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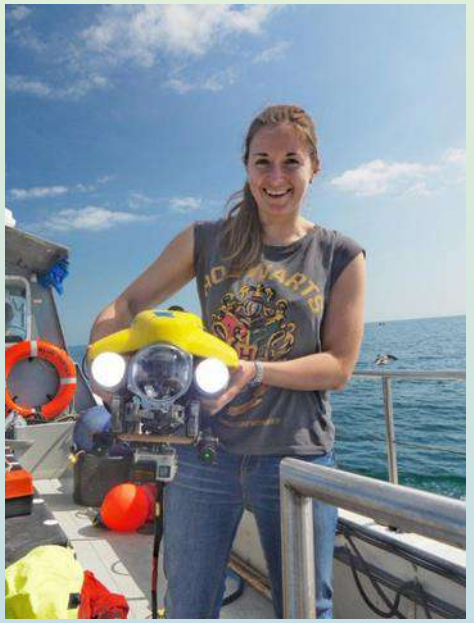
offshore shellfish ltd

Mussel culture in Lyme Bay: Emerging understanding of environmental changes



Dr Emma Sheehan & Danielle Bridger,
Dr Sian Rees, Prof Martin Attrill

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History of aquaculture

- Aquaculture – “the farming of aquatic animals and plants for food”
- Fastest growing food production system in the world – but growing the wrong way (Seafood in the future: Bivalves are better. Jennifer Jacquet et al 2017)
- Focus has been on carnivorous fishes (27% global wild caught fishes feeds farmed fishes, welfare issues, **wild live wrasse – SWME 2018**)
- Food security - A sustainable solution is to farm animals that do not require feeding – e.g. bivalves
- Less welfare issues
- Potential environmental benefits?

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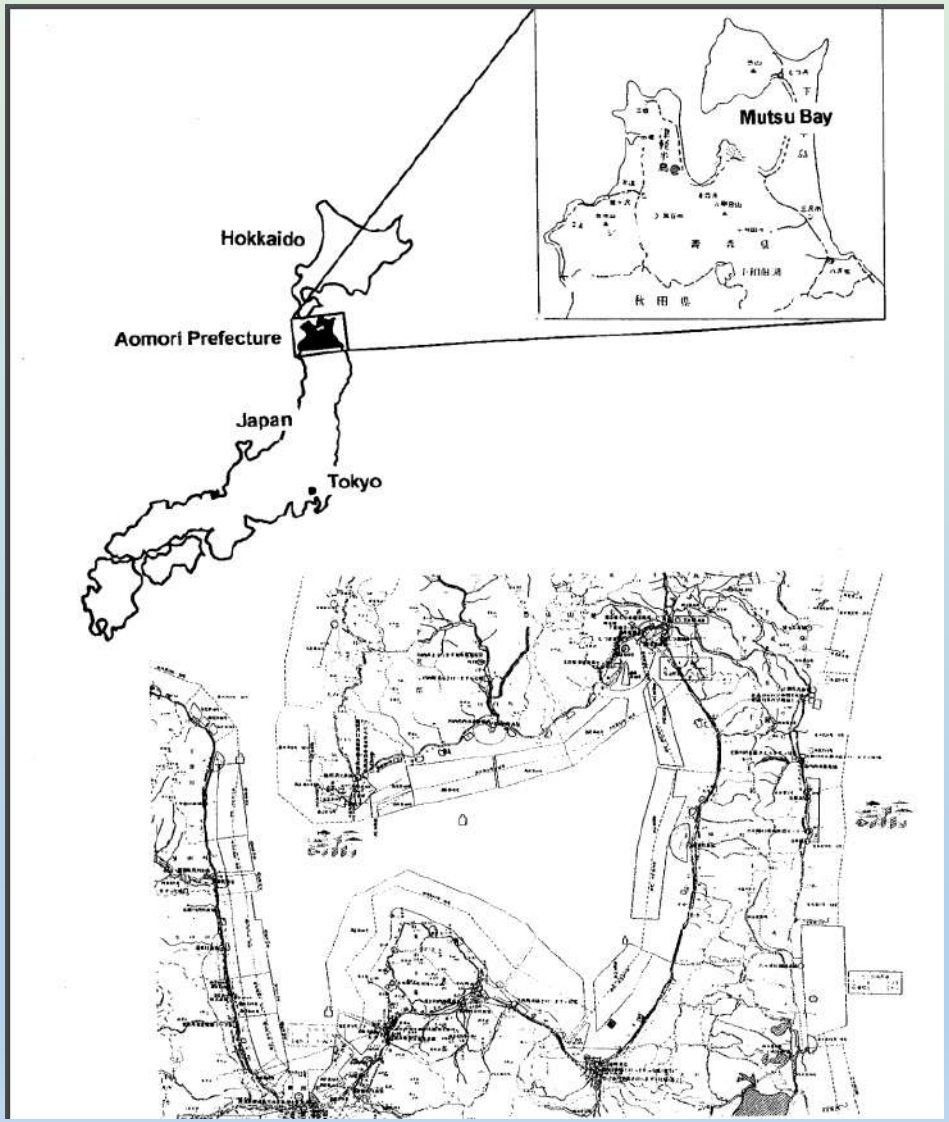
History of aquaculture

- Bivalve aquaculture dates back to Roman times
- Traditionally located inshore/enclosed sites
- Environmental and health issues
- Most extreme example: Scallop aquaculture - Japan – (Ventiller 1982)
- 1950s shift from cedar twigs sown to rice straw rope nets to synthetic materials increased spat settlement
- Mutsu Bay – enclosed and inshore
- Spat collected & Simultaneous hanging and sea bed (dredged) aquaculture



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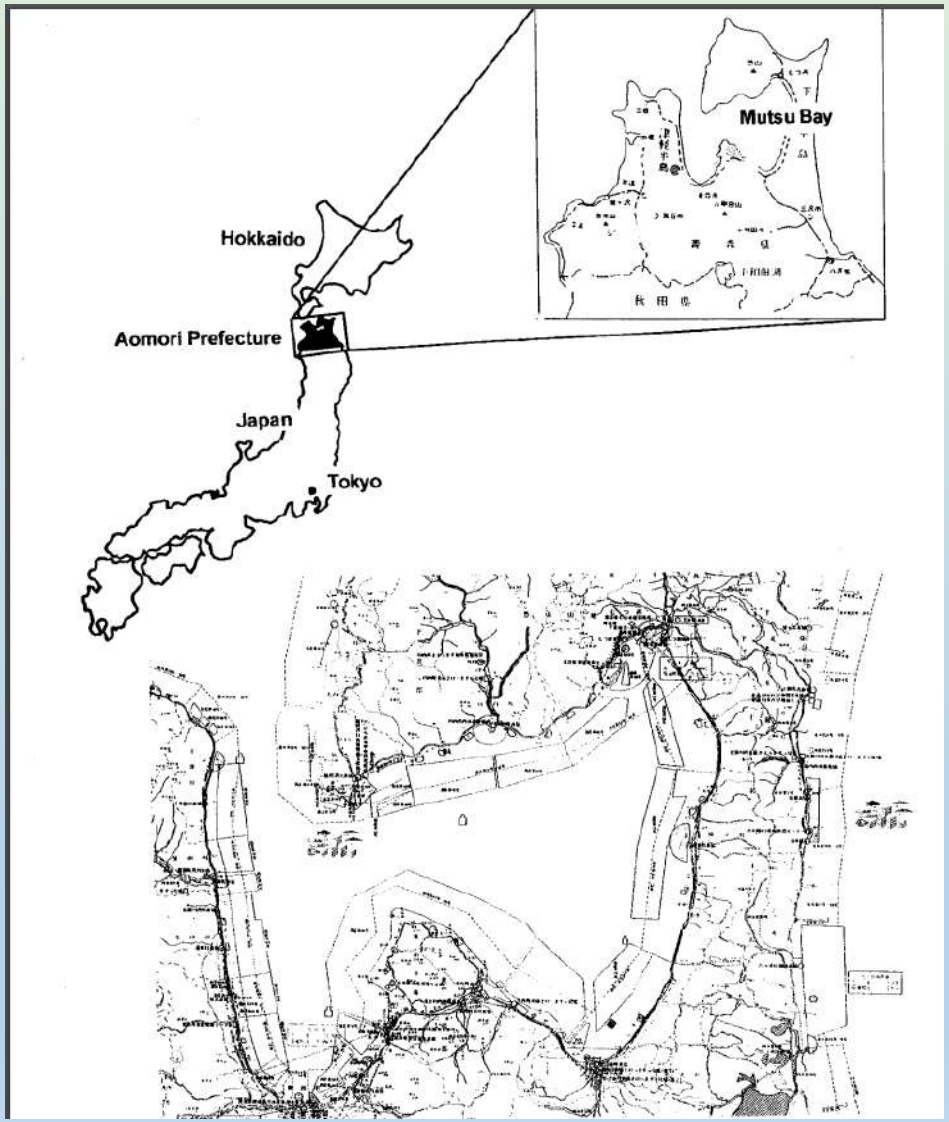
History of aquaculture: Ventilla 1982

- 1967: 64 million scallops in Mutsu Bay
- 1970: 1.7 Billion
- 1976: 4 Billion
- Scientific advice (700 million)
- Lack of nutrition, scallop raining faeces increased ammonium nitrite
- Results: Distorted shells, mass mortality, toxic red tides (poisons and toxins cause food poisoning and muscle paralysis)
- Mutsu Bay now has sustainable carrying capacity and MSC accreditation



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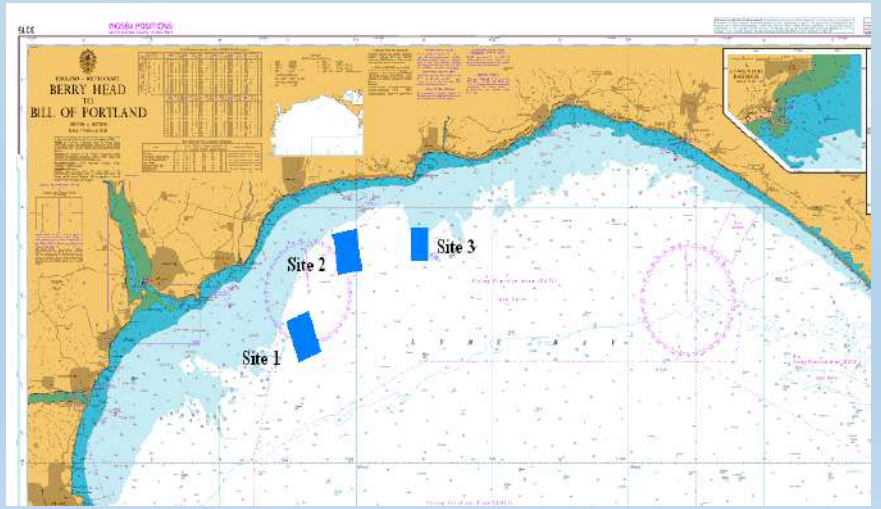
History of aquaculture

- Scotland lochs: Bacterial mats cause ecological issues
- Can a shift to offshore farms promote an ecologically more sustainable, healthier, economic and socially acceptable approach?

Offshore aquaculture in Devon

- 2010 Guardian article
- 10,000 t yr (more than entire production in Scotland)



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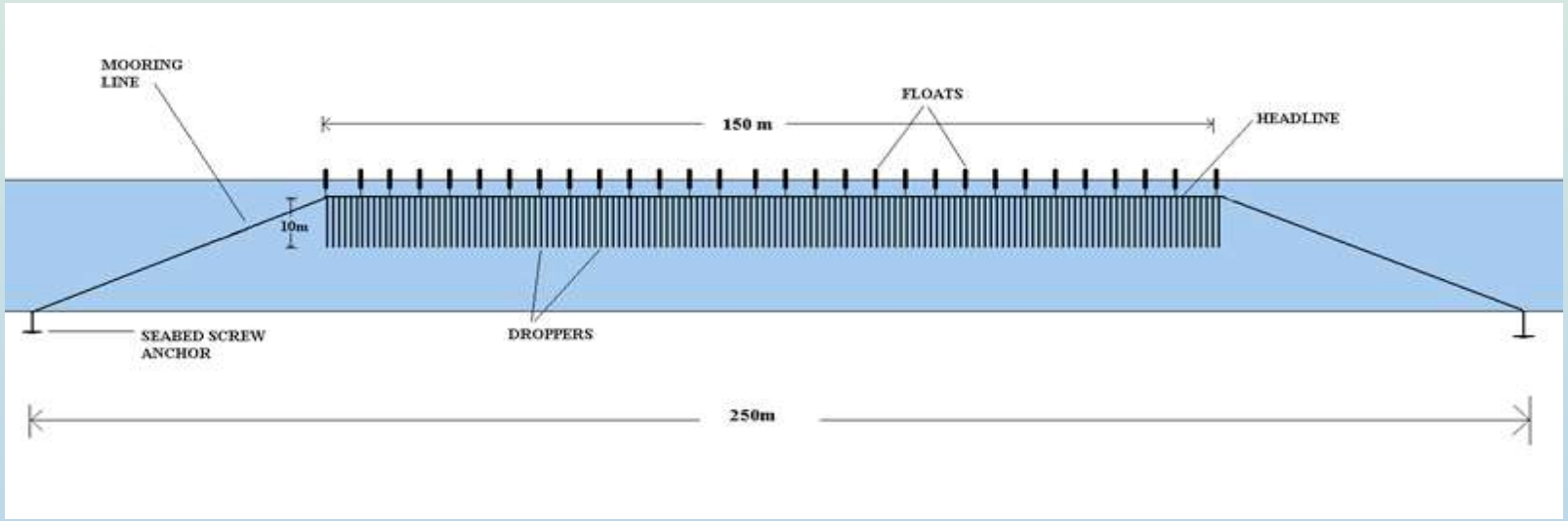
Offshore aquaculture in Devon

- Each headline: 150 m
- Droppers: 10 m
- Active suspension feeders
- 2 L water per mussel/day (ecosystem function)



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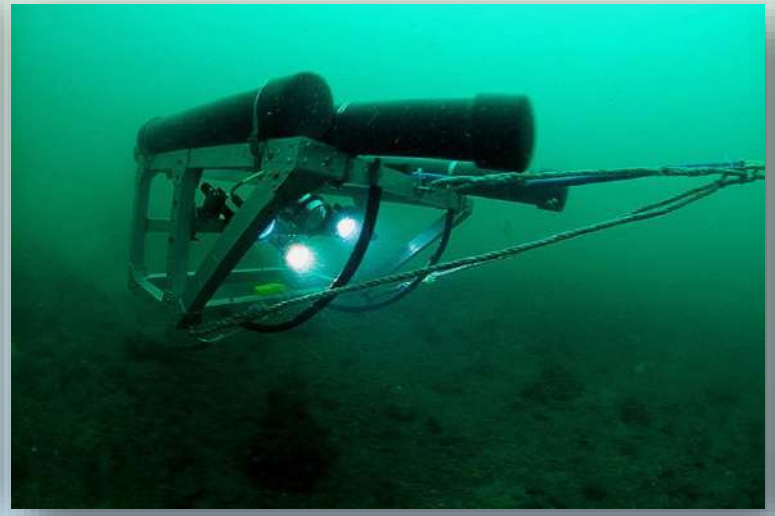
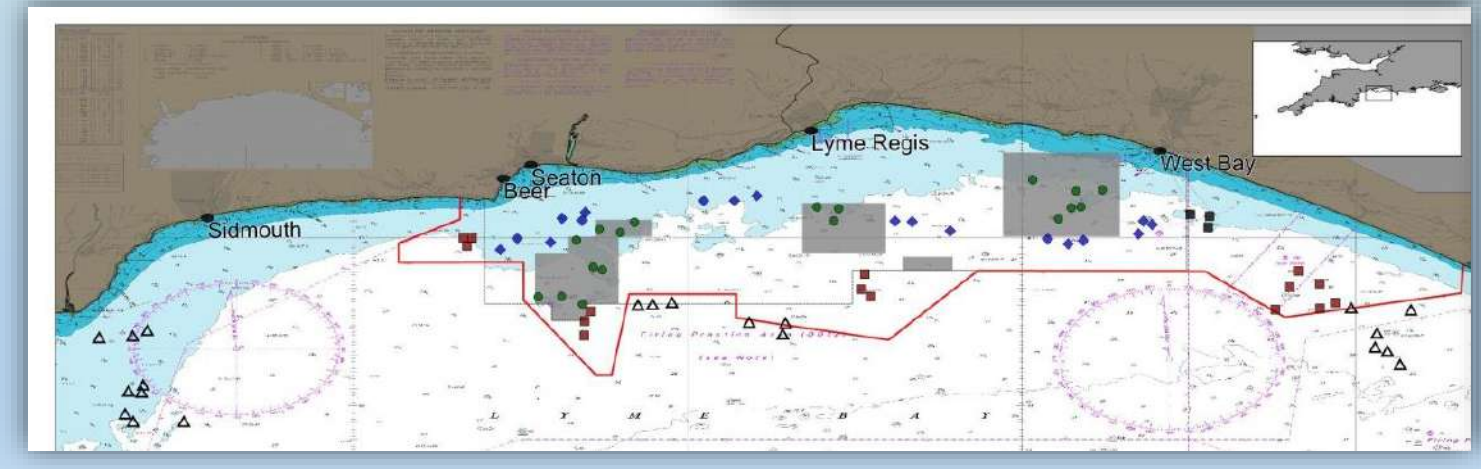
2008- Date Lyme Bay Long term monitoring project





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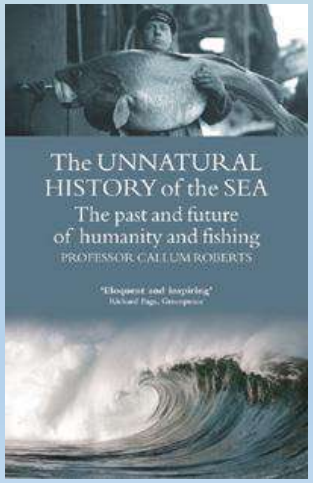
Sheehan et al 2013, Plos One & Mar Pol Bull

Farming mussels offshore

- Pre-licence survey (baseline)
- Concerns that mussel farm would change "natural sea bed conditions"
- Shifting baselines (Pauly 1995)
- Biogenic reef → sediment

"The Shifting Baseline Syndrome is a concept formulated by Daniel Pauly in 1995. It results in a drift away from true natural conditions, and as a consequence a change in perception of ecological change varying from generation to generation"



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Farming mussels offshore

- Oyster shells found 2 m below sea bed surface
- Evidence of shifting baselines?...

- Trial ropes deployed in 2013 before “The Storms” that broke the south west
- First spat collected in spring 2014

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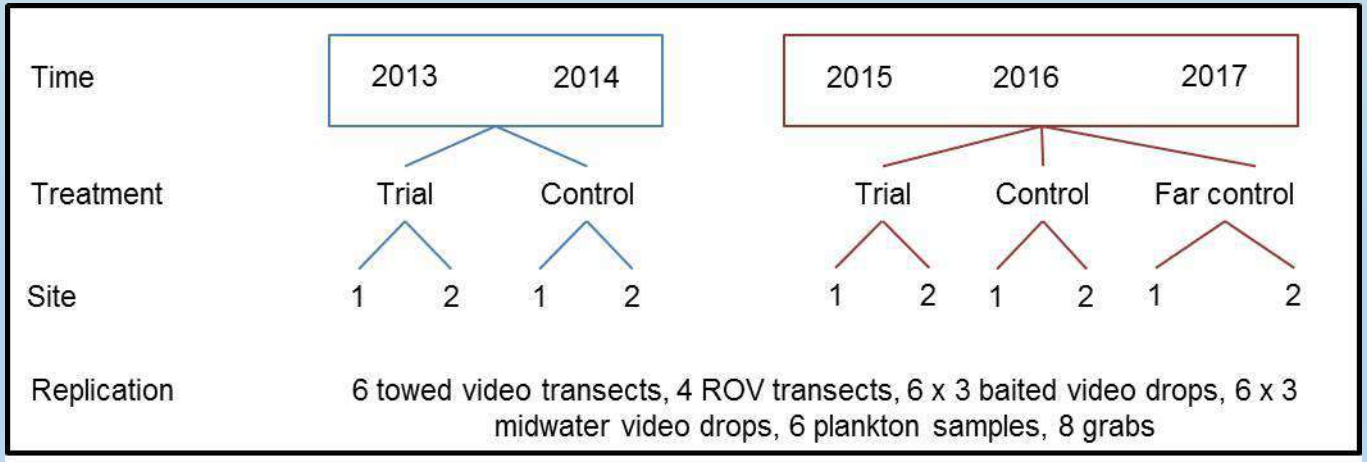
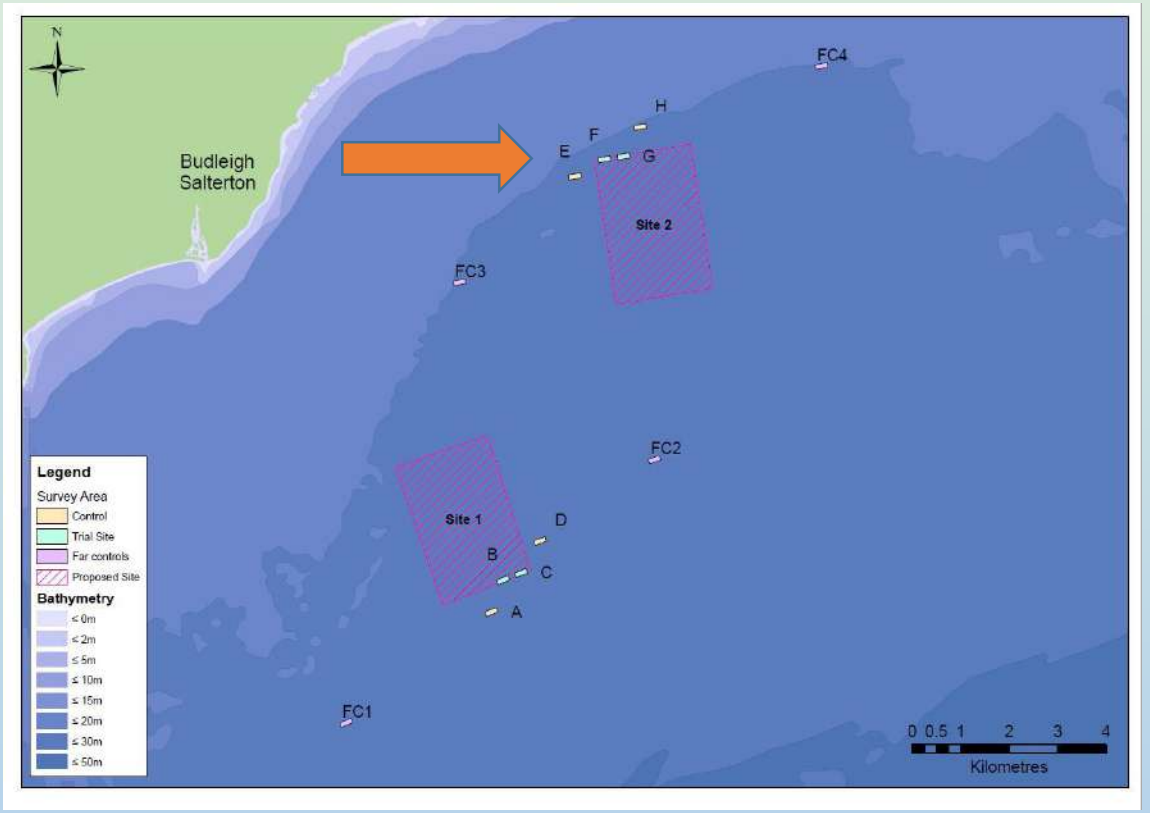
Design

- Two 100 m x 650 m trial areas.
- Two Trial stations at each Site.
- Replicate Control stations.
- Far control stations added in 2015
- Local fishers, cost/time effective methods





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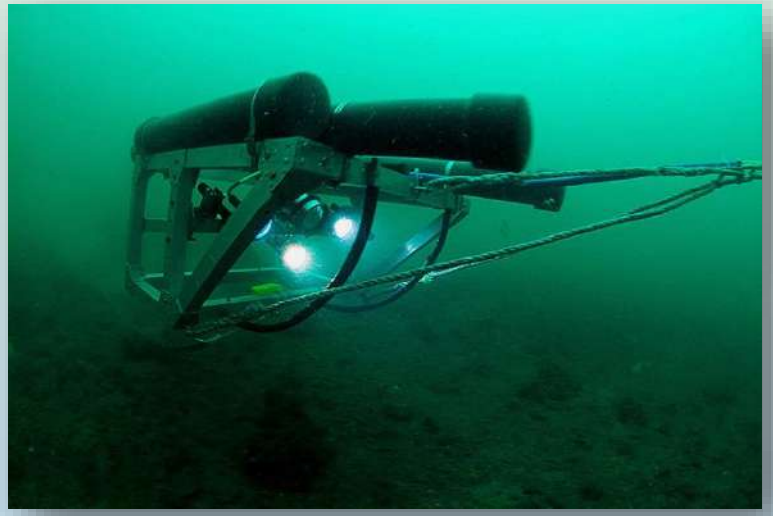
Monitoring Ecosystem key components

- Rope epifauna
- **Benthic – Infauna**
- **Benthic epifauna (sessile and sedentary)**
- **Benthic and Demersal mobile fauna**
- Mid-water mobile fauna
- Plankton
- Birds and mammals

Environmental

- **Sediment environmental variables (organic content, sediment grain size)**
- **Water column (Chlorophyll, O2, Temp, Sal)**



•Sheehan et al 2010 PLOS ONE;
•Sheehan et al 2016 Methods in Ecology and Evolution

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Rope epifauna

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Rope epifauna

- These crabs fell off a few hundred metres of rope. The full scale farm will comprise 1.75 million metres of rope.

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Infauna

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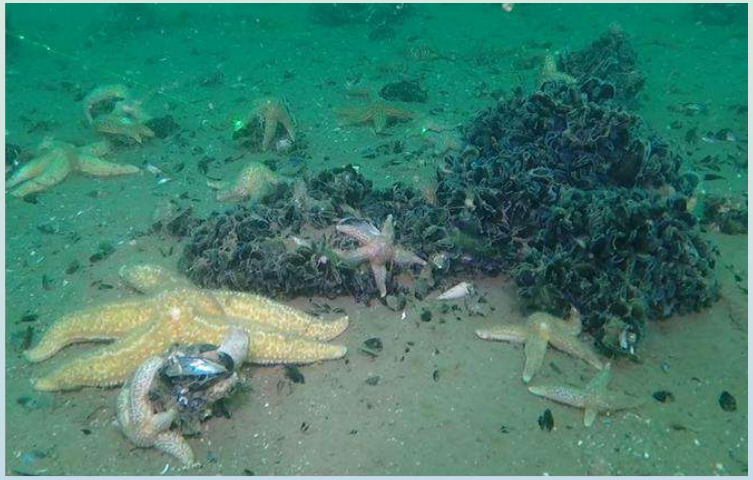
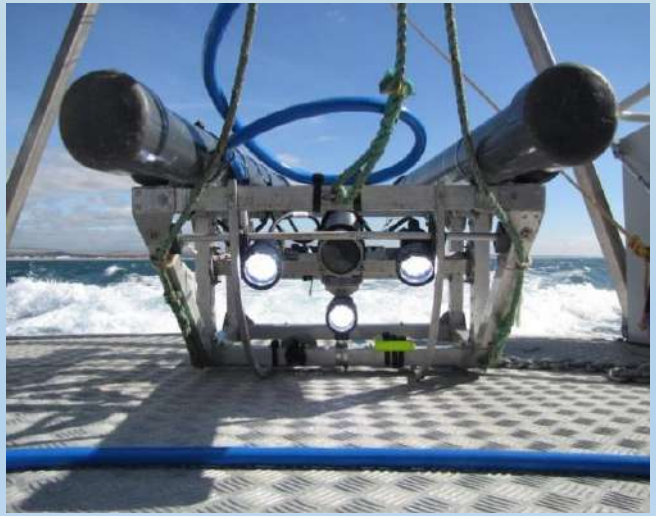
Benthic epifauna





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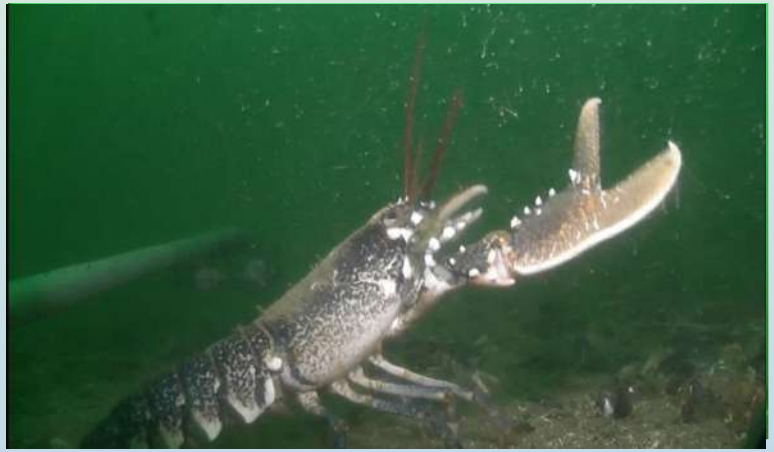
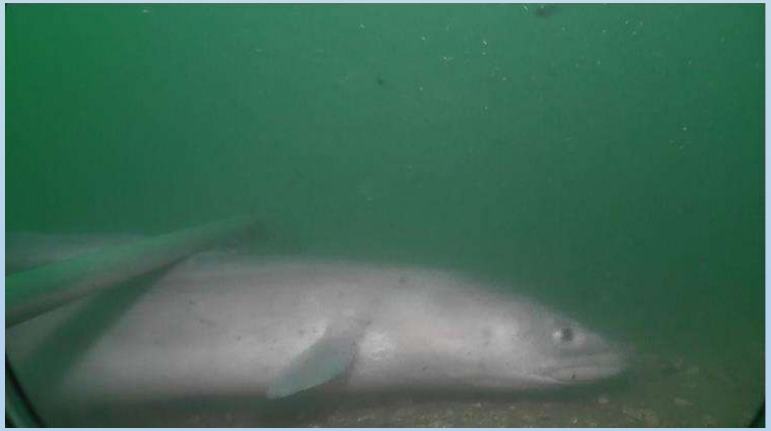
Benthic and Demersal mobile fauna





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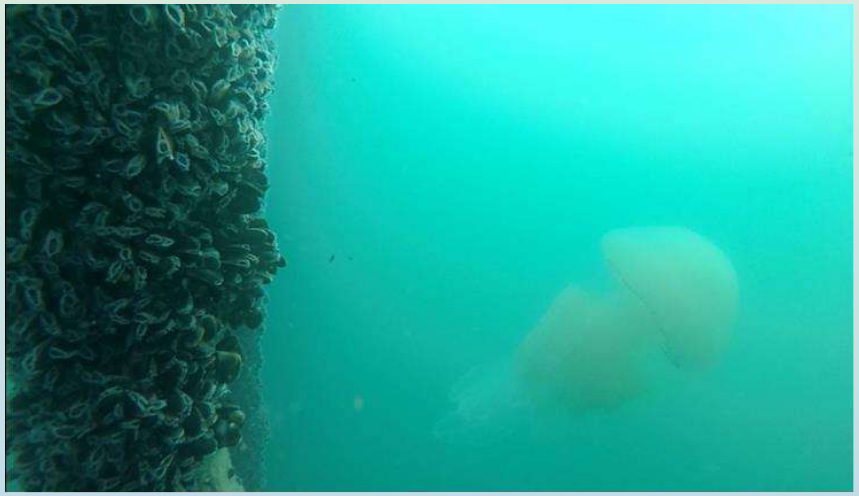
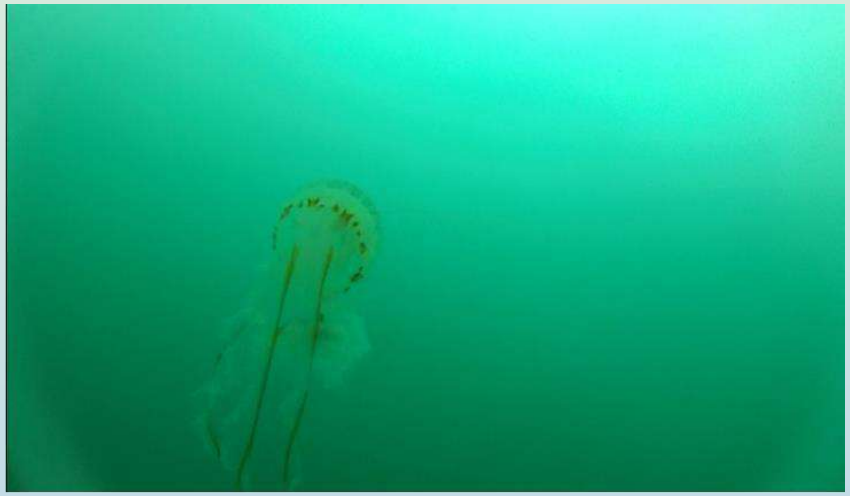
Mid-water mobile fauna





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Plankton, Birds and mammals

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Future developments

- Aquavalue project aims to integrate offshore wind with other sea users in Belgium (2015)
- 22nd May 2017 resultant Edulis project deployed a mussel longline in C-Power windfarm to test practical viability.

© Draeger et al 2017

Conclusions

- Final sample and data analysis is underway
- FAD/Artificial reef effect/fisheries exclusion/socio economic component
- Plan for next monitoring phase under development
- Contextualise it within 25 year plan
  - Environmental net gain – biodiversity & fisheries
  - Recovery – formal comparisons with MPA research

- Suggestions welcome…

- Can a shift to offshore mussel farms promote an ecologically more sustainable, healthier, economic and socially acceptable approach for aquaculture?

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- SAHFOS
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Any questions…?

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