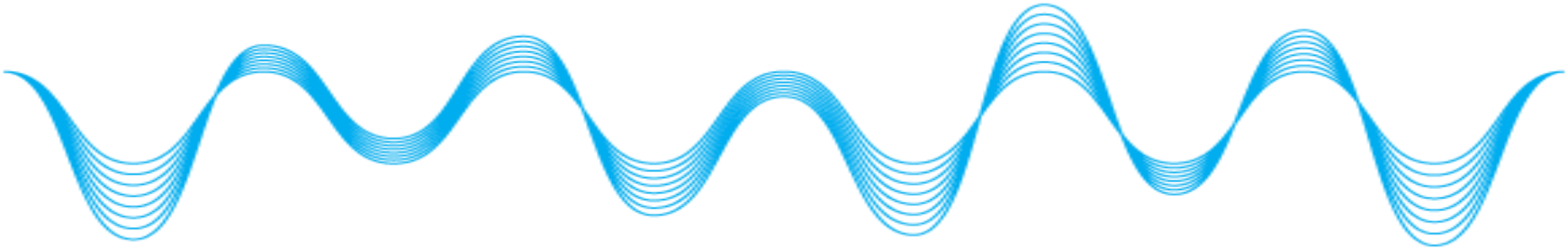
Case Study:
How do we map the seafloor?



Examining Regional Environmental Characterisation Surveys (RECs)

Lesson

This case study provides a real-life example of physics in the workplace. It examines marine archaeological research, focusing on how scientists mapped the physical properties of the seafloor at KS3 and KS4.

Using this lesson

Check out our website http://ets.wessexarch.co.uk/teachers/physics for the accompanying teacher pack and resources.

The colour-coded boxes indicate downloadable activities, discussion ideas and opportunities and links to find out more.

Details are provided in the teacher pack.

FILM

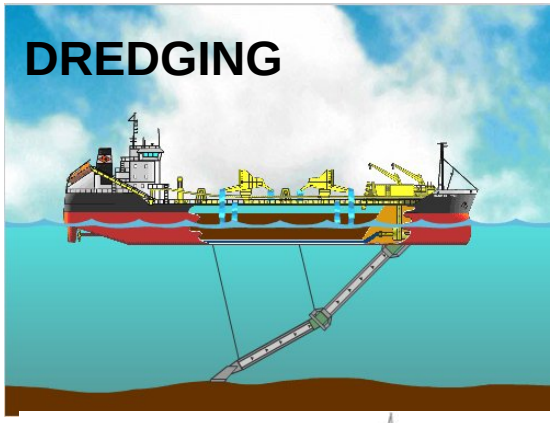
ACTIVITY

DISCUSSION

FIND OUT MORE

What is an REC?

A scientific multidisciplinary marine study of the **geology, biology** and **archaeology** of different areas of the British coast.



[Be a Seafloor Explorer]

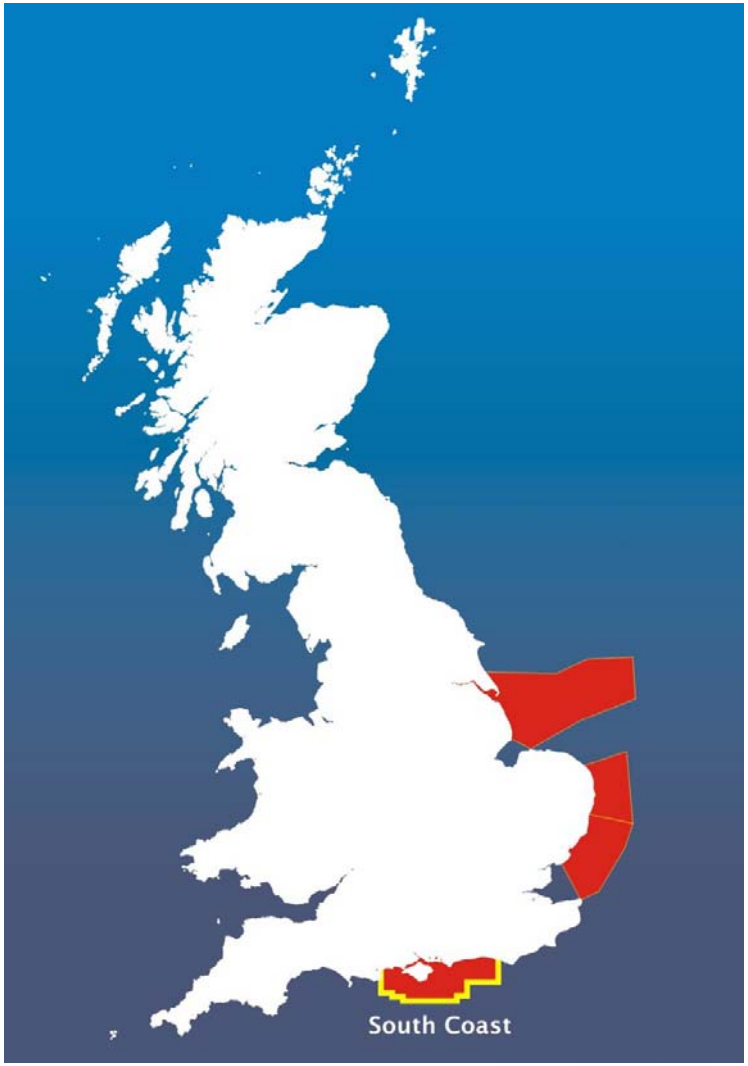
Main Objective

To provide integrated maps of the seafloor, to allow the sustainable management of offshore resources now and in the future.

Funded

Marine Aggregate Levy Sustainability Fund (MALSF)

South Coast REC survey



This lesson focuses on the scientific techniques that the archaeologists, ecologists and geologists used during the South Coast REC research.

Study Aims

• To create maps showing the morphology and sediment distribution of the seafloor (**geology**).

•To create maps showing the location of archaeological material, including prehistoric material and ship or aircraft wrecks (**archaeology**)

•To create integrated maps of sea animals communities and their physical habitats (**ecology**)

Size of study area: 5600km2

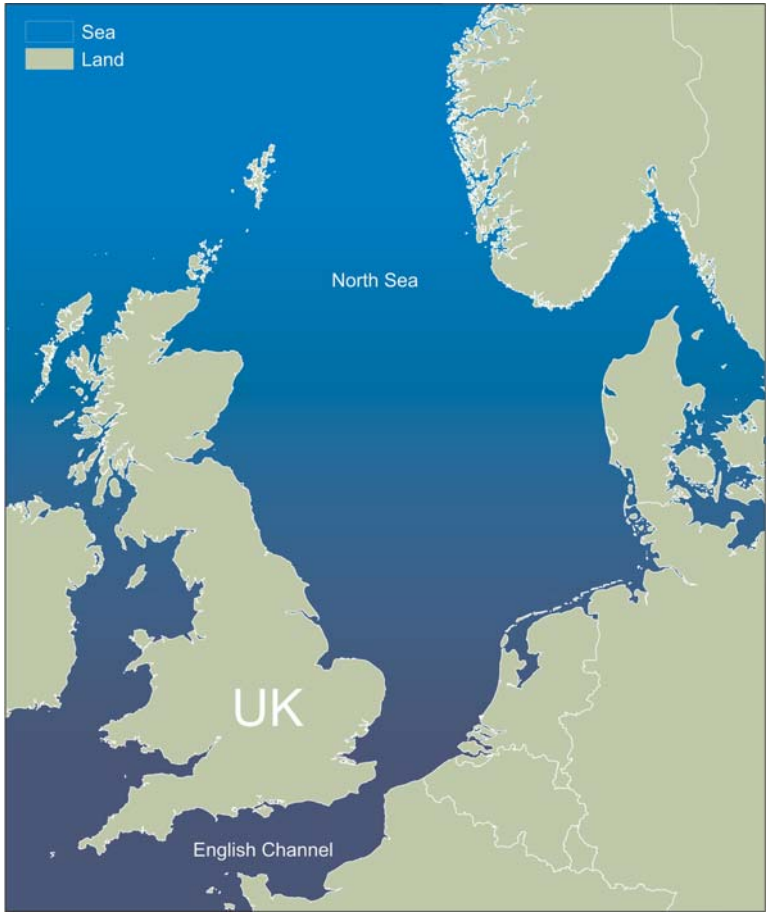
Date: 2008 - 2010

Background information

Mapping the Seafloor

18,000 Before Present (BP)

Today



Prehistoric Climate Change

Prehistoric Climate Change timechart

REC Methodology

For each of the three subject areas, there are three main stages to the research of the South Coast REC.

Stage 1	Collecting Data	• Fieldwork • Desk based assessment.
Stage 2	Results – using the data	• Creating maps • Final report
Stage 3	Recommendations	Highlighting what is special about the South Coast REC study area

Stage 1: Collecting data

Issues for researching REC study

- Covers a large area
- Looking to get a general picture of what is there
- Limited by time and money

What the scientist's did

- Fieldwork:
  - Geophysical survey
  - Vibrocorer
  - Grab Samples
  - Underwater photography
- Desk Based Assessment

Collecting samples

Discover more about Marine Careers

Fieldwork: Geophysical Survey

Geophysical survey collects information about the physical properties of the seafloor and create images. Archaeologists used several techniques

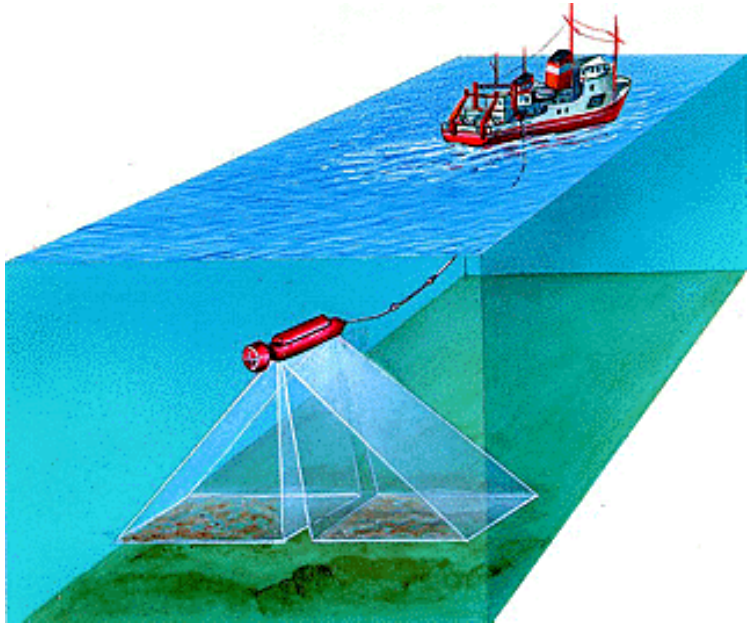
Sonar

Uses sound waves to record the seafloor
Archaeologists used several different acoustic survey methods

- Sidescan Sonar
- Bathymetry Multibeam Sonar
- Sub-Bottom Profiler

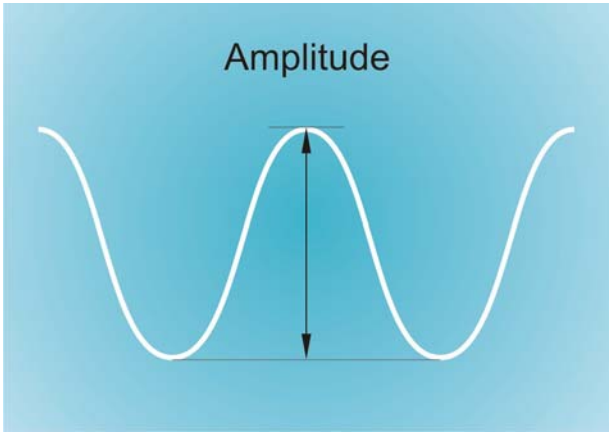
Magnetometry

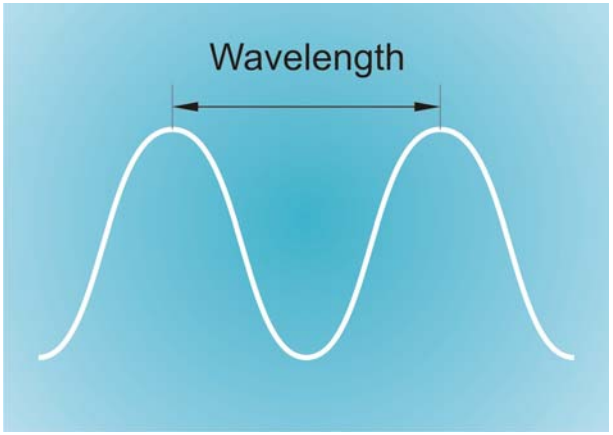
Measures magnetic changes, which is good for detecting iron (e.g. shipwrecks)

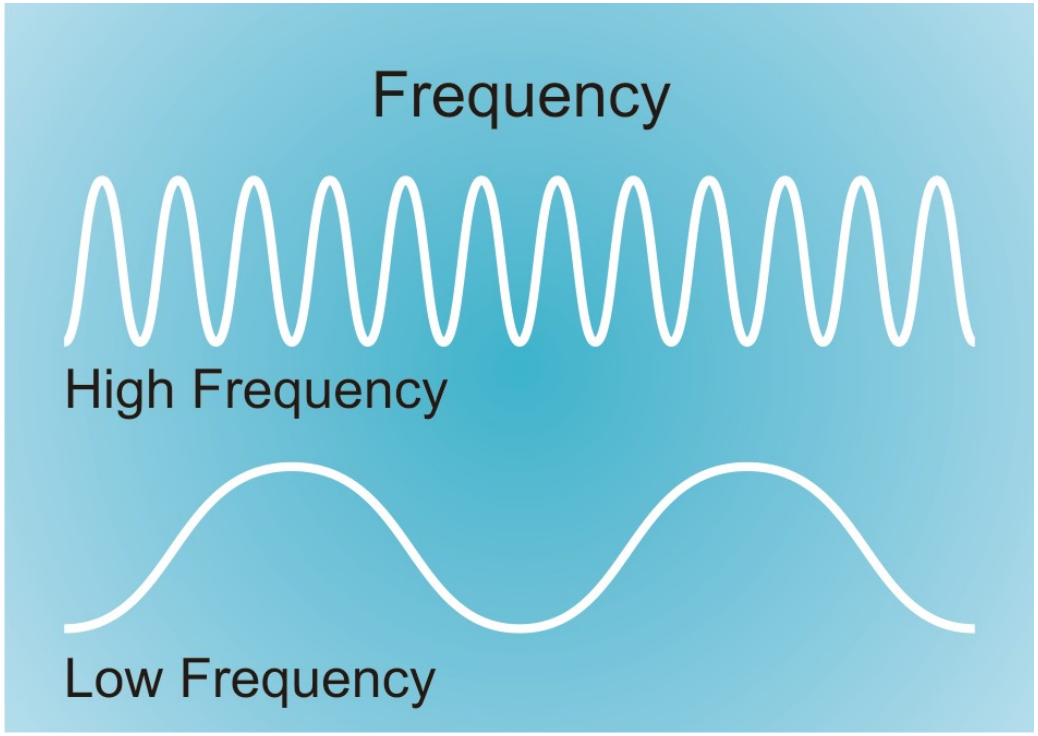


Geophysics

Acoustic geophysical techniques: the principles

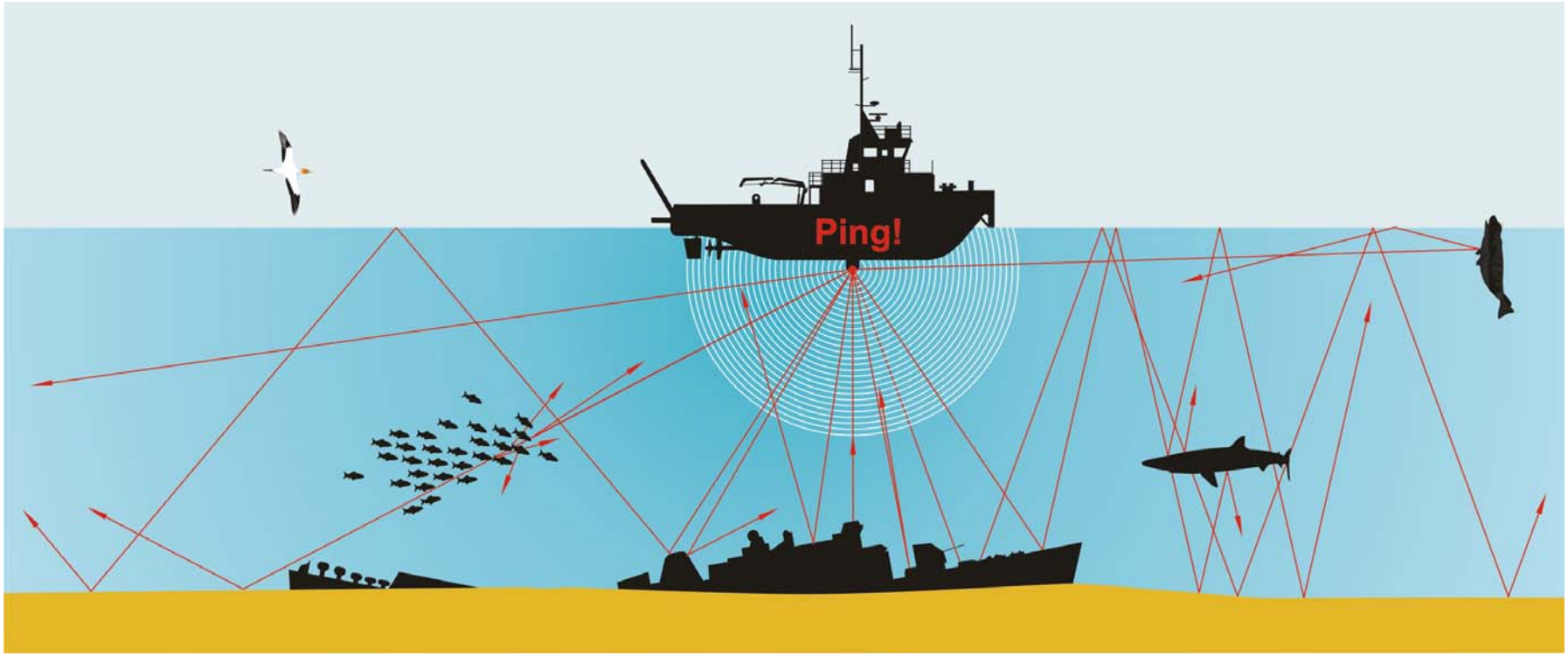




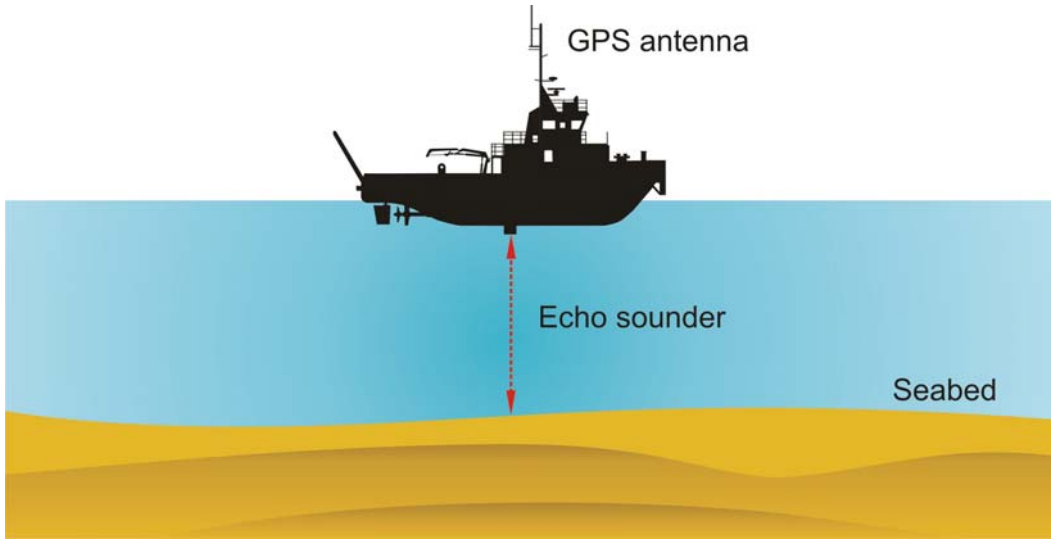


Using soundwaves

Sound waves underwater



The basics: echo sounders



Speed of sound in water
= 1,560 metres per second

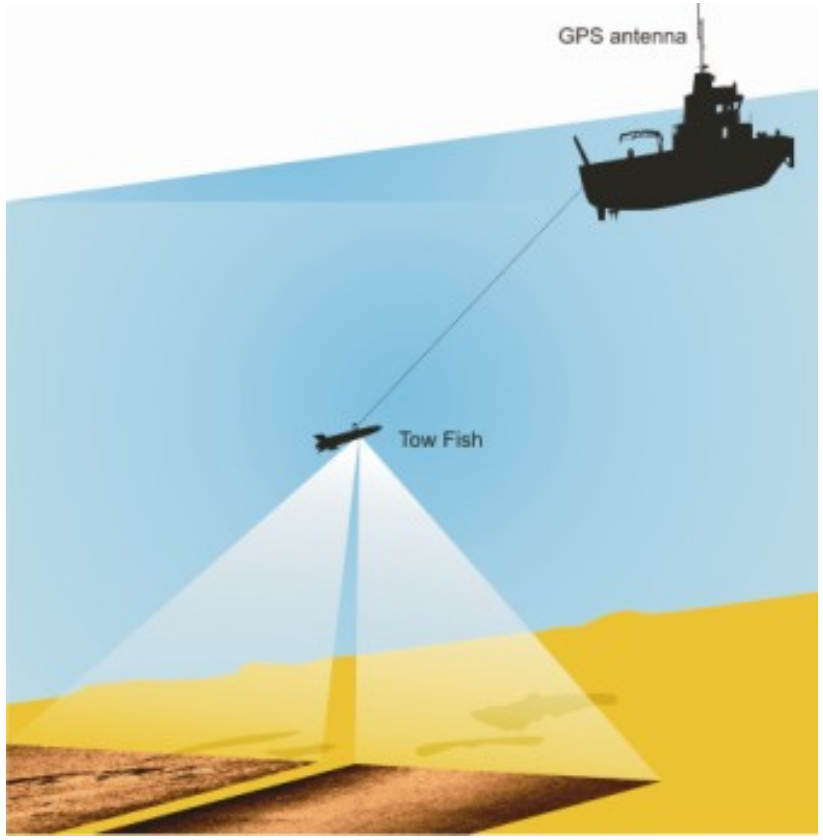
Time it took the sound wave to leave and return = 0.05 sec
Speed = distance/time
1560 = d / 0.05

$$\frac{(1560 \times 0.05)}{2} = 39$$

The seafloor is 39m deep.

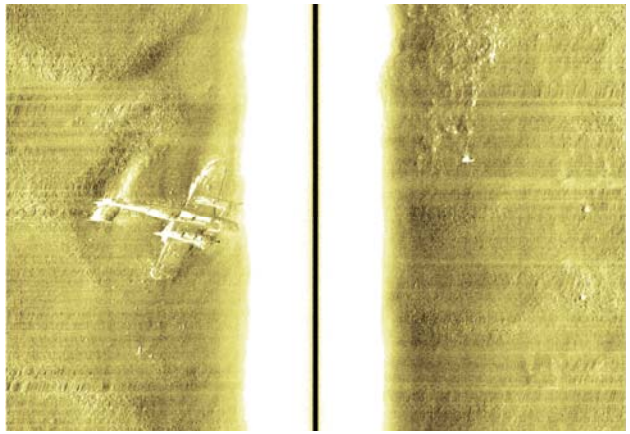
Why do we divide the equation by two?

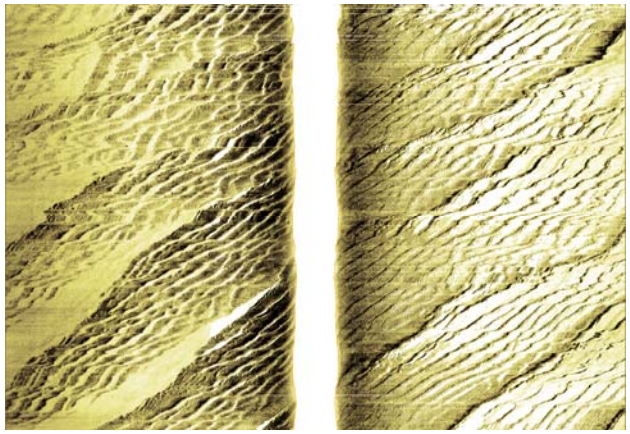
Sidescan Sonar



Why is there a white line down the middle of the images on the right?

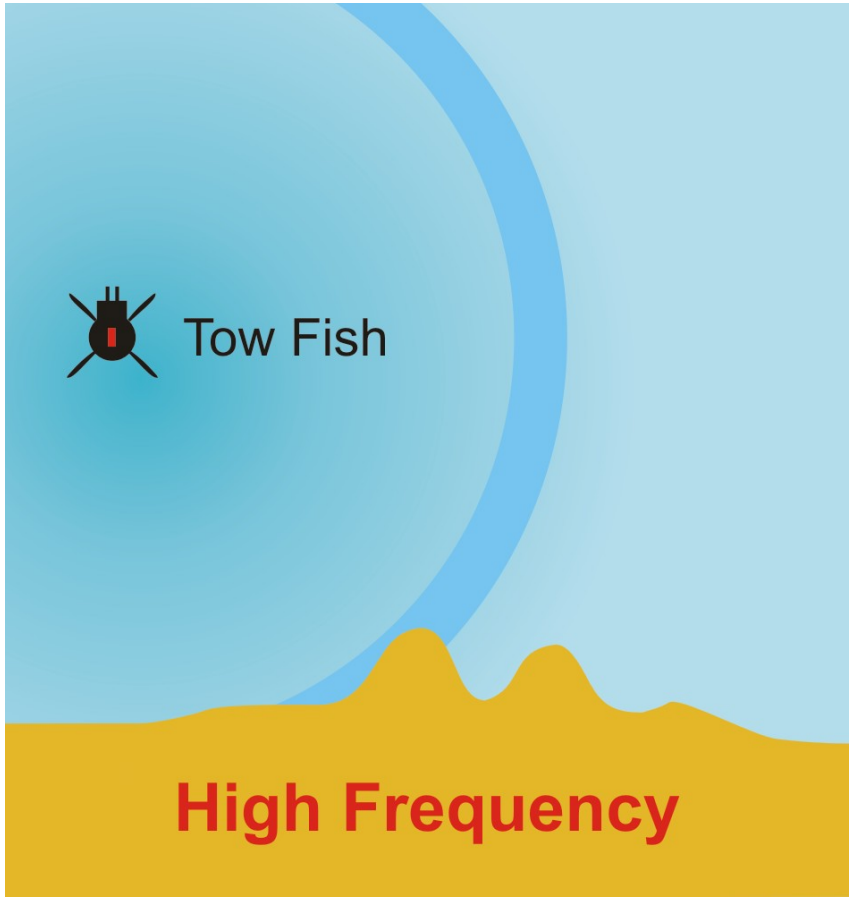
Aircraft wreck: Dornier

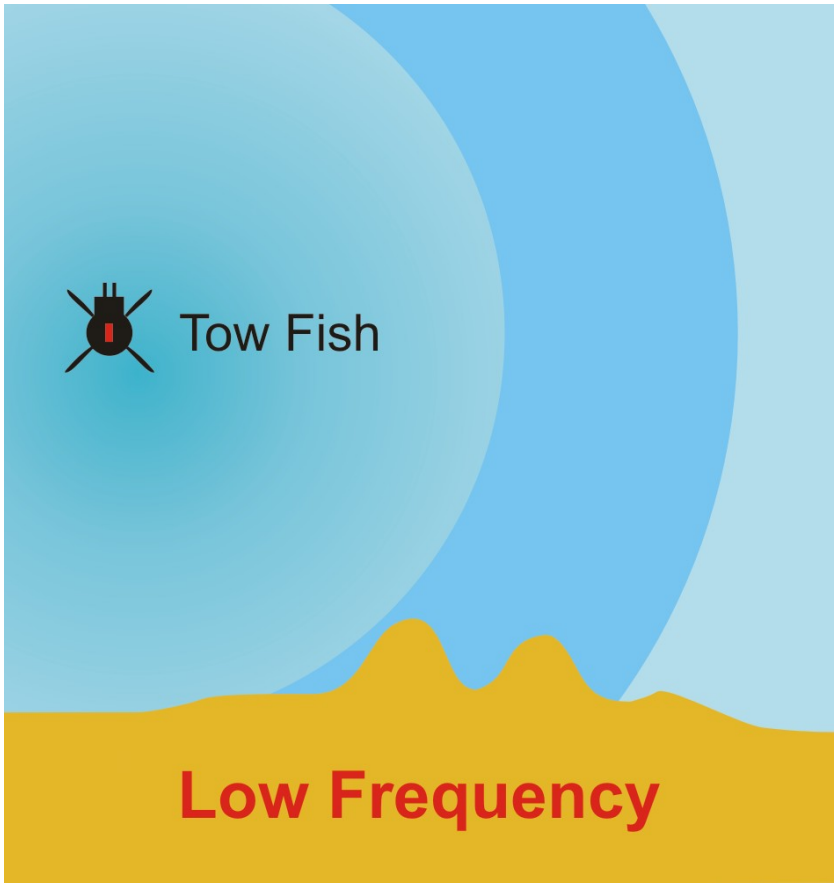




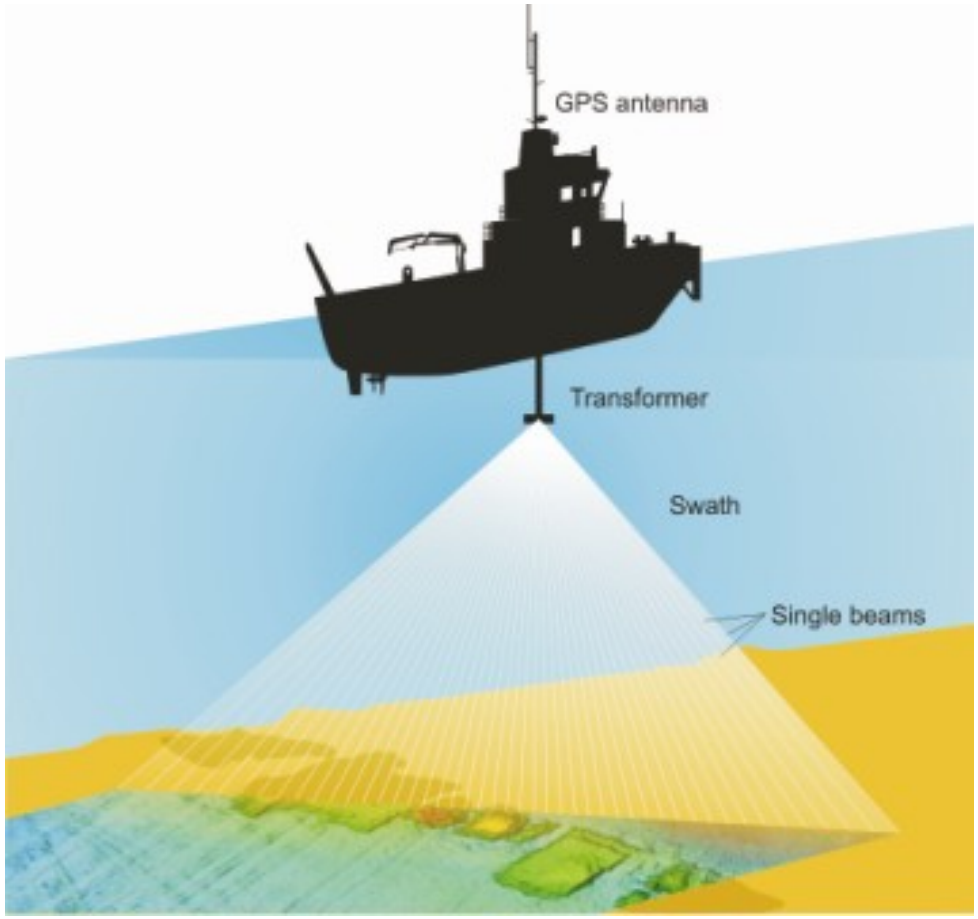
Sand ripples on the seafloor

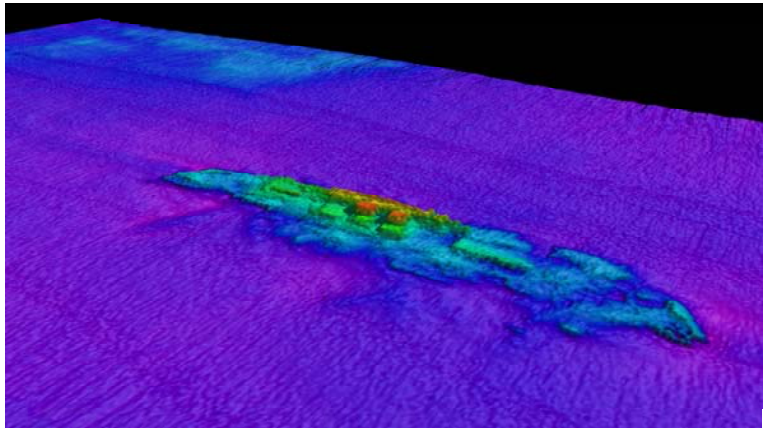
Frequency/Resolution



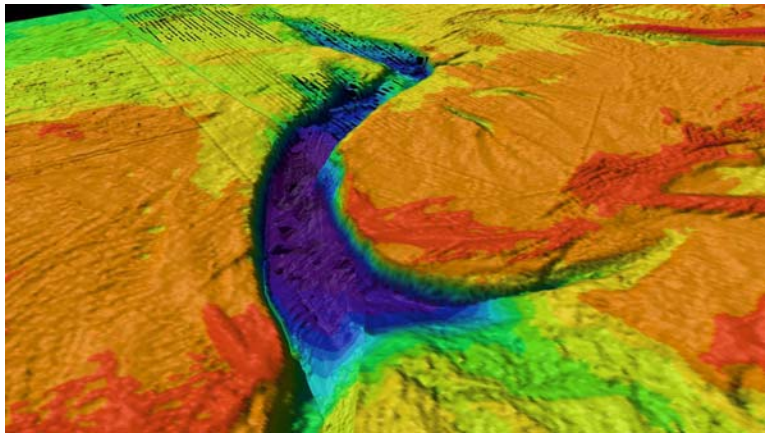


Multibeam sonar



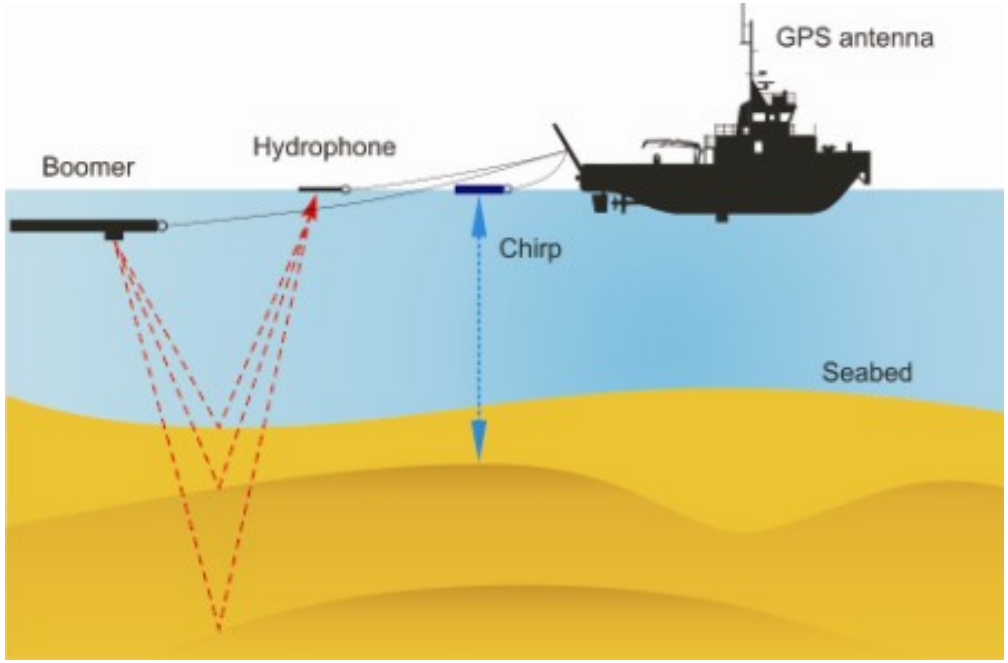


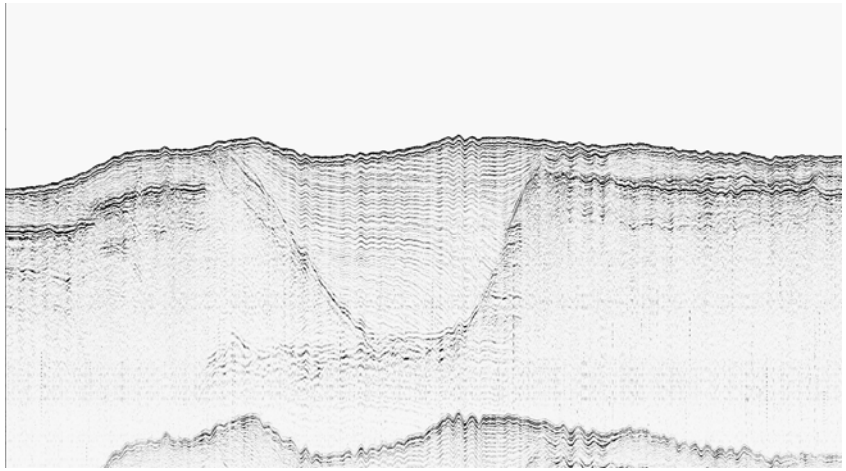
SS *Mendi*: World War I shipwreck



A tunnel valley on the seafloor

Sub-bottom profiling



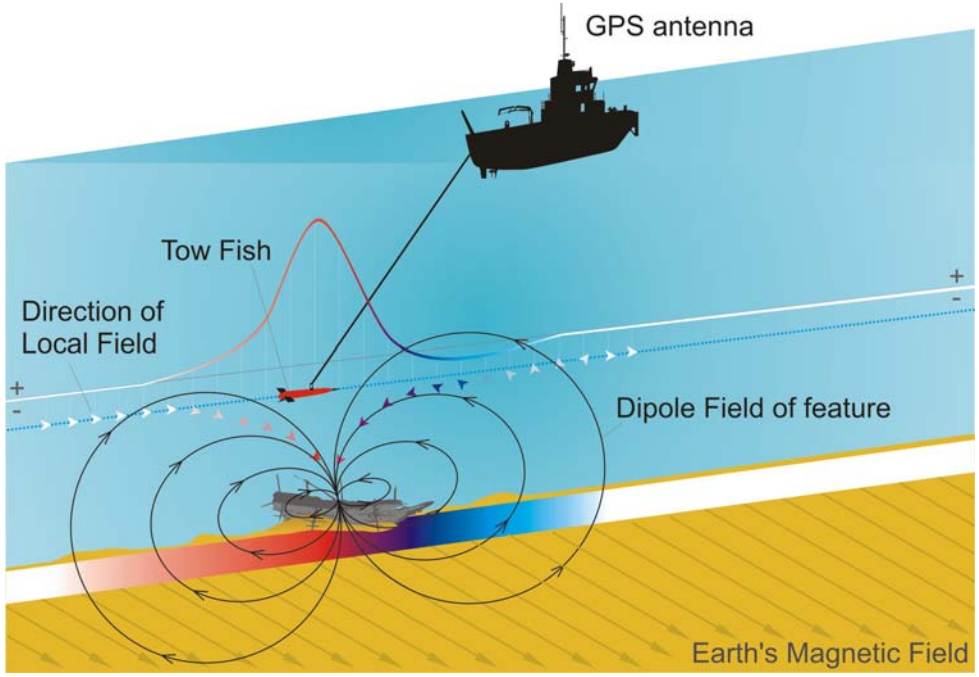


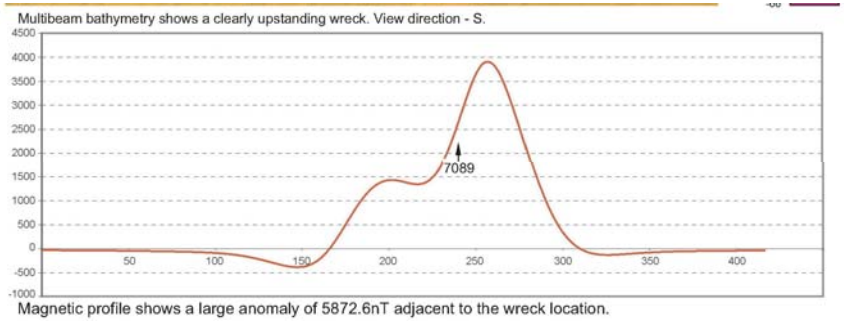
An ancient river channel filled in with buried sediments – can you see it?

Frequency: noisy neighbours

Using sound waves

Magnetometry

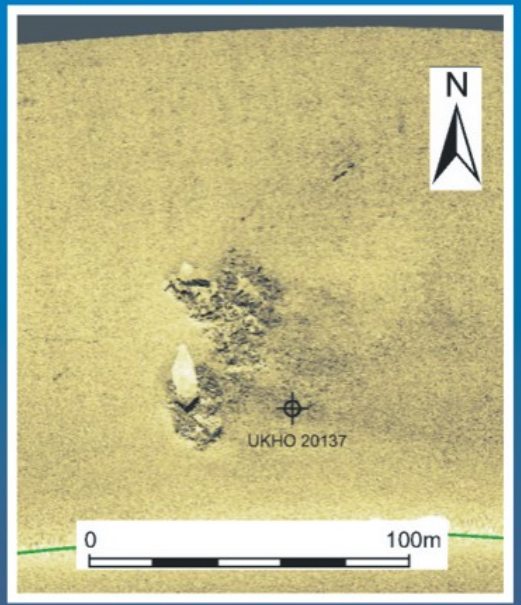


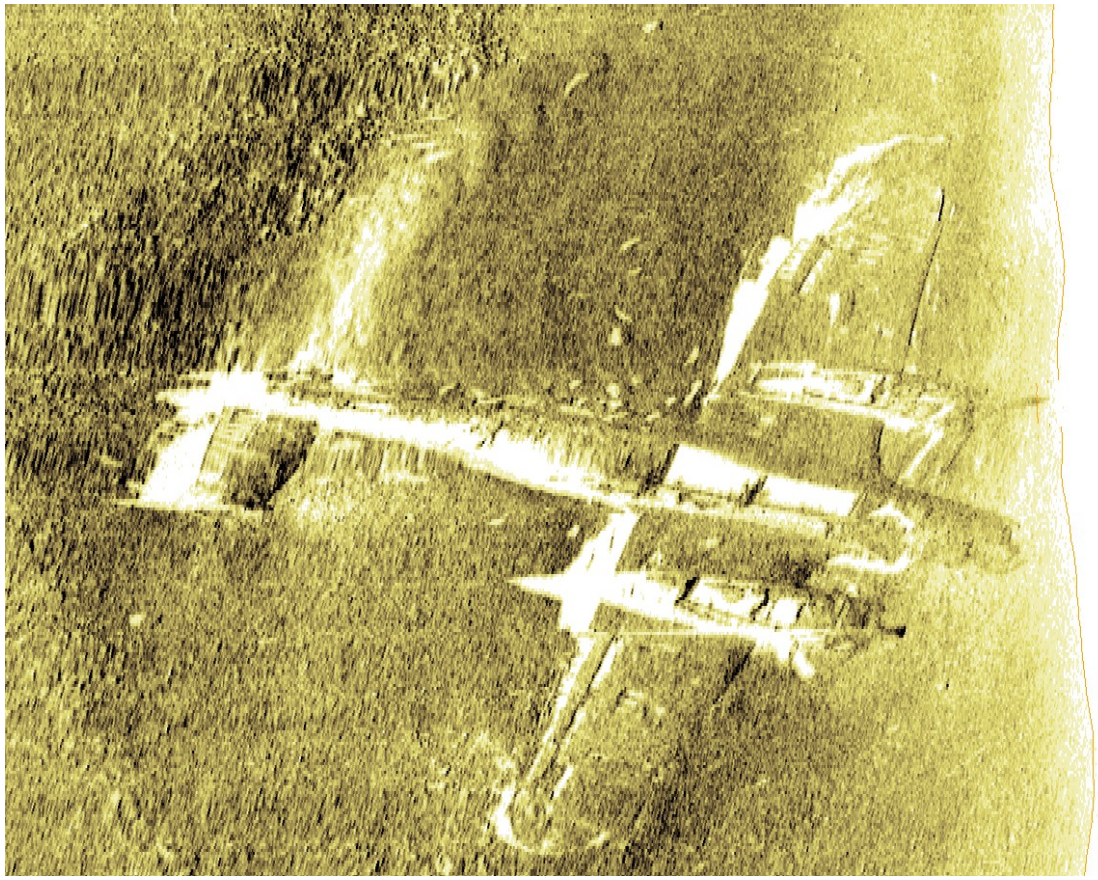


SS *Mendi*: World War I shipwreck

Results vary

This anomaly shows the remains of the ship called the HMT *Inverclyde*. It takes expertise to be able to tell if an anomaly is a ship or aircraft wreck rather than a geological feature, like rocks, on the seafloor.





Interpreting Geophysics (2)

Covering the study area

What do the lines on the map represent? Do they provide a representative coverage of the study area?

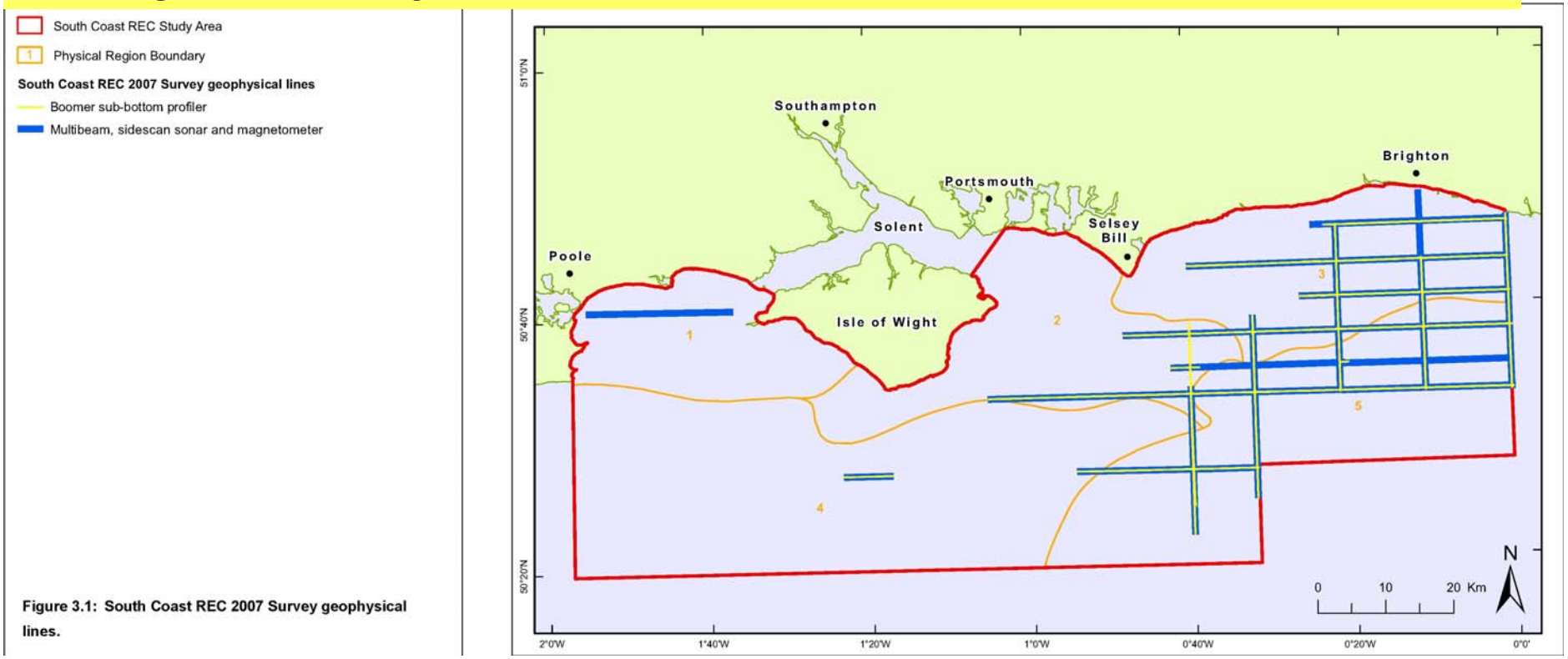


Figure 3.1: South Coast REC 2007 Survey geophysical lines.

Filling in the gaps

Archaeologists used geophysical survey collected in the past to fill in the gaps.

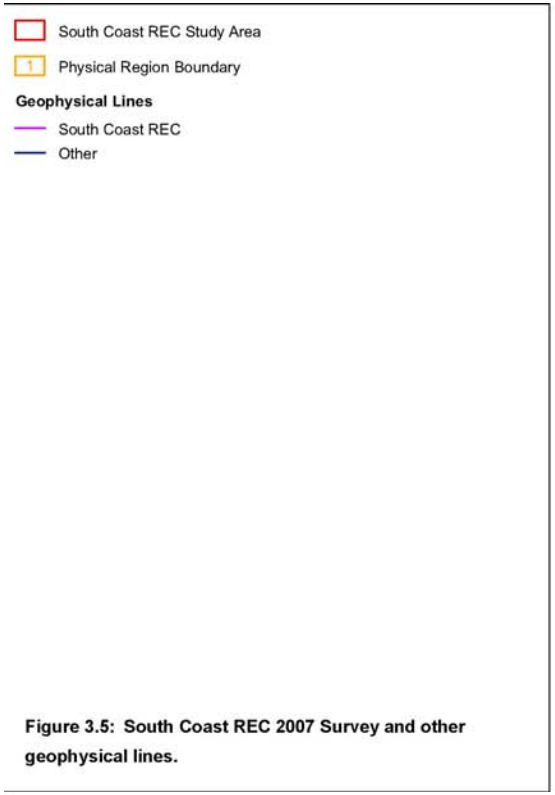
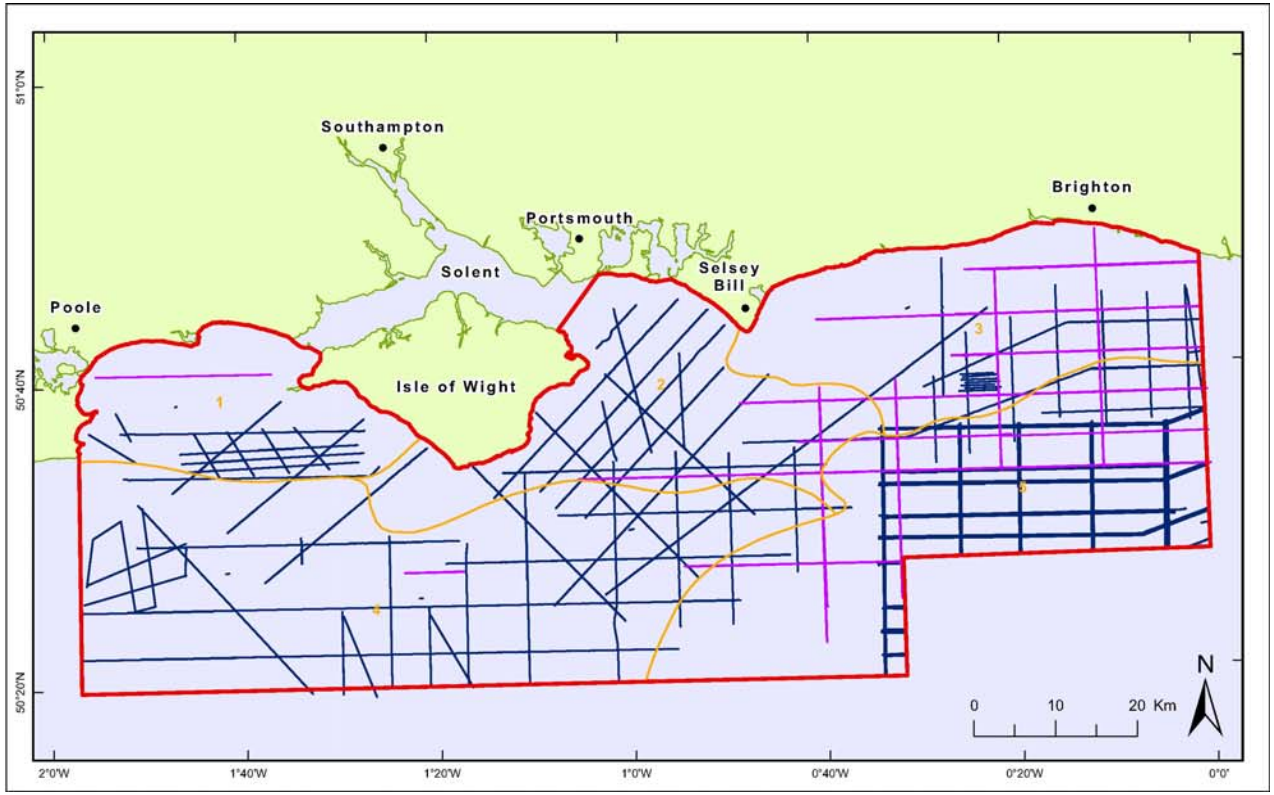


Figure 3.5: South Coast REC 2007 Survey and other geophysical lines.



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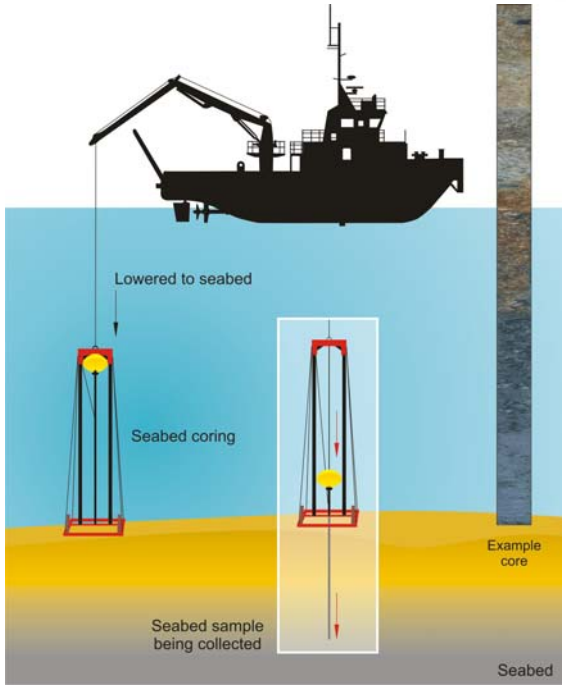
What are some of the considerations and issues when undertaking fieldwork?

Sampling: Vibrocorer

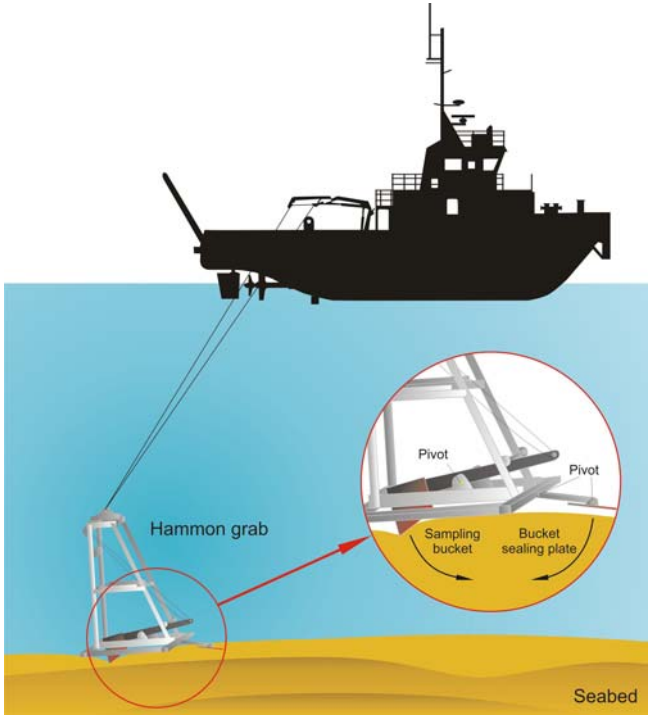


What kind of information did the scientists collect about this core?

Studying Environmental Remains

Collecting samples: Grab Samples

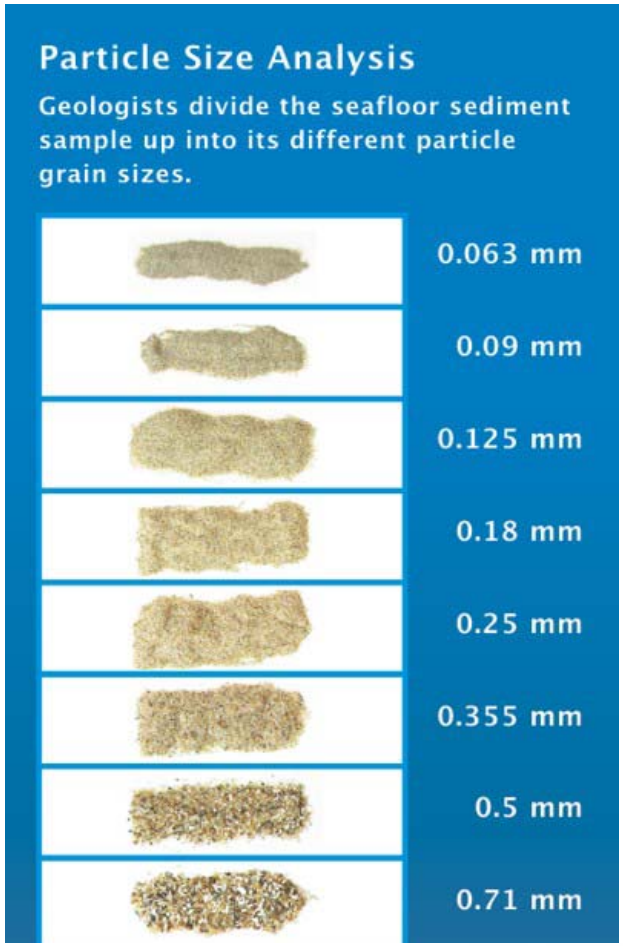
Clamshell Grab



Hamon Grab

Download out Ecology lesson

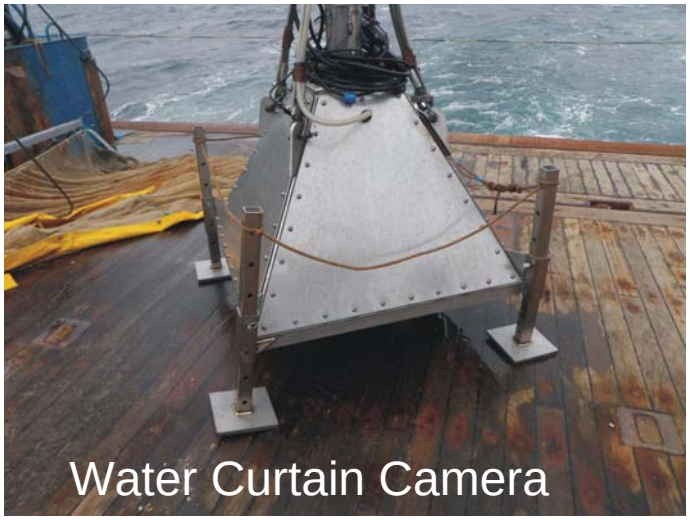
Processing Grab Samples
PSA Analysis and Folk Classification



Underwater photography


Video Sledge


Ham Cam


Water Curtain Camera

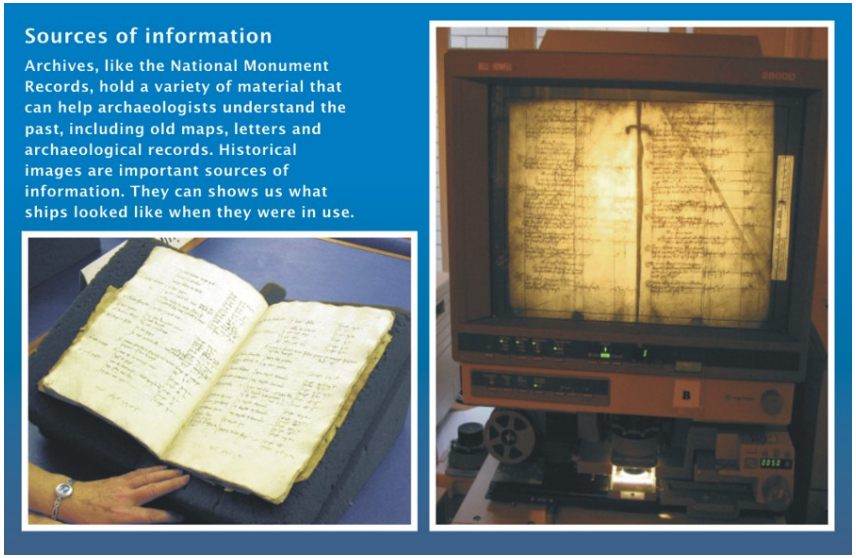

All four images© Crown Copyright

How do we study the seafloor?

Desk Based Assessment

What is a DBA?

A DBA collects together and **summarises in a report** any relevant research already undertaken and other sources of information about the archaeology, ecology and geology for the study area, parts of the study area or areas in the study area's vicinity.



Sources of information:

- Historical and previous archaeological work research
- Past geophysical survey data
- Research on sea animals, birds and fishing industry

Stage 2: Results

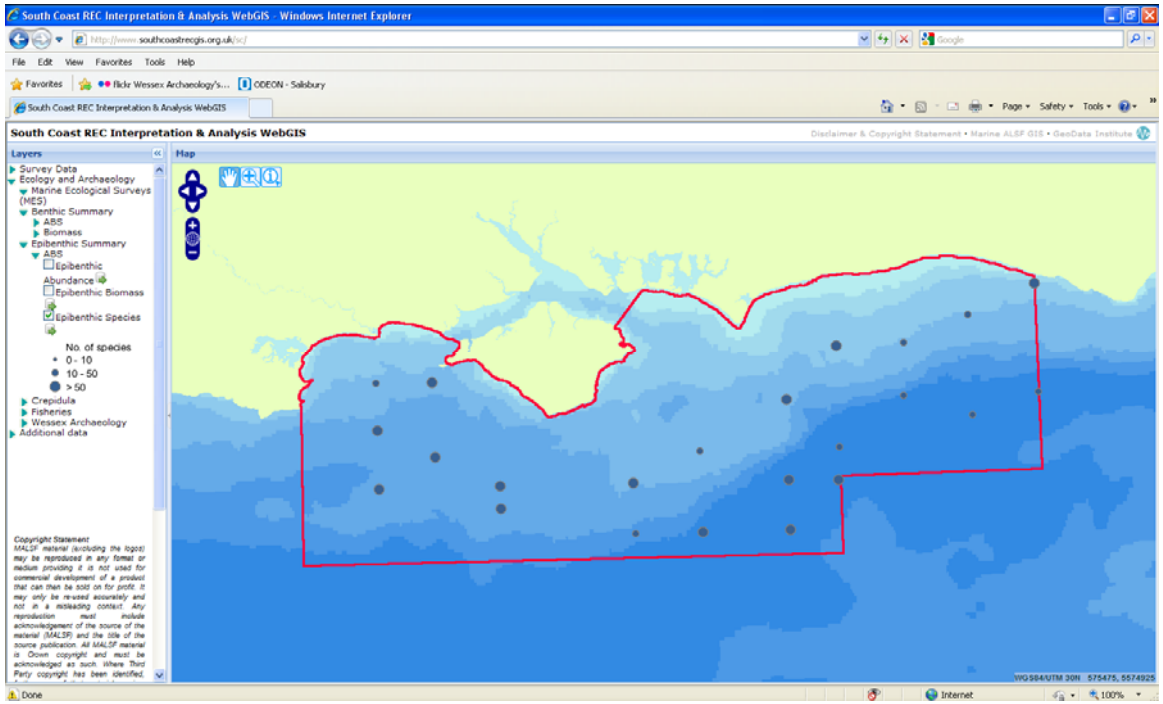
The final report covered:

- **Geology**
- **Archaeology**
- **Ecology**

To create these maps the archaeologists used GIS

GIS stands for Geographic Information System

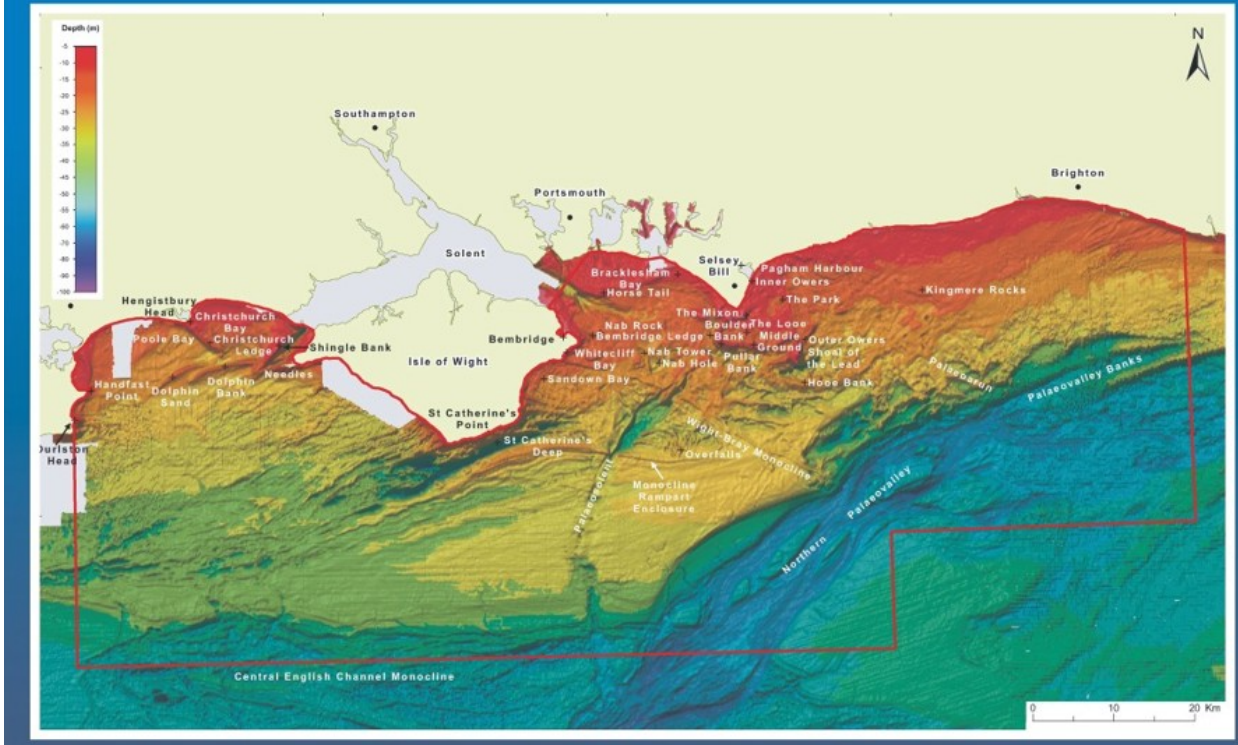
Modelling data – this helped fill in the gaps



Website: South Coast REC GIS

What does the seafloor look like?

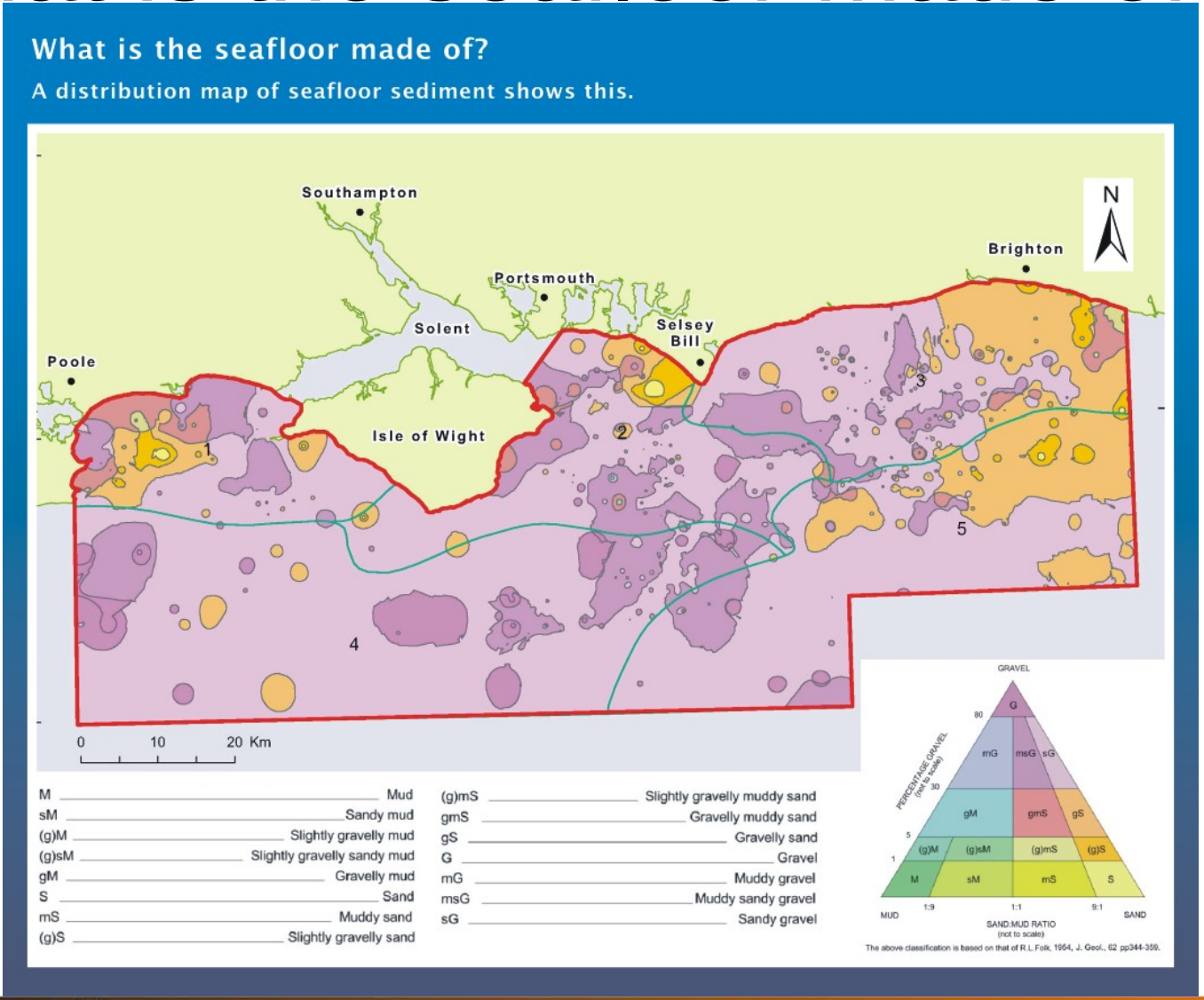
Geologists used geophysical survey bathymetry data to create this map of the South Coast seafloor.



Fly through: 3-D of the South Coast REC morphology

What is the seafloor made of?

Can you use the legend to work out what the majority of the South Coast seafloor is made of?



Slide 28

I7 SLP - need to get the traingulat with different folk classifications on to this - may need to get Karen to rekig it all so its all one.
IT, 20/05/2011

Finding Archaeology
- prehistoric landscapes

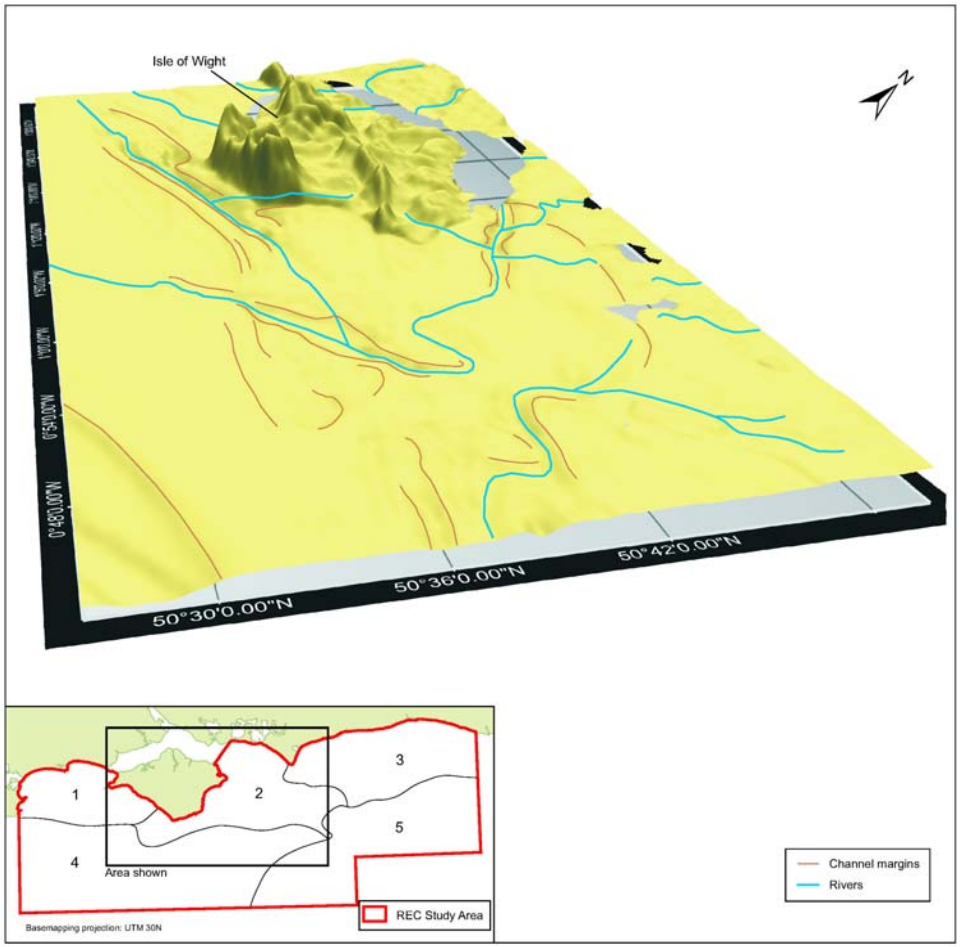


Figure 5.12: Possible landform features off the Isle of Wight.

Fly-through: palaeo-Arun prehistoric reconstruction

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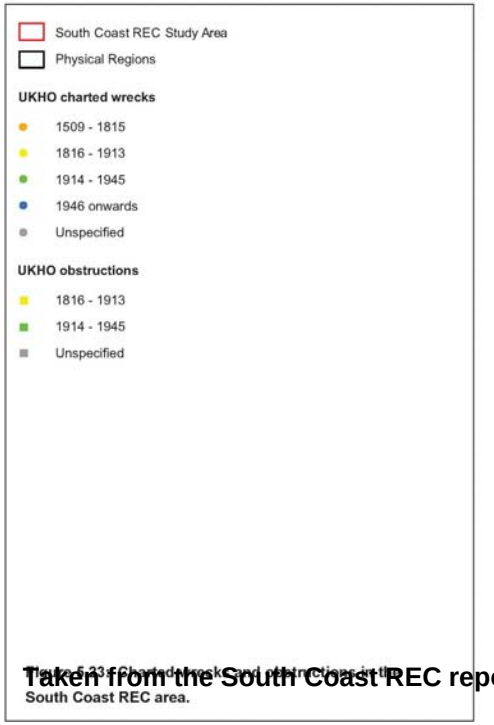
Finding ship and aircraft wrecks



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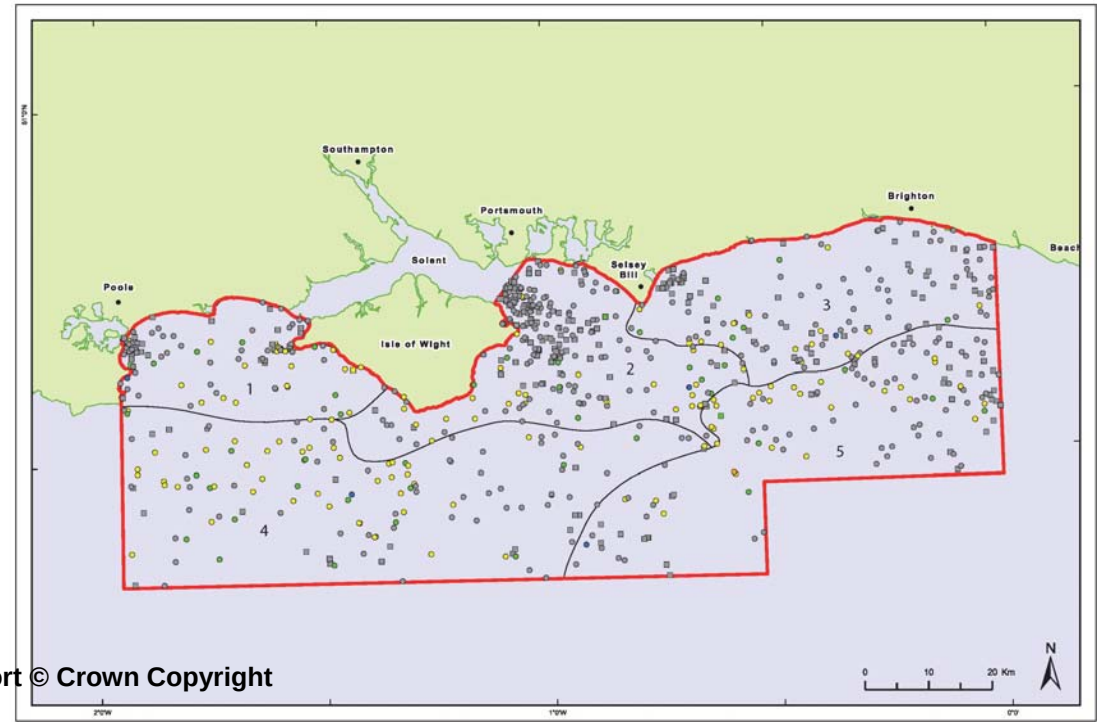

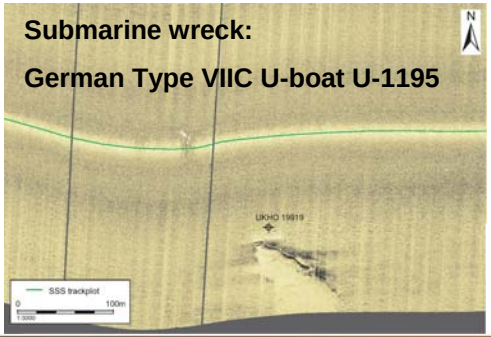

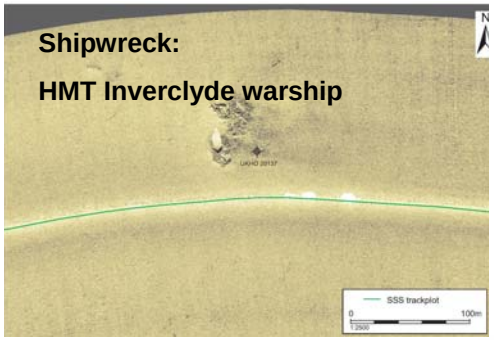

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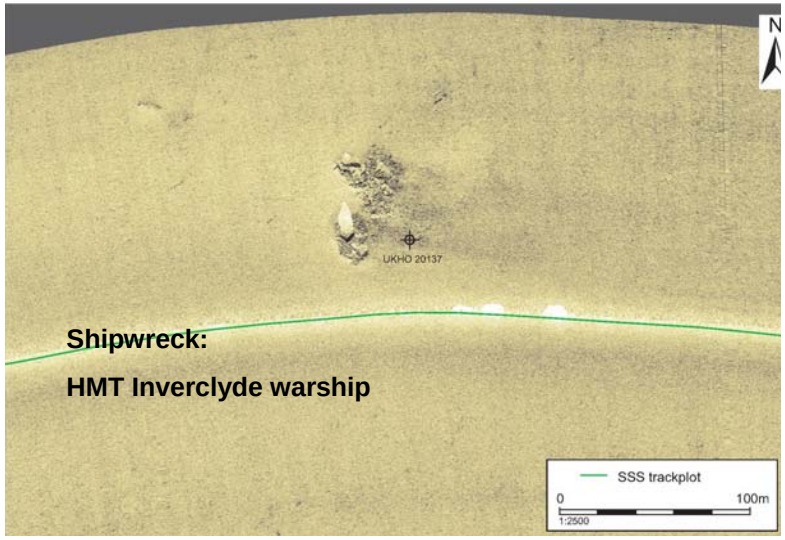
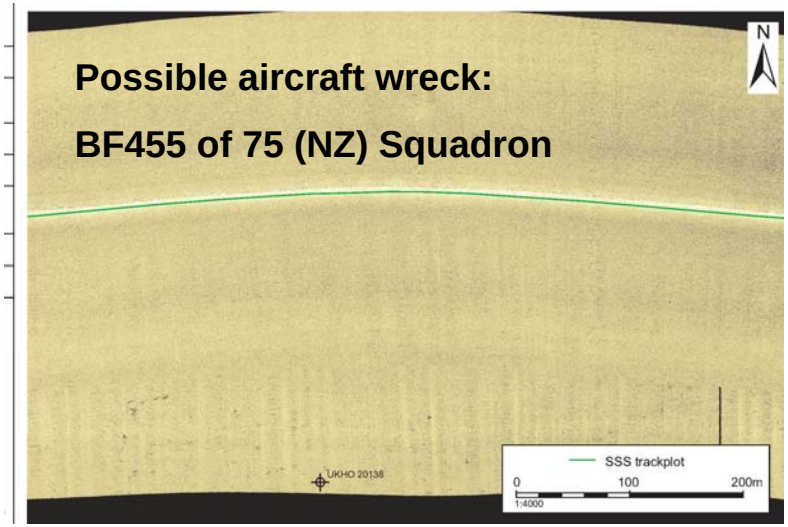
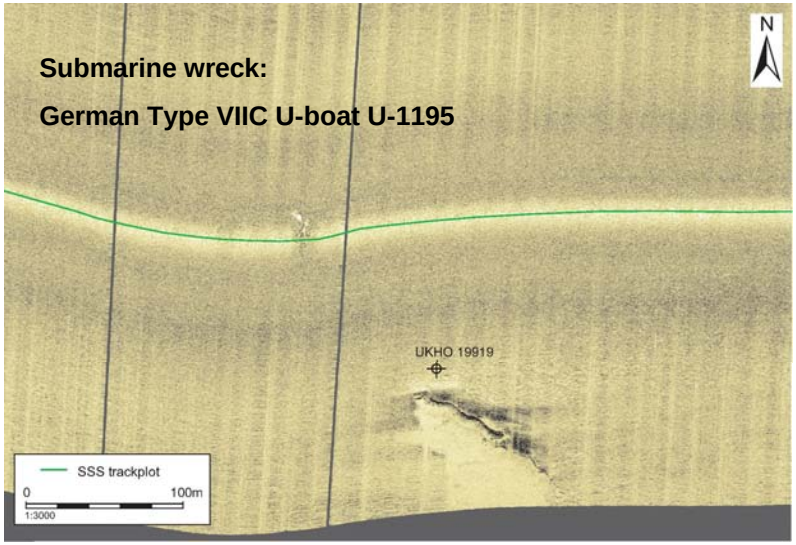
World War II geophysics results

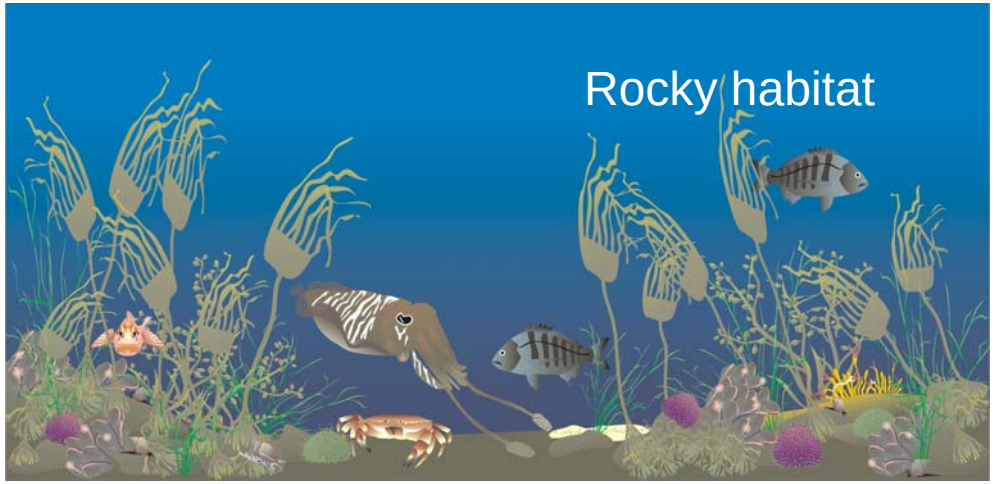


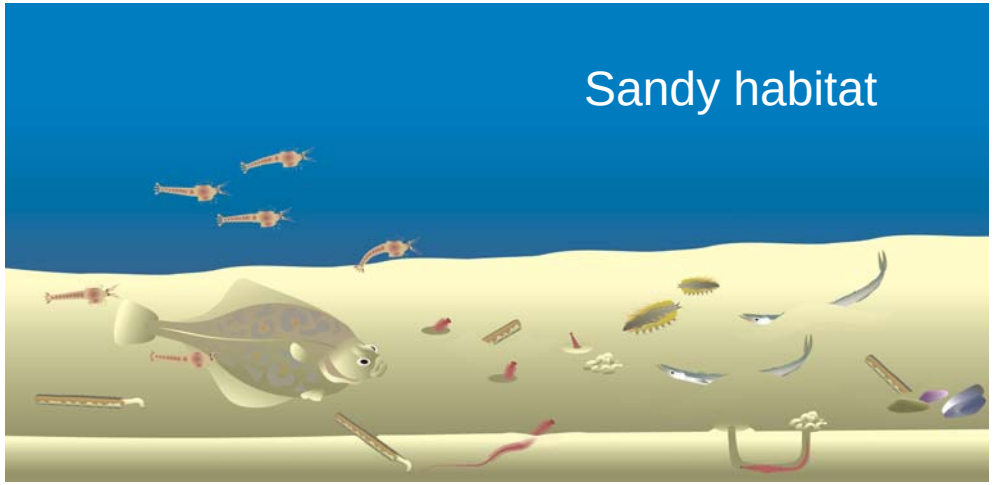




How useful is geophysical survey for finding WWII shipwrecks? Why?

Habitats





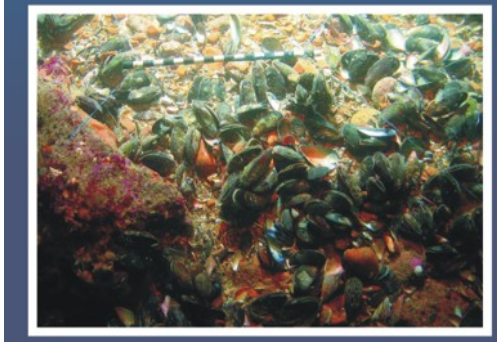
South Coast Reefs:

What are they?

This can be either rocky marine habitats or biogenic reefs, those created by sea animals.

Why are they important?

- Biodiversity hotspots with lots of different types of sea animals living there.
- They both provide shelter and a solid foundation for animals to cling on to.
- There are lots of nooks and crannies for sea animals to live in.



Biotope maps

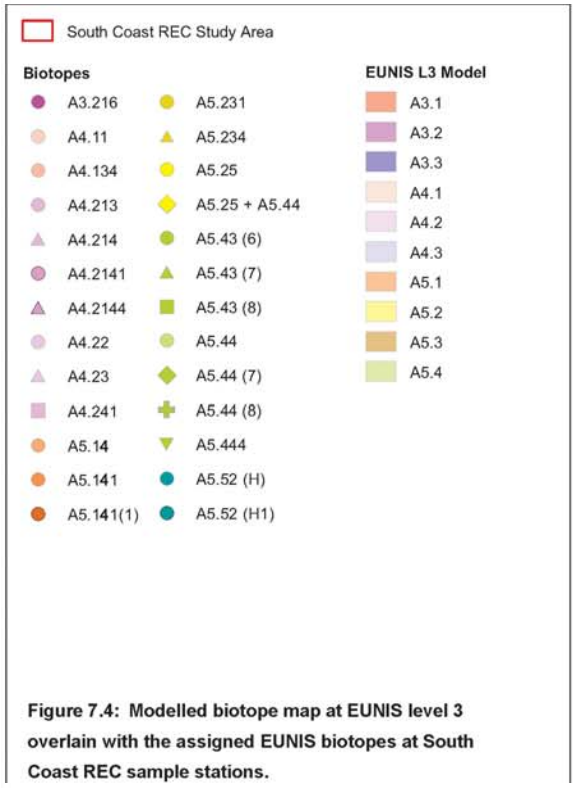
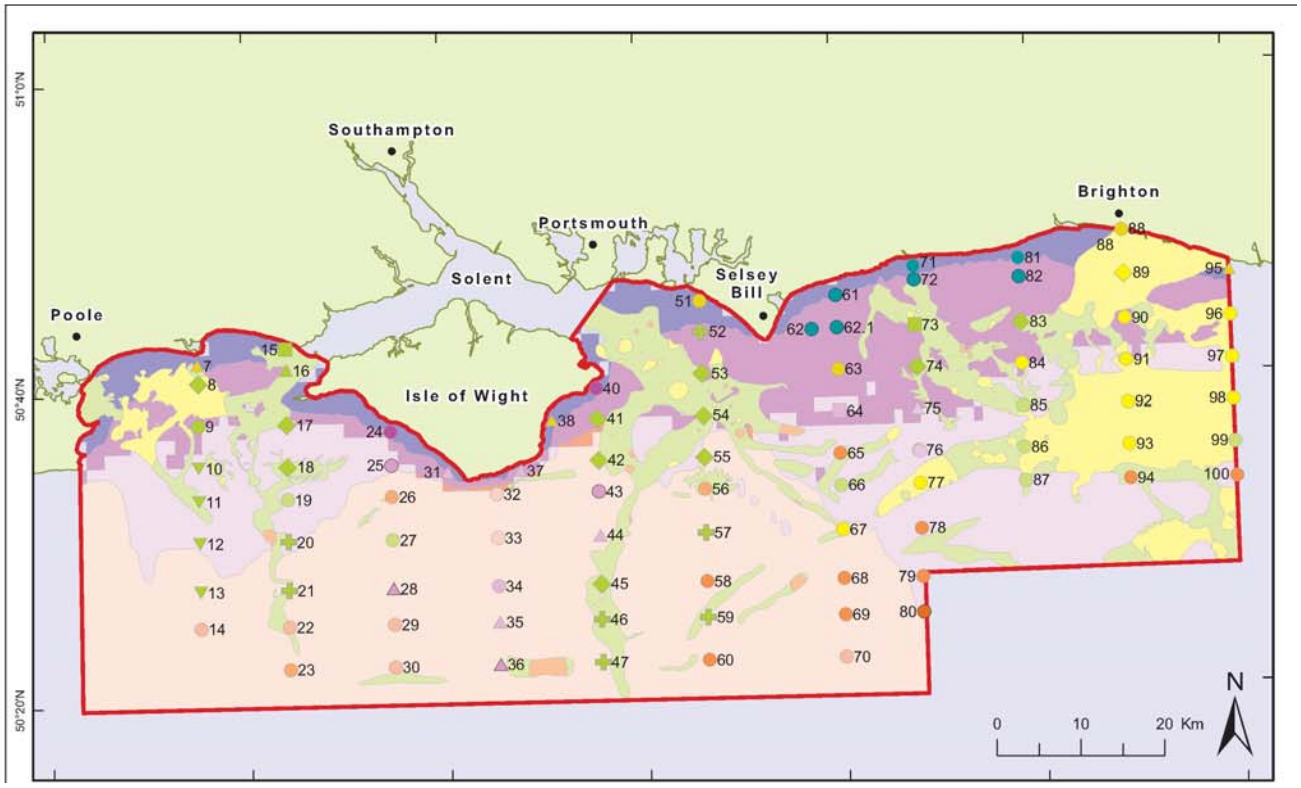


Figure 7.4: Modelled biotope map at EUNIS level 3 overlain with the assigned EUNIS biotopes at South Coast REC sample stations.



Talk to the scientist: why do we map the seafloor?

Stage 3: Recommendations

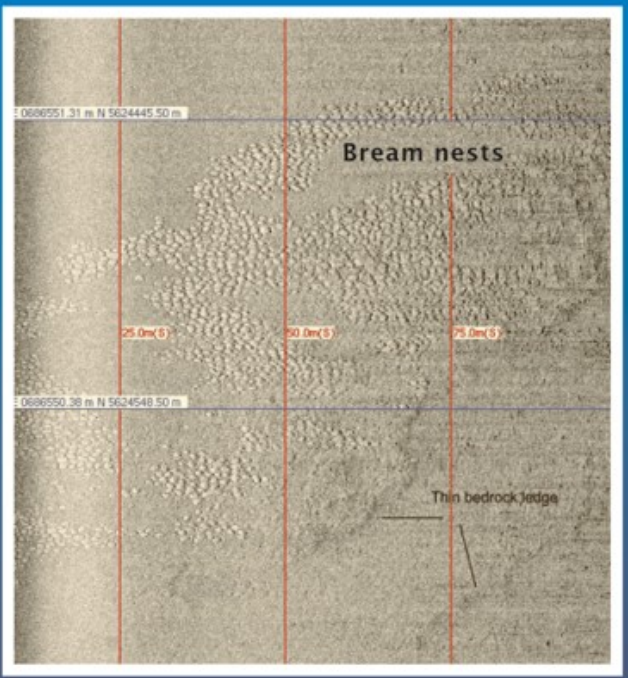
Feature of Special Interest: Black Bream Nests

Black Bream
(*Spondyliosoma cantharus*)

© Alex Holmes

Black Bream
(*Spondyliosoma cantharus*)

Sidescan geophysical data image



Can you see the Black Bream nests?
(*Spondyliosoma cantharus*)

You can find our more about Features of Special Interest on our Sustainability webpages

Discussion

- So how do we map the seafloor?
- Discuss some of the advantages and disadvantages of using these methods to collect information about the physical properties of the seafloor
  - Geophysical survey
  - Desk based assessment
  - Grab samples
- How can frequency affect the following acoustic survey techniques
  - Sidescan sonar
  - Multibeam bathymetry
  - Sub-bottom profiler
- Discuss why scientists mapped the seafloor?
- Do you think it is important that we protect our seafloor? Why?