CENTRE FOR BIODIVERSITY DYNAMICS

NTNU
Norwegian University of Science and Technology

Can Artificial Reefs function as MPAs?

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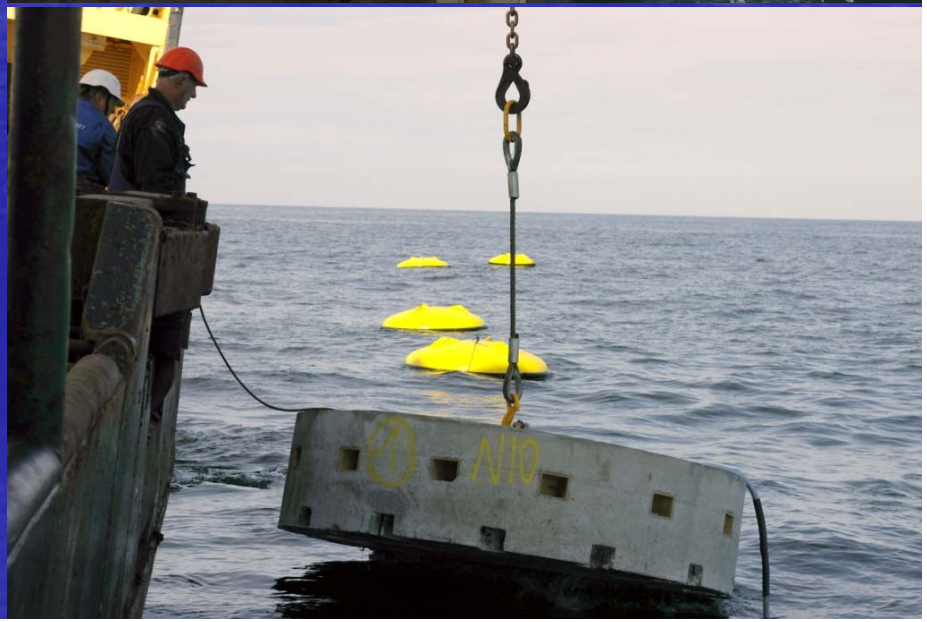
CBD workshop

16th September 2015

Reasons for deploying ARs:

- Enhance fisheries *(e.g. Seaman et al. 1991)*
- Protection of fish stocks/habitats *(e.g. Jensen 2002)*
- Restoring marine habitats (including spawning areas) *(e.g. Clark & Edwards 1995)*
- Create sites for recreational diving and fishing *(e.g. Wilhelmsson et al. 1998)*
- Research *(e.g. Seaman et al. 1991)*

Marine Renewable Energy Installations as "secondary" Artificial Reefs



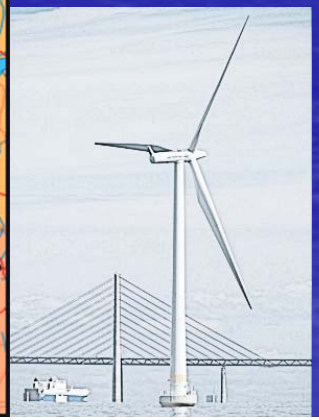
Project areas

Gløshaugen, NTNU

Lysekil research site

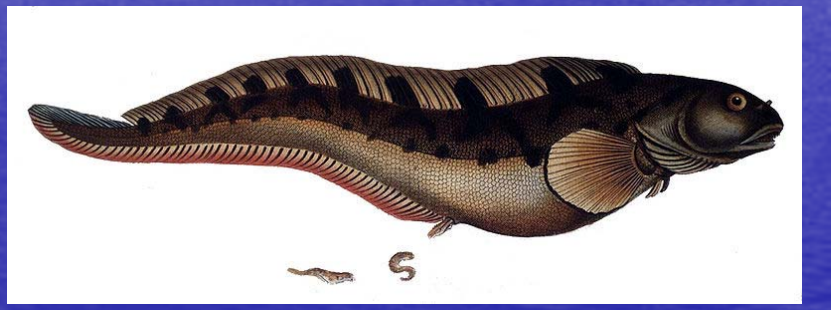
Swedish Centre for Renewable Electric Energy Conversion

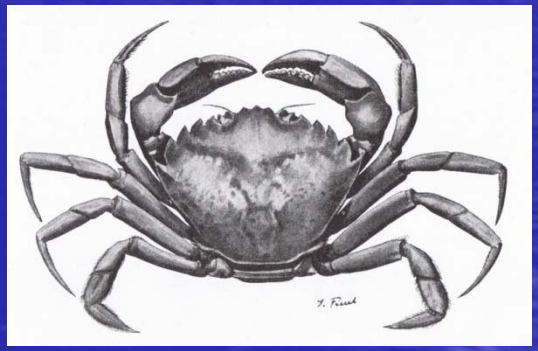
Uppsala University



Lillgrund wind farm

Marine environmental monitoring of an operating offshore wind farm: population dynamics of eelpout and shore crabs





Statkraft Ocean Energy Research Program

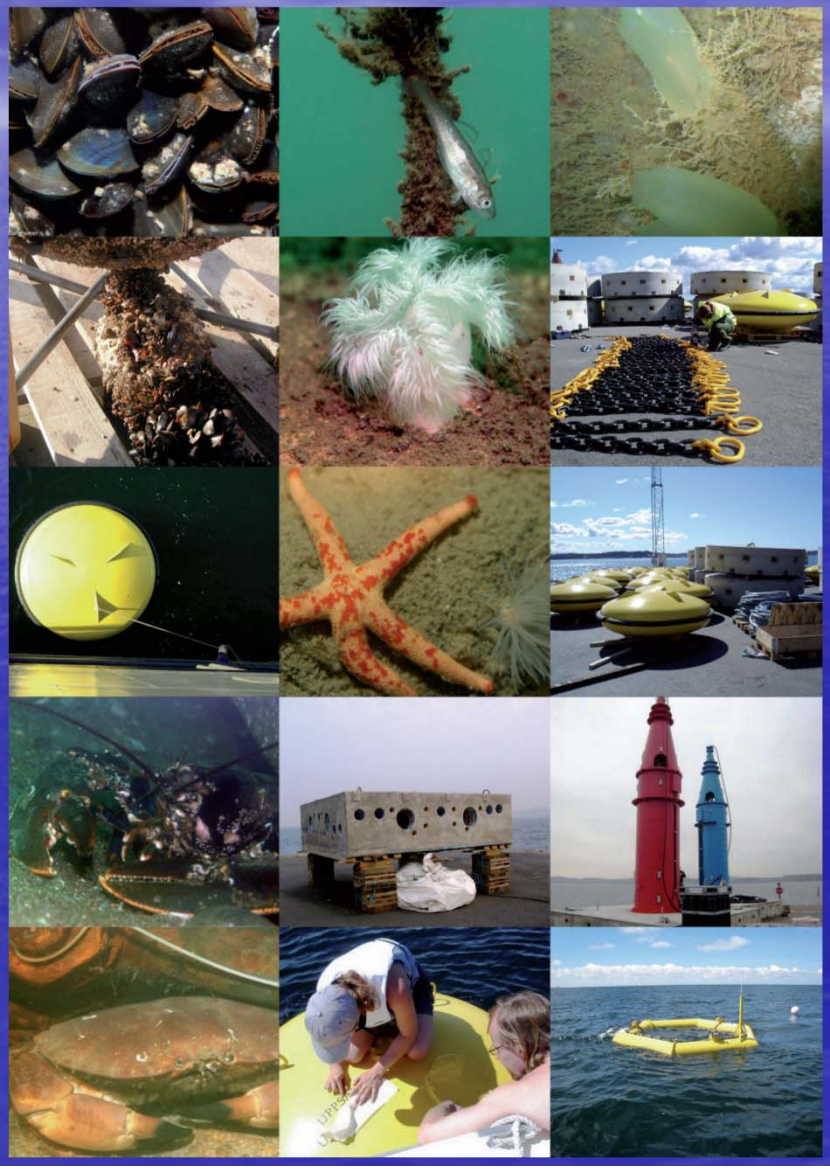
Statkraft

NTNU
Norwegian University of Science and Technology

UPPSALA UNIVERSITET

DTU Mechanical Engineering
Department of Mechanical Engineering

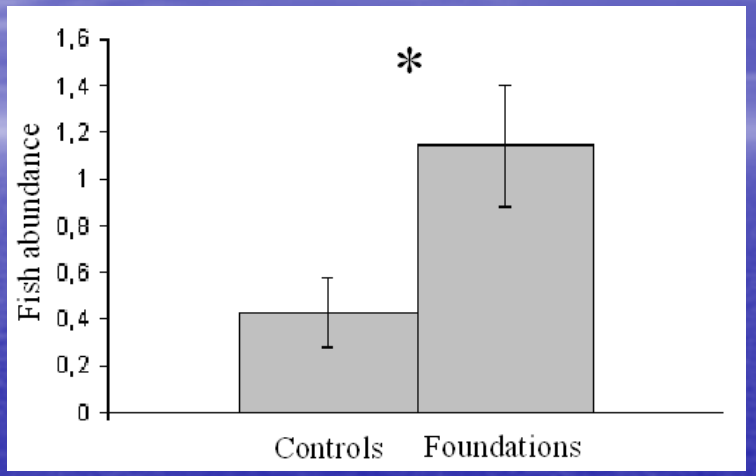
The Lysekil research site

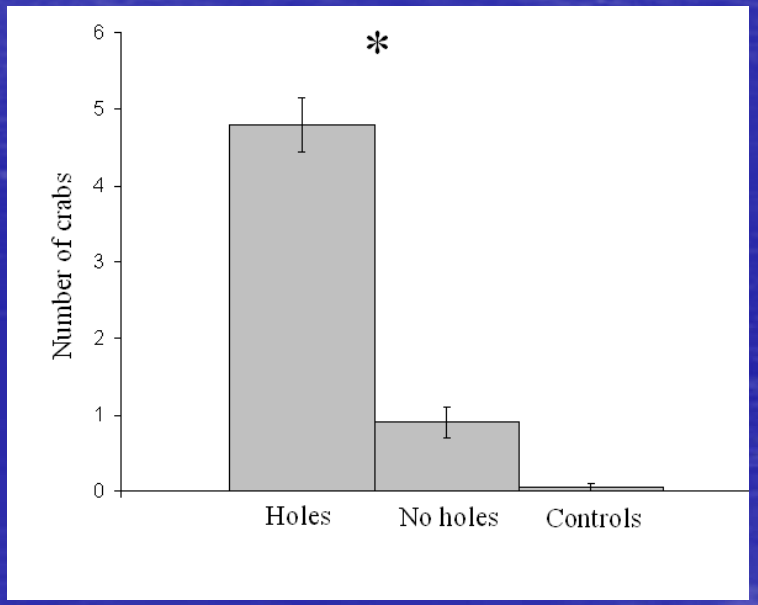


Environmental studies

- Study on potential effects of WECs on the surrounding seabed
- Estimate biofouling impacts on WECs
- Colonization patterns of fish & invertebrates on wave power foundations
- Further important marine environmenta aspects

Colonization patterns of motile fauna

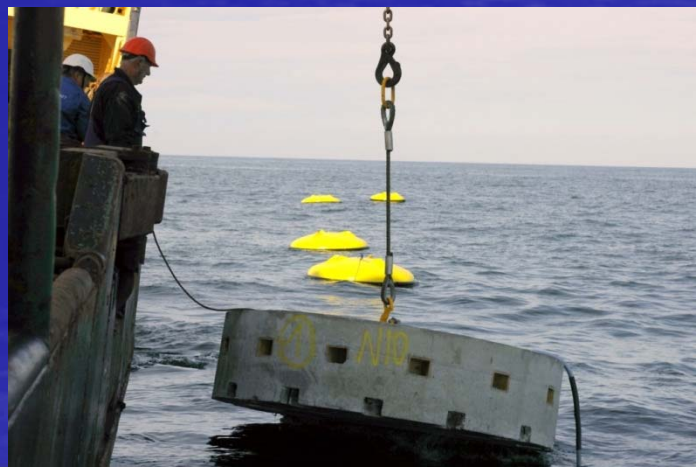




In: Langhamer O, Wilhelmsson D 2009. Marine Environmental Research

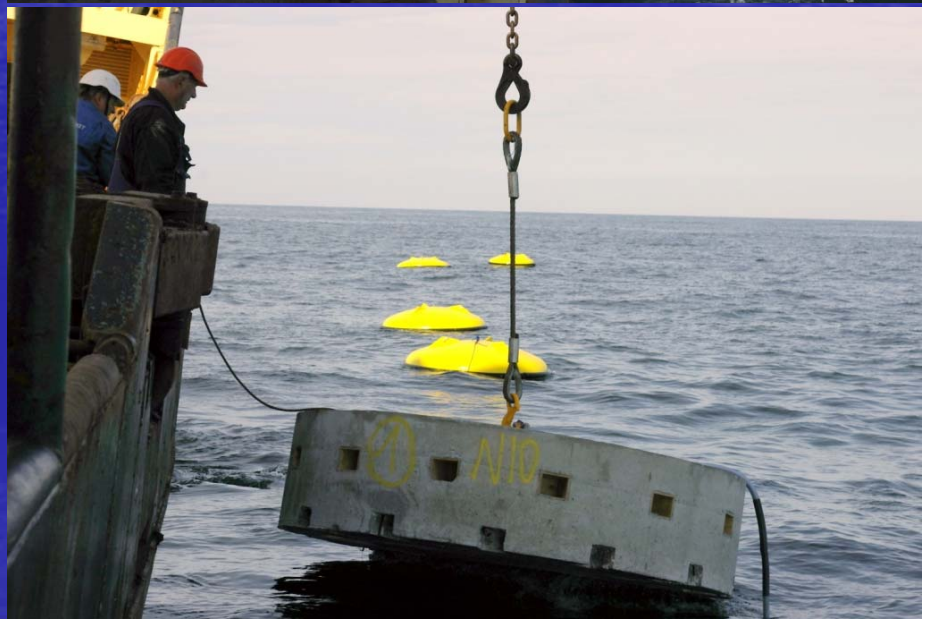
Colonization patterns of motile fauna

- Succession of colonization over time
- Added hard structures lead to new habitats
- Edible crabs use holes in foundations frequently
- Species composition similar to natural hard bottom in the surrounding



Marine Renewable Energy Installations as Artificial Reefs

WavEC Portugal



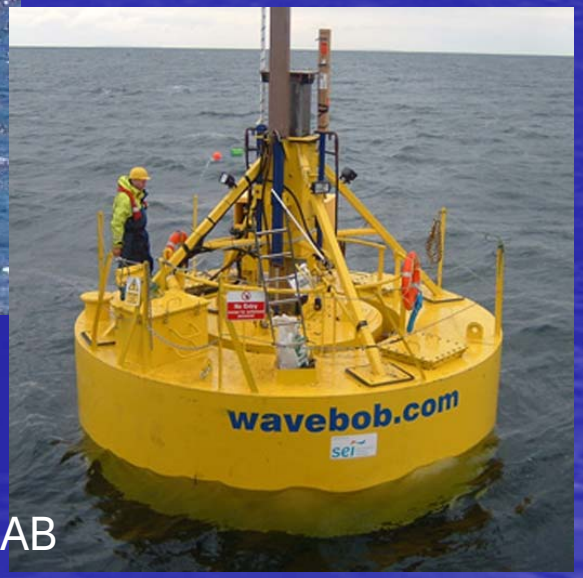
Marine Protected Areas

- «An area of intertidal of subtidal terrain, together with its overlying water and associated fauna and flora, historical and cultural features, which has been preserved by law or other effective means to protect a part or the entire enclosed environment» (IUCN 1988)

- Applications:

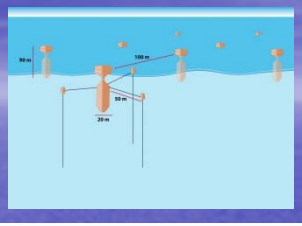
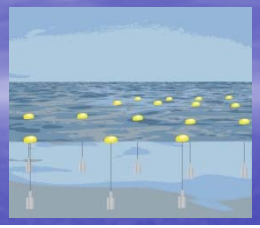
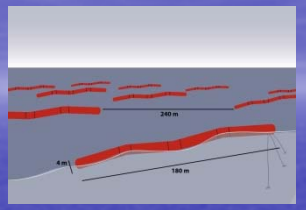
1. to protect a certain species
2. to benefit fisheries management
3. to protect whole ecosystems, biodiversity, rare habitats, or nursery & spawning grounds

The potential for Wave Energy Devices to Provide Artificial Habitats and Protect Areas from Fishing.



In: Wilhemsson D, **Langhamer O**. 2010. IUCN/Vattenfall AB

SUMMARY TABLE: WEC and MPA function

MW		Wavebob		Seabased		Pelamis	
15		#devices	area (km^2)	#devices	area (km^2)	#devices	area (km^2)
		1	1,6	300	1,5	20	5
	Commercial fish	+		+		+	
	Crustaceans	+		+		+	
	Mussels	+		+		+	
75		15	6,8	1800	7,5	100	13
	Commercial fish	+		+		++	
	Crustaceans	+		+		+	
	Mussels	+		+		+	
250		50	21	5000	25	332	36
	Commercial fish	++		++		++	
	Crustaceans	+		+		+	
	Mussels	+		+		+	
	+ may increase biomass per unit area significantly						
	++ may increase biomass significantly and 35% more per unit area						

In: Wilhemsson D, Langhamer O. 2010. IUCN/Vattenfall AB

Conclusion

- WEC farms of all sizes have the theoretical potential to increase local biomass
- Size does matter: every tenfold increase in size of the protected area increases the density of commercial fish species of about 35% (Claudet et al. 2008)

Let`s focus more on Norway

Norway; the "ocean state"

- Area
  - **Waters** under Norwegian jurisdiction: 2,3 million km^2
  - **Land territory**: 385 000 km^2
- Economic importance
  - Petroleum, aquaculture and fisheries are the main exports and foundation our welfare

WELL MANAGED MARINE PROTECTED AREAS SUPPORT FISHERIES

MPAs IMPROVE THE HEALTH OF OCEANS BY:

MPA

- Protecting and Restoring Marine Habitats
- Increasing Resilience to Environmental Changes
- Protecting Species and Rebuilding Fish Stocks

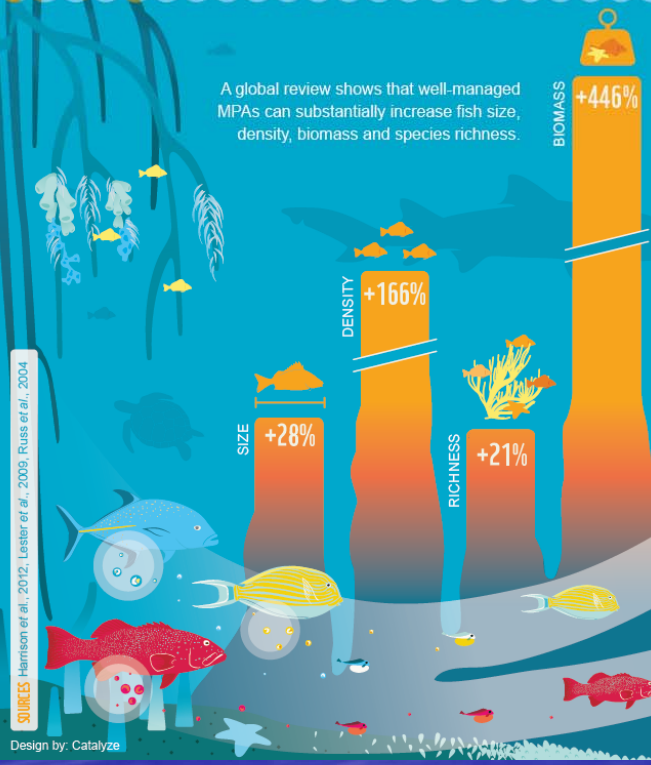
KEY PRINCIPLES FOR MPAs TO WORK:

- Well Designed Networks of MPAs
- Enforced and Complied With
- Local Community Engagement
- Part of an Integrated Management Plan
- Sustainably Financed

MPAs SUPPORT LIVELIHOODS

In Apo Islands, Philippines, fishers have doubled their catch rate 18 years after the MPA was created. As a result, they go out to sea less, saving on fuel and time.

A global review shows that well-managed MPAs can substantially increase fish size, density, biomass and species richness.



MPAs CAN PUMP FISH INTO ADJACENT AREAS

As fish populations recover within MPAs, juveniles and adults can spill over across the boundaries and replenish fishing grounds.

EXAMPLE: APO ISLAND PROTECTED AREA, PHILIPPINES

Surgeonfish and jackfish represent 40-75% of local fishery yields.

Since the MPA was established, their population has tripled...

...resulting in an increase in catch per unit effort of **+50%**

MPAs CAN EXPORT LARVAE INTO ADJACENT AREAS

Larger fish inside MPAs produce disproportionately more eggs and larvae. Some larvae then drift to fished areas.

EXAMPLE: GREAT BARRIER REEF PROTECTED AREA, AUSTRALIA

The coral trout and the stripey snapper are exploited locally.

± 50%

Local MPAs produce ± 50% of total juvenile recruitment in nearby fished areas.

Globally, WWF works to support Marine Protected Areas and ensure they contribute to securing food and livelihoods for people while conserving critical habitat and species.

www.panda.org/mpa

SOURCES Harrison *et al.*, 2012, Lester *et al.*, 2009, Russ *et al.*, 2004

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