Fieldwork ideas: Coastal systems and landscapes

This resource is part of the Fieldwork toolkit that supports our AS and A-level Geography specifications (7036, 7037).

Coastal investigation

All AS and A-level students are required to take part in fieldwork in relation to processes in both physical and human geography. At A-level, students are also required to complete an independent investigation which is the non-exam assessment (NEA) component of the specification. This investigation may be based on either human or physical aspects of geography or a combination of both. This resource has been designed to show how fieldwork and the independent investigation could be linked the study of Coastal systems and landscapes.

As the boundary between land and sea, coasts provide a variety of opportunities for first hand investigation. Coastal fieldwork investigations can take a variety of forms. They may focus on processes and landforms of erosion, studying cliff features, wave cut platforms, stacks and caves. Others may look at processes of transport and deposition, recording the effects of longshore drift, and landforms such as beaches, spits, and bars. Application studies look at the human dimension of coasts. Coastal management investigations may focus on the costs and benefits of different strategies. The use and value of the land may prompt investigations into the economic, social or environmental impacts of development.

Link to the specification

"Sources of energy in coastal environments: winds, waves (constructive and destructive).

Geomorphological processes: weathering, mass movement, erosion, transportation and deposition.

Origin and development of landforms and landscapes of coastal erosion: cliffs and wave cut platforms, cliff profile features including caves, arches and stacks; factors and processes in their development.

Origin and development of landforms and landscapes of coastal deposition. Beaches, simple and compound spits, tombolos, offshore bars, barrier beaches and islands and sand dunes; factors and processes in their development.

Human intervention in coastal landscapes. Traditional approaches to coastal flood and erosion risk: hard and soft engineering. Sustainable approaches, shoreline management/integrated coastal zone management."

Investigation ideas

- How and why do cliff profiles vary between different locations?
- What differences are there in the shore above the high water mark and below it?
- To what extent does coastal orientation and geology influence landforms at two locations?
- How does wave energy vary in different seasons/during the passage of a storm?
- What factors affect surfing conditions in different areas?
- How do beach profiles vary between two places?
- How does sediment change up and along a beach?
- What has been the impact of the building of groynes/breakwater?
- How and why do coastal management strategies vary?
- What factors affect the development of a spit?
- How effective are the hard engineering and sustainable coastal management approaches at two contrasting stretches of coast?

Possible hypotheses

- Geology is an important factor in determining cliff height, shape, profile and gradient.
- Weather conditions and beach aspect influence variations in wave characteristics.
- Cliff profiles decrease in gradient with distance from headlands.
- Beach material will become smaller and rounder in the direction of longshore drift.
- Beach profiles vary in profile with larger material found at the backshore.
- Beach material is sorted along as well as up the beach.
- Longshore drift is an active/ongoing process.
- Groynes have no impact on beach profile or beach material.
- Coastal management strategies at X are successful in preventing erosion.

Possible methods

- Cliff profiles, using clinometer and tape to work out height.
- Measurement of dimensions of caves, arches, stacks, wave cut platforms, using clinometer and tape.
- Recording geological features: rock type and structure, resistance, direction of rocks, lithology, dip, presence of bedding planes and faults.
- Beach sediment measurement, eg size and shape using a meter rule or callipers, Cailleux Roundness Index and Powers' scale of roundness.
- Beach profile, eg a transect along the beach from sea level to the coastline (backshore/berm sea wall/dunes) to show the changing gradient and/ or transects at intervals along the beach.
- Measurement of thickness of beach sediment along the profile.
- Quadrat analysis of beach material along a transect(s) or line/systematic sampling.
- Wave types, ie constructive or destructive. Wave measurements-height, frequency, swash time, wavelength. Prevailing wind direction.
- Wave approach information using a compass or Google earth/aerial photos which will show the predominant wave direction.
- Longshore drift evidence, eg surface load information using painted corks.
- Groyne measurements, eg vertical height to the top of the groyne from the sand/pebbles on both the updrift and downdrift sides of the groyne.
- Field sketches and photos that can be labelled and annotated, eg coastal features, eg beaches, pictures of differing pebble sizes and shapes from different locations on the beach, the effect of groynes.
- Geological identification of pebbles to show source area.
- Mapping the existing coastal defences and assessing the effectiveness (possibly done by an index).
- Visual/environmental impact assessment of both the threat created by erosion and the approaches to coastal management.
- Questionnaire surveys to investigate resident/stakeholder perceptions of coastal erosion and/or the management of erosion.
- A land use survey of a coastal community at risk because of coastal retreat.

Sample investigation: coastal management schemes

Hypothesis: Coastal management schemes at X have environmental and economic impacts.

Breakwaters and large groynes are used to help retain beach material, and protect vulnerable cliffs. This type of interference with coastal systems can cause longer term problems downdrift (social, economic and environmental).

Data Collection

Equipment

- Tape measure
- Clinometer
- Compass
- Float

Methods

- Map location of sea defences, do simple measurements, eg of sea walls and groynes, later drawn to scale.
- Annotated field sketches of hard engineering coastal defences. Take photographs of schemes. Take photos to show scouring beyond groynes and other defences.
- Beach profiles at either end of beach.
- Measure wave frequency, height, type of wave.
- Measure sand height either side of groynes to relate to longshore drift.
- Make observations of the current situation along the coast-describe and sketch former and perhaps continued erosion, slumping, cracks in cliffs, rill patterns in the cliff face, undercutting by wave action etc.
- Mapping/short transect to show land uses and human activities.
- Measure speed and direction of longshore drift using float method or painted stones.
- Questionnaire surveys to establish perceived reasons for management. Interviews with tourists, locals, business owners about future risks, challenges and solutions.
- Perception surveys/environmental quality surveys/index of visual quality to assess attractiveness and effectiveness of coastal defences or recreational impact at visitor sites.

- Include secondary data, eg the use of old photographs and maps to compare past and present coastline positions, the use of local authority websites, Natural England, wildlife group sites.

Encouraging independence during the planning and data collection phase (A-level)

It is important to allow candidates to have the opportunity to demonstrate their independence in the following areas:

- planning the enquiry/posing enquiry questions and devising hypotheses
- selecting and implementing data collection techniques.

Presentation of data and statistical analysis

- Annotated maps, sketches and photographs of different defence methods/designs, effects of scouring beyond last groyne.
- Located graphs to show variations in wave frequency and height.
- Tables and bar graphs to show the depth of sand/rocks on the updrift and downdrift sides of a groyne. These could be overlaid onto beach profiles to produce more complex techniques.
- Pie charts to show the size/shape of material in the quadrats along transects.
- Compass rose to show the direction of wave approach.
- Located proportional flows to show longshore drift rates.
- Land use map.
- Draw annotated beach profiles for both ends of the beach to scale.
- Calculate the index of visual quality (mean EQS scores) at various sites.
- Superimpose old photographs and maps on to present day to compare coastal position and shape.
- Tabulated results of questionnaire, with accompanying graphs to summarise data.

Analysis

What is the evidence for longshore drift and erosion along this coast? How does this affect beach profiles and sediment size? What are the benefits and costs of coastal management strategies? How does land use affect the strategies used? What have been the economic, environmental and social impacts of the strategies? Do the costs outweigh the benefits? What are people's attitudes to the defence strategy used? The effects of groynes and other sea defences may have brought security to many residents, but they may have damaged the environment in the longer term.

Possible limitations

Any evaluation will have to consider whether data collected over a short period is secure enough to make decisions on. Summer beaches and waves do not look or behave like those in winter or in stormy conditions. Longshore drift techniques are not very reliable. Secondary, even historical data will show how the defences evolved over time.

Much of the investigation is qualitative so there may be concerns over the subjectivity of some of the data.

Extending the study

Consider comparing the effectiveness of hard and soft engineering strategies in two contrasting areas.

Investigate the advantages and disadvantages of the scheme(s) for different groups of people.

What has been the overall impact of the scheme over adjacent areas of coast? Has it been cost effective? Summarise with a cost benefit analysis.

Sources of secondary data

- Research information from the local council engineering departments regarding the costs of coastal management schemes, and the predicted lifetime of the engineering works. Find out current planning restrictions for the coastal zone.
- Use evidence from local histories, old maps, old newspapers and photographs to determine how the coast used to look.
- RGS section on coastal fieldwork techniques, limitations and data presentation techniques: rgs.org/OurWork/Schools/Fieldwork+and+local+learning/Fieldwork+techniques/Coasts.htm
- Background information to coasts, fieldwork techniques and analysis geography-fieldwork.org/coast/coastal-processes/2-fieldwork.aspx
- Maps and air photos using a postcode search bing.com/maps/
- Photos of every OS grid square geograph.org.uk/
- Shoreline Management Plans (SMPs) environment-agency.gov.uk/research/planning/104939.aspx