Upscaling IMTA in offshore environments - challenges and possibilities

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“upscale aquaculture systems”, AquaNor Forum, 18. August 2011, Trondheim, Norway
Problems & Limitations of Aquaculture

**Limited development in Germany?**

- shallow coastal sea (low depth)
- high sediment load (Wadden Sea)
- harsh conditions
  - high waves
  - strong currents
  - wind speed
- high tidal level (4 m)
- conflicts
  - user and consumer
  - regulations
  - environment (impacts and quality)
  - health

Buck et al. (2004), *Ocean & Coastal Mgmt.*
Buck et al. (2003), *Kluwer Law International*
Offshore Wind Farm

Construction of the Alpha Ventus wind farm in the EEZ 60 km off the coast of Germany.
Multi-use ideas to maximize the benefit of an offshore area:

1. Ecology
   • Creating MPA’s (nursery, sustainable fisheries...)
   • Set-up artificial reefs

2. Tourism

3. Additional energy resources

4. Offshore Aquaculture

5. Bio-Remediation / Bio-Extraction
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)”
Offshore-AQ-Projects in the German Bight

Modified after Buck et al. (2008), Helg. Marine Research
**Saccharina Latissima**  
(*Laminaria saccharina*)  
Sugar Kelp


- offshore
- sheltered
- rotation

Buck & Buchholz (2005), *Aquaculture*
Mytilus edulis
Blue Mussel

Buck et al. (2005), J. Appl. Ichthyology

Consideration of mechanical loads on grounding constructions of windmills by aquaculture devices

Longline for bioextraction
Development of representative load cases for Offshore Wind Turbine foundation installations

Buck et al. (2006), *Ocean, Offshore, and Arctic Engineering*
Simulation of forces on the total system

Wave action on the foundation / cage

Forces on the coupling / interaction
IMTA = nutrient budgets in balance (0 discharge)

Compatibility of current aquaculture techniques with establishment on a multi-use platform and possible innovations

1. defense line: filter feeders
2. defense line: seaweeds

McVey & Buck (2008), WAS
Key Issues:

1. Upscaling aquaculture requires a move offshore.
2. IMTA concepts should form the basis for new enterprises to fulfill criteria of sustainability and environmental friendly techniques => acceptance
3. Offshore aquaculture can only be conducted by a consortium and not by single farmers/fishermen.
4. Multi-use concepts will have a better acceptance for both stakeholders and would save costs.