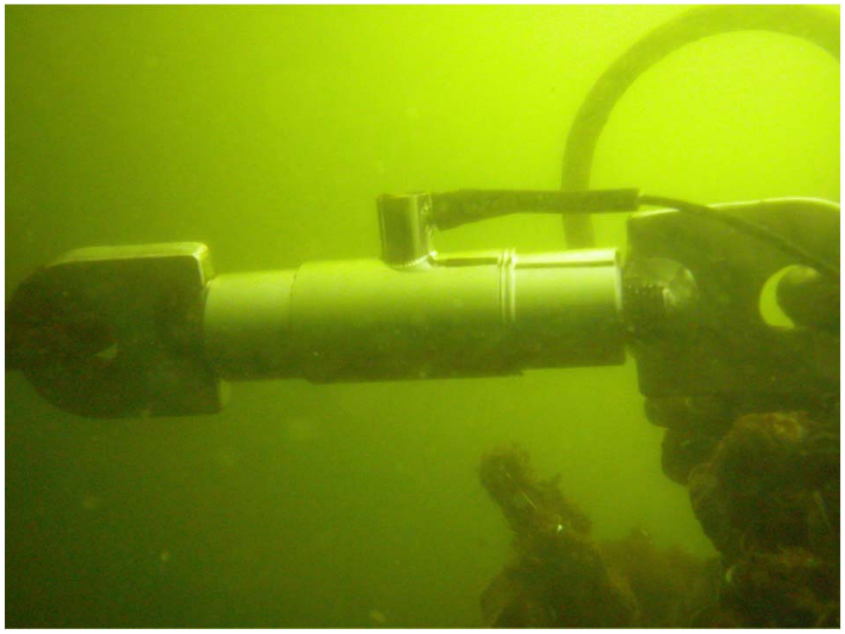
Berechnung von alternativen Anschlusspunkten im Fundament





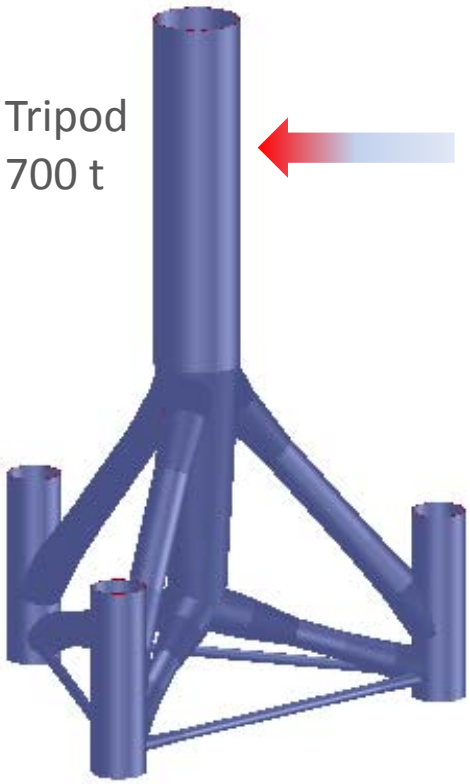




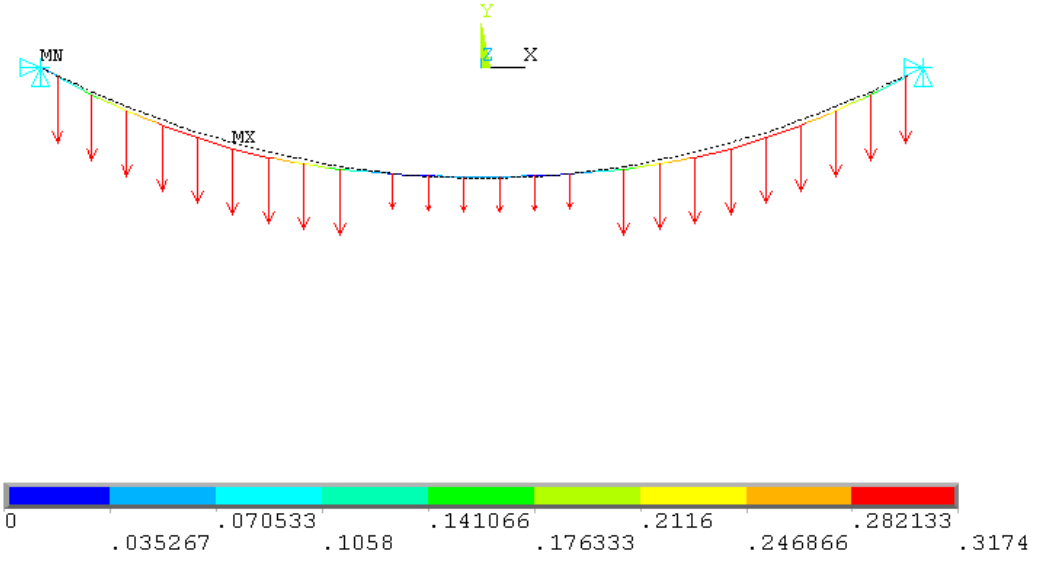


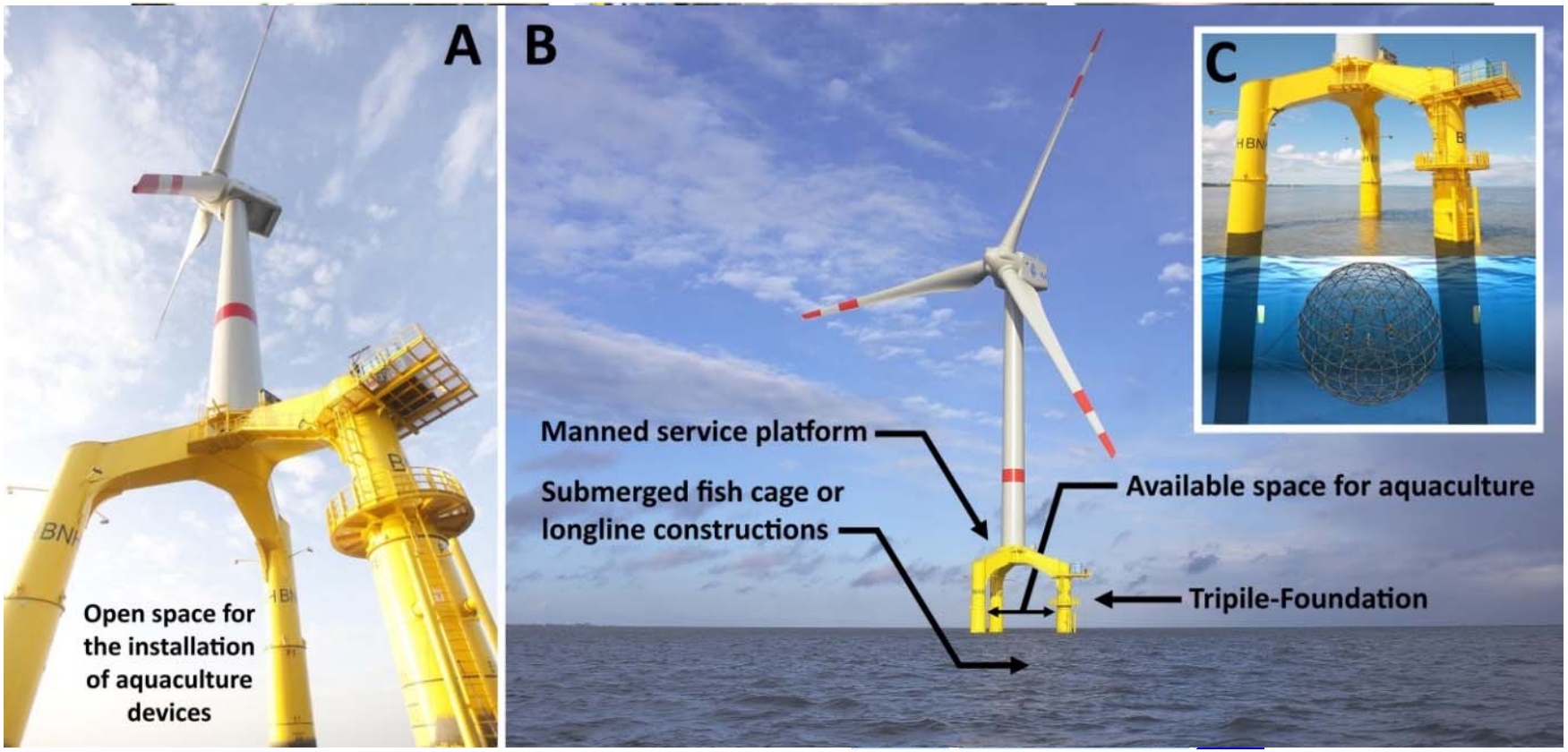
Unterwasser Kraftsensor an Langleine/Kollektoren

Tripod
700 t



Summe der Verformungen sowie die Verformungslinie bei einem Kraftangriffswinkel von 90°





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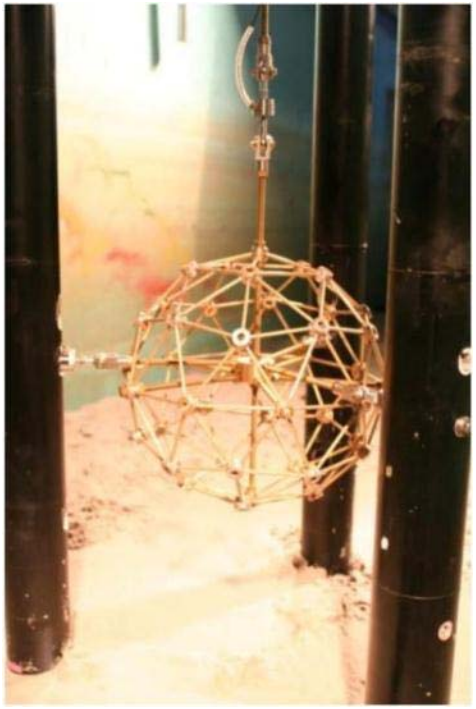


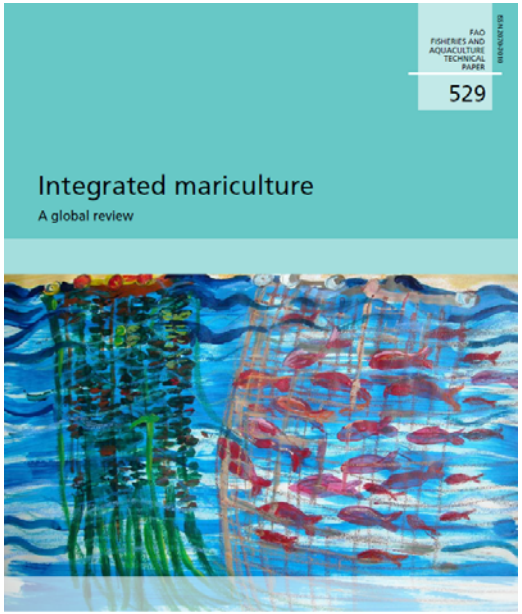
FRANZIUS-INSTITUT für Wasserbau und Küsteningenieurwesen

Leibniz Universität Hannover

Aquakulturtechnologien und Systemdesign

→ IMTA

Additional commercial value → IMTA



Bioextraction

"An environmental management strategy by which nutrients are removed from an aquatic ecosystem through the harvest of enhanced biological production, including the aquaculture of suspension-feeding shellfish or algae"

Ecological Engineering

"Ecological Engineering is an emerging field that uses ecological processes within natural or constructed systems to achieve environmental goals"

Balanced Ecosystem Approach

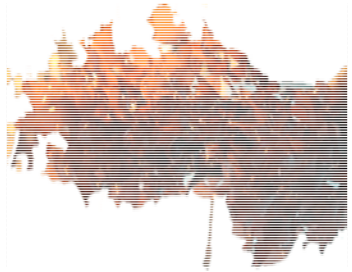
"Fed aquaculture of finfish or shrimp with extractive organic aquaculture of shellfish and extractive inorganic aquaculture of seaweed (IMTA)"

Integrierte multi-trophe Aquakultur

Scophthalmus maximus

Saccharina latissima

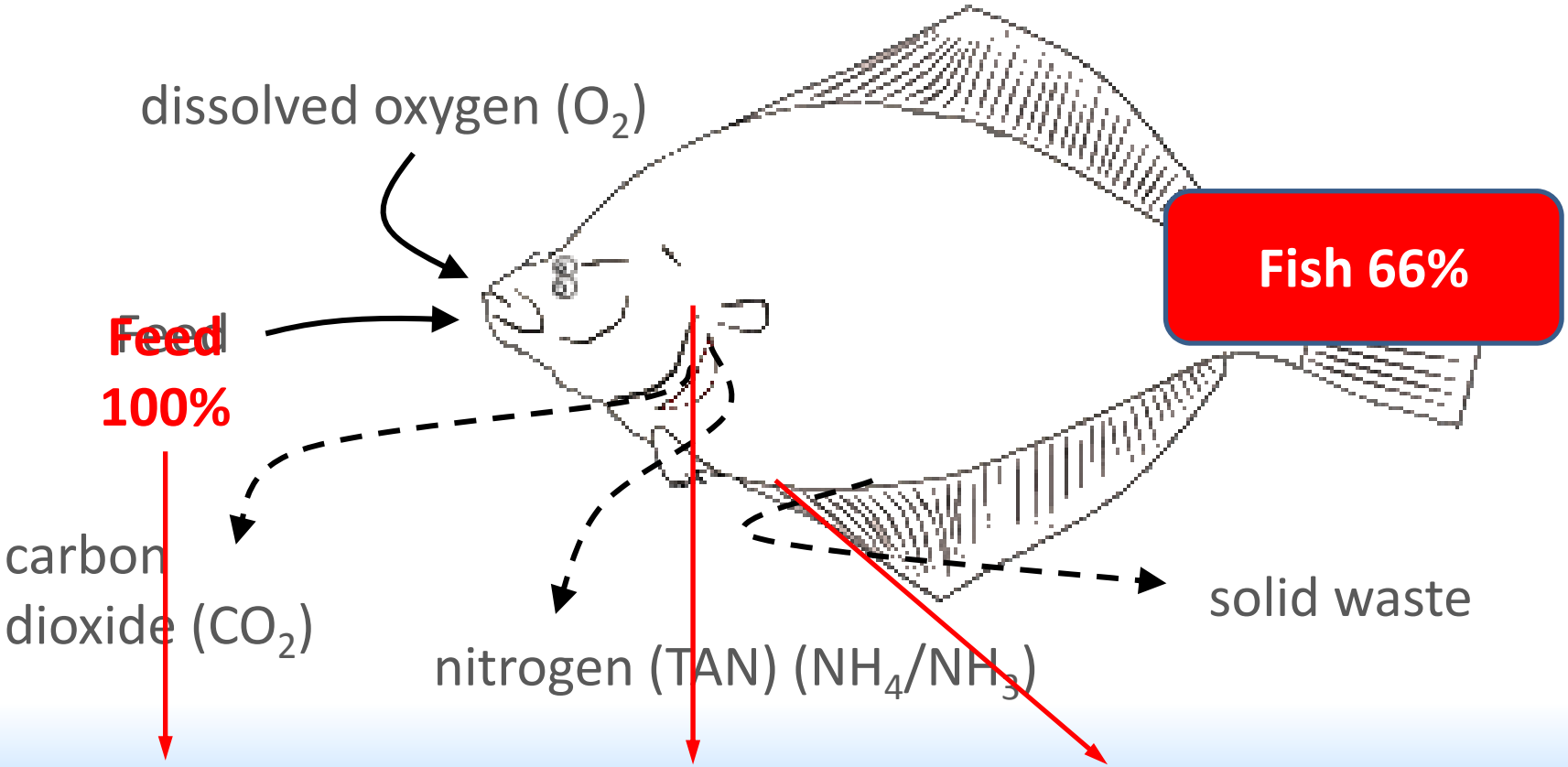
Palmaria palmata



Mytilus edulis

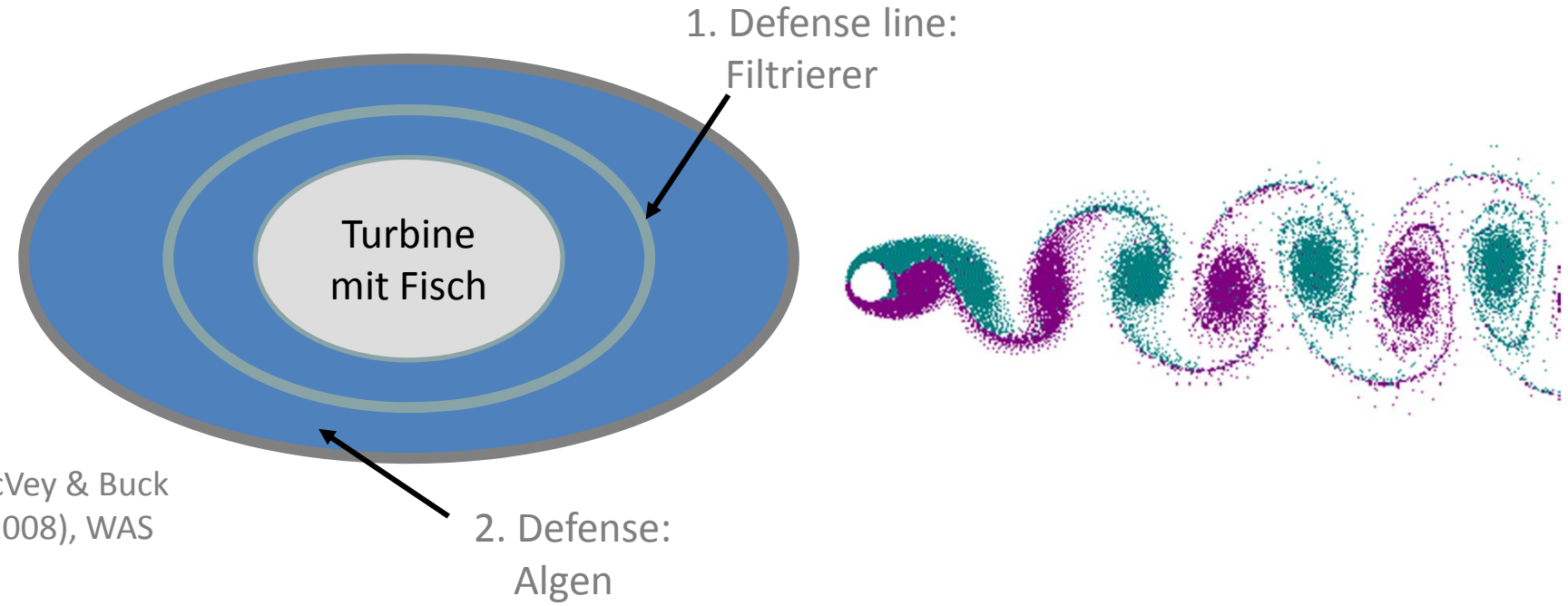
Crassostrea gigas
Ostrea edulis

FLOWS OF MATTER (N) - Turbot



IMTA

(Integrierte multi-trophische Aquakultur)



IMTA

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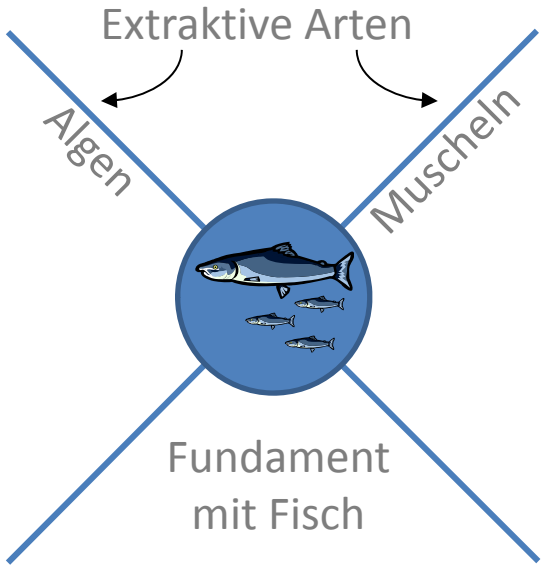
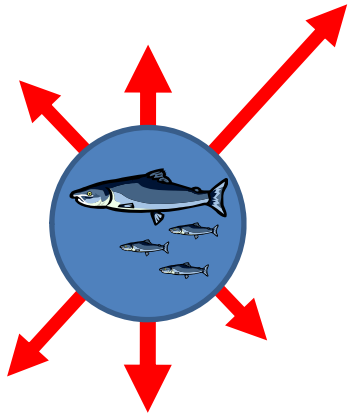
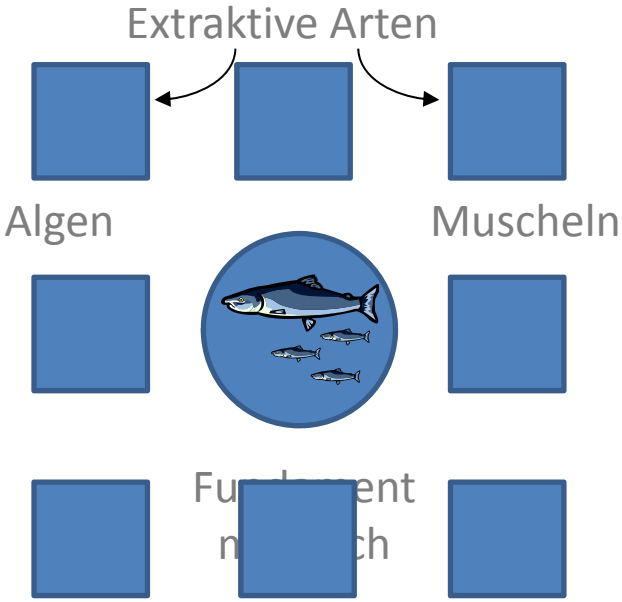
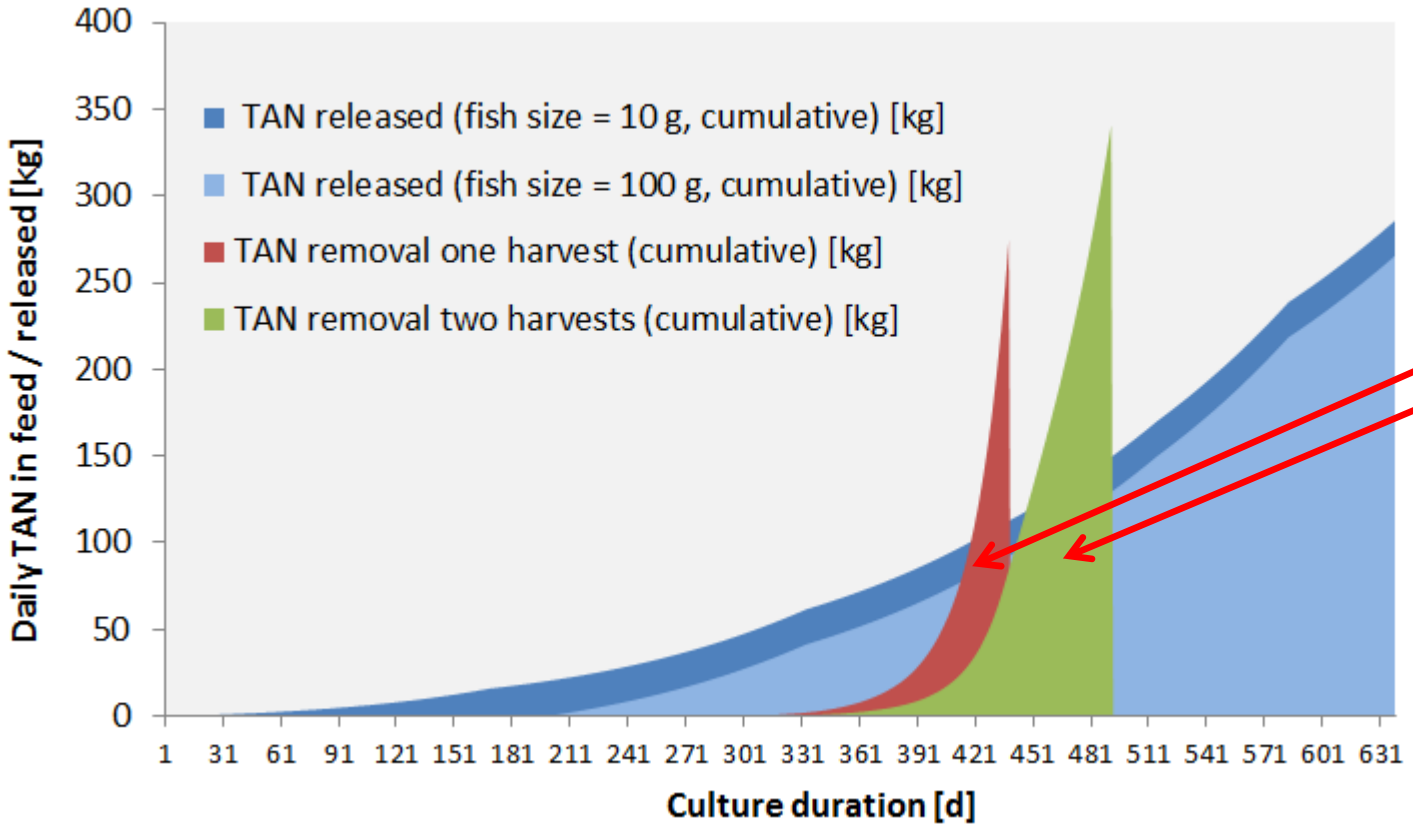




Verschiedene Richtungen



Basisdaten 07: Fisch & Makroalge



264.52 kg

- Zwei Ernten innerhalb eines Jahres
- Vergrößerung der Algenbiomasse zur Kostenreduzierung (675 €·t^{-1})
- Emissionskonzept
  - *Ecosystem service*
  - *Credits*
  - *tax reduction*

Grote & Buck 2016

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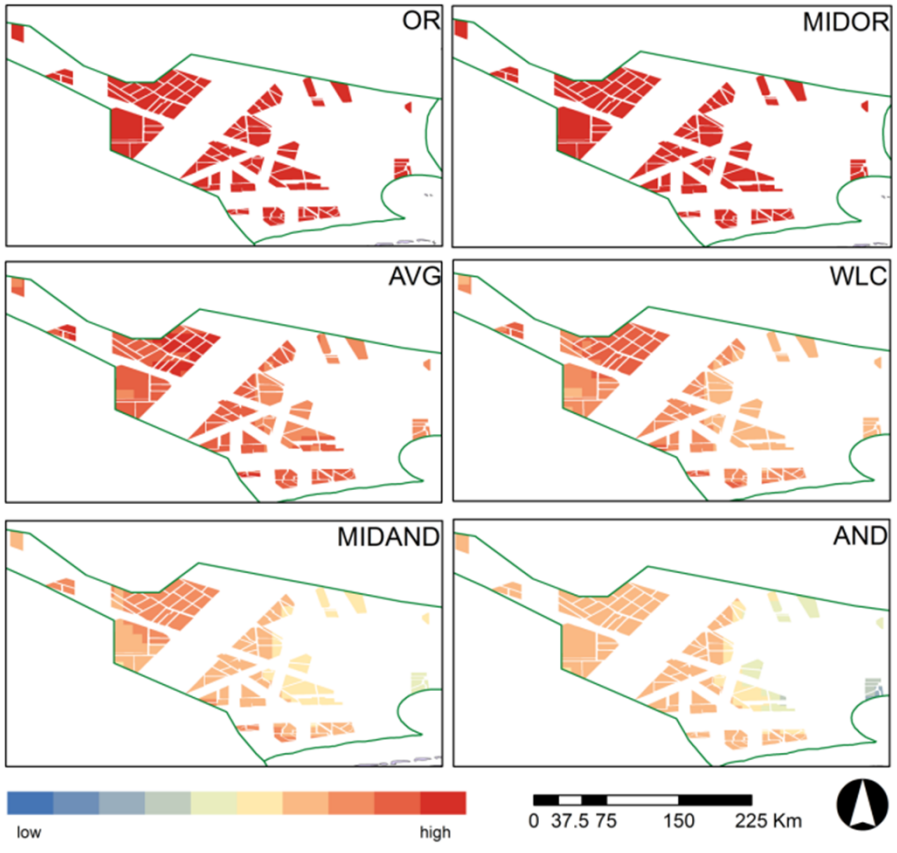
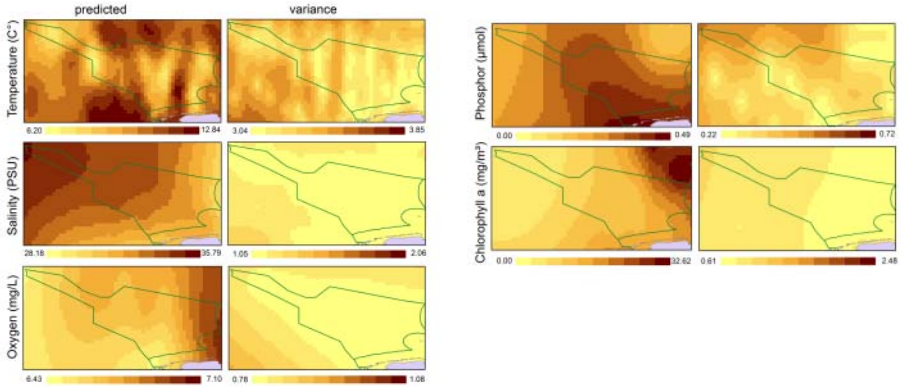


Map of generated OWA scenarios for oarweed *(Laminaria digitata*) at a depth of 0 to 10m that report aquaculture suitability (0 – 10, 10 = most suitable) from the 2nd quarter of the cultivation year.



Gimpel et al. 2015

All presented data/information are published in ISI-Journals or can be obtained from
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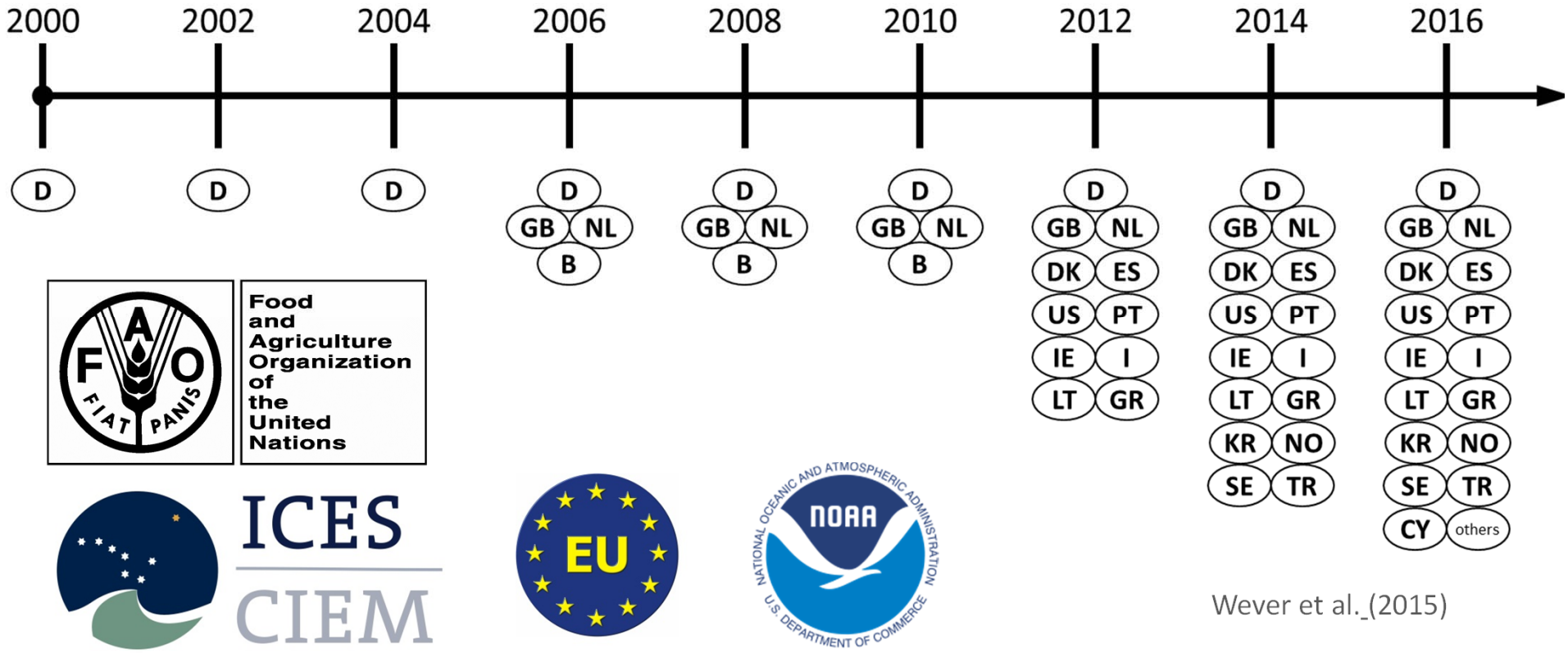


Food and Agriculture Organization of the United Nations

ICES CIEM

EU

NOAA

Wever et al. (2015)

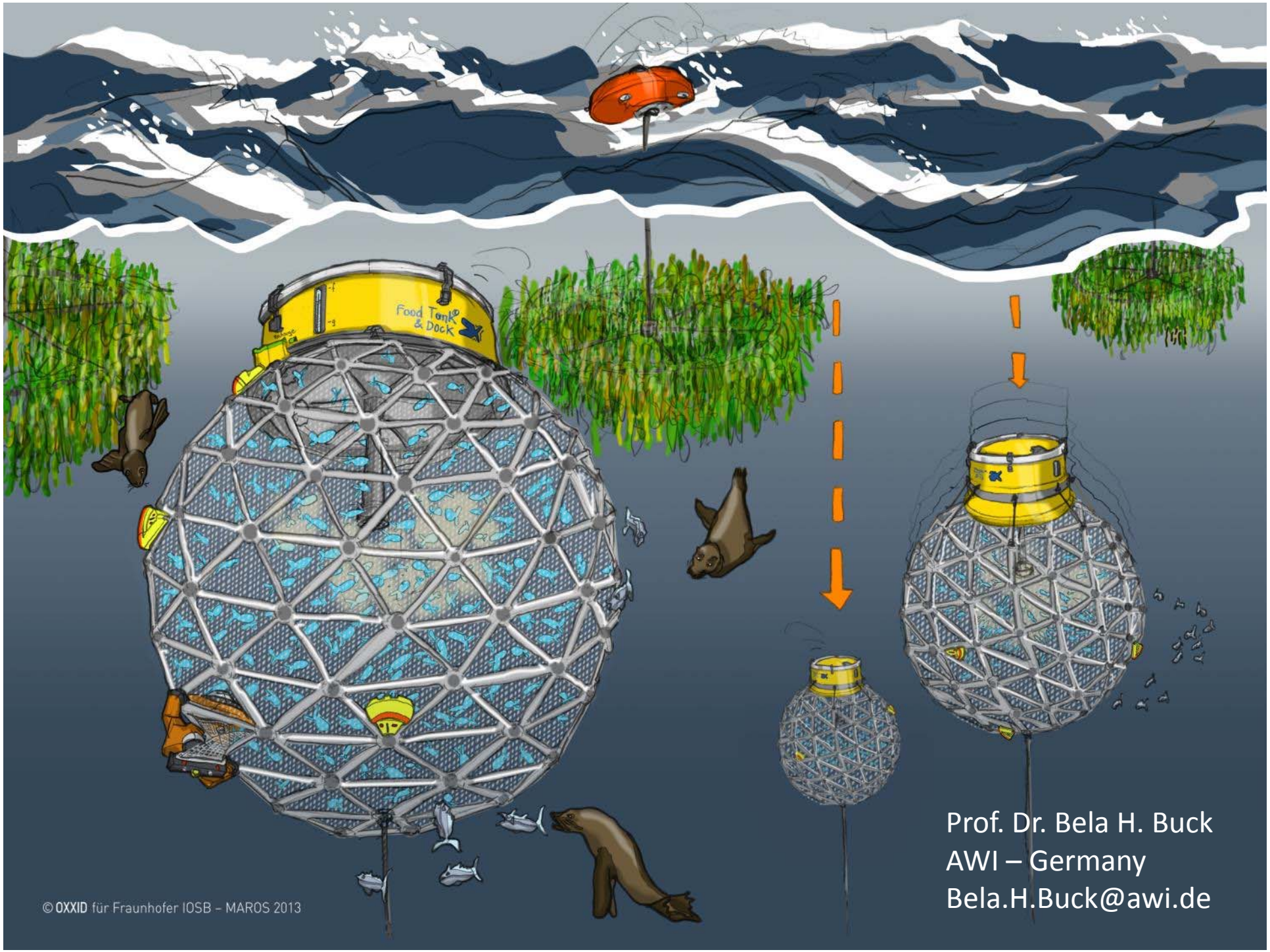
Fazit:

keine Monokulturen

Integration fördern

auf Balance setzen

und dabei immer frisch



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