UCC

CMRC

Coastal & Marine Research Centre
Ionad Taighde Cósta is Mara
Understanding Our Oceans

ERI

PICES

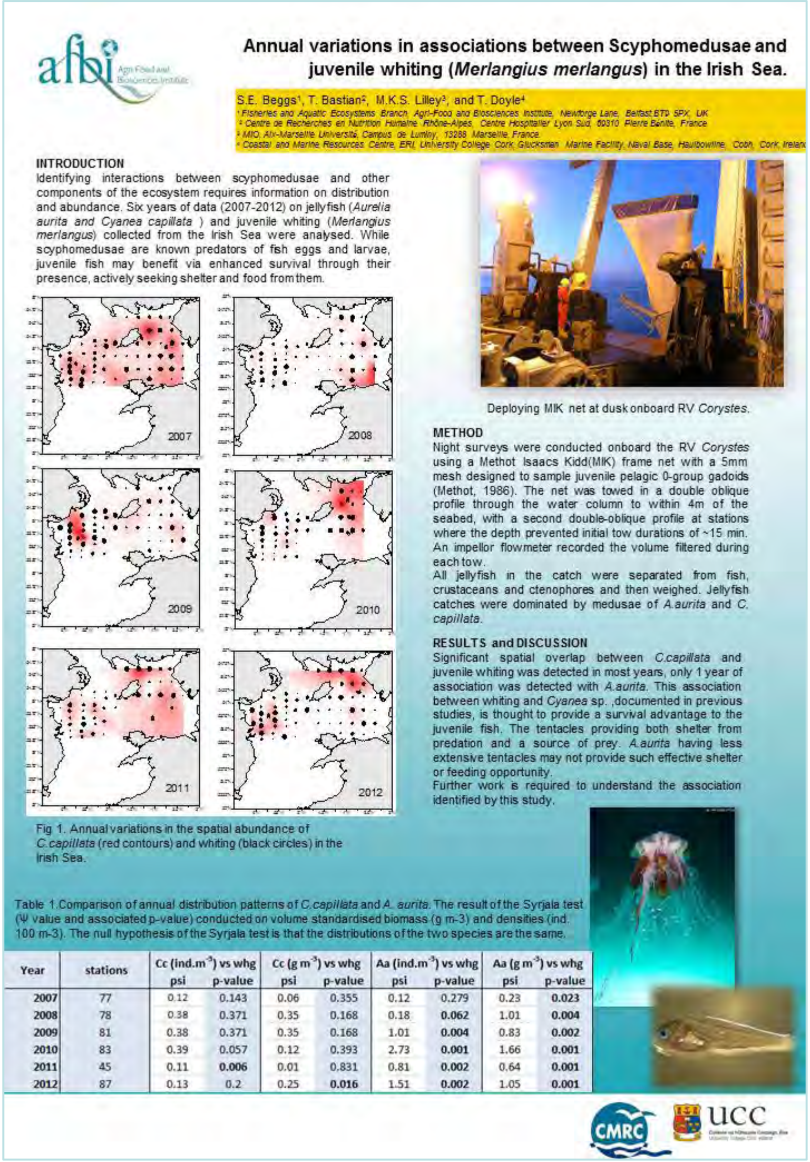
Detrimental impacts of jellyfish on finfish aquaculture: insights from the North East Atlantic

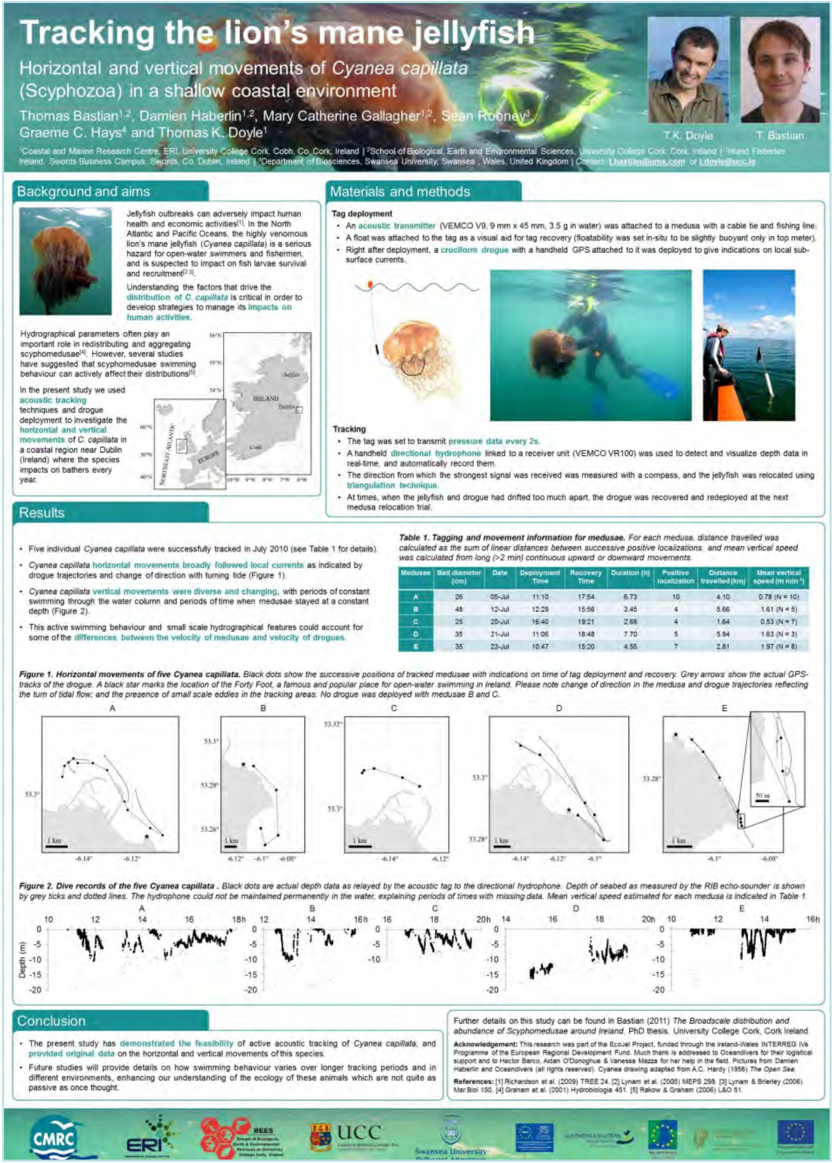
Thomas K. Doyle, Emily J. Baxter, Thomas Bastian, Graeme C. Hays, Hamish D. Rodger and Neil M. Ruane

Coastal & Marine Research Centre, University College Cork




Some great posters to check out!

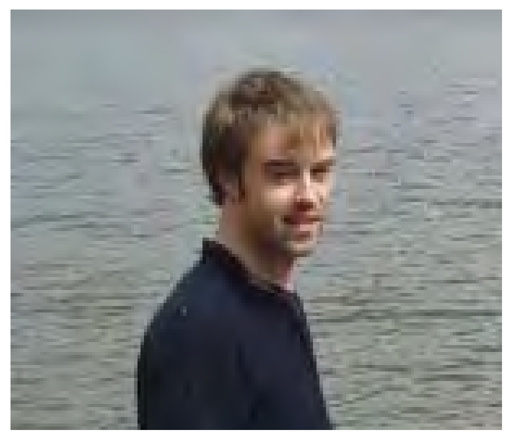




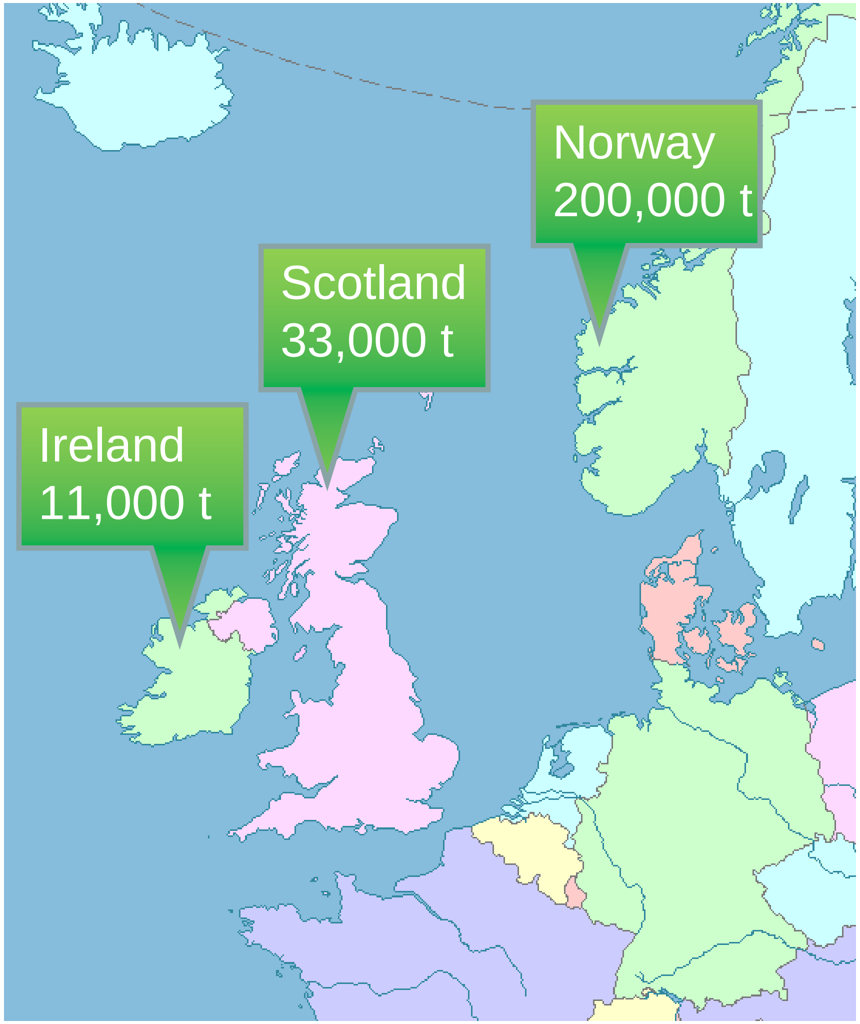
A collaborative effort



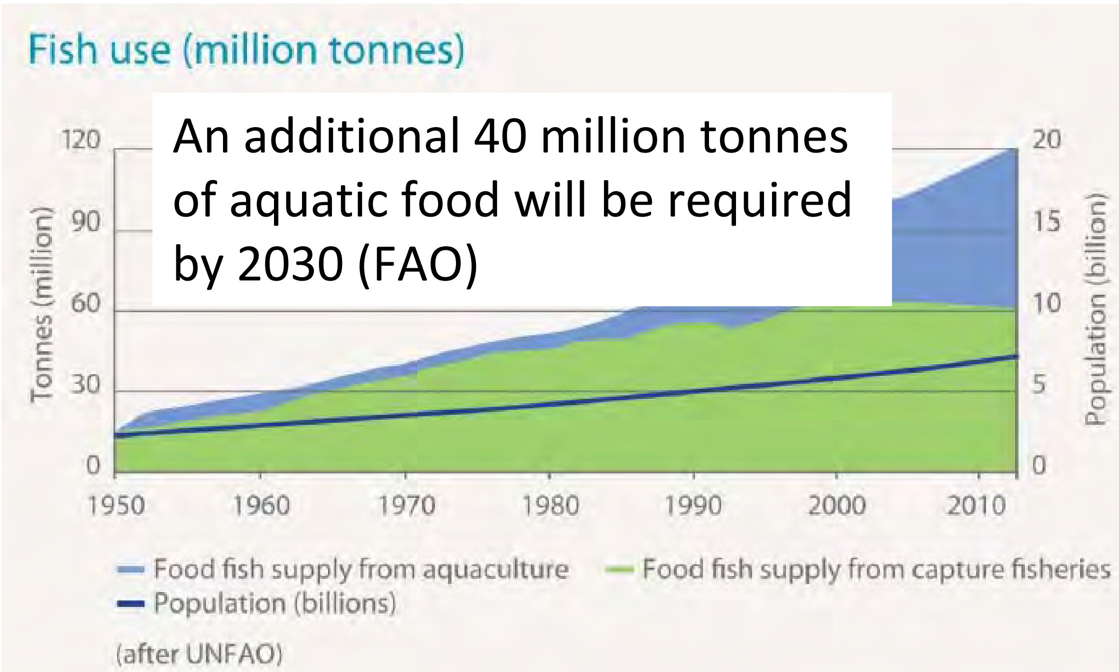


Salmon (*Salmo salar*) aquaculture in North East Europe (NEA)



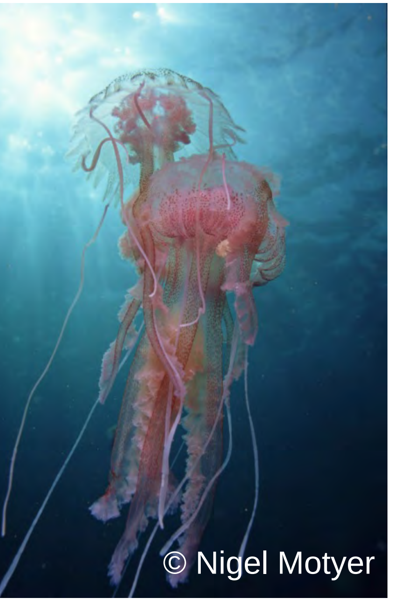
The future of salmon aquaculture in NEA

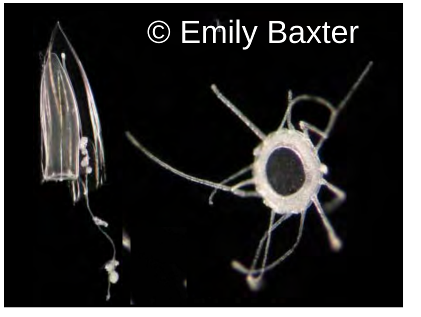


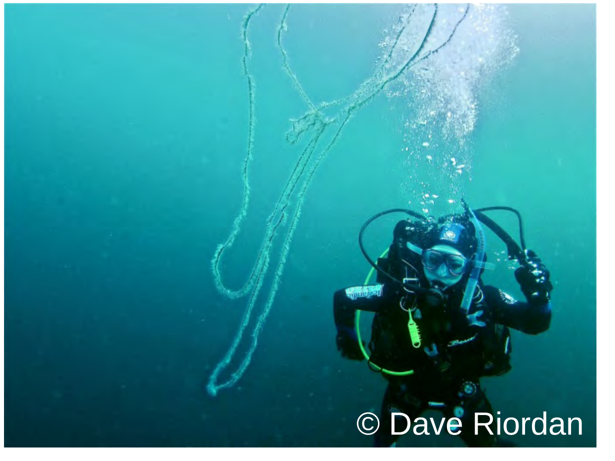
- However, there are a number of key problems:
  - Increasing competition for space
  - Environmental protection
  - Animal health – specifically Pancreas disease (PD), sea lice control and gill disorders & mass mortality events

Jellyfish that cause 'mass mortality events'

- There are four species that have caused major salmon fish kills in the past
  - The mauve stinger (*Pelagia noctiluca*)
  - *Muggiaea atlantica* (siphonophore)
  - *Apolemia uvaria* (siphonophore)
  - *Solmaris corona*







Doyle et al (2009) J Plankt Res

Baxter et al (2011) Aquacult Environ Interact


Fish farm


© Nigel Motyer

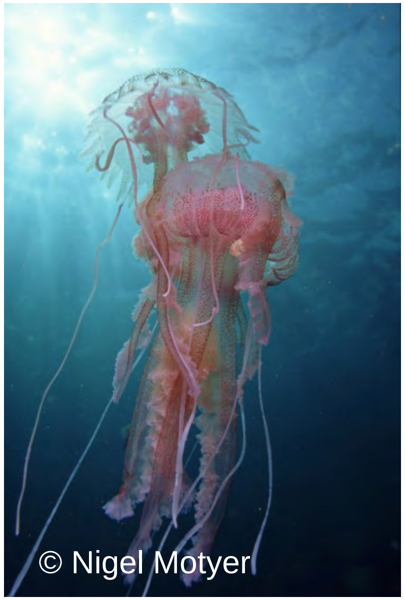

© NIEA

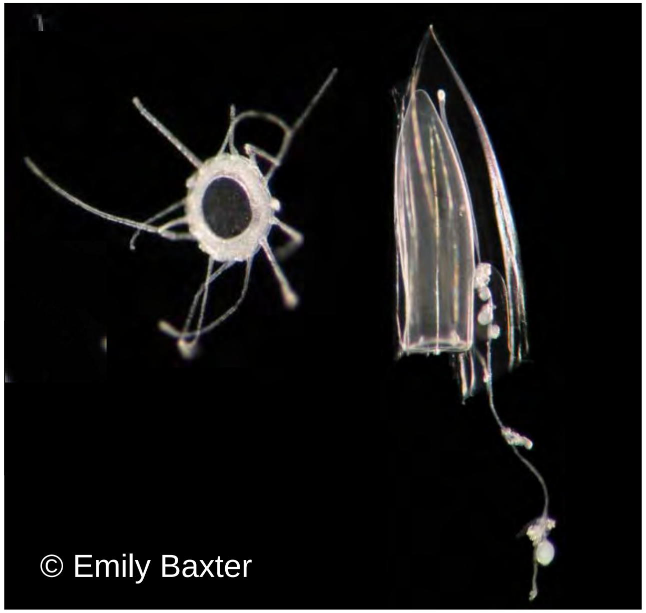
Other mass mortality events…

- >100,000 farmed salmon in Norway caused by the siphonophore *Muggiaea atlantica* (Fosså et al. 2003)
- This species was also a suspected causative agent of over 1,000,000 salmon killed off northwest Ireland in 2003 (Cronin et al. 2004)
- The siphonophore *Apolemia uvaria*, the oceanic hydromedusa *Solmaris corona* and the neritic hydromedusa *Phialella quadrata* have also been previously implicated in fish kill events (Bruno & Ellis 1985, Båmstedt et al. 1998)

Characteristics of jellyfish that cause mass mortality events

- Most are oceanic or shelf species (i.e. they need to be carried into an aquaculture site)
- Some of them can multiple very rapidly (3-4 weeks)
- Can occur in very high densities e.g. 100s – 1000s individuals m^{-3}
- Can occur in enormous aggregations 10s – 100s km^{-2} spatial extent





Gill disorders in salmon aquaculture

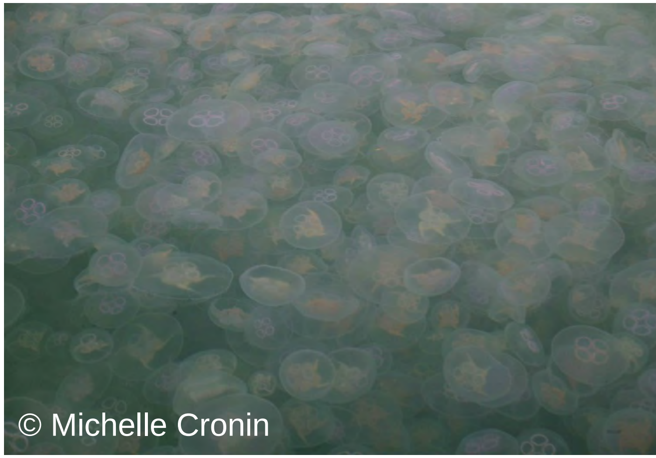
- Gill disorders may be multi-factorial with 1□ damage caused by jellyfish and then 2□ infection by bacteria or parasite

- Between 2003 and 2006 Irish farms suffered an average of 12% mortality due to gill disorders (Rodger & Mitchell 2005)

What species cause gill disorders?

- All jellies that cause mass mortality events (e.g. *Pelagia, Muggiaea, Solmaris*)

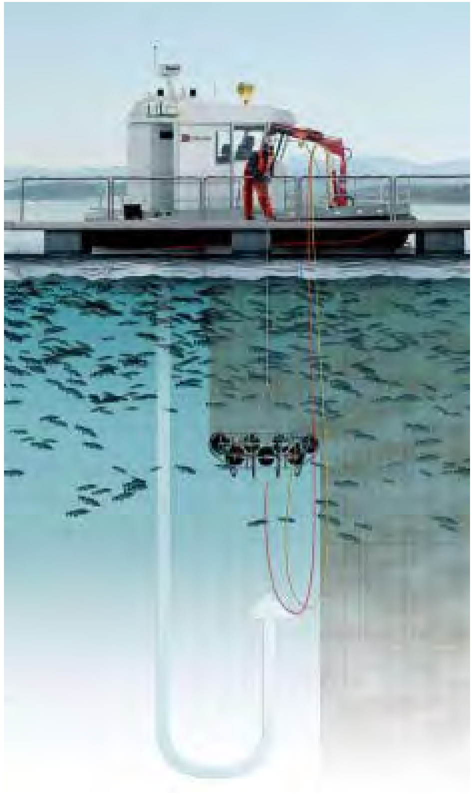
- Many small jellyfish species (e.g. *Phialella quadrata*) may cause background mortalities but also many large scyphomedusae e.g.
    - The common jellyfish (*Aurelia aurita*)
    - The Lion's Mane (*Cyanea capillata)*



Baxter et al (2011) Plos One; Baxter et al (2011) Aquacult Environ Interact

An unexpected cause of gill disorders – biofouling hydroids

- A problematic fouling organism on aquaculture installations is the colonial hydroid *Ectopleura larynx* (syn. *Tubularia larynx*)
- Two types of net cleaning are used: 1) In-situ net washing using high pressure jet washers and 2) changing of fouled nets

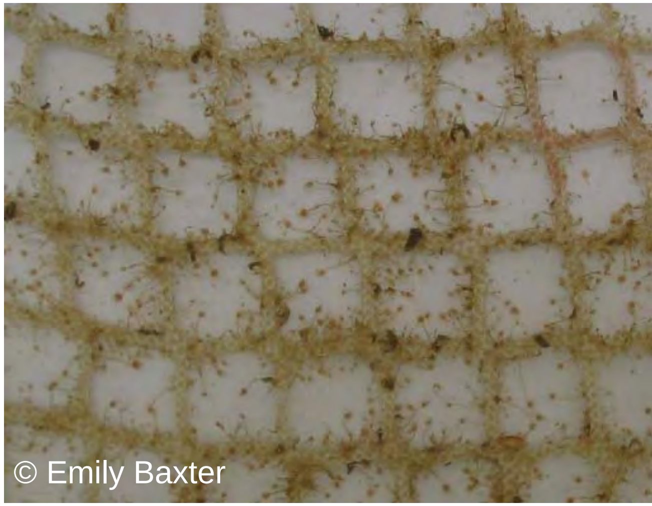


Baxter et al (2012) Fish Veterinary Journal

Characteristics of jellyfish that cause gill disorders

- No unifying characteristics but some generalisations can be made:
  - Occur in lower densities
  - Many are local species (home grown)
  - Hydrographic factors or behaviour may led to local aggregations

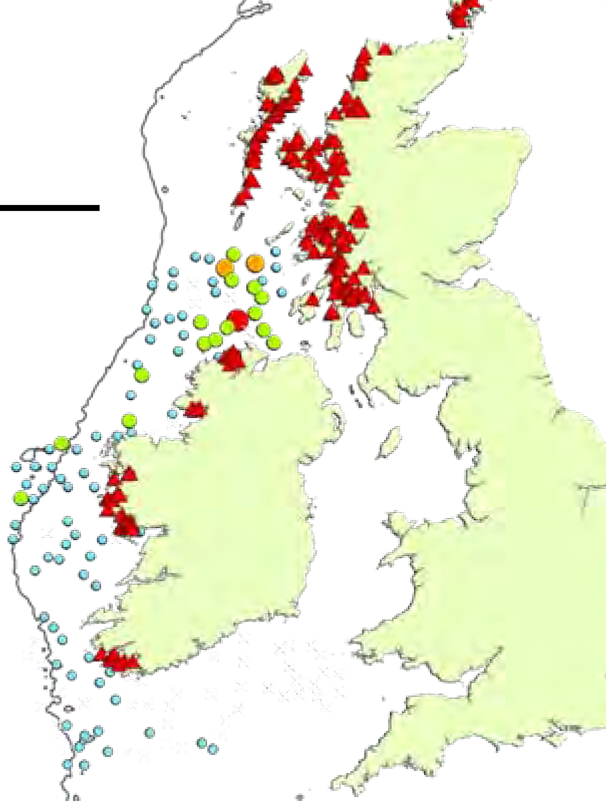
© Johnny Woodlock



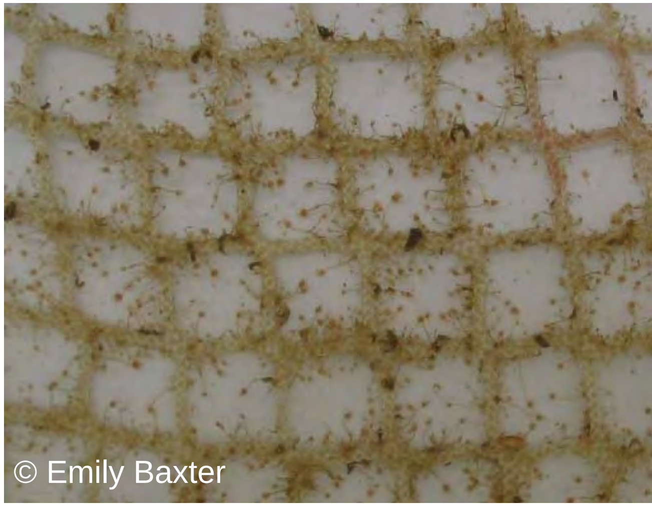
© Emily Baxter

So what are the real threats?

- Mass mortality event at a single farm:
  - *The Mauve stinger (Pelagia)*
  - *Muggiaea*



- Gill disorders at a national level:
  - At a single farm losses of 5-10% may seem acceptable, but when widespread such losses add up



Bastian et al (2011) ICES J of Mar Sci and Baxter et al (2012) Fish Veterinary Journal

So where to next?

- We know we have a growing problem… hurricane analogy (batten down the hatches)

Development of an early warning system

- It would help if we knew when a jellyfish bloom is going to occur

- However, this is only part of the solution e.g. what do farmers do if they know a large bloom of *Pelagia* is heading their way?

How can the aquaculture industry ‘batten down the hatches’?

- Bubble curtains…

- Design and field trials (several weeks) of such a system are required to assess the effectiveness of this technology and to investigate the operating parameters such as operating depth, pressure and air flow rates
- If it works, we need to develop low cost method for running the bubble curtains (renewable energy)

How can the aquaculture industry ‘batten down the hatches’?

- Forcing salmon lower in the water…

- We need to understand the vertical distribution of jellyfish

How can the aquaculture industry ‘batten down the hatches’?

- Moving aquaculture cages offshore

- Are there less aggregations further offshore?

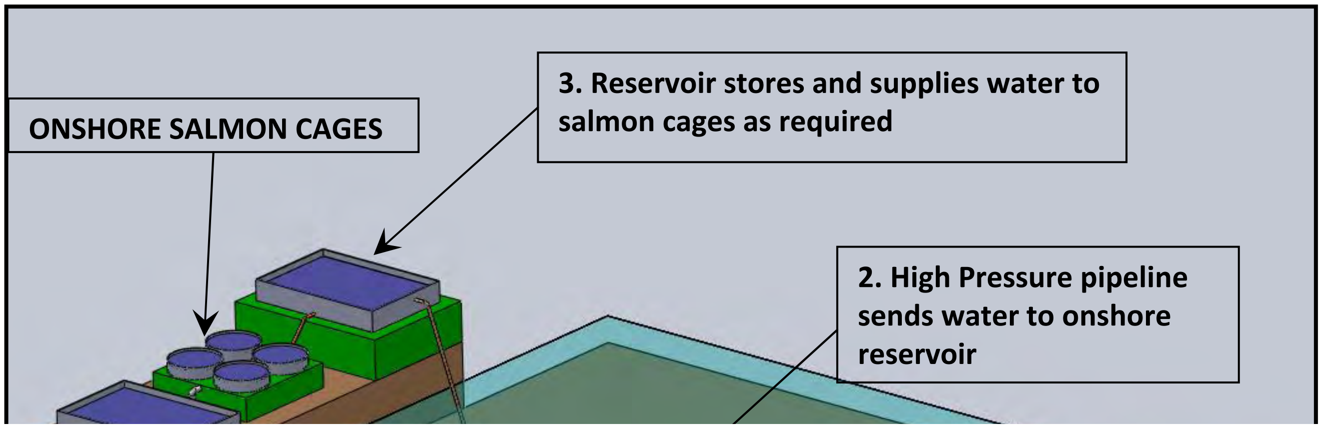
How can the aquaculture industry ‘batten down the hatches’?

- New cage designs with rotating meshes and scrubbers

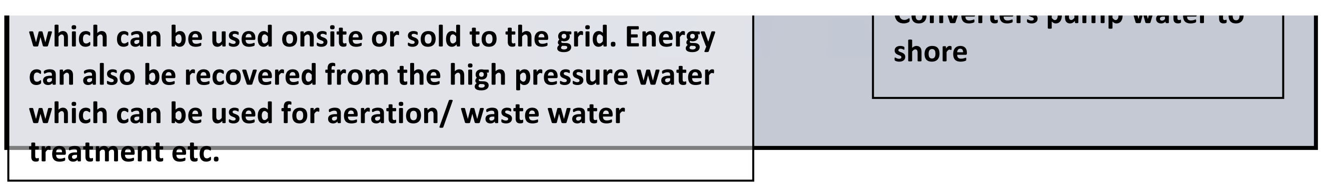
- Requires new cage design that is cost effective, and removes waste (jelly debris) generated from scrubbers

How can the aquaculture industry ‘batten down the hatches’?

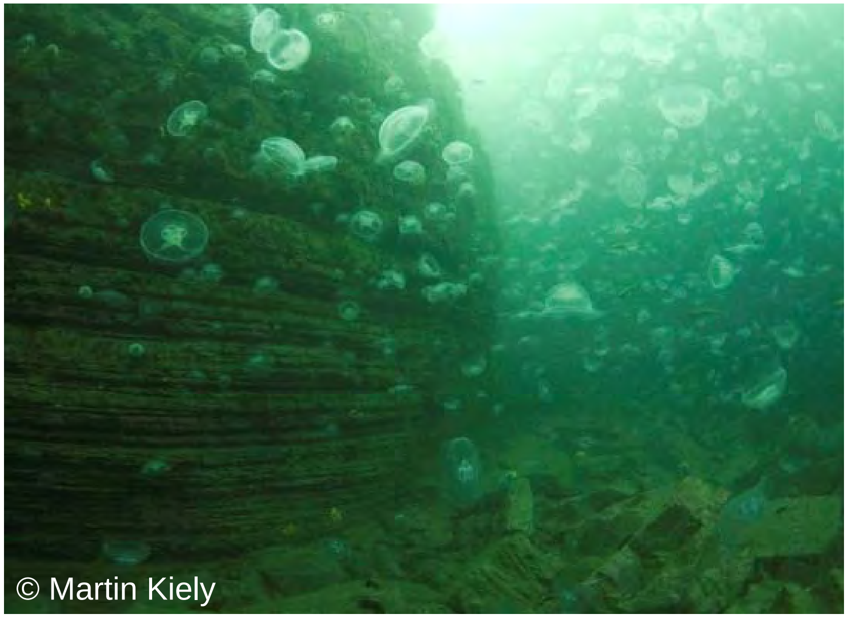
- Moving aquaculture onshore (closed containment systems)



- The high cost currently makes closed containment salmon aquaculture not commercially viable
- Concepts where renewable energy devices are used to meet the water flow and energy requirements of salmon farms should be developed and assessed technically, economically and in terms of their practicality.



The future?



Acknowledgements

National Development Plan 2007—2013

Science, Technology & Innovation Programme

Marine Research Sub-Programme

Sea Change
Casadh na Taoide

Marine Institute
Foras na Mara

NETWORKING INITIATIVE

This research was carried out under the *Sea Change* strategy with the support of the Marine Institute and the Marine Research Sub-programme of the National Development Plan 2007–2013.

NDP
National Development Plan 2007 - 2013

PICES

ERDF

SOUTHERN & EASTERN
Regional Assembly
Promoting Our Region

IRELAND WALES
2007 – 2013

Ireland's EU Structural Funds
Programmes 2007 - 2013

Co-funded by the Irish Government
and the European Union

EUROPEAN REGIONAL
DEVELOPMENT FUND