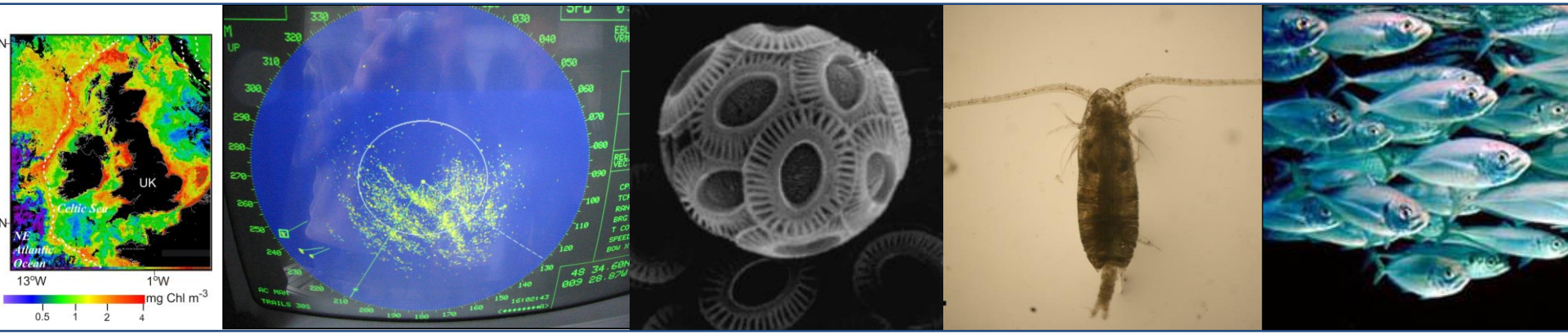


Tides and the Oceanography of the NW European Shelf

Jonathan Sharples

University of Liverpool

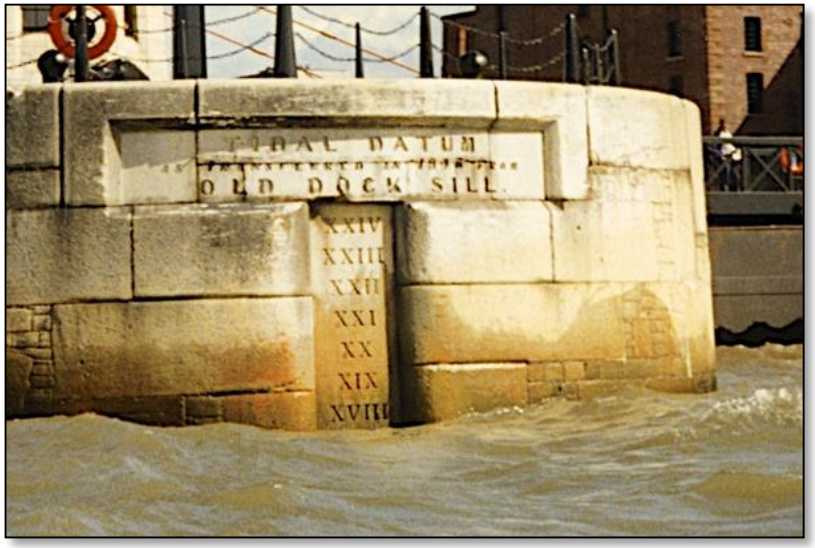
School of Environmental Sciences

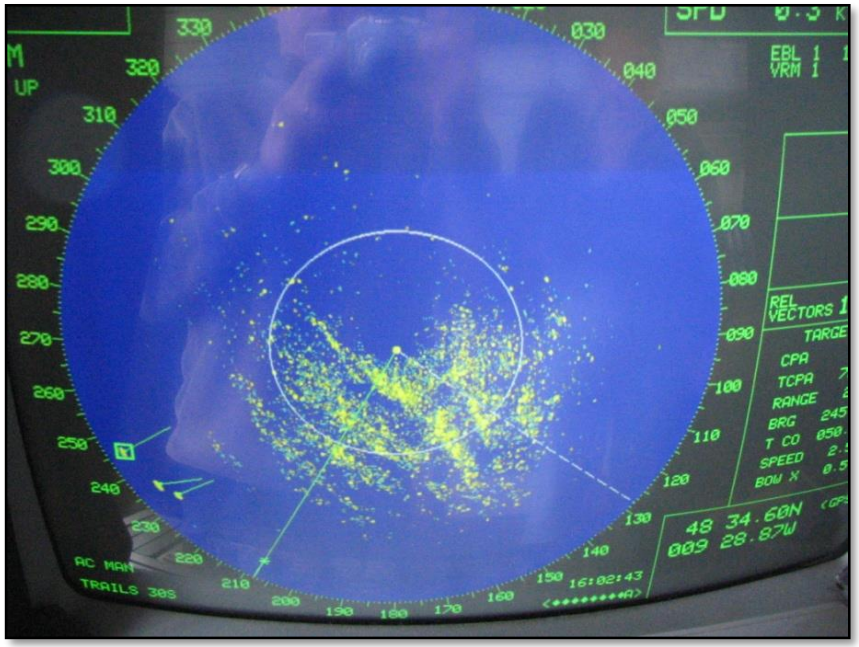
1919 - 2019 Oceans 100

2 Parts:

Part 1:

Why are UK tides so big?

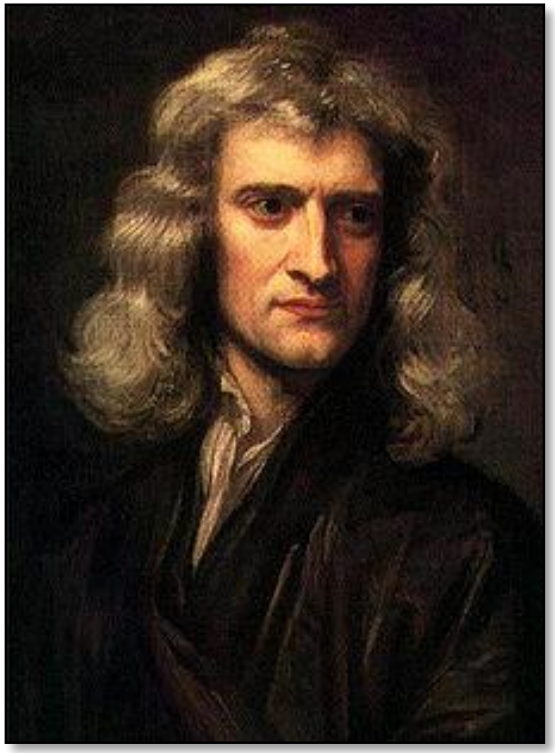




Part 2:

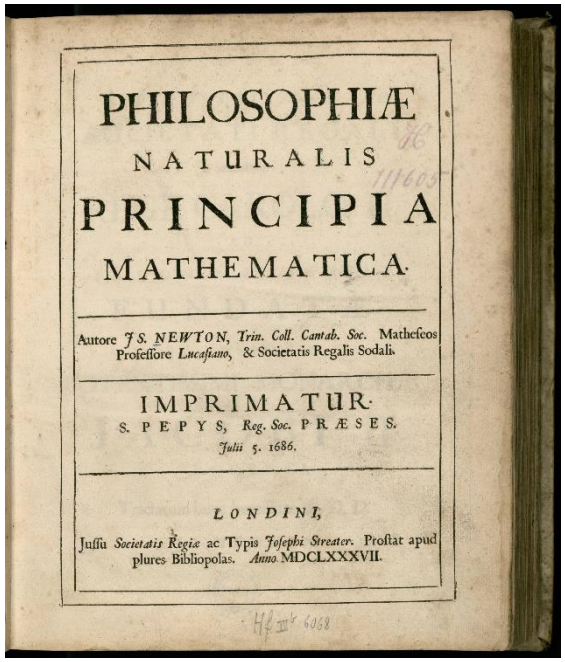
Underwater tidal waves

1. Why are UK tides so big?



Sir Isaac Newton
1643-1727

Isaac Newton predicted that the tide should have a *range* of about 1 metre.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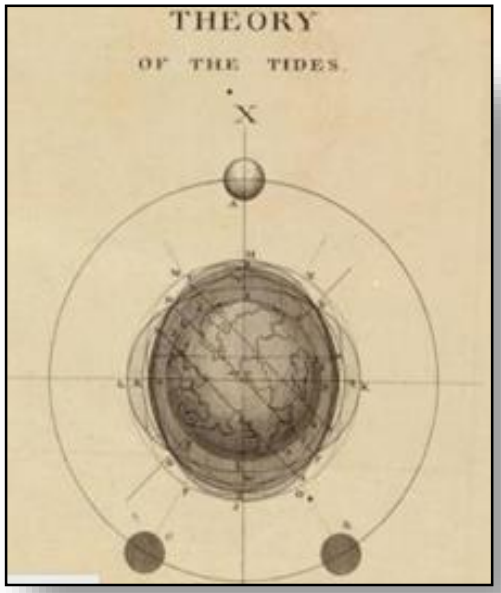
MATHEMATICA

Autore *J S. NEWTON, Trin. Coll. Cantab. Soc.* Matheſeos Profeſſore *Lucaſiano*, & Societatis Regalis Sodali.

IMPRIMATUR.
S. PEPYS, *Reg. Soc.* PRÆSES.
Julii 5. 1686.

LONDINI,
Juſſu *Societatis Regiæ* ac Typis *Joſephi Streater*. Proſtat apud plures Bibliopolas. *Anno* MDCLXXXVII.



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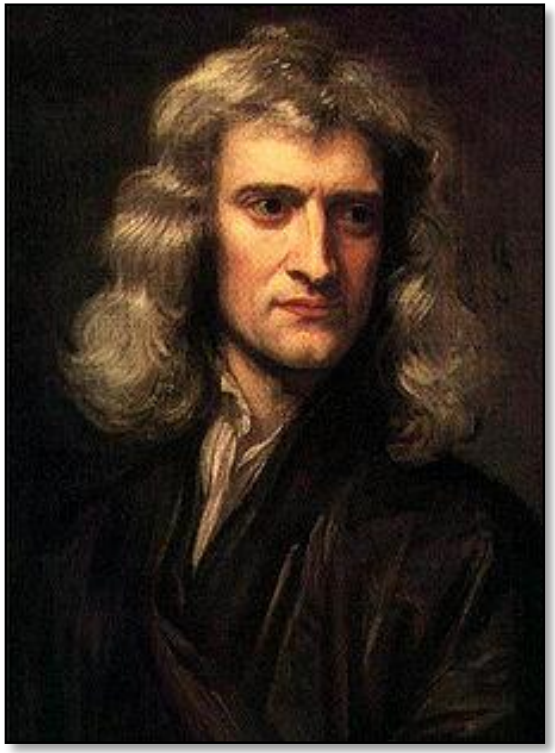
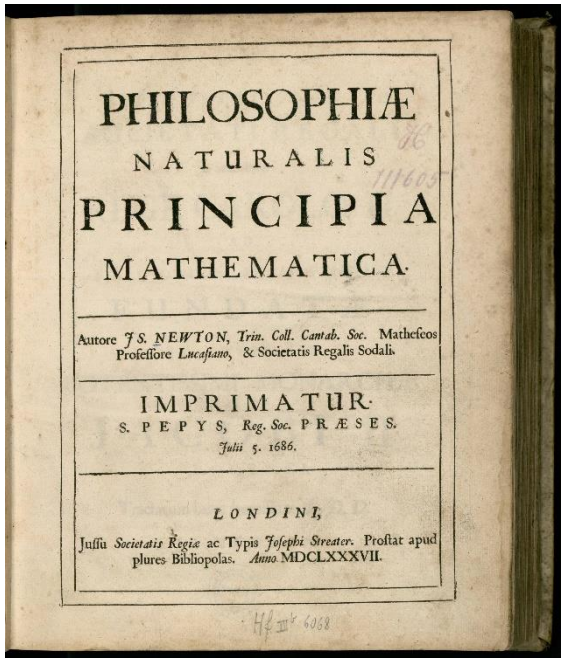


Sir Isaac Newton
1643-1727

But the tide in Liverpool has a range of up to 9 metres.

How does that happen?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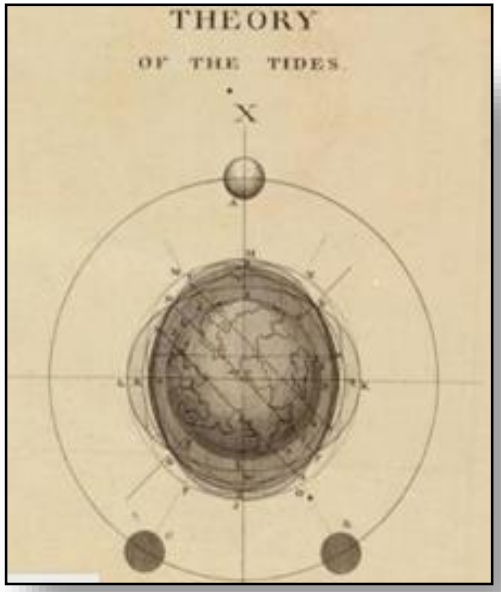

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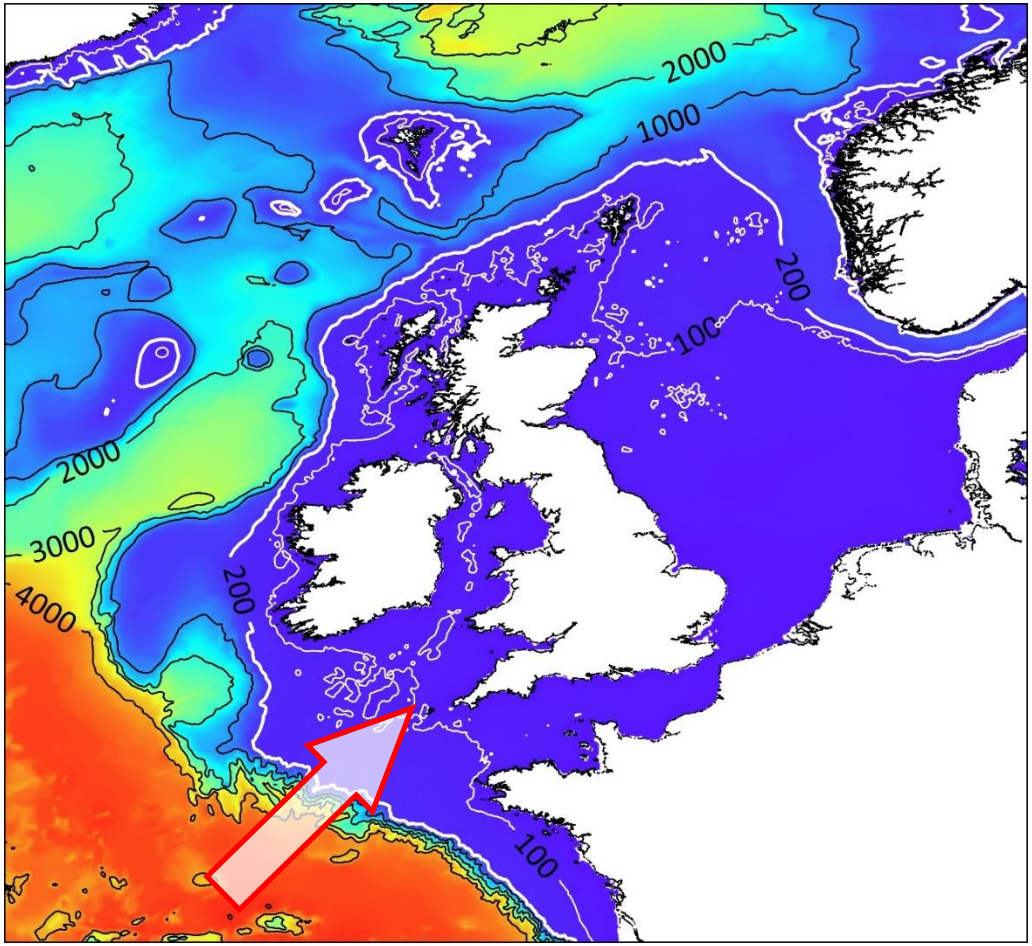
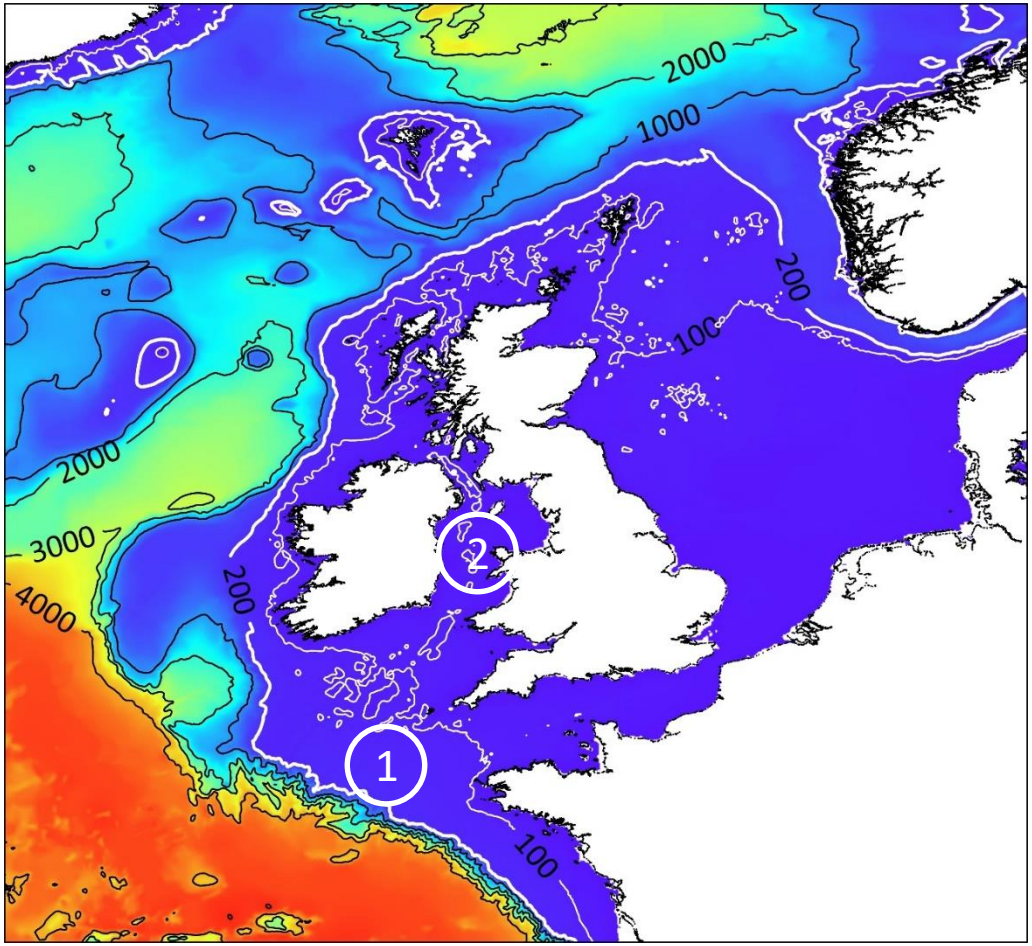


The tide is not generated locally.

The tide is formed out in the Atlantic Ocean, and moves as a wave towards the UK.

tidal wave enters here, one wave every 12½ hours

1. Why are UK tides so big?



1. What happens to the tidal wave as it crosses onto the shelf?

2. What happens to the tidal wave in the semi-enclosed Irish Sea?

1. Why are UK tides so big?

Waves approaching a beach get bigger.

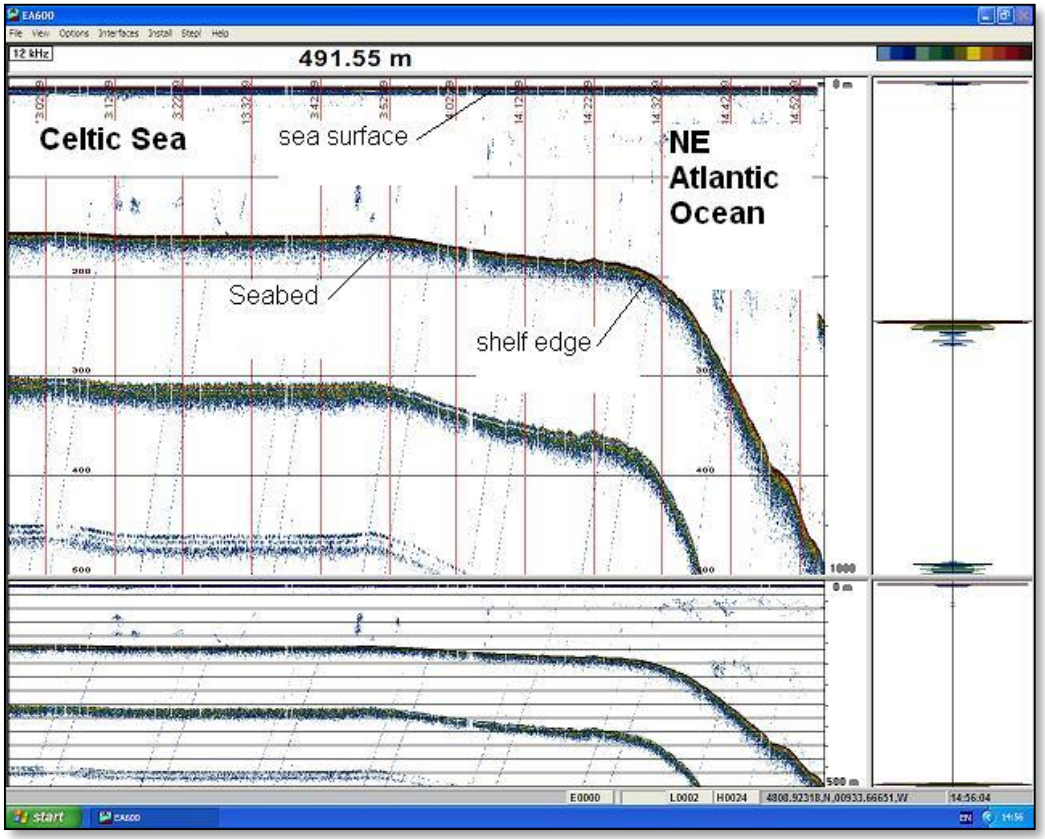
This is because:

The wave slows down in shallower water.

But the wave has to conserve energy.

So its size increases to balance the drop in speed.

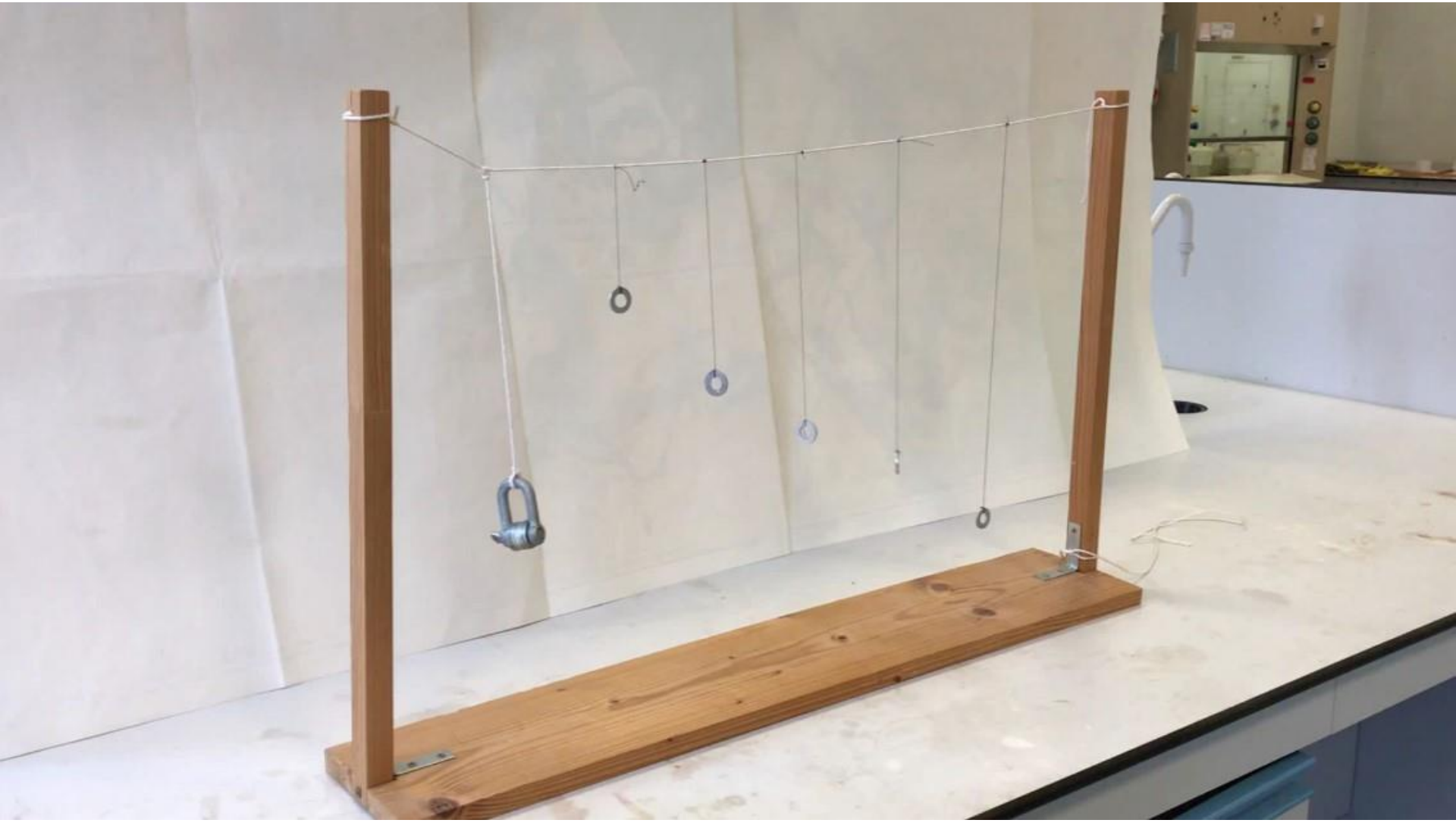
1. Why are UK tides so big?



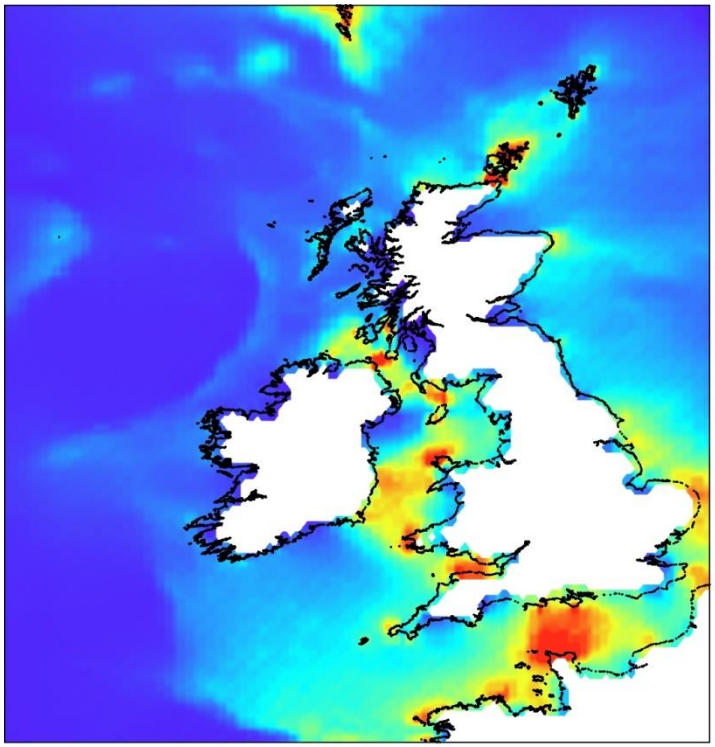
The same happens to the tidal wave crossing onto the shelf.

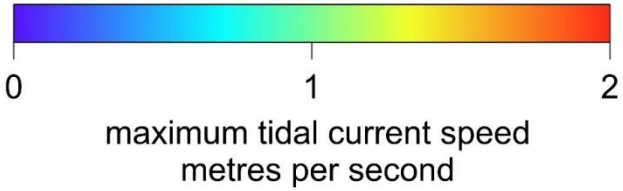
The tidal range is increased by a factor of about 2.

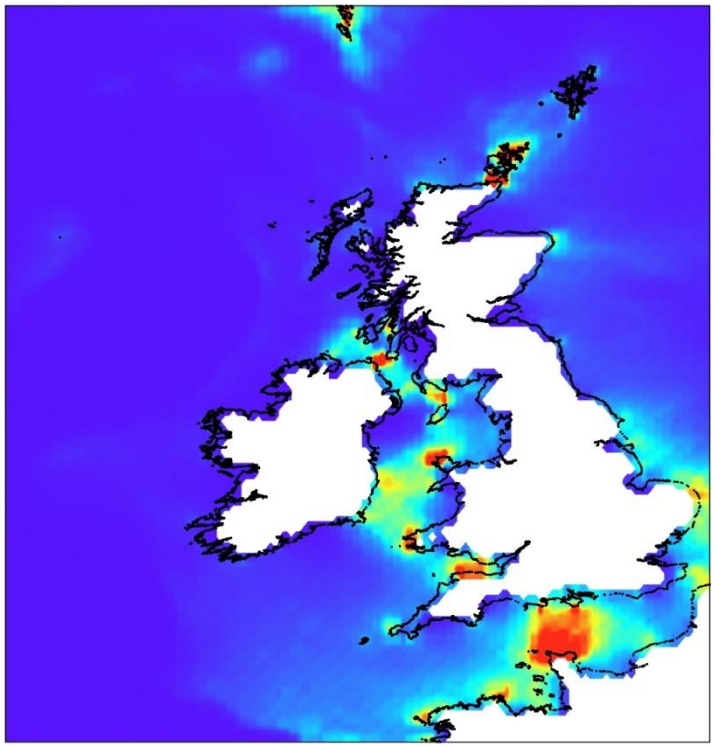
1. Why are UK tides so big?

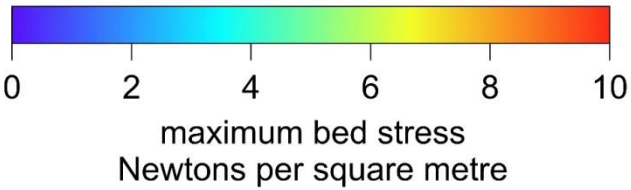


A Consequence of Big Tides









A Consequence of Big Tides

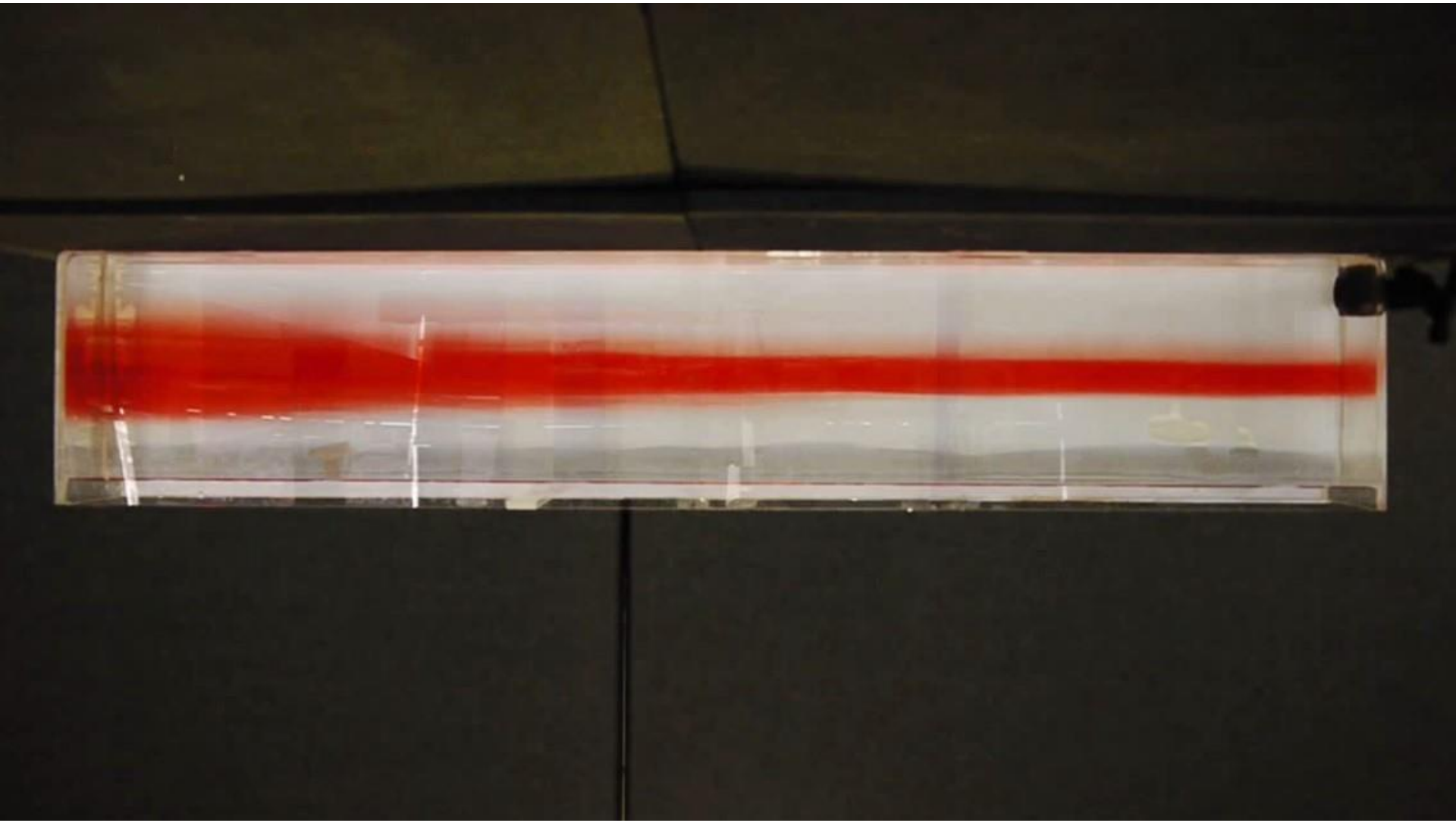
Nephrops norvegicus
(Dublin Bay prawn)

Irish Sea maximum bed stress is about 5 Newtons per square metre.

This is what you would feel in a wind of ***200 km per hour***.

So, tides cause 4 hurricanes per day at the sea bed of the Irish Sea.

2. Underwater Tidal Waves



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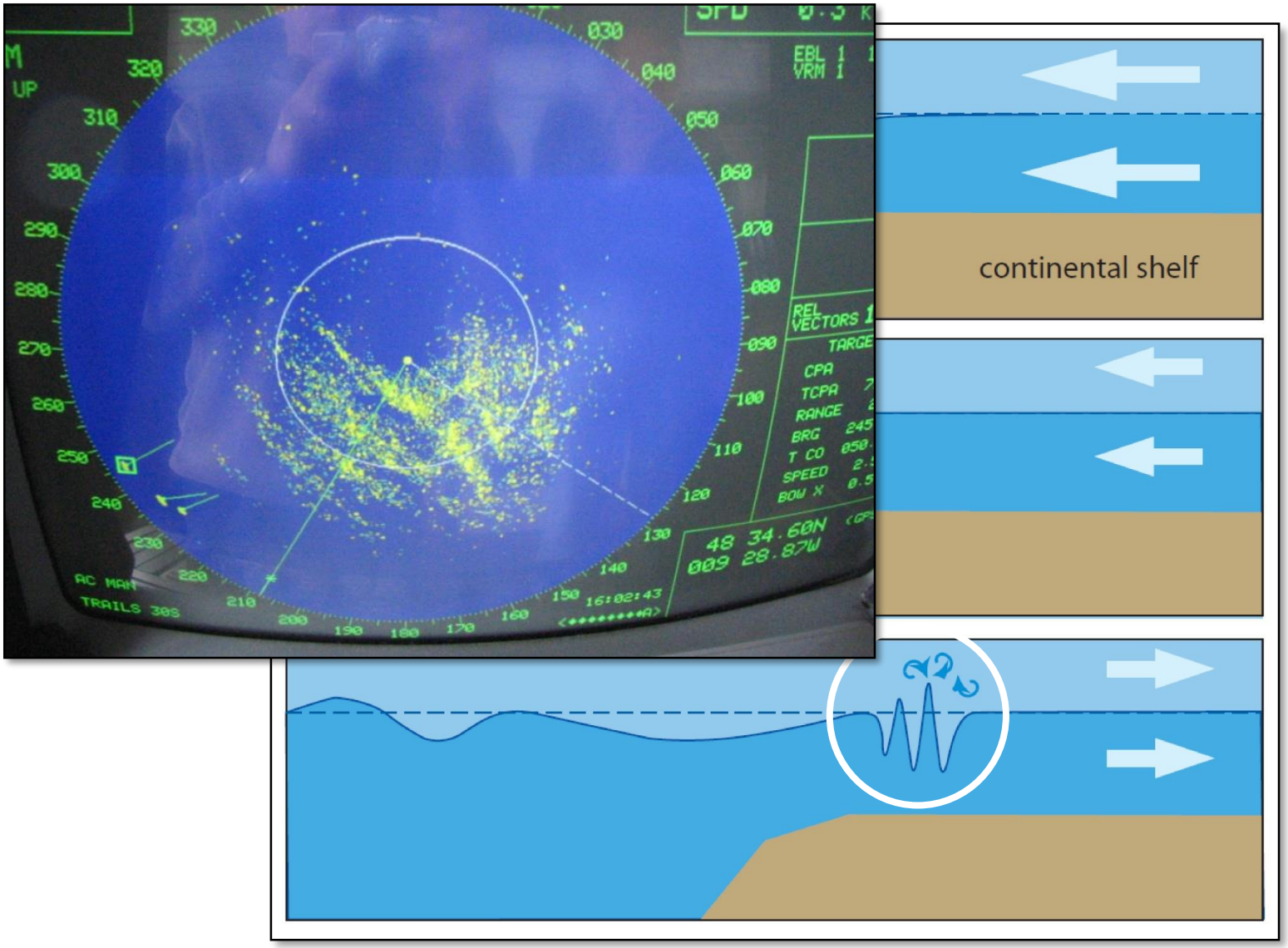
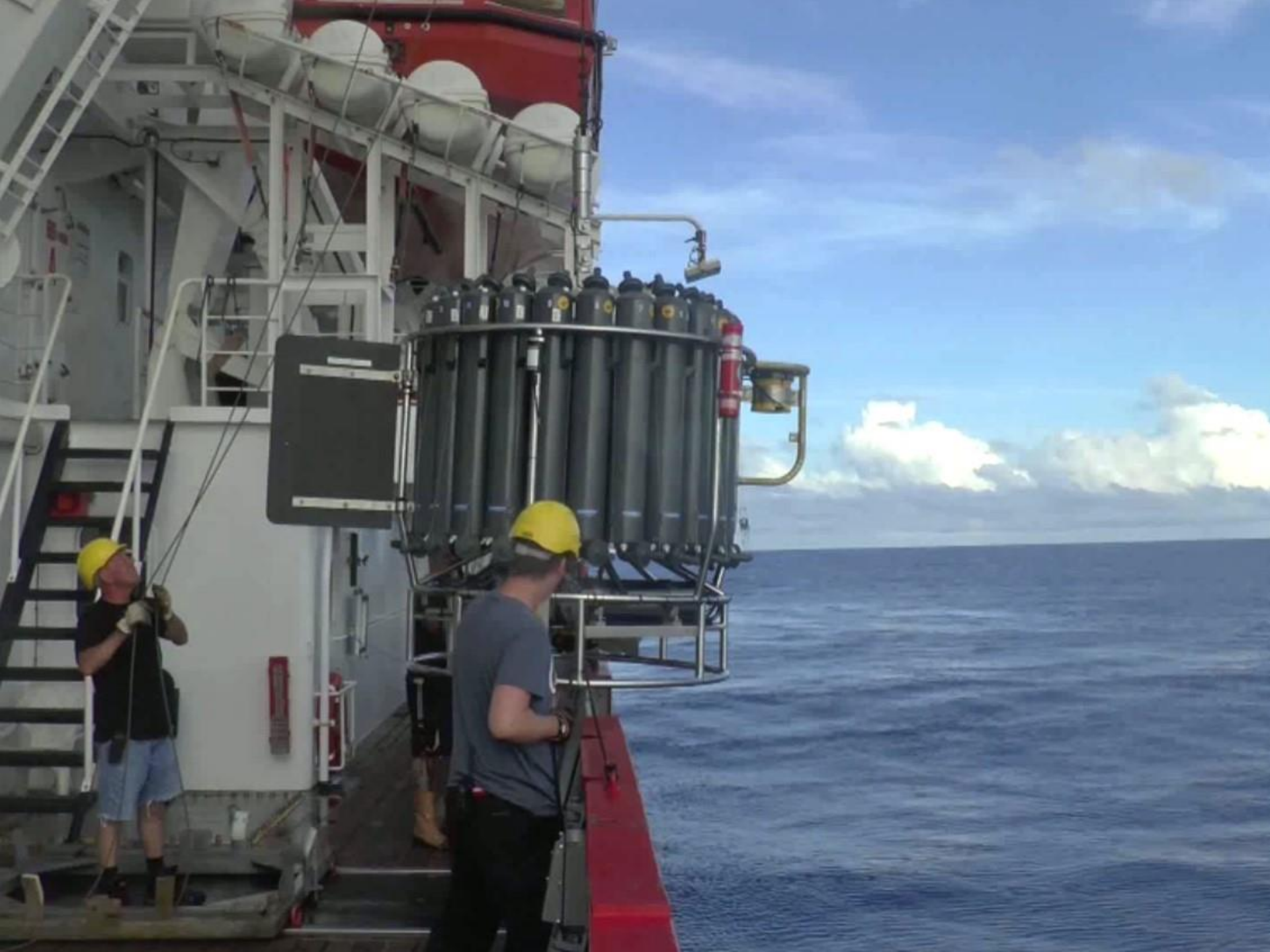
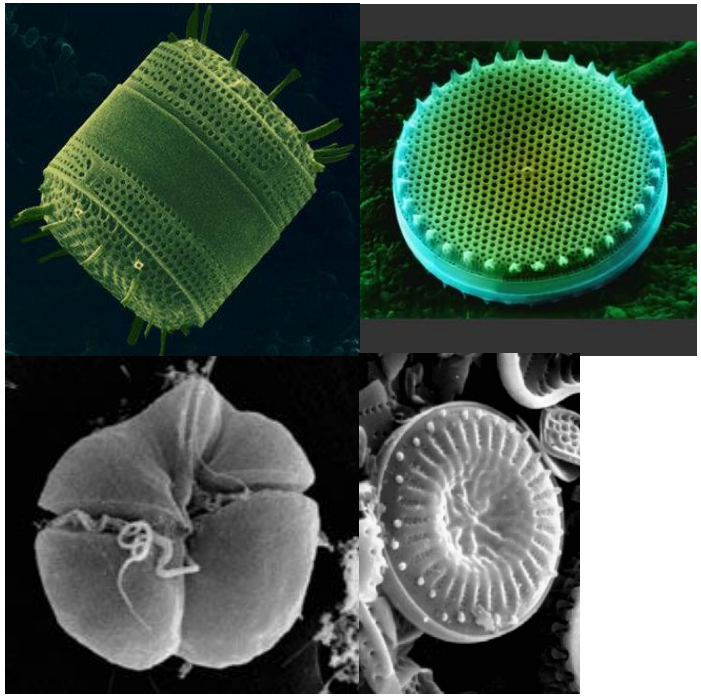
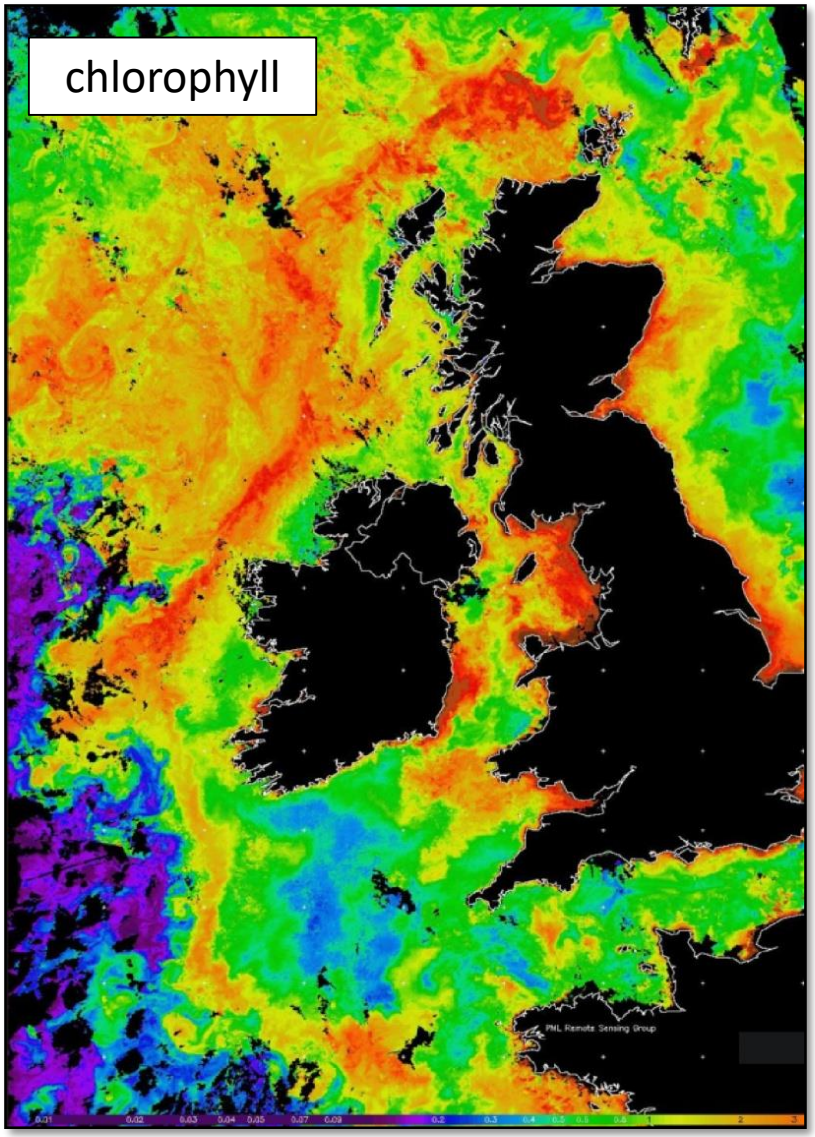




Consequence of Underwater Tidal Waves



Ocean Plants:
microscopic, single-celled and VERY numerous



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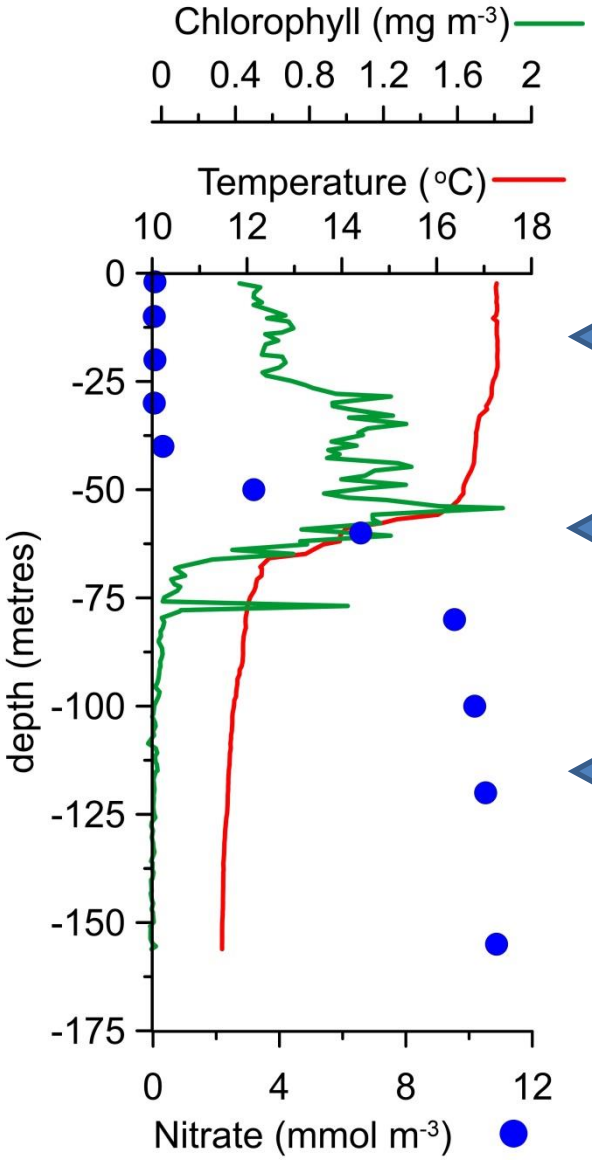
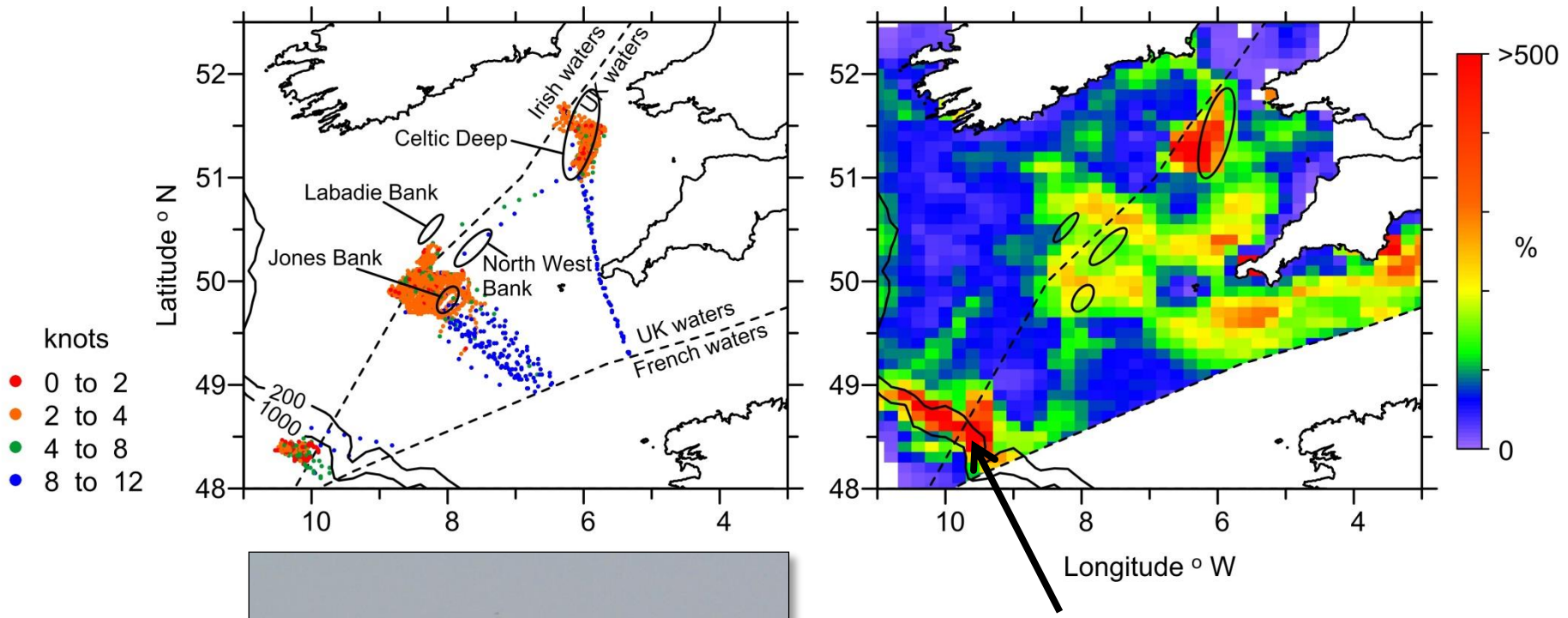


Surface water: lots of light, but no nutrients

Breaking tidal wave mixes nutrients upwards

Deep water: lots of nutrients, but no light

Consequence of Underwater Tidal Waves



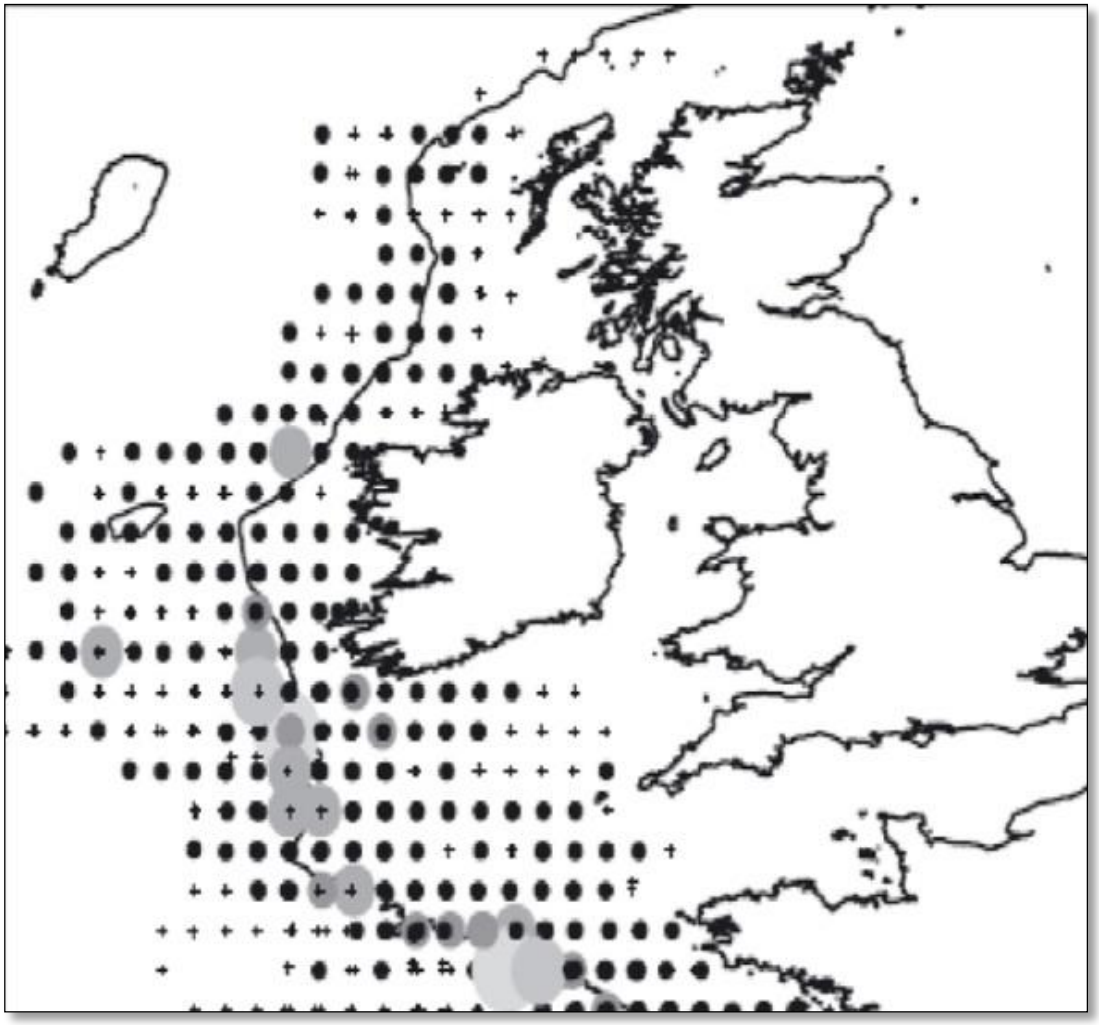
The shelf edge is the most heavily fished area of the sea

Consequence of Underwater Tidal Waves

Distribution of mackerel eggs

→

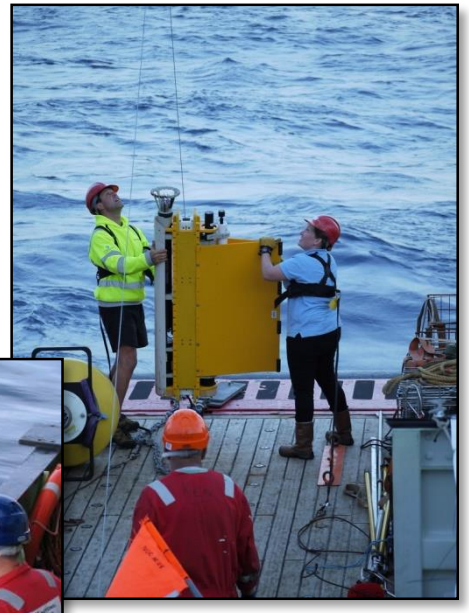
Spawning fish like the shelf edge



NW European Tides……

……are a lot larger than most other tides around the world, and….

…….are vitally, perhaps surprisingly, important to the life of the sea.



Further Information

Jonathan.Sharples@liverpool.ac.uk

http://pcwww.liv.ac.uk/~jons/

Video at: https://www.youtube.com/watch?v=VMvArDs-Ov8&feature=youtu.be

See also:

Posters available: