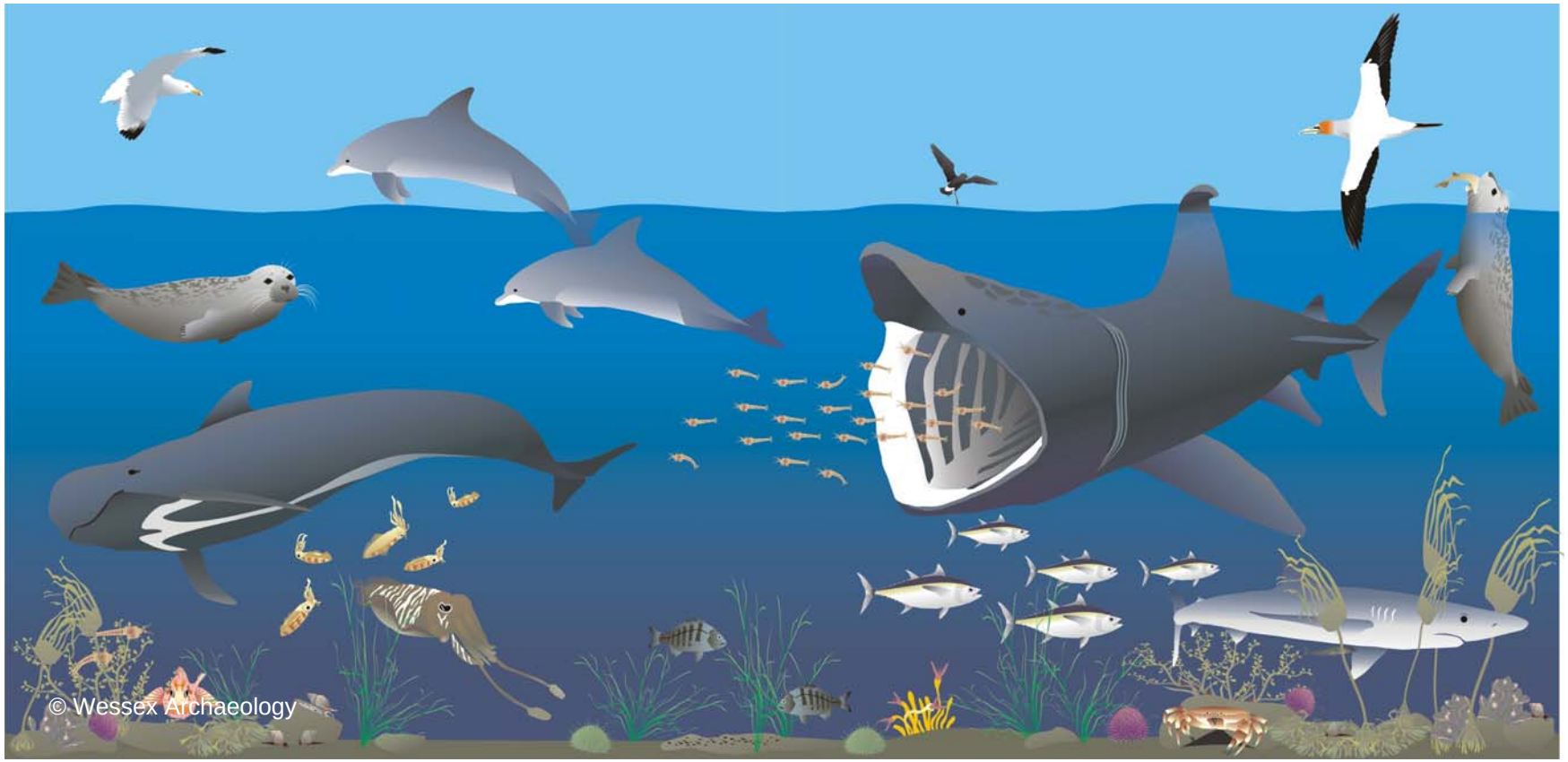
Case Study: What sea animals live on the seafloor?



Examining Regional Environmental Characterisation surveys (RECs)

Lesson

This case study provides a real life example of biology in the workplace. It examines marine ecological research, focusing mapping habitats at KS3 and KS4.

Using this lesson

Check out our website http://ets.wessexarch.co.uk/teachers/biology 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

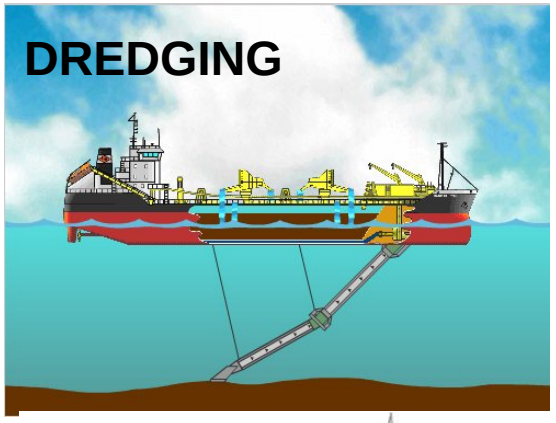
ACTIVITY

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.



E-game:

Be a Seafloor Explorer

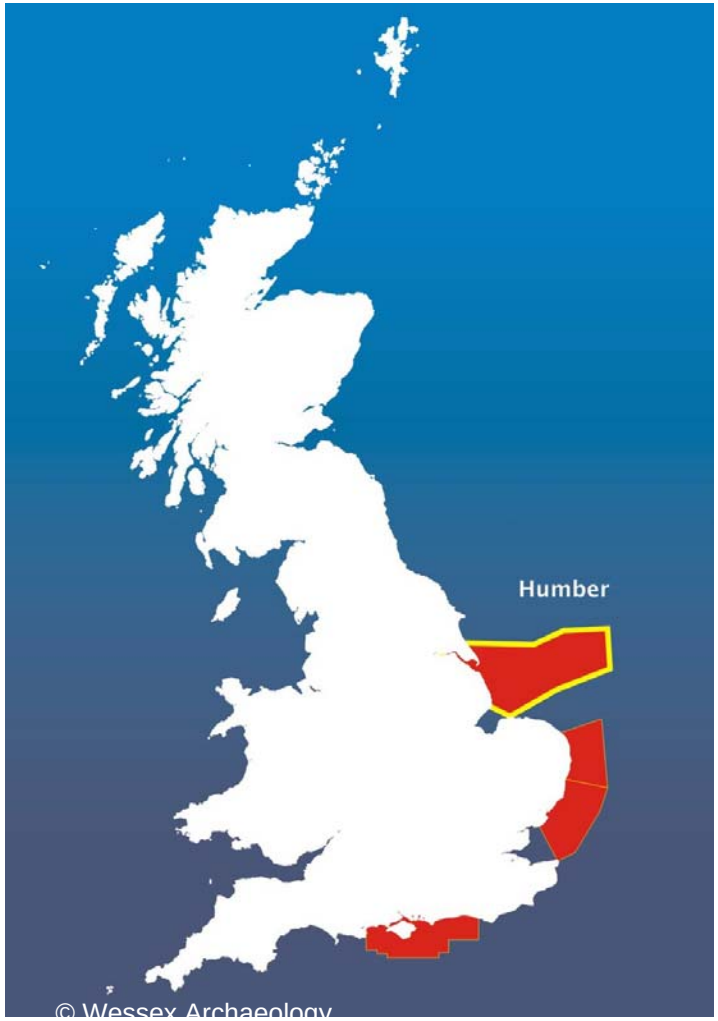
Main Objective

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)

Humber REC Ecology



This lesson focuses on the Humber REC study area and the ecology element of the scientific research.

Ecological aims of study

•To focus on understanding the marine environment in this area

•To create integrated maps of sea animals communities and their physical habitats

• To inform marine planning to use the sea sustainability and protect our marine wildlife

Size of study area: 11,000km^2

Date: 2008 - 2011

Talk to the Scientist: Marine Ecology

Background information

REC Methodology

There are four main stages to the ecology section of the Humber REC.

Stage 1	Collecting Data	•Desk Based Assessment •Fieldwork •Initial process of data
Stage 2	Results – using the data	•Modelling •Biotope maps
Stage 3	Recommendations	Highlighting what is special about the Humber REC study area

Stage 1: Collecting data

Desk Based Assessment

What is a DBA?

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

Explore Chapter 2 of the Humber REC Report

Information includes reviews of the following subjects

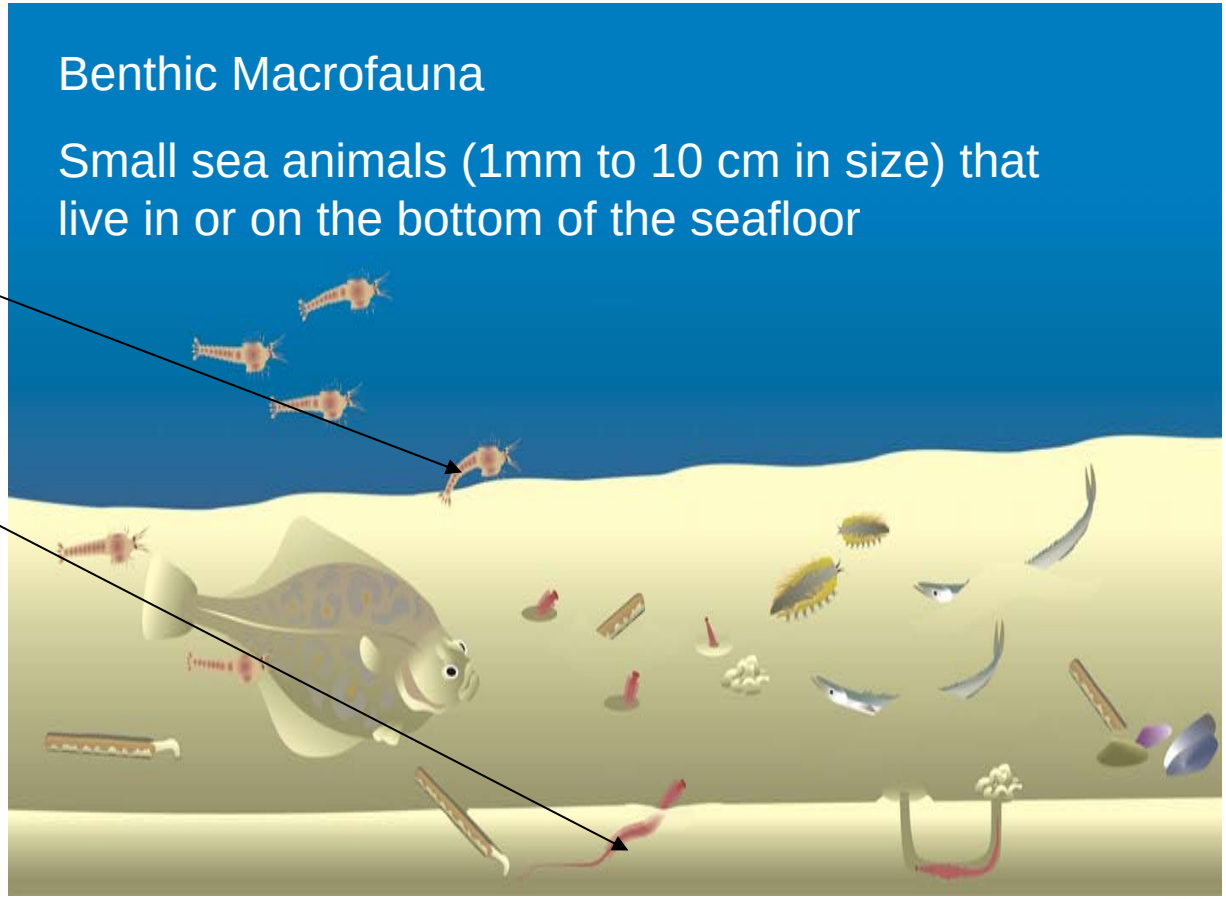
- Birds of special interest
- Cetaceans e.g. dolphins
- Pinnipeds e.g. seals
- Protected sites e.g. conservation areas
- Fishing industry
- Dredging industry

Fieldwork: Studying Benthic Macrofauna

Divided into two main groups:

Epifauna live on or just above seafloor

Infauna live buried in the seafloor sediments



Interactive:

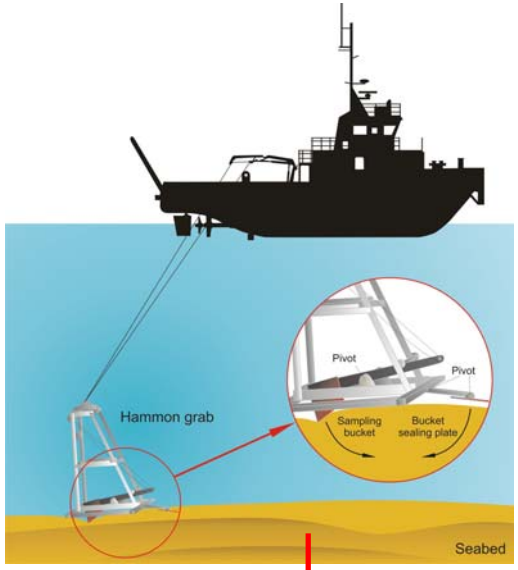
Infauna or Epifauna?

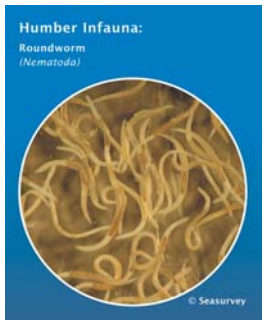
Talk to the Scientist:

Benthic macrofauna

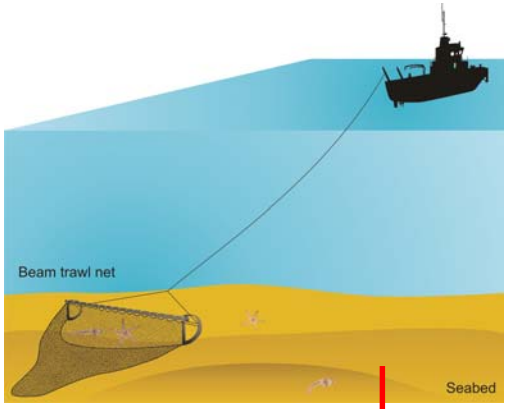
Ecology Sampling Techniques

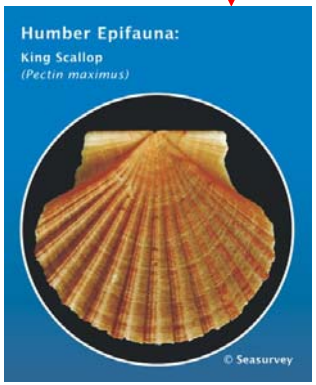
Hamon Grab





Beam Trawl





Talk to the Scientist:

Ecology Fieldwork

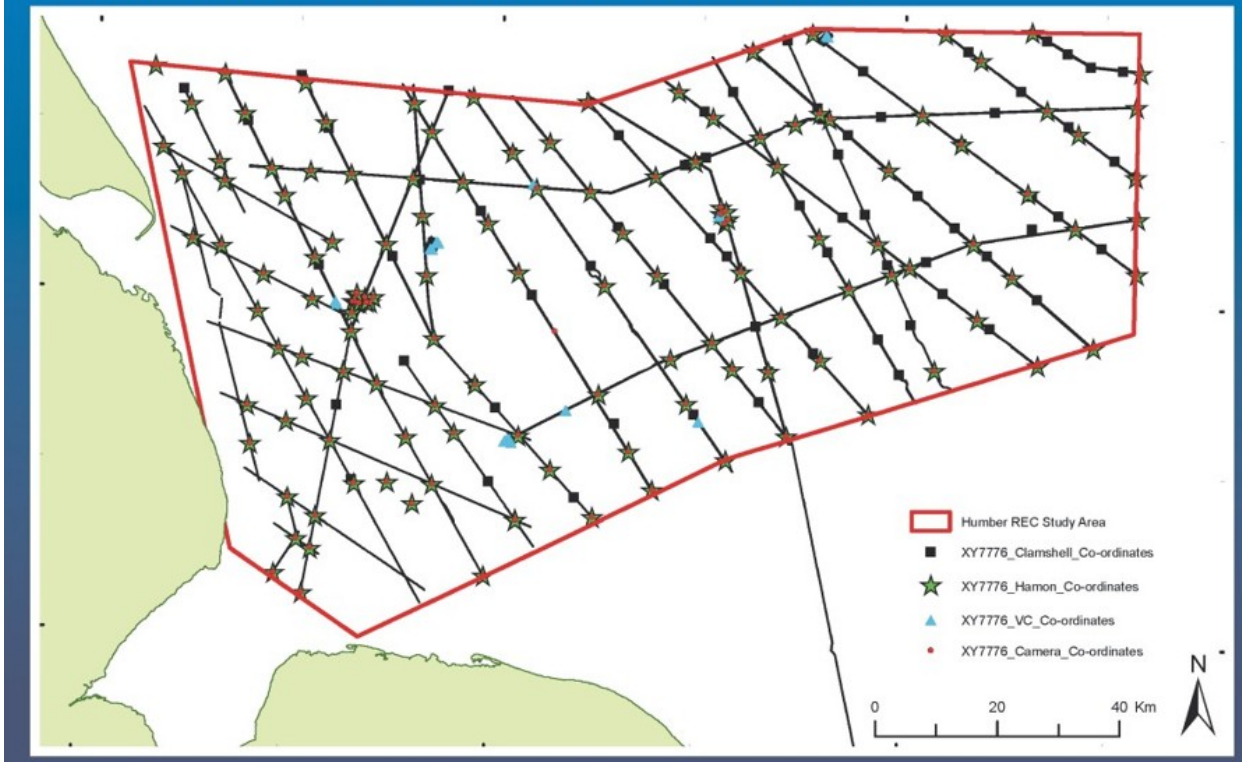
Underwater photography

Humber Ecology Samples

Ecologists take different types of samples by a variety of methods across the study area. These include:

- Hamon Grab
- Beam Trawl
- Video or Camera

This map shows the locations of both ecological and geological sample stations in the Humber study area. The stars show the Hamon Grab sample stations.



Will this sampling strategy provide representative data for the Humber REC study area?

Seafloor images

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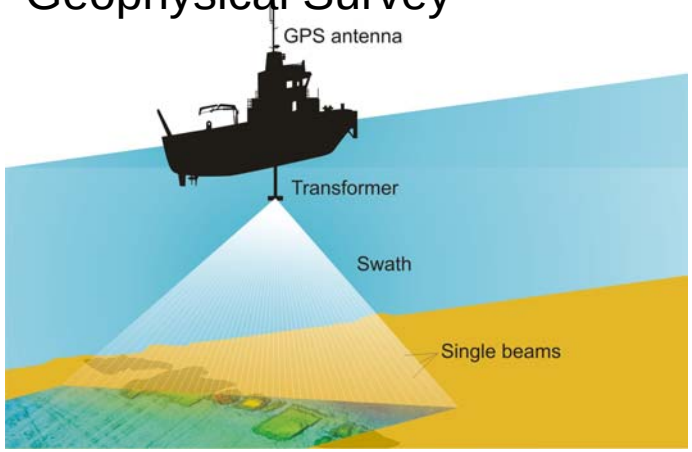
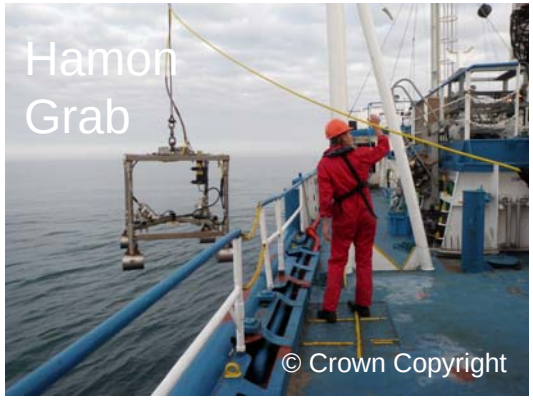
Geophysical Survey



On the boat: sorting samples

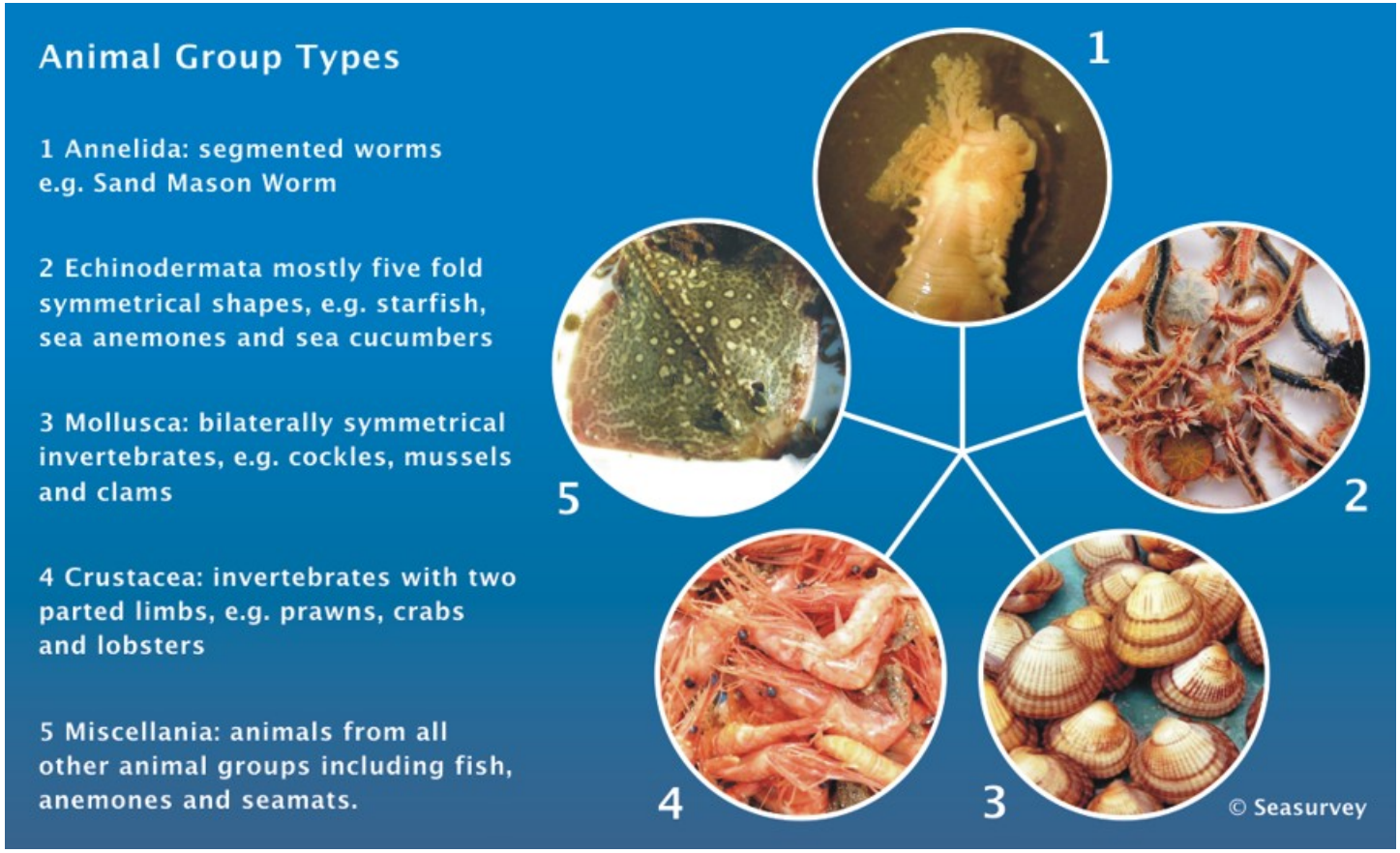


In the lab

Sorting by Phyla (Animal Type)

Interactive or Activity Sheet:

In the Lab



In the lab

Taxonomy – identifying species

Common Name:

Bristle worm

Latin name:

Ophelia borealis

Common Name:

Bee spinoid

Latin name:

Spiophanes bombyx

Initial results for Hamon Grab

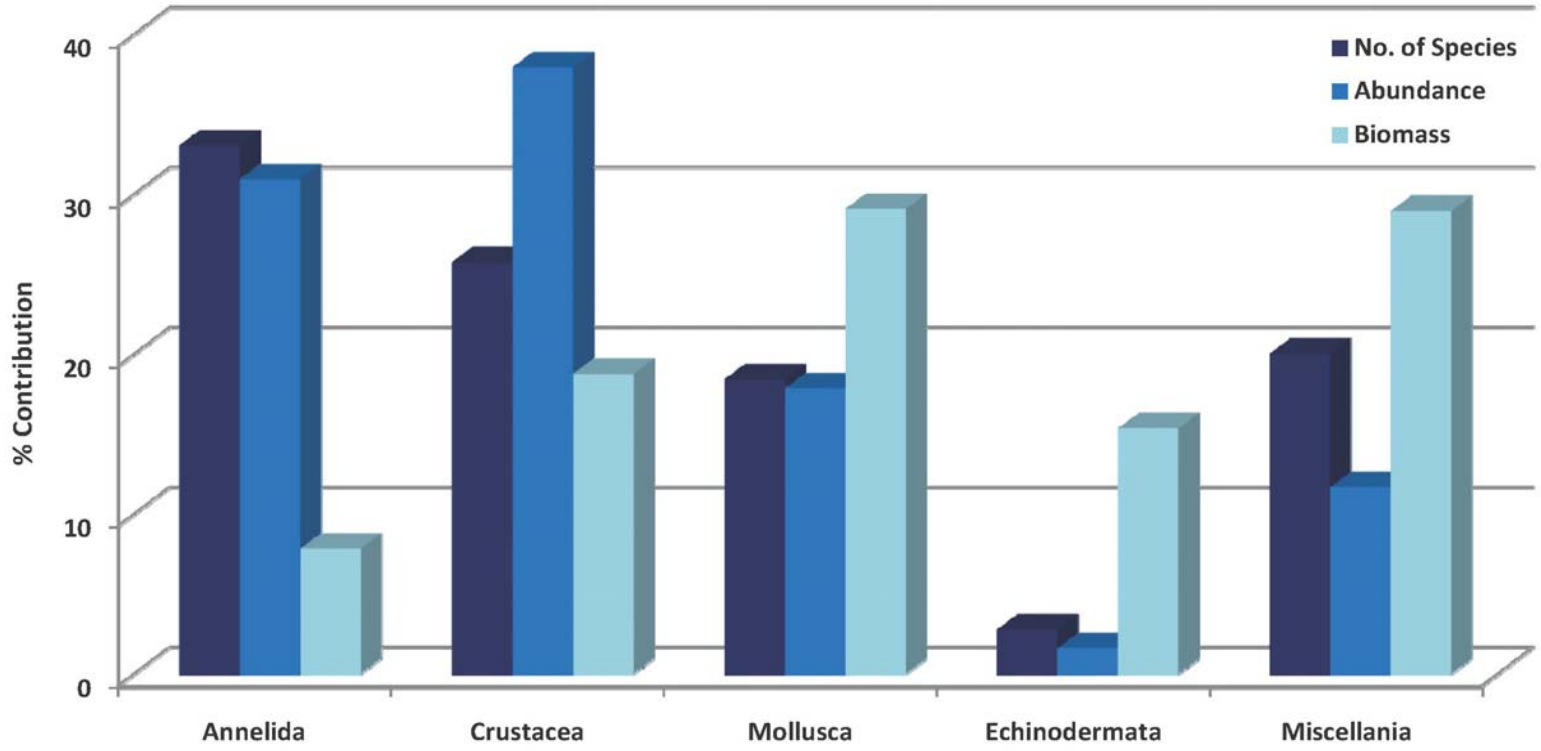
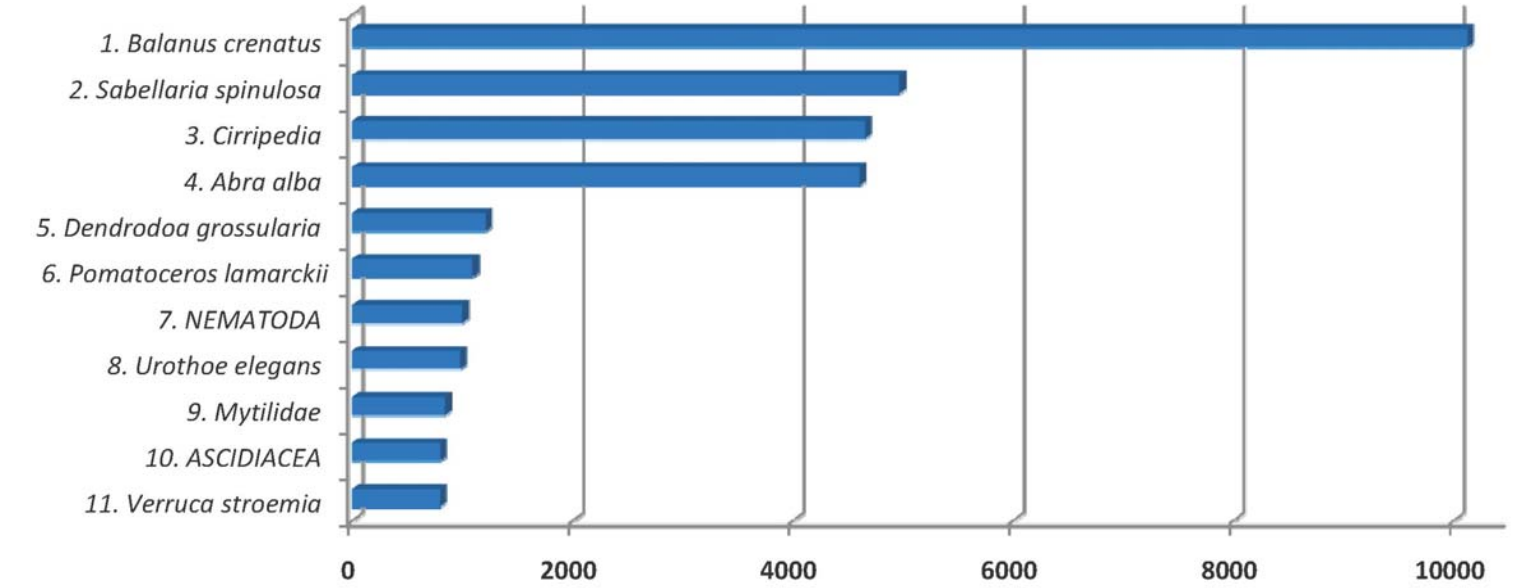


Figure 6.1.1: Relative contributions of major phyla to the number of benthic species (diversity), abundance and biomass (g AFDW) recorded from 0.1 m² Hamon grab samples taken across the Humber REC study area.

What does this graph tell us about the Hamon Grab samples?

Top ten species collected by the Hamon Grab



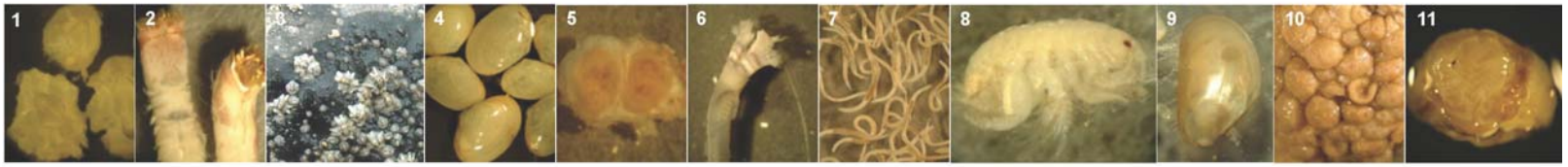


Figure 6.1.2: Total abundance across 135 samples of the eleven most abundant species recorded in 0.1 m² Hamon grab samples taken across the Humber REC area. Photographic images of these species are also shown.

Plotting these results

Plotting initial results on a map of the study area by

- Abundance (see image)
- Biodiversity
- Biomass

What does this map tell us about the diversity of Hamon Grab samples in the Humber REC?

What does this mean?

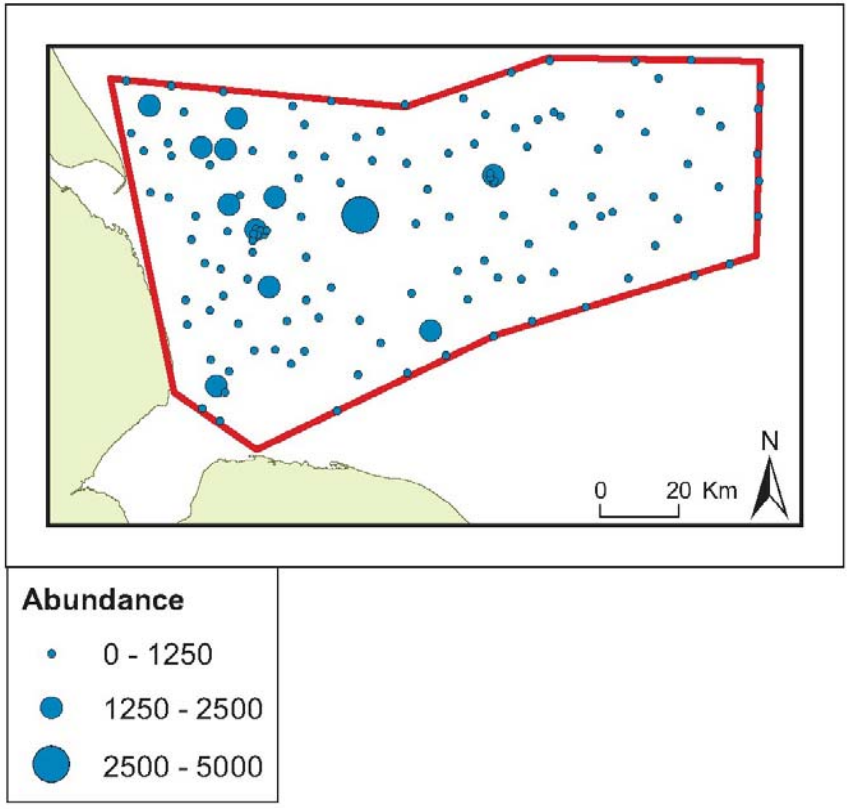


Figure 6.1.4: Total abundance of animals recorded per 0.1 m^2 Hamon Grab sample taken from within the Humber REC study area.

Initial results for Beam Trawl

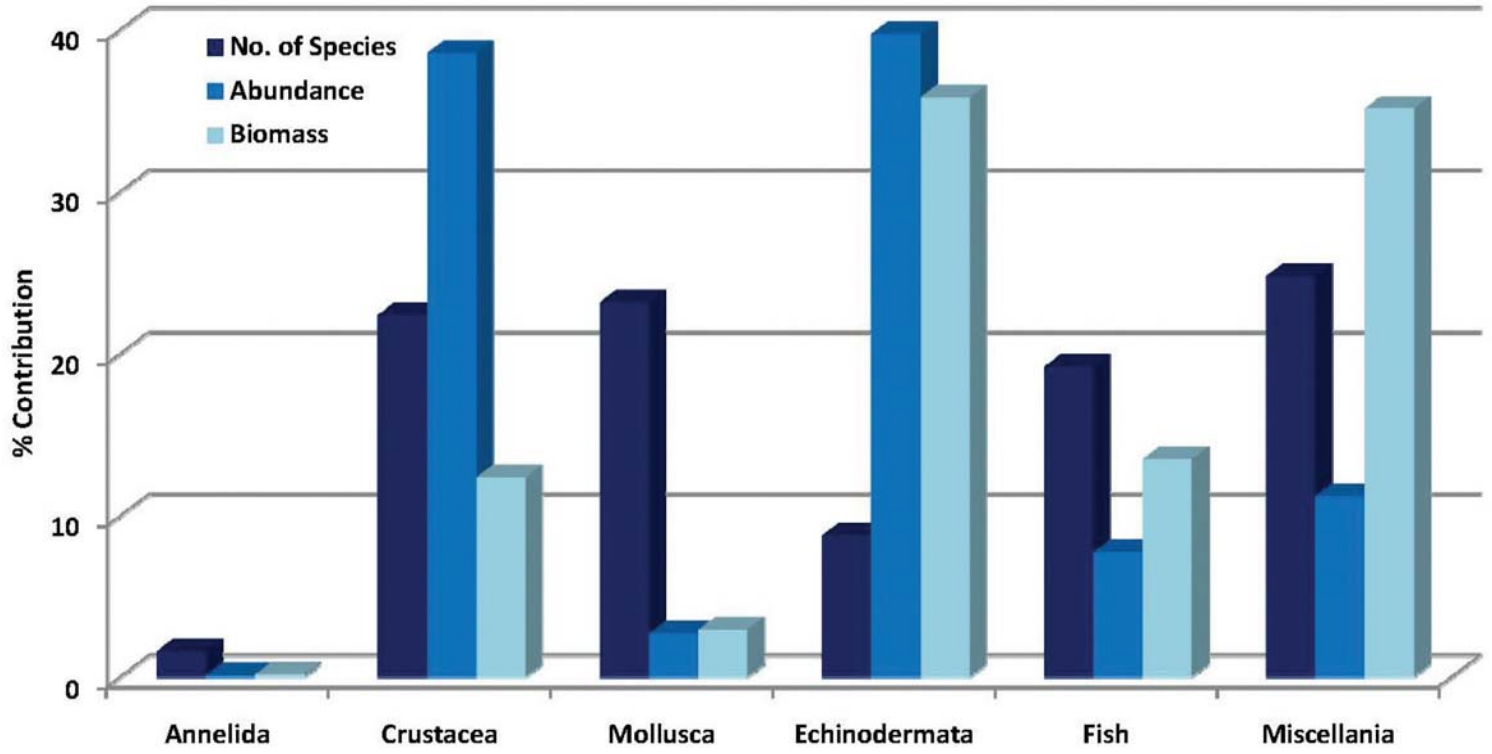


Figure 6.2.1: Relative contributions of major phyla to the number of benthic species (diversity), abundance and biomass (g Wet Weight) recorded from 2 m Beam trawl samples taken across the Humber REC area.

Top ten species collected by Beam Trawl

The common names of these species

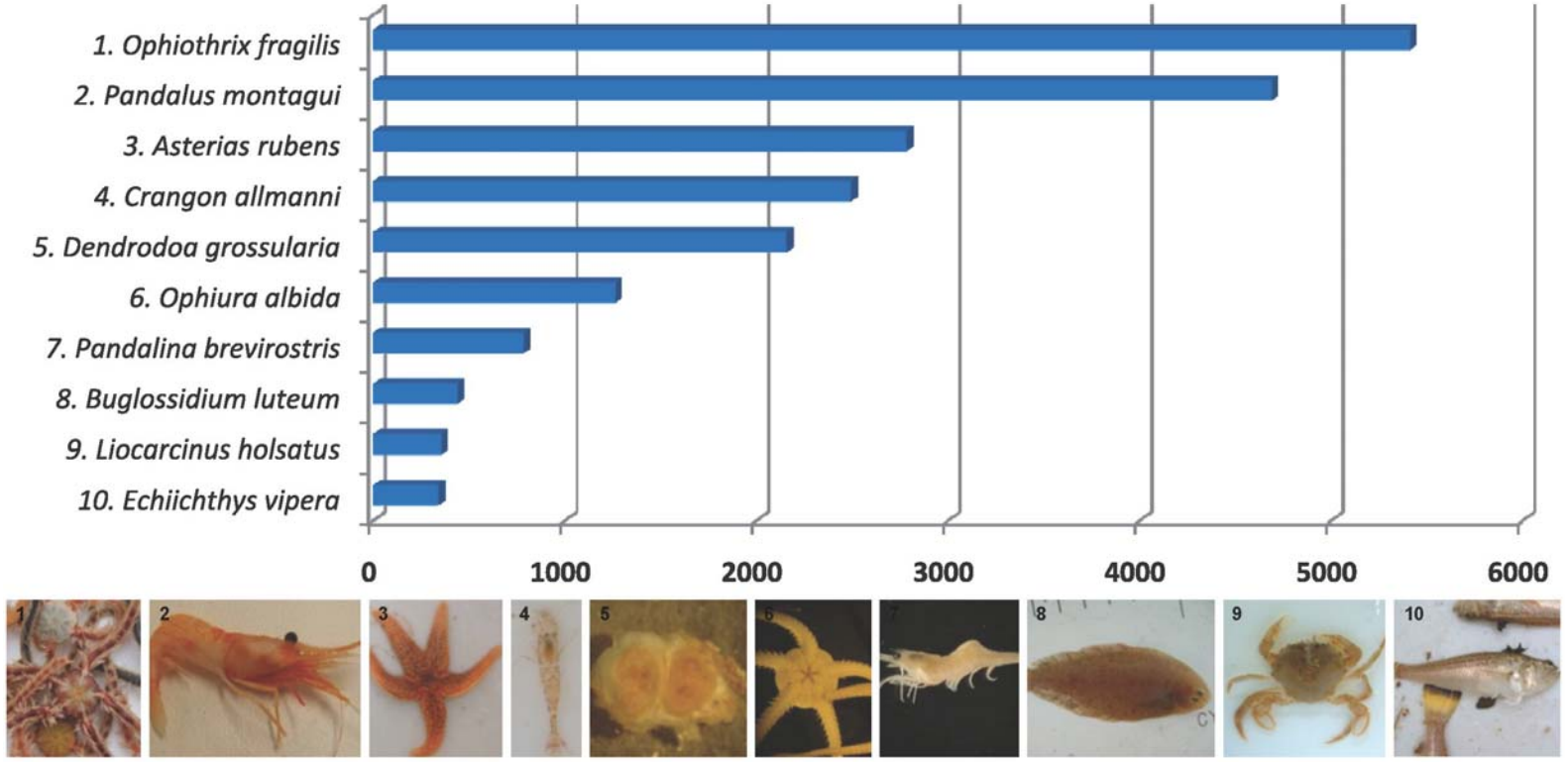


Figure 6.2.2: Total abundance across 30 samples of the ten most abundant species recorded in 2 m beam trawl samples taken across the Humber REC area. Photographic images of the top ten benthic species are also shown.

Working with Geologists

Geologists' work on the REC is vital for the ecologists.

Geology Methodology

- Samples of the seafloor
- Geophysical survey of the seafloor
- Photographs of the seafloor

Geology Results

- Create maps of what the seafloor looks like (morphology)
- Create maps of what the seafloor is made of

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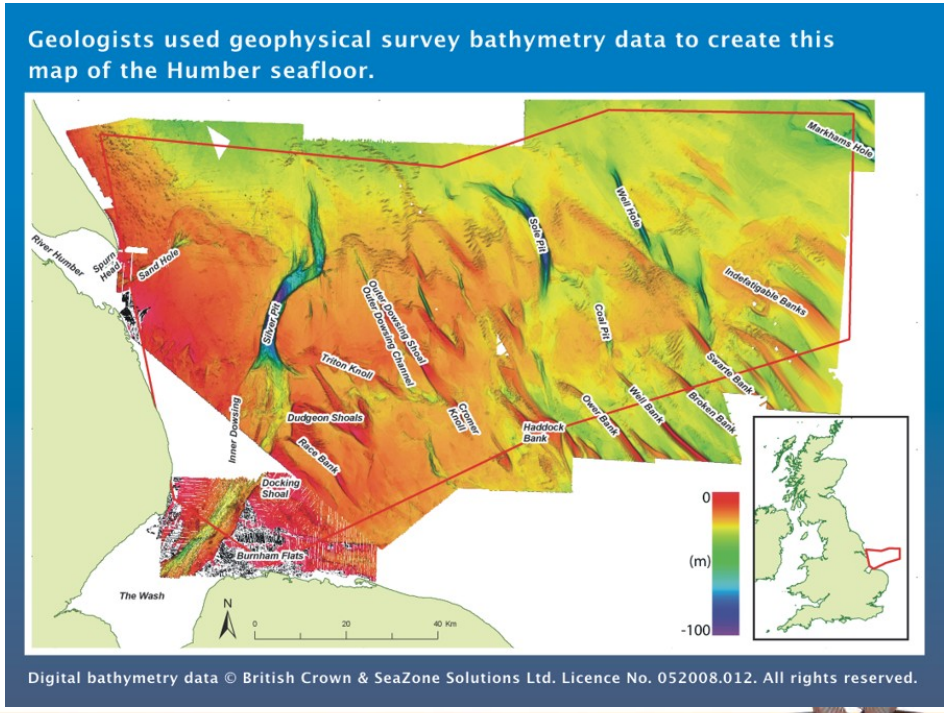
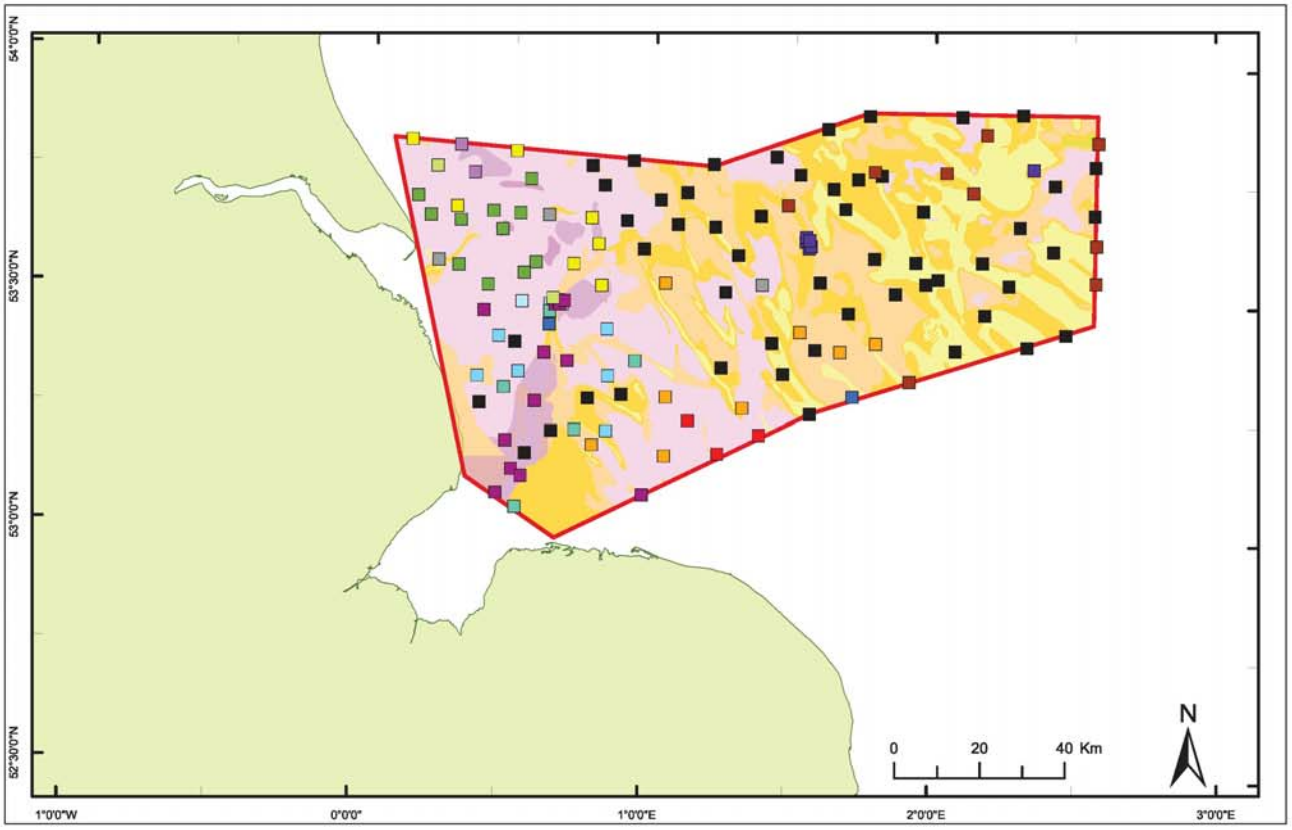


Initial results: sea animal habitats

Benthic Assemblages	Seabed Sediment
1	Sand S
2	Muddy sand mS
3	Slightly gravelly sand (g)S
4	Gravelly muddy sand gmS
5	Gravelly sand gS
6	Gravel G
7	Muddy sandy gravel msG
8	Sandy gravel sG
9	Humber REC Study Area
10	
11	
12	
13	
14	
15	

Figure 6.1.12: Distribution of benthic assemblages identified through multi-variate analysis of grab sample data (Figure 6.1.0–6.1.11). Sediment data from BGS Folk distribution.



What habitats do benthic assemblage 11 live in?

Stage 2: Results
Biotope descriptions

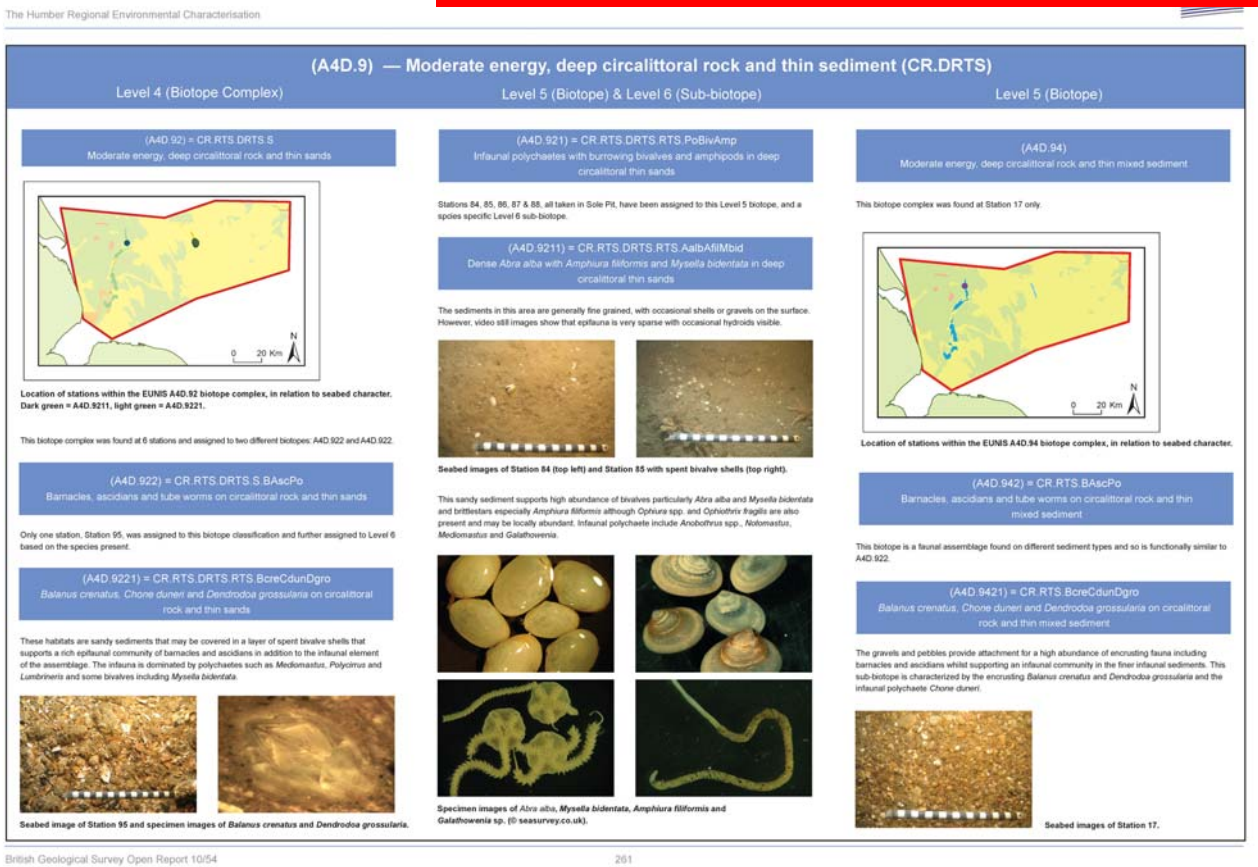
Talk to the Scientist: Biotopes

Biotopes:

A system of describing different habitats and sea animals communities.

A short biotope name = general description

A long biotope name = more detailed description


The Humber Regional Environmental Characterisation

(A4D.9) — Moderate energy, deep circalittoral rock and thin sediment (CR.DRTS)

Level 4 (Biotope Complex) | Level 5 (Biotope) & Level 6 (Sub-biotope) | Level 5 (Biotope)

(A4D.92) = CR.RTS.DRTS.S
Moderate energy, deep circalittoral rock and thin sands

Location of stations within the EUNIS A4D.92 biotope complex, in relation to seabed character. Dark green = A4D.9211, light green = A4D.9221.

This biotope complex was found at 6 stations and assigned to two different biotopes: A4D.922 and A4D.922.

(A4D.922) = CR.RTS.DRTS.S.BAscPo
Barnacles, ascidians and tube worms on circalittoral rock and thin sands

Only one station, Station 95, was assigned to this biotope classification and further assigned to Level 6 based on the species present.

(A4D.9221) = CR.RTS.DRTS.RTS.BcreCdunDgro
Balanus crenatus, *Chone duneri* and *Dendrodoa grossularia* on circalittoral rock and thin sands

These habitats are sandy sediments that may be covered in a layer of spent bivalve shells that supports a rich epifaunal community of barnacles and ascidians in addition to the infaunal element of the assemblage. The infauna is dominated by polychaetes such as *Mediomastus*, *Polycirrus* and *Lumbrineris* and some bivalves including *Mysella bidentata*.

Seabed image of Station 95 and specimen images of *Balanus crenatus* and *Dendrodoa grossularia*.

(A4D.921) = CR.RTS.DRTS.RTS.PoBivAmp
Infaunal polychaetes with burrowing bivalves and amphipods in deep circalittoral thin sands

Stations 84, 85, 86, 87 & 88, all taken in Sole Pit, have been assigned to this Level 5 biotope, and a spcies specific Level 6 sub-biotope.

(A4D.9211) = CR.RTS.DRTS.RTS.AalbAfilMbid
Dense *Abra alba* with *Amphiura filiformis* and *Mysella bidentata* in deep circalittoral thin sands

The sediments in this area are generally fine grained, with occasional shells or gravels on the surface. However, video still images show that epifauna is very sparse with occasional hydroids visible.

Seabed images of Station 84 (top left) and Station 85 with spent bivalve shells (top right).

This sandy sediment supports high abundance of bivalves particularly *Abra alba* and *Mysella bidentata* and brittlestars especially *Amphiura filiformis* although *Ophiura* spp. and *Ophiothrix fragilis* are also present and may be locally abundant. Infaunal polychaete include *Anobothrus* spp., *Notomastus*, *Mediomastus* and *Galathowenia*.

Specimen images of *Abra alba*, *Mysella bidentata*, *Amphiura filiformis* and *Galathowenia* sp. (© seasurvey.co.uk).

(A4D.94)
Moderate energy, deep circalittoral rock and thin mixed sediment

This biotope complex was found at Station 17 only.

Location of stations within the EUNIS A4D.94 biotope complex, in relation to seabed character.

(A4D.942) = CR.RTS.BAscPo
Barnacles, ascidians and tube worms on circalittoral rock and thin mixed sediment

This biotope is a faunal assemblage found on different sediment types and so is functionally similar to A4D.922.

(A4D.9421) = CR.RTS.BcreCdunDgro
Balanus crenatus, *Chone duneri* and *Dendrodoa grossularia* on circalittoral rock and thin mixed sediment

The gravels and pebbles provide attachment for a high abundance of encrusting fauna including barnacles and ascidians whilst supporting an infaunal community in the finer infaunal sediments. This sub-biotope is characterized by the encrusting *Balanus crenatus* and *Dendrodoa grossularia* and the infaunal polychaete *Chone duneri*.

Seabed images of Station 17.

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Description and locations of biotope called A4D.9211

Biotope Map

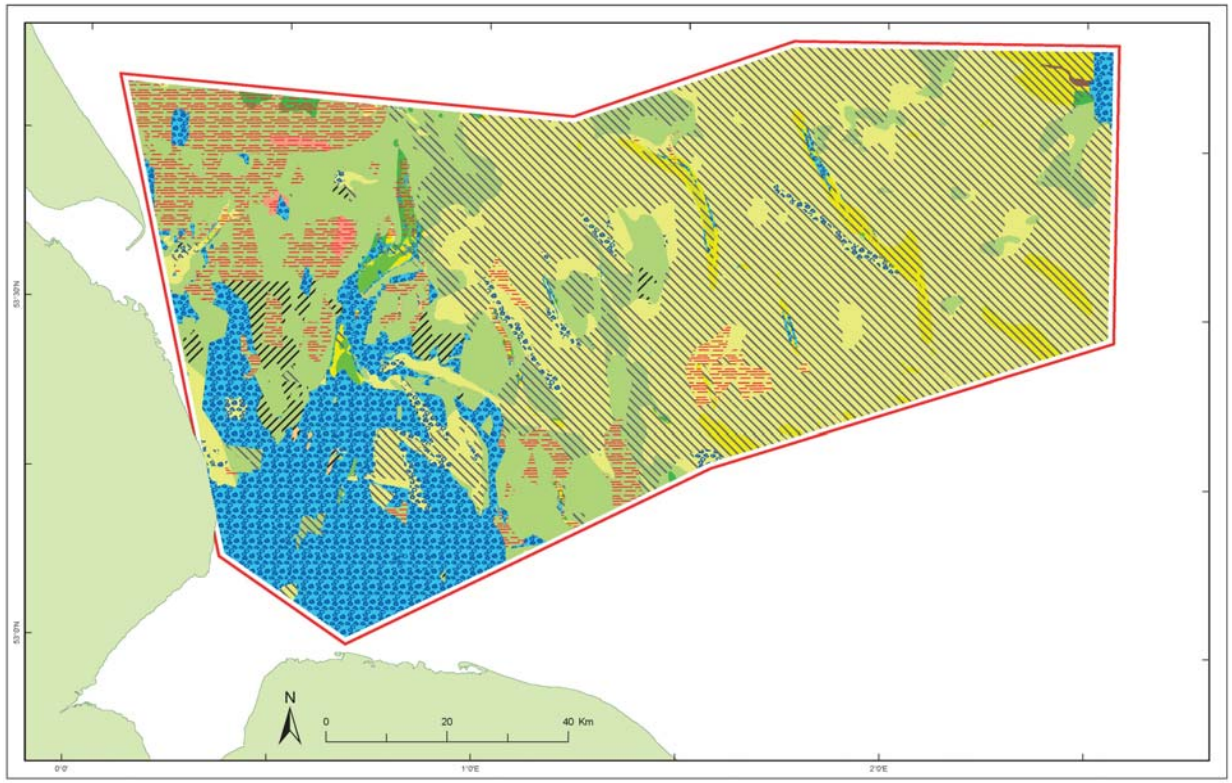


Figure 7.2.5: Map of the full coverage biotope model. This model combines modeled habitat (EUNIS Level 4—see Fig. 7.1.6) and modeled biology (RECHUMB model of functional biological groups—see Fig. 7.2.4) to give a map of predicted biotopes at EUNIS Level 5.

Legend

Can you locate Biotope A4D.921 on the map? What does it tell us about the extent and location of this biotope?

Stage 3: Recommendations

Features of Special Interest

For ecology:–

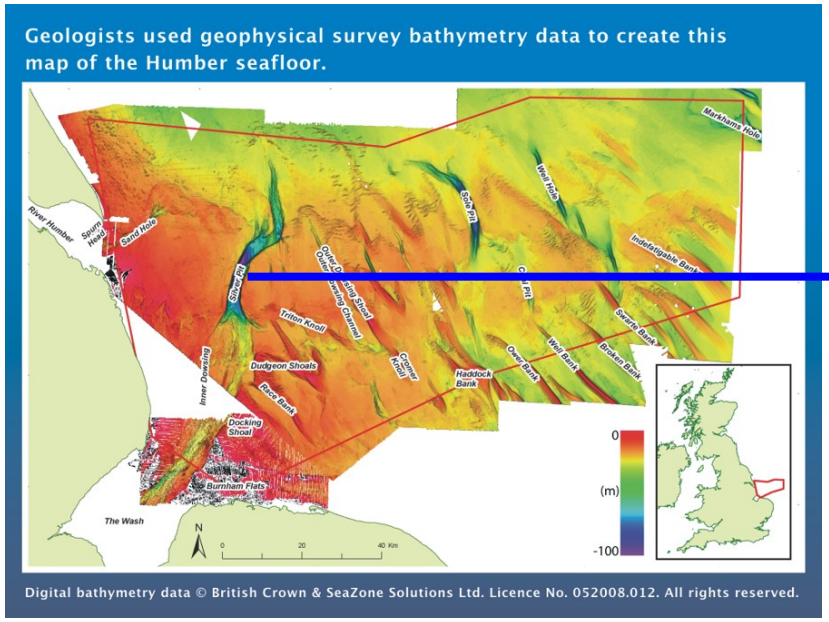
- Annex I habitats
- Rare
- Alien species found in the study area
- The Silver Pit

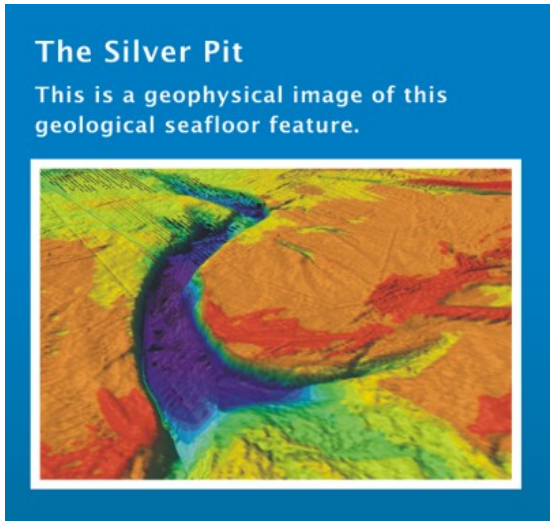
Talk to the Scientist:

Humber REC Results

[Explore the Seafloor Sustainability webpage]

Features of Special Interest
Silver Pit: a special habitat



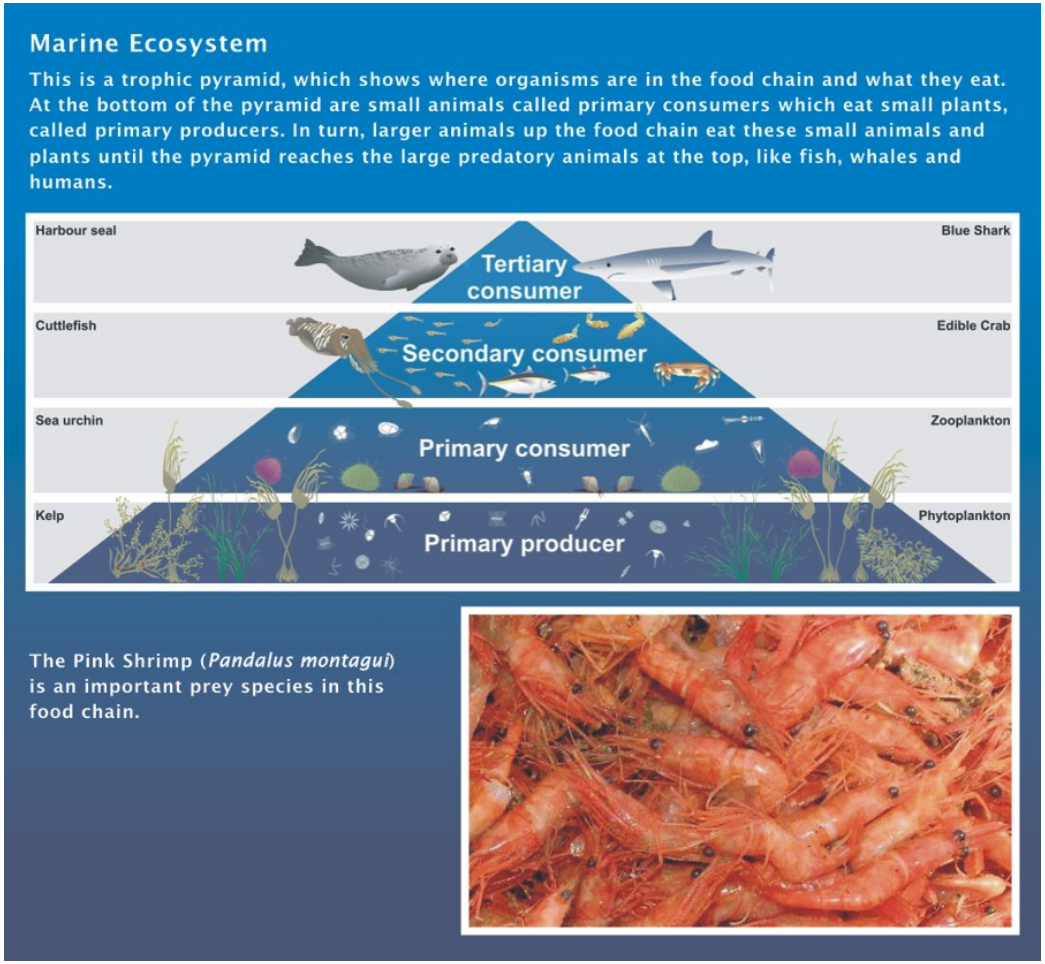


- A deep tunnel valley on the seafloor
- Over 50 kilometres long
- Deepest point 100m

Silver Pit: What is special about it?

- **High biodiversity**: the mud reefs built by Ross Worm provide homes for lots of different animals.
- **A secure home**: the deep valley means sea animals are protected from anthropogenic (human) activity.
- **A good food source:** it is a favourite habitat of Pink Shrimp, which are an important part of marine ecosystems.

Interactive: Food Chains



What lives in the Silver Pit?

- Ross Worms make reefs out of mud to live in (another Annex I habitat)
- Brittle starfish beds
- Blue Mussels
- Amphipod species

Discussion

Activity Sheet:

Case Study Review

- What animals live on the seafloor?
- Name the different methods the ecologists used to find out about sea animals and their habitats?
- What is a biotope map? How do you make one?
- How will the maps be useful in the future?
- Should we protect our marine life? Why?