Understanding the potential for marine megafauna entanglement risk from marine renewable energy developments

Steven Benjamins, Violette Harnois, Helen Smith, Lars Johanning, Lucy Greenhill, Caroline Carter, Ben Wilson

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Entanglement

- Global conservation problem for many species
- Involves ropes, chains, etc.
- Are MRE moorings a risk?

Marine megafauna

Legal requirements (e.g. EC Habitats Directive) necessitate risk assessment

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Review of entanglement

- **Fisheries**

- Aquaculture
- Subsea cables
- Moorings & an

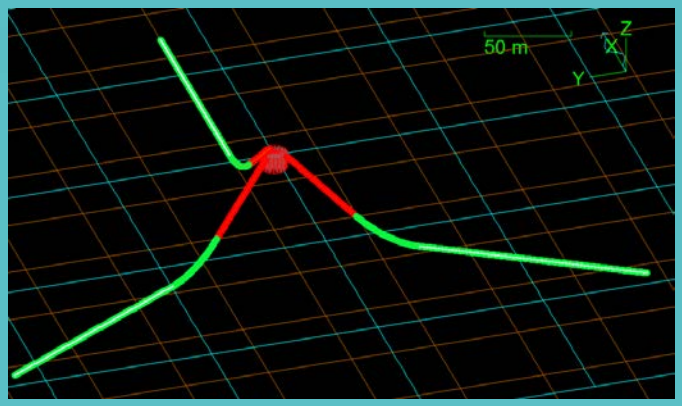
Main group of concern:
Baleen whales

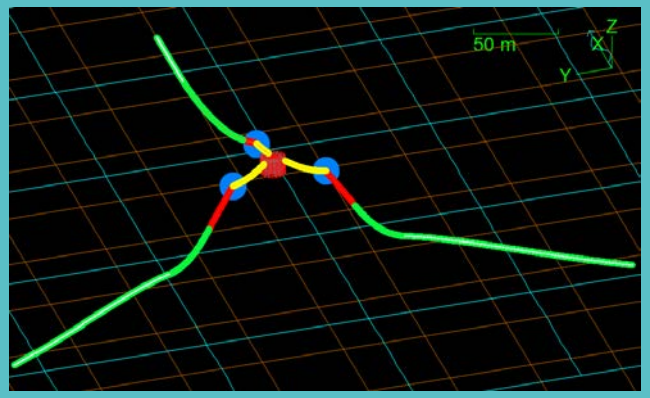
Additional concern:

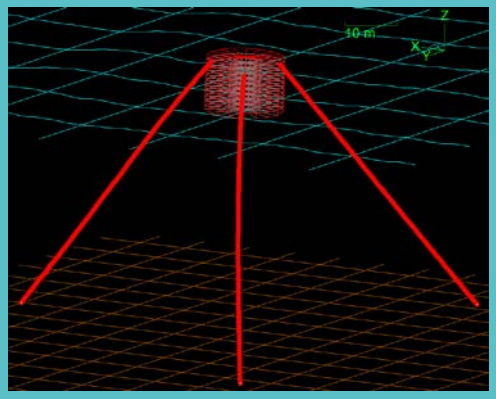
- Derelict fishing gears snagged in moorings

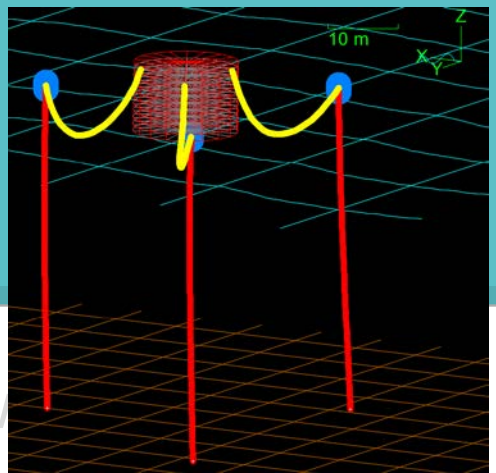
Risk assessment: Mooring modelling

- Simulated floating structure
- 6 different mooring configurations:
  - Catenary
    - With chain
    - With chain and Nylon
    - With chain and Polyester
  - Catenary with accessory buoy
  - Taut
    - With Nylon
  - Taut with accessory buoy
- Mooring behaviour was simulated across wave periods of 1-10 s, wave heights of 1, 5, 10 m









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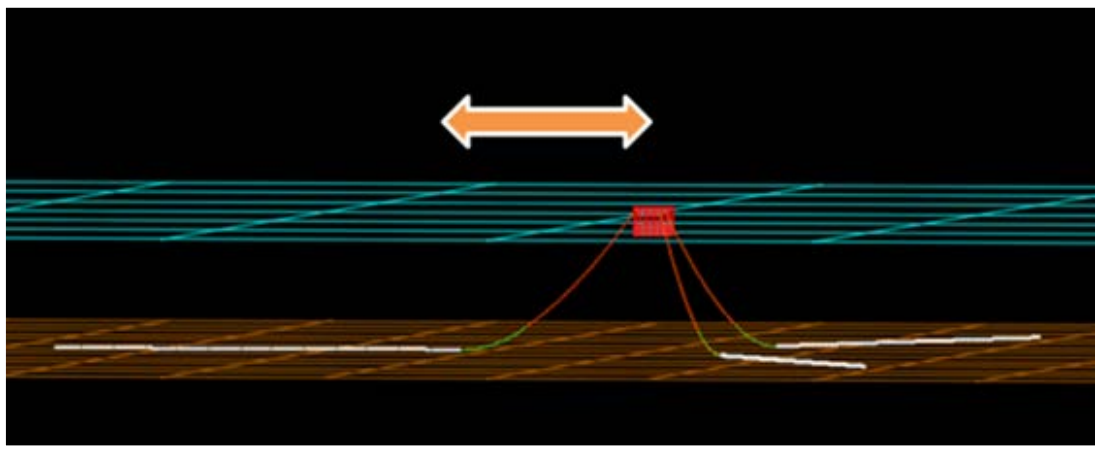
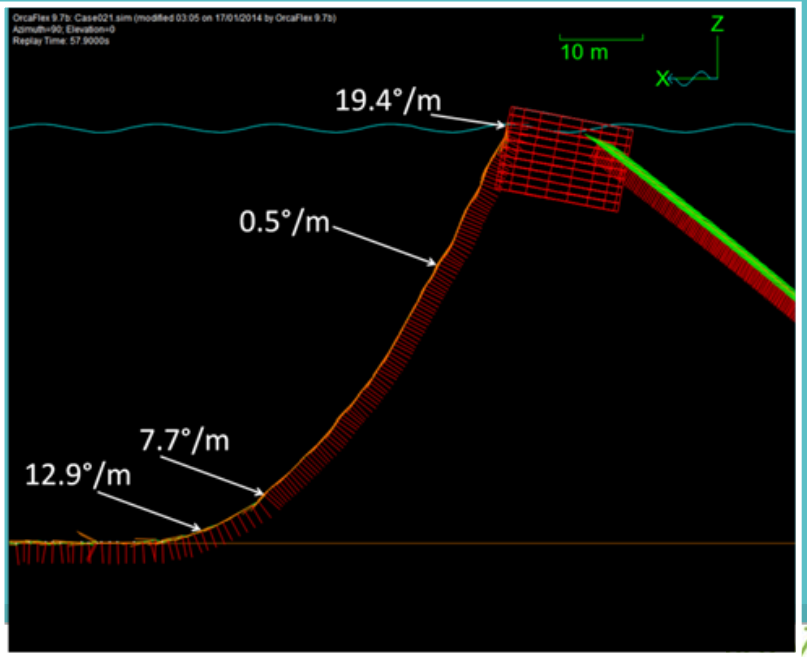
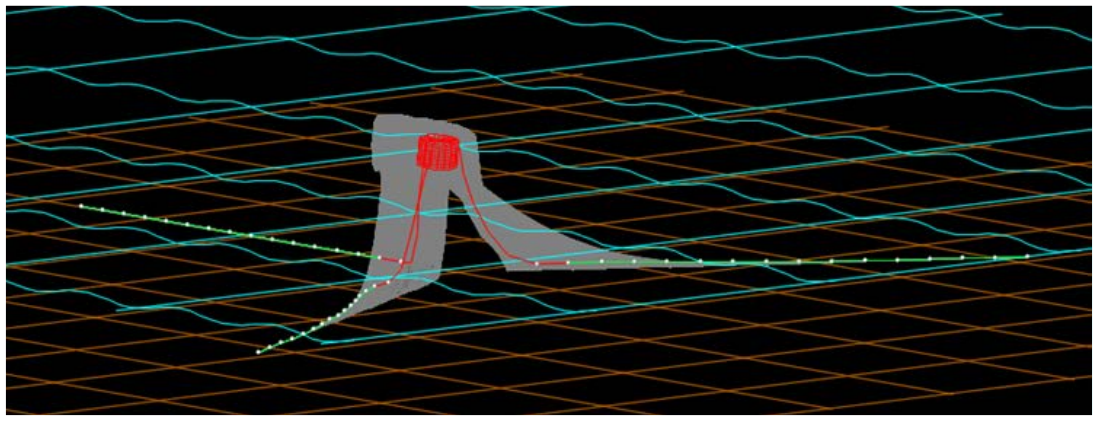
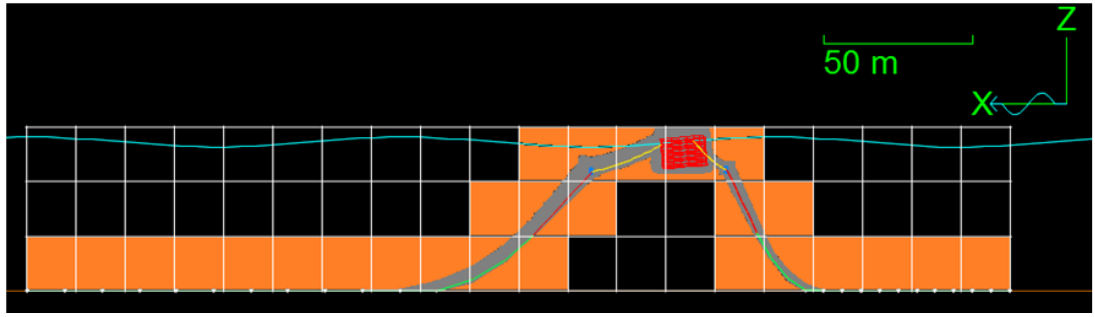
Risk assessment: Mooring modelling

- Tension characteristics
- Swept volume
- Curvature









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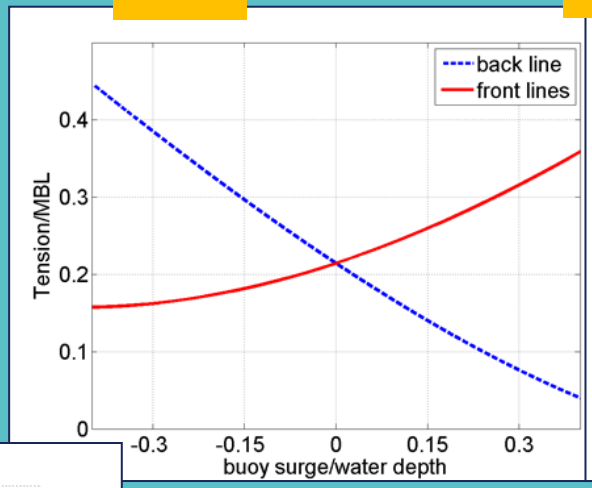
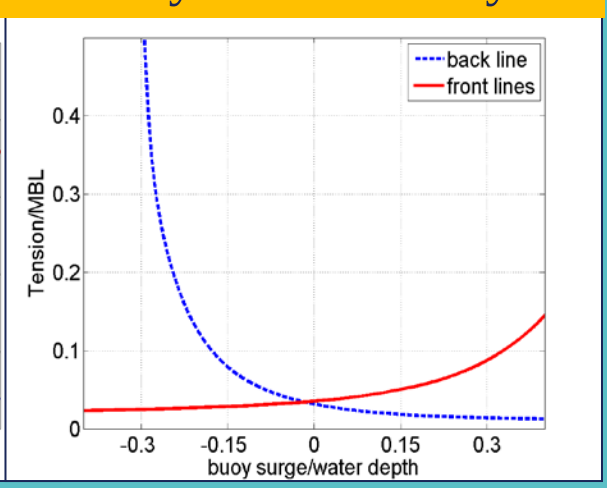
Risk factors: Mooring design

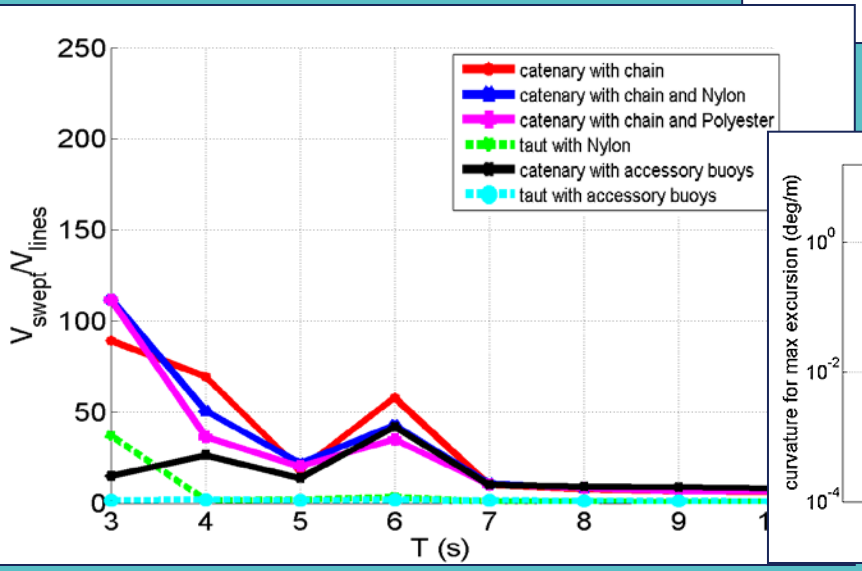
- Tension characteristics
- Swept volume
- Curvature

Taut

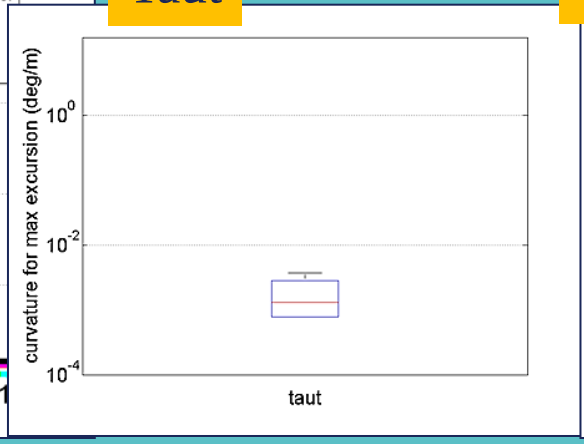


Catenary with chain/Nylon





Taut



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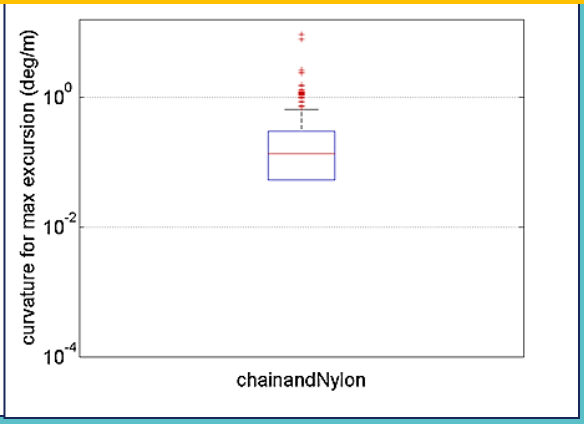

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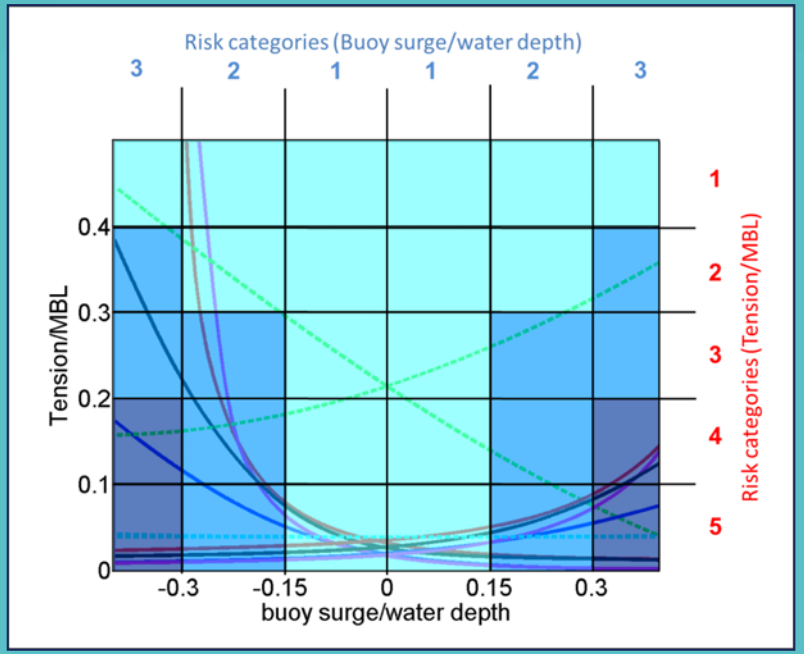
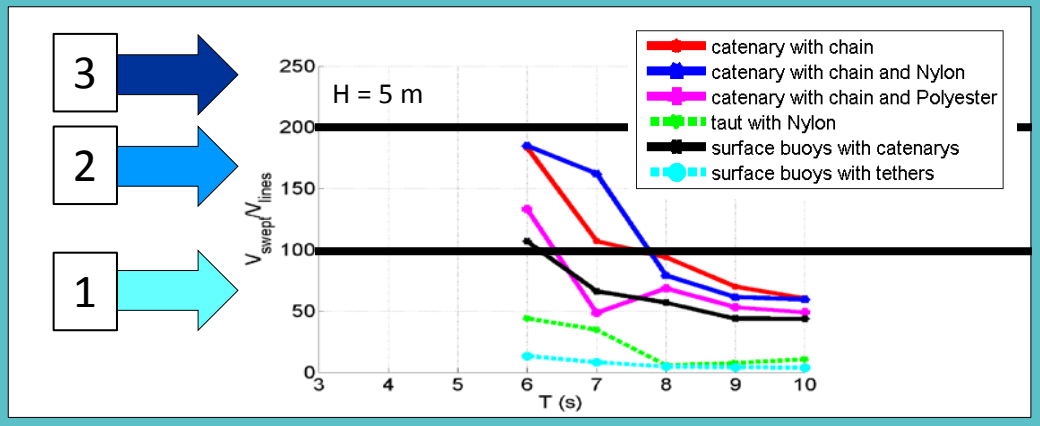
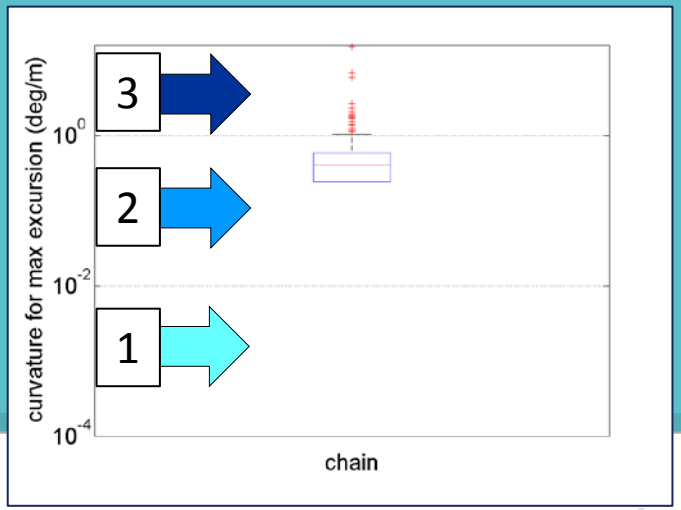
Risk factors: Mooring design

- Tension (high = good; low = bad)
- Swept volume (small = good; large = bad)
- Curvature (limited = good; large = bad)







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Risk factors: Biology

- Body size (small = good; large = bad)
- Flexibility (flexible = good; rigid = bad)
- Sensory systems (long-range = good; short-range = bad)
- Feeding mode (pursuit hunting = good; lunge feeding = bad)

Relative risk assessment

Species group			Catenary & chain	Catenary & chain & nylon	Catenary & chain & polyester	Taut & nylon	Catenary & accessory buoy	Taut & accessory buoy
Cetaceans	Baleen whales	Large whales						
		Medium-sized whales						
	Toothed whales	Sperm whale						
		Medium-sized whales and dolphins						
		Small whales, dolphins and porpoises						
Pinnipeds	Seals							
	Sea lions/fur seals							
Sea turtles								
Sharks	Basking sharks							
	Other large sharks							
Ocean sunfish								

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Conclusions

- Very limited data on non-fisheries entanglements
- Mooring entanglement risk likely low for most megafauna
- Possible exception: **Baleen whales**
- Mooring design influences relative risk; assessment approach to be refined as more data become available
- Important to consider risk early during project development
- Risks around arrays will depend upon device distribution, densities, extent of mooring sharing between devices
- Need to assess risk of derelict fishing gears