

ASSESSING THE CONSERVATION VALUE OF GEOLOGICAL SITES IN THE MARINE ENVIRONMENT: Numerical Assessment of Candidate Sites

Contract Number: F90-01-665

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Prepared for the Joint Nature Conservation Committee
by the Centre for Applied Oceanography, School of Ocean Sciences,
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May 2004



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Section A: Overview

Report A1 Initial Observations

The generation of a preliminary list of prospective offshore candidate sites within the pilot study area has proved to be difficult; this is primarily attributable to both a deficiency with respect to original data and also the availability of existing data. During the compilation of the report it has become clear that a more significant volume of data is available in relation to coastal sites as opposed to those located further offshore.

Data procurement via the BGS is ongoing and will be submitted at a later date as an addendum to this report. The initial list of prospective candidate sites has, as a consequence, been restricted and comprises 49 possible locations. Of these, 15 are existing coastal geomorphology Geological Conservation Review (GCR) sites which have been assessed in order to justify possible extensions into the marine environment. The majority of the remaining 34 sites have been identified by sources within the School of Ocean Sciences, University of Wales, Bangor and from sites listed within the British Geological Survey's Offshore Regional Reports relating to the geology of the Irish Sea and Cardigan Bay. It is, however, considered highly likely that many more additional and smaller prospective sites exist within the pilot study area but have as yet either to be identified or the data related to them is restricted in terms of its distribution or availability.

During the initial phase of the numerical assessment, when reviewing the status of the existing coastal GCR sites, it became clear that additional criteria needed to be considered in order to more accurately assess the possible justification of boundary extension. When assessing the scientific criteria it became evident that all existing coastal GCR sites, together with their prospective extension zones, consistently produced high scores; however, it was considered that any possible justification for an extension into the marine environment would also need to account for a site's 'dependence' upon its immediately adjacent marine environment. This dependence would primarily relate to contemporary processes, for example sediment supply and erosion, which would not/could not necessarily apply to the offshore sites. It was considered that these active processes probably needed to be considered and quantified within the threat criteria section for existing GCR's only, and as a consequence, a 'Correction' factor has

subsequently been introduced (Figure A1.1). The introduction of a correction factor related to a coastal sites inter-dependence upon its adjacent marine environment and its assessed threat value has introduced a 'corrected threat factor' which often enhances the initially evaluated threat factor.

During the initial search, review and assessment of the potential sites, it became clear that most sites have as yet to be either formally identified, named or even assigned technically appropriate scientific descriptions. For the purposes of this report reference numbers have been assigned to the sites assessed.

It is considered that the existing coastal geomorphology GCR sites have been comprehensively reviewed within the preceding report 'The Conservation of Nationally Important Marine Geoscience Sites: a feasibility study. Part 1: Reports A1 to A6. Contract Number F90-01-600. As a consequence, reports have not been produced in relation to these candidate sites; however, numerical assessments incorporating the corrected threat factor have been carried out.

The marine thematic block assigned to an individual site has, in some cases, not been entirely clear. For example, in the case of the roches moutonnées, rock pinnacles, sea mounds and submarine canyons; the features primarily fall within the category related to the Quaternary, as glacial/postglacial processes have resulted in their formation or appearance. It must, however, be noted that other thematic blocks relating to solid geology could also be utilized in these cases.

Tables have been produced for both the offshore sites and coastal GCR's in an attempt both to illustrate and highlight potentially more important sites which may warrant conservation or extension within the marine environment. The tables have been constructed using scores produced via the scientific criteria section. In cases where equal values for the aforementioned criteria have been produced, a secondary driving mechanism related to the site's potential threat criteria has been implemented. For the purposes of this report, lower potential threat values are deemed to accentuate a site's position in relation to the site's importance and its potential conservability.

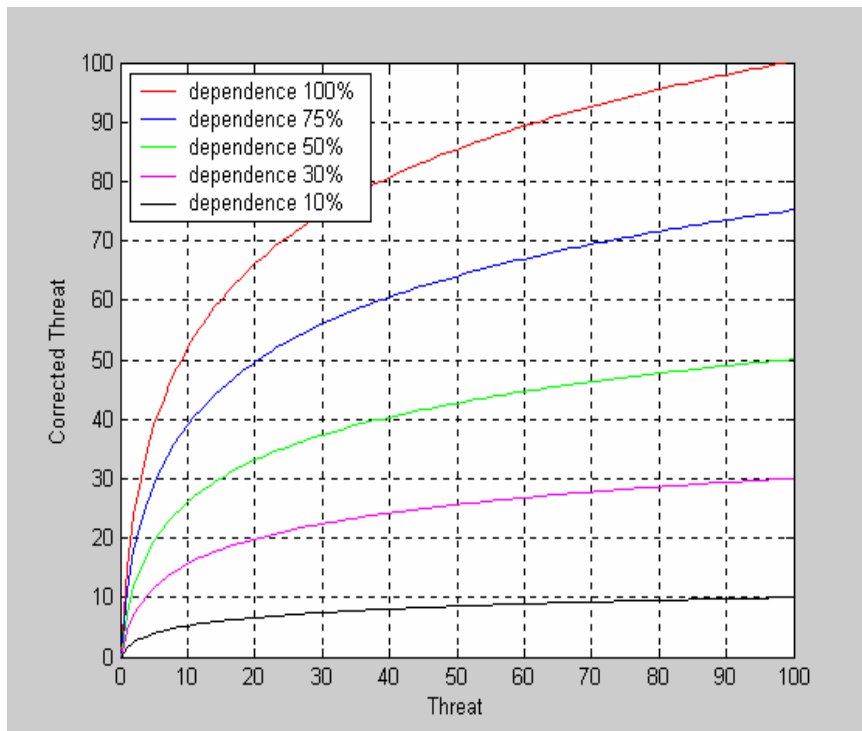


Figure A1.1 Interdependence Correction Factor for Coastal GCR's

The top scoring offshore site was assigned potential geotope status, whilst the second placed site was defined as potentially three separate 1st order sites nested within larger second order conservation zones. The majority of the other assessed sites were defined as prospective 1st order Marine Earth-science Conservation Areas (MECA's).

The table produced in relation to the coastal sites seemed consistent with the initial assessment conducted within the feasibility report in that it highlighted many of the sites that would possibly benefit from an extension into the sub-tidal environment. These include the sites of Ainsdale, Ynyslas, Newborough and Morfa Dinlle.

No attempt was made to define an accurate boundary with regard to any potential site's exact location and lateral extent. This was largely due to the lack of available data with respect to the majority of sites subjected to numerical evaluation. For the top scoring sites warranting potential conservation, a much more detailed study would be required in order to accurately define and delineate their exact lateral extension within the marine environment.

Report A2 Scientific Criteria

The scientific criteria assessment section produced a large range of values associated with the assessed sites, the lowest value being 23 and the greatest value being 80. There did, however, appear to be an element of ambiguity within the central region of the table and some future adjustments with respect to the weighting of the individual criteria may be required.

The scientific values assigned to each site are effectively estimates based on the available data, although it is considered that more accurate values, given a larger volume of data, would not greatly alter the current overall ratings. Additional data may, however, alter individual scores related to some sites within the central region of the table and this may influence which sites may or may not be considered worthy of conservation. This will depend on the threshold at which potential selection is based.

Report A3 Threat Criteria

The weighting given to individual threat criteria may require consideration; for example, under the present system, a very real and important threat to an individual site could at best carry a value of 5%. All assigned threat values are either low or very low, and it is not entirely clear if this is a true reflection of the real threat.

It is unclear as to whether an effective distinction can be made within such a short range of threat values, for example; with two sites scoring values of 8 and 10 respectively, a distinction cannot be made when the errors in assessing the values assigned to individual criteria are potentially significant given the lack of available data.

The potential threat values should in reality take into account not only contemporary factors but also potential future threats. With respect to dredging, structures, aggregate extraction etc, if a situation changes in a few years then a threat that does not currently exist may well become a real factor. Although it is understood that it would be difficult to predict long-term changes in, for example, the requirements of industry and changes in marine environmental policy, some consideration with respect to these potential threats should be taken into account.

It is considered that some of the potential threat factors and their attributes have not been fully taken into consideration; for example, some potential threats could have an effect upon natural processes which in turn have not been assessed, and these processes could subsequently have an impact upon the system.

Report A4 Integrity and Conservability Criteria

The combination of the individual values has produced a figure that does not appear to produce any pattern with respect to the need to conserve potentially important sites. Very high and high values can be found both at the top and bottom of the final league table. Similar scatter has been observed with respect to moderate values. All low-moderate values have, however, been found toward the base of the table.

Report A5 Confidence Criteria

With respect to the confidence values, it has been considered that values associated with each assessed section be kept separate, rather than combining each individual confidence section in order to produce an overall confidence value. This has been undertaken as it was considered that a low confidence factor in association with a lack of data for scientific criteria could be negated by more easily assessed high confidence values associated with both threat and integrity criteria. It has also been noted that confidence was almost always higher within the integrity section than within the scientific section.

Report A6 General Comments

Offshore pingo sites apparently do not exist (C. James, pers. com. 2004) and as a result were omitted from the final assessment.

Some of the sites were not defined as offshore, for example; storm beach, submerged forest and concretions. These, therefore, did not exactly fall within the remit.

It is possible that buried features, for example, the river channels in Liverpool Bay, Holocene sediment sequences within Tremadoc Bay, Loch Striven and the Menai Strait, require different criteria in order to provide a more effective assessment. In these cases it is considered that some of the factors addressed are irrelevant; similarly, additional criteria may need to be created.

The values assigned to each individual factor were up to and equalling, but not exceeding, the value assigned to each box, as estimates were frequently found to fall somewhere between individual box values.

Conservability with respect to site 18, is deemed impossible as it is currently an active bedform.

There were no available data in relation to the pinnacle located within Beauforts Dyke.

No data were available with respect to the Submerged Drumlins located within Morecambe Bay.

No data were available with respect to the Mud Pinnacles, north of Anglesey, and this resulted in a low score with respect to the scientific criteria.

Problems with respect to the confidence values were highlighted by the following observations:

- As confidence was high that no data existed with respect to a site, confidence scored highly.
- Due to a lack of data its importance with respect to geoscience was low. As a result of this, some confidence values work against others and it may be necessary to group confidence values separately or omit and change some of them.
- Potential sites identified within the preliminary report and omitted from the final assessment are as follows:

Site number 8) Pingos

Site number 17) North Sand Ridges

Site number 33) Submerged Drumlins

Site Number 27) Gravel Waves

- Detailed maps illustrating the precise lateral extent of the site's subjected to assessment do not exist, however, as additional data becomes available, it may be possible to improve upon the base map utilized throughout this report.

Section B: Offshore Reports

B1. Lune Deep

Reference number: 1

Assessment Position: 5

Location: Lancashire, North West England

Latitude 53° 50' 00 - 54° 00' 00

Longitude 03° 00' 00 - 03° 10' 00

A narrow elongated steep-sided incision/channel, located at the entrance to Morecambe Bay. The feature is orientated in a northeast-southwest direction, and extends for over 14km, with a maximum width of 3.5km and a maximum depth of approximately 50m. This asymmetric channel feature is considered to be of glacial/postglacial origin.

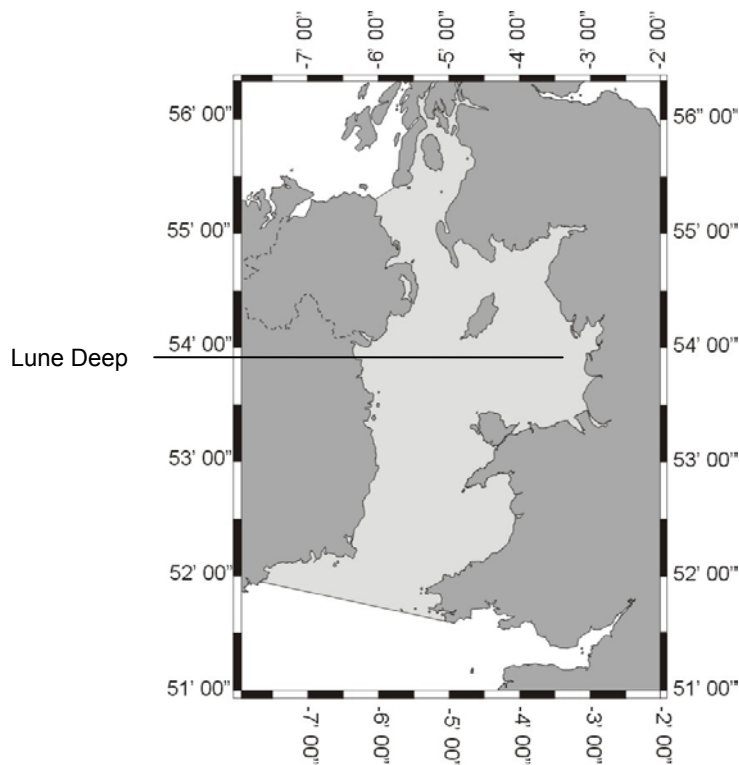


Figure 1. Lune Deep, Morecambe Bay

Marine Thematic Block: Quaternary geology and geomorphology: Quaternary of Wales

Prospective Status: 1st order M.E.C.A.

Numerical assessment

The site scores a value of 57% in terms of the scientific criteria, although it must be noted that there is a considerable lack of data to support this estimate and confidence can only be described as moderate. The potential threat values result in one of the higher scores with a correspondingly high confidence value; however, the near-field values are double those of the far-field. The integrity/conservability assessment results in a particularly high value and looks at the site as whole rather than individual components within the feature.

Scientific value – 56%

Confidence – 48%

Near-field Threats – 6

Confidence – 34

Far-field Threats - 3

Confidence – 37

Total Threat – 9%

Total Confidence – 71%

Site Preservation – 30/40

Confidence – 35/40

Conservability – 15/30

Confidence – 15/30

Regenerative Ability – 25/30

Confidence – 25/30

Source

Mr E. I. Rees. School of Ocean Sciences, University of Wales, Bangor.

B2. Symmetrical Mega-Ripples

Reference number: 2

Assessment Position: 6

Location: West of Holyhead, Anglesey

Latitude 53° 17' 00 - 53° 19' 00

Longitude 05° 06' 00 - 05° 08' 00

The system consists of several large, unusually symmetrical mega-ripples, typically 15m high and 200m apart, running west-east within an elongated north-south running hollow channel. The site is located toward the northern end of St. Georges Channel. The features were investigated during the 1960's and were described in a paper by Harvey (1966).

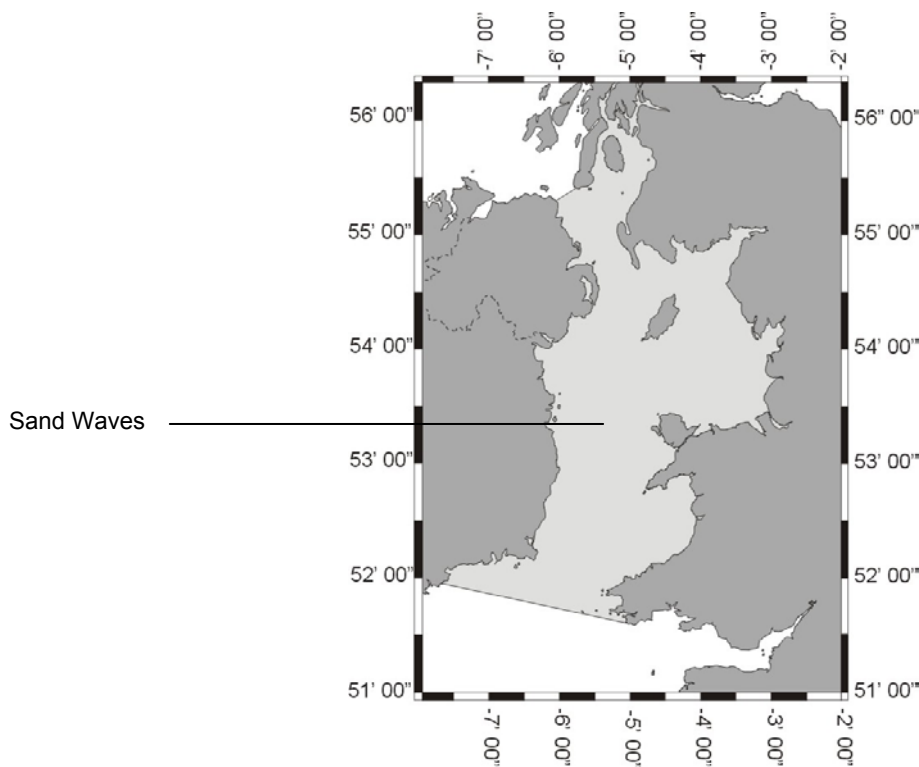


Figure 1. Location of Mega-ripples, west of Holyhead

Marine Thematic Block: Quaternary geology and geomorphology: Quaternary of Wales

Prospective Status: 1st order M.E.C.A.

Numerical assessment

The site scores 56% in terms of the scientific criteria, although it must be noted that the only available data relating to the site comes from Harvey (1966). Potential near-field threats are considered to be low although they are derived from individual criteria and collectively produce one of the highest potential threat values. It is unclear whether the ripples are relict or active features, therefore confidence within the integrity and conservability section remains moderate at best.

Scientific value – 56%

Confidence – 58%

Near-field Threats – 9

Confidence – 32

Far-field Threats - 3

Confidence – 38

Total Threat – 12%

Total Confidence – 70%

Site Preservation – 35/40

Confidence – 30/40

Conservability – 15/30

Confidence – 15/30

Regenerative Ability – 15/30

Confidence – 10/30

Reference

Harvey, J.G. (1966). Large Sand Waves in the Irish Sea. *Marine Geology*, (4) 49-55

B3. Rock Platform

Reference number: 3

Assessment Position: 13

Location: Northwest of Holyhead

Latitude 53° 20' 00 - 53° 30' 00

Longitude 04° 30' 00 - 04° 50' 00

The sea-floor to the northwest of Holyhead consists of a thin veneer of sediment overlying what is often bare rock. The underlying geology of the region is dominated by Precambrian metamorphic rock and the lack of unconsolidated sediment and associated exposure of solid bedrock is largely attributable to the particularly strong currents found at this location.

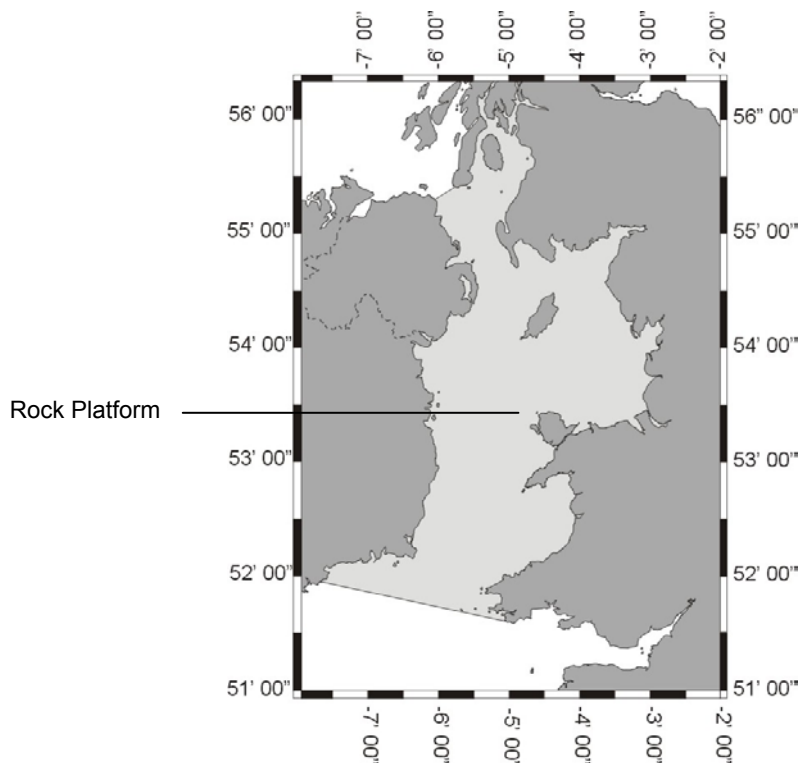


Figure 1. Rock Platform

Marine Thematic Block: Precambrian of England and Wales: Structural and Metamorphic Geology

Prospective Status: 1st order M.E.C.A.

Numerical assessment

The site confidently scores 46% in terms of the scientific criteria, however it must be noted that the assessment is based on very little available data. Near-field and far-field threat values are confidently found to be negligible; given the nature of the feature being assessed this is unsurprising. A very confident high value (80%) is obtained with respect to the sites integrity and conservability.

Scientific value – 46%
Confidence – 67%

Near-field Threats – 1
Confidence – 38
Far-field Threats - 0
Confidence – 40
Total Threat – 1%
Total Confidence – 78%

Site Preservation – 25/40
Confidence – 30/40
Conservability – 25/30
Confidence – 25/30
Regenerative Ability – 30/30
Confidence – 30/30

Key Reference

Jackson, D.I., Jackson, A.A., Evans, D., Wingfield, R.T.R., Barnes, R.P. & Arthur, M.J. (1995). *United Kingdom offshore regional report: The geology of the Irish Sea*. London: HMSO for the British Geological Survey.

B4. Bais Bank

Reference number: 4

Assessment Position: 3

Location: Cardigan Bay, West Wales

Latitude 51° 55' 00 - 52° 05' 00

Longitude 05° 15' 00 - 05° 30' 00

A particularly good example of a Banner Bank system, located to the north of St David's Head within the south-western region of Cardigan Bay. It is known that sediment and biological samples were taken from the area during a CCW sponsored cruise during 2001 (E.I. Rees, pers. com. 2004). The bank is orientated in a northeast to southwesterly direction, parallel to the coast approximately 10km northwest of St David's Head. The bank is almost 20km in length and in places up to 2km wide; it extends up to 30m above the sea-bed, approximately 10m below O.D.

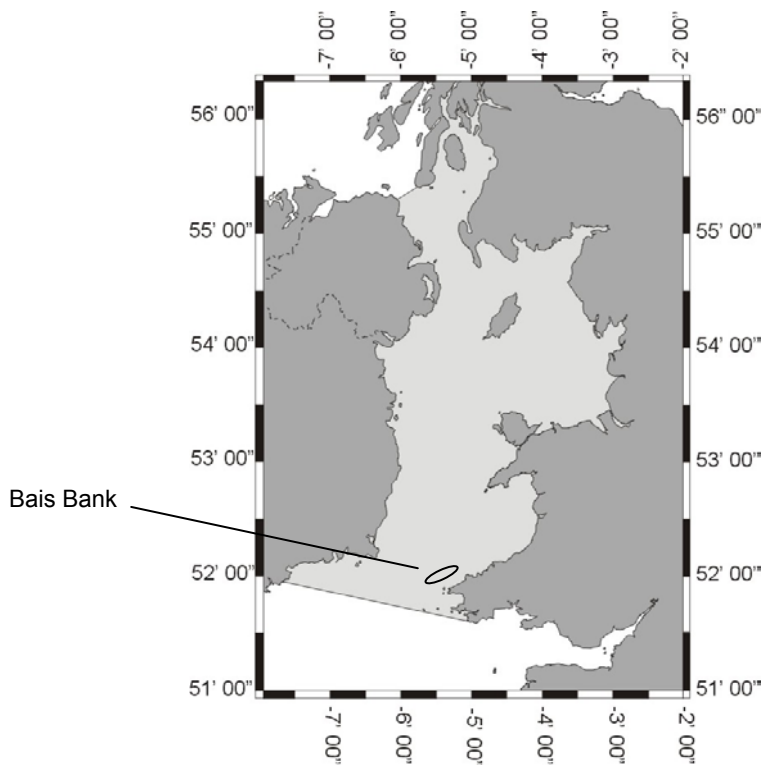


Figure 1. Bais Bank, Cardigan Bay

Marine Thematic Block: Quaternary geology and geomorphology: Quaternary of Wales

Prospective Status: 1st order M.E.C.A.

Numerical assessment

The numerical assessment indicates the system to be an important feature within the pilot study area, returning a reasonably high score in terms of the scientific criteria. Near-field threats are considered to be low, with confidence in making this assessment considered to be high. Far-field threats are considered to be negligible with a similarly high confidence level. A deficiency in the amount of available data relating to the site with respect to its regenerative ability and conservability results in the low value for the associated confidence assessment within that particular section. It is not entirely clear whether the system is an entirely active bedform or is a relict feature being subjected to contemporary processes.

Scientific value – 66%

Confidence – 73%

Near-field Threats – 11

Confidence – 35

Far-field Threats - 1

Confidence - 35

Total Threat – 12%

Total Confidence – 70%

Site Preservation – 35/40

Confidence – 32/40

Conservability – 15/30

Confidence – 10/30

Regenerative Ability – 22/30

Confidence – 10/30

Source

Mr E. I. Rees. School of Ocean Sciences, University of Wales, Bangor.

B5. Sarns/Sarnau

Reference number: 5

Assessment Position: 2

Location: Cardigan Bay, West Wales

Latitude 52° 20' 00 - 52° 50' 00

Longitude 04° 00' 00 - 04° 30' 00

These deposits are considered to be the most important features of positive relief within the shallower regions of Cardigan Bay (Pantin, 1991) and consist of three 'Sarns', Sarn Badrig, Sarn y Bwch and Sarn Cynfelyn. They trend in either a southwest or westerly direction out from the coast of West Wales for approximately 10-15km and can be up to 3km wide with an average height of 20m. According to Garrard (1977), the Sarns are considered to represent piedmont moraines formed by local Welsh ice during the Devensian glaciation, truncated at their western ends by the southward moving Irish Sea ice.

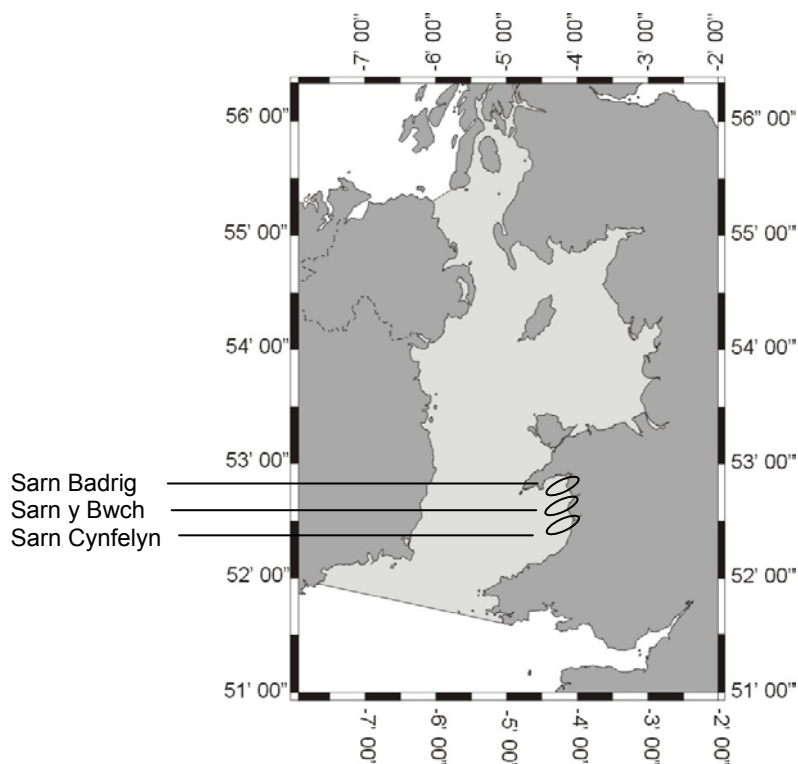


Figure 1. Sarn locations within Cardigan Bay

Marine Thematic Block: Quaternary geology and geomorphology: Quaternary of Wales

Prospective Status: 1st order M.E.C.A.'s nested within larger second order conservation zones.

Numerical assessment

In terms of scientific value the Sarns/Sarnau return a significantly high score, with a rating of 68% coupled with a 78% confidence rating. Near-field threats are considered to be low, although confidence in making this assessment is considered to be only moderately high. Far-field threats are however, confidently considered to be negligible. The regenerative ability of these features is deemed to be zero; however, it is estimated that the features themselves may have experienced a degree of degeneration/modification due to contemporary marine processes operating upon them. The ability to conserve the Sarnau themselves is considered to be at best moderate, as conservation with respect to anthropogenic activity would be relatively easy in comparison to the near impossible task of inhibiting the effects that natural processes impose upon them.

Important Features:

Sarn Badrig
Sarn y Bwch
Sarn Cynfelyn

Scientific value – 68%
Confidence – 70%

Near-field Threats – 7
Confidence – 31
Far-field Threats - 1
Confidence - 38
Total Threat – 8%
Total Confidence – 69%

Site Preservation – 30/40
Confidence – 35/40
Conservability – 15/30
Confidence – 15/30
Regenerative Ability – 30/30
Confidence – 30/30

References

Garrard, R.A. (1977). The sediments of the South Irish Sea and Nynphe Bank area of the Celtic Sea. 69-92 in *The Quaternary History of the Irish Sea*. Kidson, C. and Tooley, M.J. (editors). *Geological Journal Special Issue*, N^o 7.

Pantin, H.M. (1991). The sea-bed sediments around the United Kingdom. Their bathymetric and physical environment, grain size, mineral composition and associated bedforms. British Geological Survey, Research Report SB/90/1, Offshore Geology Series.

B6. Gas Seep

Reference number: 6

Assessment Position: 8

Location: 2.5km north of Barmouth

Latitude 52° 40' 00 - 52° 50' 00

Longitude 04° 10' 00 - 04° 20' 00

Gassy seep feature located within Cardigan Bay, approximately 2.5km offshore, north of Barmouth. The site was only found and recognised in 2003 and is probably the first gassy seep to be found within U.K. inshore waters (E.I. Rees, pers. com. 2004). The site appears to be relatively small, confined to a maximum extent of less than 50m across. These features are listed within the annexe to the Habitats Directive.

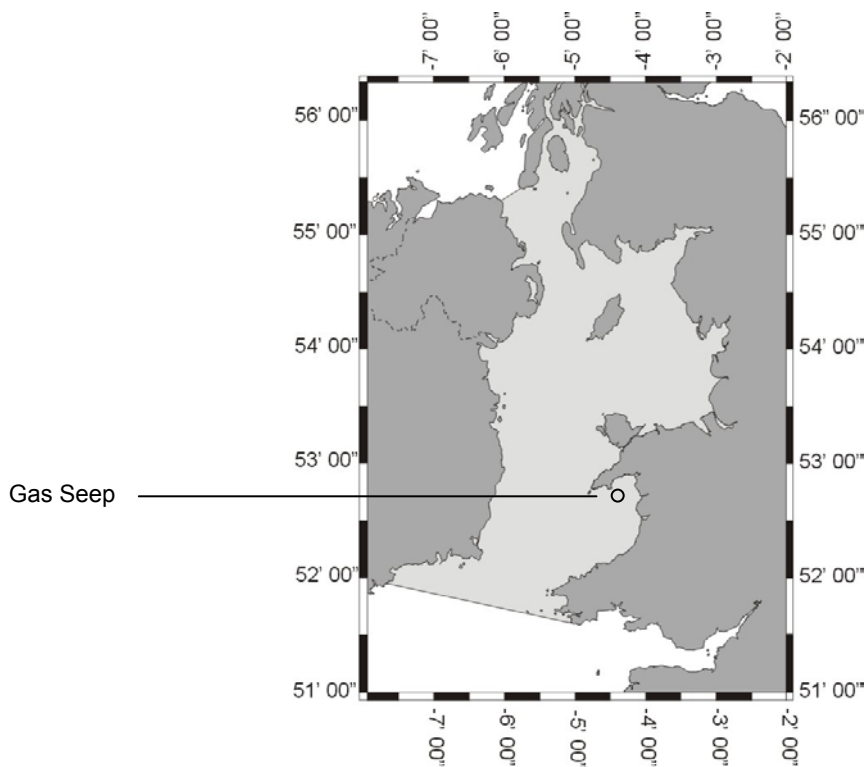


Figure 1. Location of Gassy Seep, Cardigan Bay

Marine Thematic Block: Quaternary geology and geomorphology: Quaternary of Wales

Prospective Status: 1st order M.E.C.A.

Numerical assessment

The site scores 54% in terms of the scientific criteria, although there have been numerous surveys carried out in the recent past, there seems to be an absence of data specific to the identification of individual seeps and the justification or potential for future research is consequently deemed to be high. Both near and far-field potential threat values are confidently considered to be low.

Scientific value – 54%
Confidence – 64%

Near-field Threats – 3
Confidence – 34
Far-field Threats - 1
Confidence – 39
Total Threat – 4%
Total Confidence – 73%

Site Preservation – 20/40
Confidence – 20/40
Conservability – 15/30
Confidence – 20/30
Regenerative Ability – 30/30
Confidence – 25/30

References

- Beggs, T.R. (1974). *The movements of water and sediment in Tremadoc Bay*. Unpublished MSc. Thesis, University of Wales Bangor.
- Earle, D.A. (1974). *Consolidation and related properties of some sediments from Tremadoc Bay, North Wales*. Unpublished MSc. Thesis, University of Wales Bangor.
- Fenemore, P.R. (1976). *Reflexion and refraction acoustics, Tremadog Bay (North Wales)*. Unpublished MSc. Thesis, University of Wales Bangor.
- Jackson, P.D. (1976). *Geotechnical Mapping of the Sea-bed. Final Report, Part II – Electrical Measurements*. N.E.R.C. Contract No. F60/4/22.
- Patterson, J. (1975). *Analysis of sidescan sonar records taken in Tremadoc Bay, North Wales*. Unpublished MSc Thesis, University of Wales Bangor.
- Simpkin, P.G. & Taylor-Smith, D. (1976). *Geotechnical Mapping of the Sea-bed. Final Report, Part III & IV – Acoustics & General Conclusions*. N.E.R.C. Contract No. F60/4/22
- Sommerville, J.H. (1973). *A continuous seismic profiling survey of Tremadoc Bay*. Unpublished MSc Thesis, University of Wales Bangor.

B7. Moribund Sand Ridges

Reference number: 7

Assessment Position: 11

Location: Northeast Isle Of Man

Latitude 54° 20' 00 - 54° 30' 00

Longitude 04° 10' 00 - 04° 20' 00

The features consist of the King William and Ballacash tidal sand ridges, located approximately 15km off the northeast tip of the Isle of Man. The ridges are orientated in an east-west direction and extend over 12km in length, with a maximum width of 3km. These shallow ridges can be found at depths of approximately 7m below O.D. and are thought to be relics of lower early-mid Holocene sea-levels (Kenyon *et al.*, 1981).

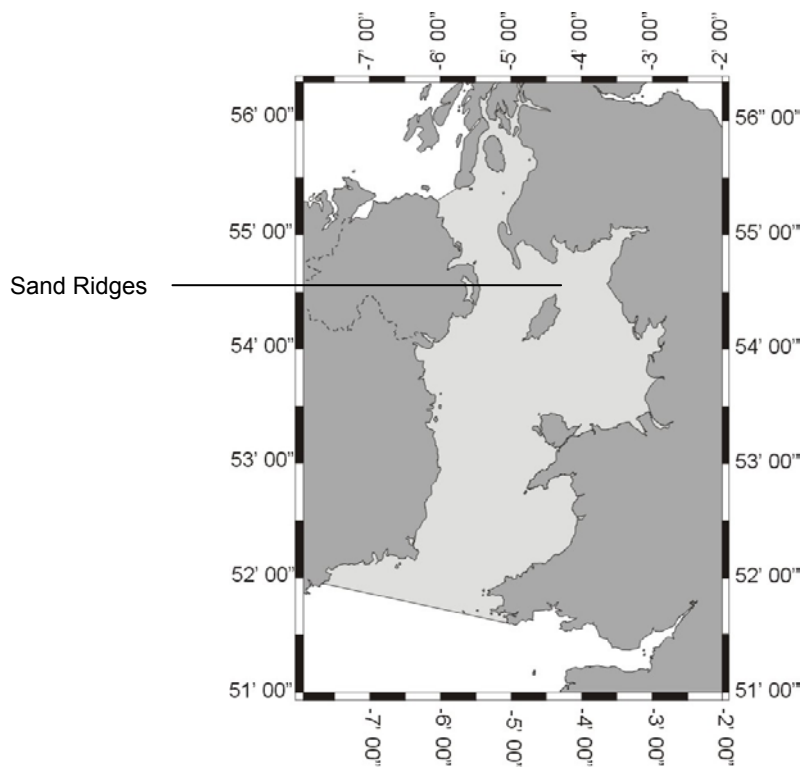


Figure 1. Moribund Sand Ridges

Marine Thematic Block: Quaternary geology and geomorphology.

Prospective Status: 1st order M.E.C.A.

Numerical assessment

The site scores 50% in terms of the scientific criteria, however it must be noted that the assessment is based on very little available data and as a consequence the associated confidence value is a low-moderate 50%. Near-field threat values are found to be moderately high, primarily attributable to the fact that any form of direct disturbance could be deemed significant, however far-field threats are deemed to be low. Assessing the site in terms of its integrity and conservability proves to be difficult, given the limited data available.

Scientific value – 50%
Confidence – 50%

Near-field Threats – 9
Confidence – 28
Far-field Threats - 1
Confidence – 32
Total Threat – 10%
Total Confidence – 60%

Site Preservation – 25/40
Confidence – 20/40
Conservability – 12/30
Confidence – 20/30
Regenerative Ability – 22/30
Confidence – 22/30

Key Reference

Kenyon, N.H., Belderson, R.H., Stride, A.H. & Johnson, M.A. (1981). Offshore tidal sandbanks as indicators of net sand transport and as potential deposits. *Special Publication of the International Association of Sedimentologists*, Vol. 55, 257-268.

B8. Scour Moats

Reference number: 9

Assessment Position: 18

Location: Main Channel

Latitude 53° 50' 00 - 54° 10' 00

Longitude 05° 10' 00 - 05° 50' 00

These features interpreted as scour pits are located within the main channel to the west of the Isle of Man and consist of what are in effect several 'moats', surrounding rocky prominences outcropping on the sea-floor. The moats are up to 500m wide and 40m deep and are thought to have been derived from the scouring action of powerful tidal currents around the rocky prominences during the early Holocene (Jackson *et al.*, 1995).

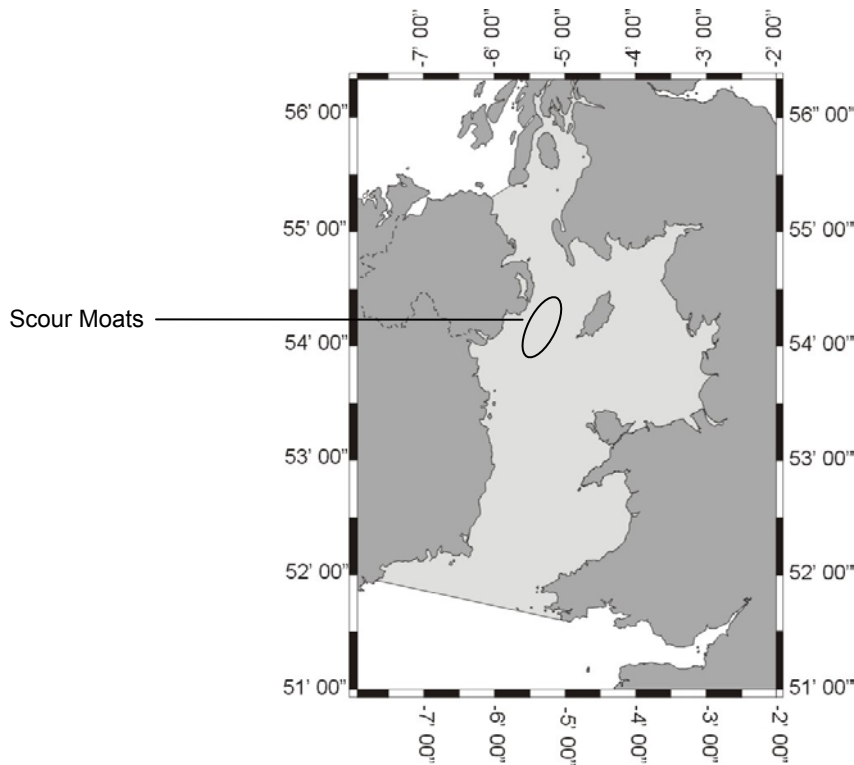


Figure 1. Scour Moat locations

Marine Thematic Block: Quaternary geology and geomorphology.

Prospective Status: 1st order M.E.C.A.

Numerical assessment

The site scores 41% in terms of the scientific criteria with an associated low confidence rating of 48%. It is thought that their importance in terms of the listed scientific criteria is limited, although they do in part reflect elements of environmental change experienced within the region during the early Holocene. The lack of data relating to the site is considered not to contribute greatly to this low score and additional data would not therefore further enhance the site's scientific importance. Both near and far-field threat values are confidently assessed to be moderately low or negligible, whilst the integrity and conservability section returns a moderate score of 60% with an associated confidence rating deemed at best to be only a moderate 55%.

Scientific value – 41%

Confidence – 48%

Near-field Threats – 4

Confidence – 29

Far-field Threats - 1

Confidence – 35

Total Threat – 5%

Total Confidence – 64%

Site Preservation – 20/40

Confidence – 30/40

Conservability – 10/30

Confidence – 10/30

Regenerative Ability – 30/30

Confidence – 30/30

Key Reference

Jackson, D.I., Jackson, A.A., Evans, D., Wingfield, R.T.R., Barnes, R.P. & Arthur, M.J. (1995). *United Kingdom offshore regional report: The geology of the Irish Sea*. London: HMSO for the British Geological Survey.

B9. Roches Moutonnées

Reference number: 10

Assessment Position: 24

Location: Southern North Channel

Latitude 54° 10' 00 - 54° 30' 00

Longitude 05° 00' 00 - 05° 30' 00

These appear to be subglacial landforms, located within the southern North Channel and are generally of crag and tail form. The features are orientated such that they imply formation due to southward moving ice.

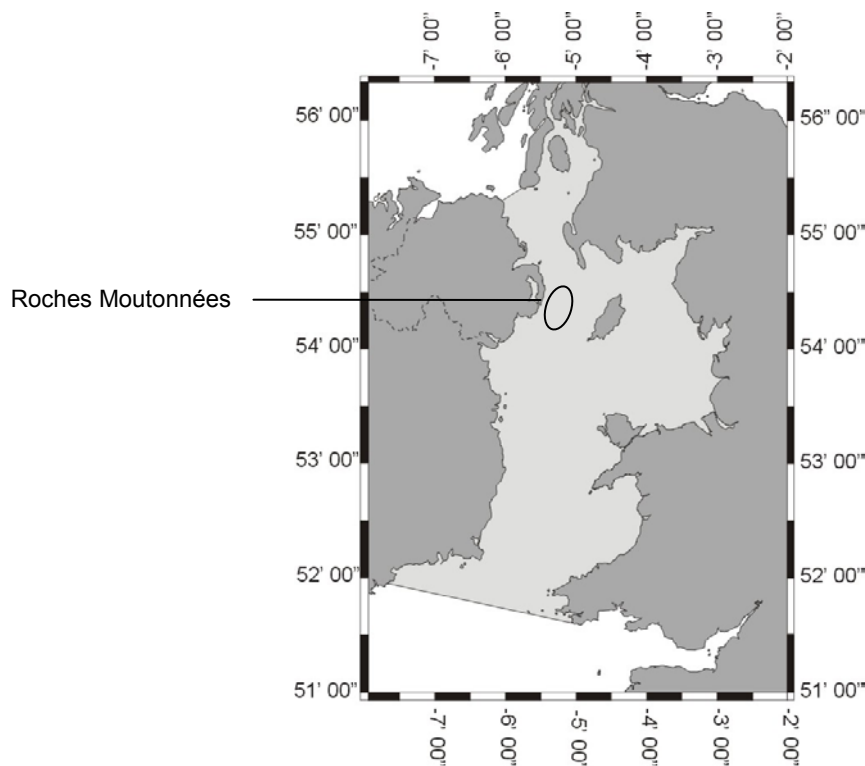


Figure 1. Roches Moutonnées location

Marine Thematic Block: Quaternary geology and geomorphology.

Prospective Status: 1st order M.E.C.A.

Numerical assessment

The site scores poorly (28%) in terms of the assessed scientific criteria, however there is an associated confidence rating that seems relatively high (70%) given the lack of available data. Near-field threats are confidently considered to be very low, whilst far-field threats are confidently deemed to be negligible. A high score is attained within the integrity and conservability section (75%), coupled with a very high confidence rating of 85%.

Scientific value – 28%

Confidence – 70%

Near-field Threats – 2

Confidence – 38

Far-field Threats - 0

Confidence – 47

Total Threat – 2%

Total Confidence – 85%

Site Preservation – 25/40

Confidence – 30/40

Conservability – 20/30

Confidence – 25/30

Regenerative Ability – 30/30

Confidence – 30/30

Key Reference

Jackson, D.I., Jackson, A.A., Evans, D., Wingfield, R.T.R., Barnes, R.P. & Arthur, M.J. (1995). *United Kingdom offshore regional report: The geology of the Irish Sea*. London: HMSO for the British Geological Survey.

B10. Scour Cauldrons

Reference number: 11

Assessment Position: 23

Location: West of Anglesey

Latitude 52° 40' 00 - 53° 30' 00

Longitude 05° 00' 00 - 05° 50' 00

These features are located within the Western Trough, approximately central between Ireland and North Wales. They consist of shallow depressions within the sea-floor that have been inferred by Wingfield in (Jackson *et al.*, 1995), to have been formed during the early Holocene on either side of a narrow high-tidal volume strait.

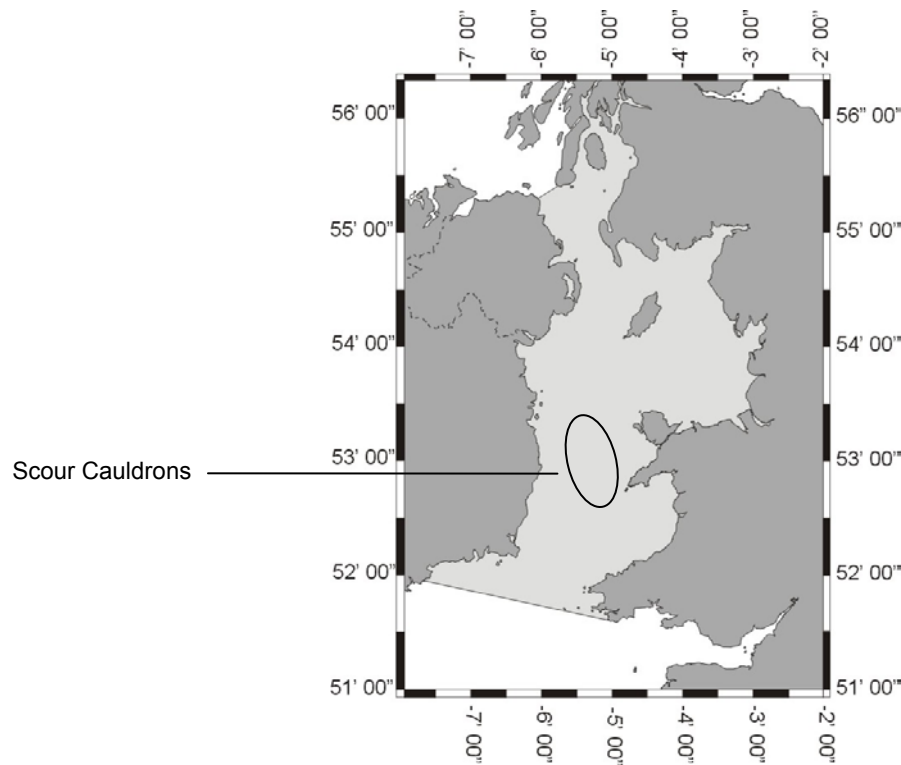


Figure 1. Scour Cauldron Locations

Marine Thematic Block: Quaternary geology and geomorphology.

Prospective Status: 1st order M.E.C.A.s

Numerical assessment

The features scores 32% in terms of the assessed scientific criteria with a low associated confidence rating of 45%. It is noted that the features return low scores with respect to all the assessed scientific criteria, furthermore it is envisaged that additional data would not significantly influence the overall outcome. Both near and far-field threat values are deemed to be effectively low or negligible, although confidence in making this assessment is at best considered to be moderate. The integrity and conservability section results in moderate scores with respect to both the assessed criteria and the associated confidence.

Scientific value – 32%

Confidence – 45%

Near-field Threats – 4

Confidence – 26

Far-field Threats - 1

Confidence – 27

Total Threat – 1%

Total Confidence – 78%

Site Preservation – 15/40

Confidence – 10/40

Conservability – 7/30

Confidence – 15/30

Regenerative Ability – 30/30

Confidence – 30/30

Key Reference

Jackson, D.I., Jackson, A.A., Evans, D., Wingfield, R.T.R., Barnes, R.P. & Arthur, M.J. (1995). *United Kingdom offshore regional report: The geology of the Irish Sea*. London: HMSO for the British Geological Survey.

B11. Periglacial Ground

Reference number: 12

Assessment Position: 15

Location: North of Anglesey

Latitude 53° 00' 00 - 54° 00' 00

Longitude 04° 00' 00 - 05° 30' 00

The features are contained within an extensive area immediately to the north of Anglesey. The area has been described by Wingfield (1987), as containing relict polygonal textures which were interpreted as periglacial ice-wedge polygons, extending up to 80m in diameter.

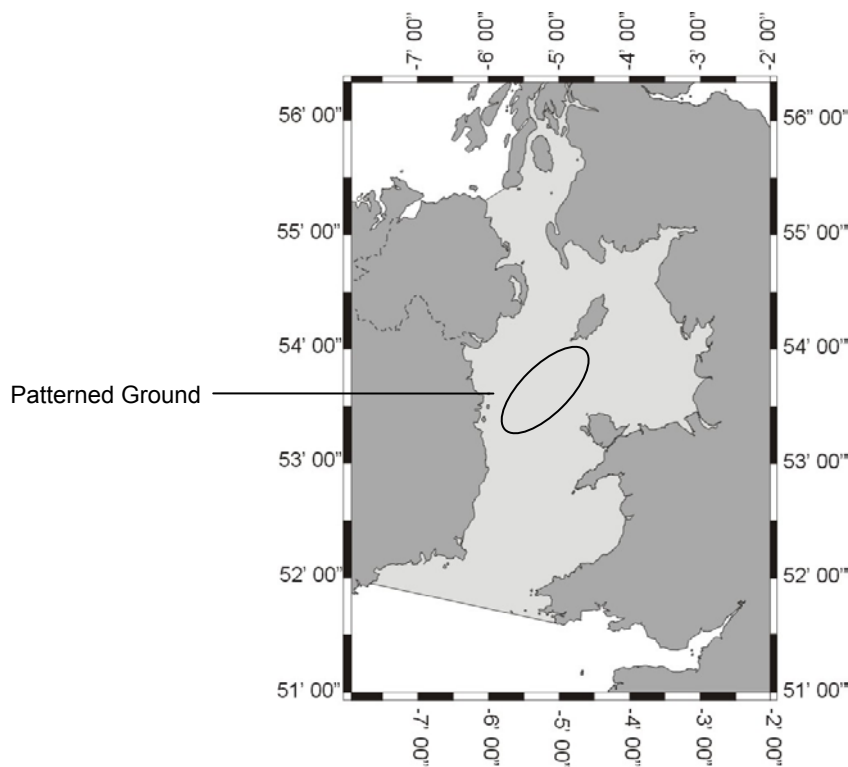


Figure 1. Periglacial Ground

Marine Thematic Block: Quaternary geology and geomorphology.

Prospective Status: 1st order M.E.C.A.

Numerical assessment

The site only scores 44% in terms of the scientific criteria, however it must be noted that the assessment is based on very little available data and this is reflected in the associated low confidence rating. Near-field threats are deemed to be moderately low and far-field threats rated as negligible however, given the lack of available data this may not reflect their true value. The integrity and conservability of the site produces a rating of 57%, with an associated confidence rating of 65%.

Scientific value – 44%

Confidence – 49%

Near-field Threats – 9

Confidence – 23

Far-field Threats - 1

Confidence – 36

Total Threat – 10%

Total Confidence – 59%

Site Preservation – 15/40

Confidence – 15/40

Conservability – 12/30

Confidence – 20/30

Regenerative Ability – 30/30

Confidence – 30/30

Key References

Jackson, D.I., Jackson, A.A., Evans, D., Wingfield, R.T.R., Barnes, R.P. & Arthur, M.J. (1995). *United Kingdom offshore regional report: The geology of the Irish Sea*. London: HMSO for the British Geological Survey.

Wingfield, R.T.R. (1987). Giant sand waves and relict periglacial features on the sea bed west of Anglesey. *Proceedings of the Geologists' Association*. 98, 400-404.

B12. Canyon Formations

Reference number: 13

Assessment Position: 17

Location: Mull of Galloway

Latitude 54° 30' 00 - 54° 40' 00

Longitude 04° 45' 00 - 04° 55' 00

The features consist of submarine canyon heads, located to the south of the Mull of Galloway, steeply sloping down into Beauforts Dyke. According to Jackson *et al* (1995), the channels leading down into the canyon may possibly be derived from the action of braided rivers located upon a post-glacial outwash plain.

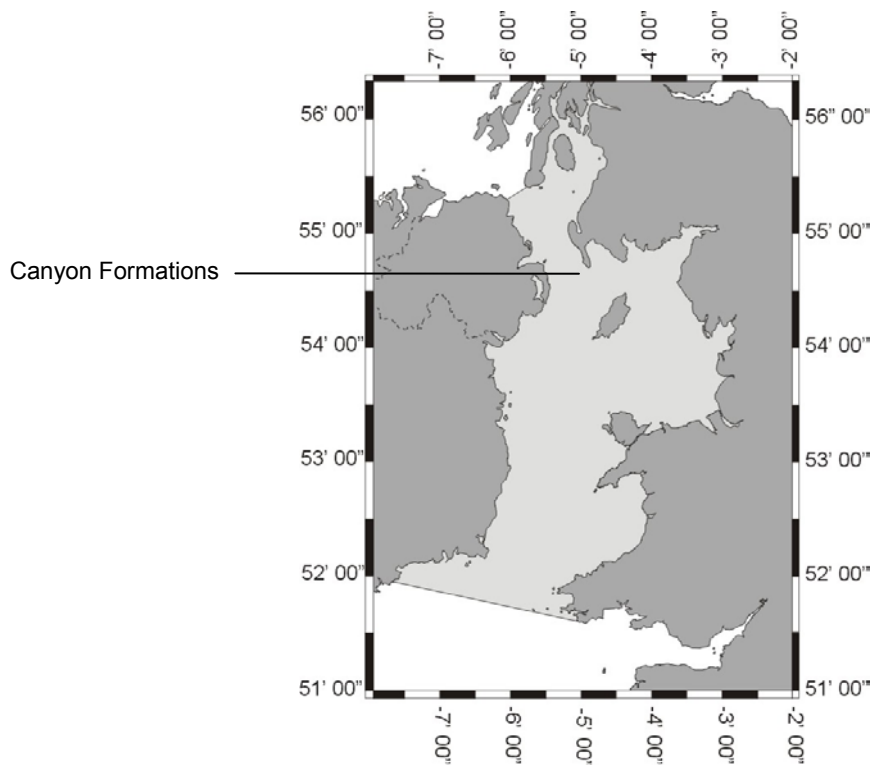


Figure 1. Canyon Formations

Marine Thematic Block: Quaternary geology and geomorphology.

Prospective Status: 1st order M.E.C.A.

Numerical assessment

The site scores 41% in terms of the scientific criteria with an associated confidence rating of 53%, which is primarily attributable to the lack of available data relating to the site. The scientific criteria scores poorly, primarily due to the low values associated with the potential and existing research sections of the numerical assessment. Difficulty in assessing other aspects related to the scientific criteria may also contribute to the relatively low score. Both near and far-field threat values are confidently assessed to be low or negligible, whilst the integrity and conservability section returns a moderate score of 65% with an associated confidence rating deemed at best to be only a moderate 55%.

Scientific value – 41%

Confidence – 53%

Near-field Threats – 2

Confidence – 38

Far-field Threats - 1

Confidence – 39

Total Threat – 3%

Total Confidence – 77%

Site Preservation – 20/40

Confidence – 20/40

Conservability – 15/30

Confidence – 10/30

Regenerative Ability – 30/30

Confidence – 25/30

Key Reference

Jackson, D.I., Jackson, A.A., Evans, D., Wingfield, R.T.R., Barnes, R.P. & Arthur, M.J. (1995). *United Kingdom offshore regional report: The geology of the Irish Sea*. London: HMSO for the British Geological Survey.

B13. Gravel Reefs

Reference number: 14

Assessment Position: 28

Location: Cardigan Bay

Latitude 52° 00' 00 - 52° 50' 00

Longitude 04° 10' 00 - 04° 50' 00

Located within Cardigan Bay are up to 18 active and irregular shaped gravel reef systems. They are in general relatively small (>2km) in both length and breadth, although their thickness is not known. They are considered to be lag deposits that originated from the winnowing of glacial deposits.

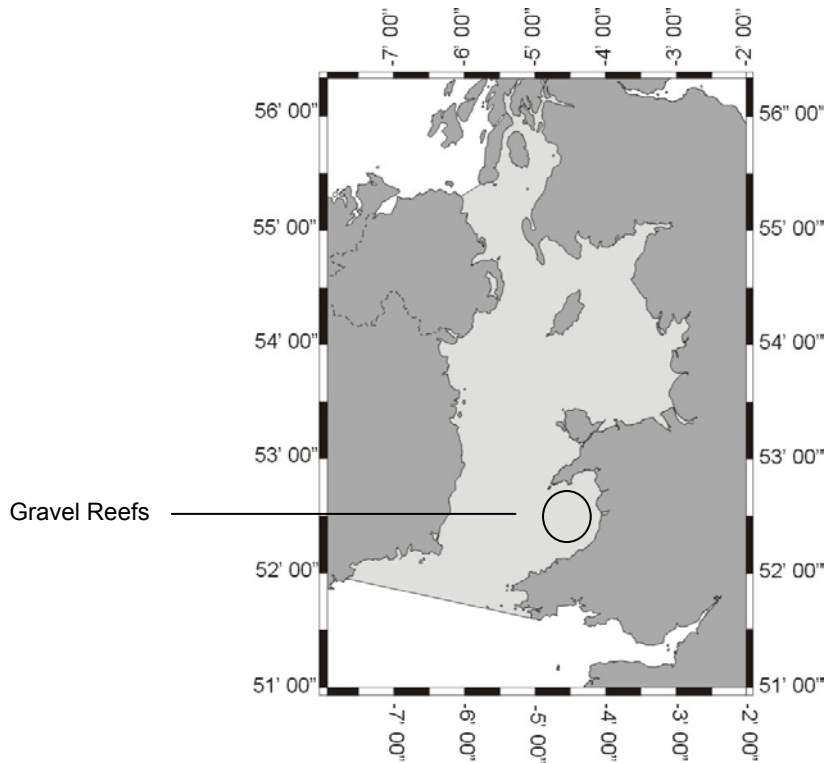


Figure 1. Gravel Reef locations

Marine Thematic Block: Quaternary geology and geomorphology.

Prospective Status: 1st order M.E.C.A.s

Numerical assessment

The features score poorly (23%) in terms of the assessed scientific criteria; this low score is not primarily attributable to the lack of data associated with the gravel reefs. The sites are deemed to have a low scientific value due to their very nature and the relative abundance of the features being assessed. Near-field threat values are significant in contrast to those posed by far-field effects, however given the number of these features within Cardigan Bay the overall threat value is considered to be negligible. A low score of 43% is attained within the integrity and conservability section, coupled with a similarly low confidence rating of 47%.

Scientific value – 23%

Confidence – 66%

Near-field Threats – 6

Confidence – 35

Far-field Threats - 2

Confidence – 38

Total Threat – 8%

Total Confidence – 73%

Site Preservation – 12/40

Confidence – 17/40

Conservability – 8/30

Confidence – 10/30

Regenerative Ability – 23/30

Confidence – 20/30

Key Reference

Tappin, D.R., Chadwick, R.A., Jackson, A.A., Wingfield, R.T.R. & Smith, N.J.P. (1994). *United Kingdom offshore regional report: The geology of Cardigan Bay and the Bristol Channel*. London: HMSO for the British Geological Survey.

B14. Gravel Patches

Reference number: 15

Assessment Position: 29

Location: North of Anglesey

Latitude 52° 00' 00 - 52° 50' 00

Longitude 04° 10' 00 - 04° 50' 00

The candidate sites consist of two gravel patches located to the north of Anglesey. The features trend in a northeast-southwest direction and are inferred to be lag deposits caused by the winnowing of finer sediments by the action of strong tidal currents. The more northerly deposit is substantially less extensive than its more southern counterpart. Notably, both features are located on the leeward side (with respect to the flood-tidal currents) of the smooth rocky platform located to the northwest of Holyhead.

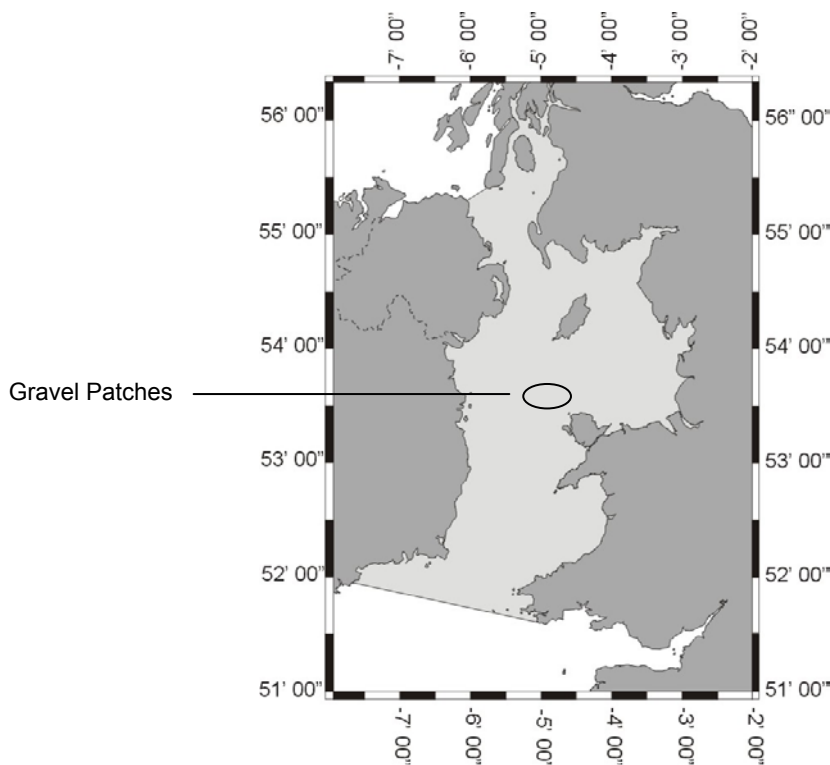


Figure 1. Gravel Patch locations

Marine Thematic Block: Quaternary geology and geomorphology.

Prospective Status: 1st order M.E.C.A.s

Numerical assessment

The features score poorly (23%) in terms of the assessed scientific criteria; this low score is not primarily attributable to the lack of data associated with the gravel patches. Near-field threat values are significant in contrast to those posed by far-field effects. A low score of 43% is attained within the integrity and conservability section, coupled with a similarly low confidence rating of 47%.

Scientific value – 23%
Confidence – 66%

Near-field Threats – 6
Confidence – 35
Far-field Threats - 2
Confidence – 38
Total Threat – 8%
Total Confidence – 73%

Site Preservation – 12/40
Confidence – 17/40
Conservability – 8/30
Confidence – 10/30
Regenerative Ability – 23/30
Confidence – 20/30

Key Reference

Jackson, D.I., Jackson, A.A., Evans, D., Wingfield, R.T.R., Barnes, R.P. & Arthur, M.J. (1995). *United Kingdom offshore regional report: The geology of the Irish Sea*. London: HMSO for the British Geological Survey.

B15. Sand Ridges

Reference number: 16

Assessment Position: 19

Location: West of Pembrokeshire

Latitude 51° 30' 00 - 51° 50' 00

Longitude 04° 40' 00 - 05° 10' 00

The features are located toward the extreme southern edge of the pilot area, 10-20km off the west coast of Pembrokeshire and consist of three sand ridges. These inactive sand ridges are located at depths between 20 and 60m below O.D. and are thought to be relics of lower early-mid Holocene sea-levels (Kenyon et al, 1981).

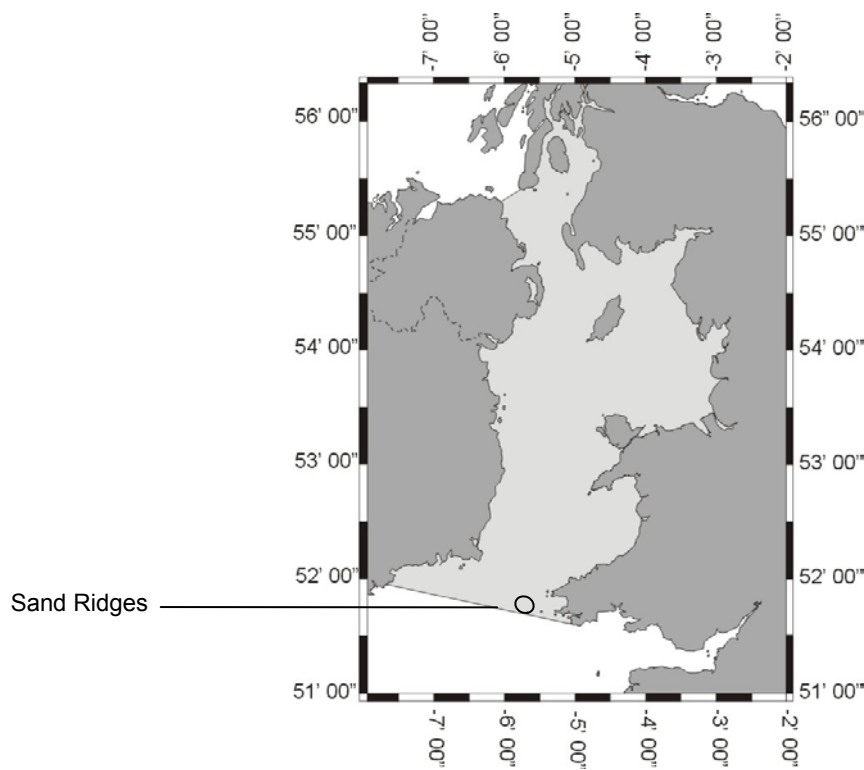


Figure 1. Sand Ridge locations

Marine Thematic Block: Quaternary geology and geomorphology.

Prospective Status: 1st order M.E.C.A.

Numerical assessment

The site scores 38% in terms of the scientific criteria with an associated confidence rating of 61%. It is thought that their importance in terms of the listed scientific criteria is again limited, although they do in part reflect elements of environmental change experienced within the region during the early Holocene. The lack of data relating to the site may contribute to the low score and additional data may further enhance the site's scientific importance. Near- field threats are deemed to be moderately high, whilst far-field threat values are confidently assessed to be moderately low. Additional data relating to local prevailing current regimes and aspects of sediment transport would be required in order to fully assess the conservability and integrity of the features. The moderate score and associated confidence rating within the aforementioned section reflects the deficiency in good data pertaining to the site.

Scientific value – 38%
Confidence – 61%

Near-field Threats – 8
Confidence – 29
Far-field Threats - 3
Confidence – 35
Total Threat – 11%
Total Confidence – 64%

Site Preservation – 20/40
Confidence – 20/40
Conservability – 15/30
Confidence – 10/30
Regenerative Ability – 25/30
Confidence – 22/30

Key Reference

Tappin, D.R., Chadwick, R.A., Jackson, A.A., Wingfield, R.T.R. & Smith, N.J.P. (1994). *United Kingdom offshore regional report: The geology of Cardigan Bay and the Bristol Channel*. London: HMSO for the British Geological Survey.

B16. Active Sand Waves

Reference number: 18

Assessment Position: 30

Location: Cardigan Bay

Latitude 52° 20' 00 - 52° 40' 00

Longitude 05° 00' 00 - 05° 20' 00

The features consist of giant active sand waves located within Cardigan Bay. The sand waves possess heights of between 15-40m and are located to the southwest of Bardsey Island in a water depth of between 70 and 90m. The deposits are located proximal to a region where bedload parting occurs and net sediment transport is in the ebb tidal direction toward the southwest.

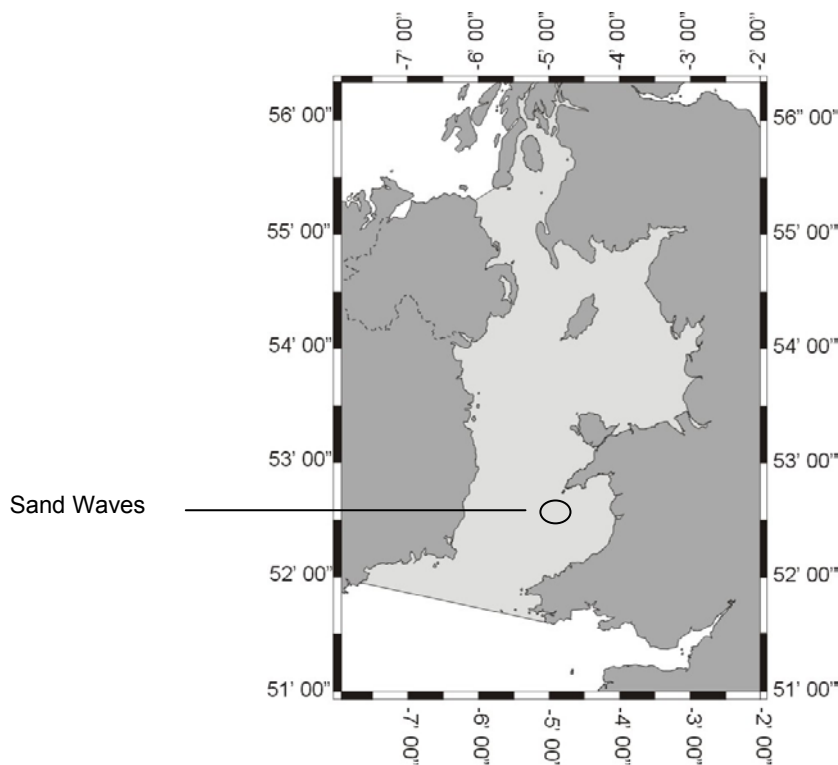


Figure 1. Sand Wave Locations

Marine Thematic Block: Quaternary geology and geomorphology.

Prospective Status: 1st order M.E.C.A.s

Numerical assessment

The features score a moderate 45% in terms of the assessed scientific criteria. Both near and far-field threat values are confidently deemed to be low. The features score a low 40% within the integrity and conservability section, coupled with a moderate-high confidence rating of 67%. The features however confidently score zero within the conservability section as they are deemed to be actively mobile, thereby making effective long term conservation impossible.

Scientific value – 45%

Confidence – 63%

Near-field Threats – 2

Confidence – 39

Far-field Threats - 1

Confidence – 39

Total Threat – 3%

Total Confidence – 78%

Site Preservation – 30/40

Confidence – 20/40

Conservability – 0/30

Confidence – 25/30

Regenerative Ability – 10/30

Confidence – 22/30

Key Reference

Tappin, D.R., Chadwick, R.A., Jackson, A.A., Wingfield, R.T.R. & Smith, N.J.P. (1994). *United Kingdom offshore regional report: The geology of Cardigan Bay and the Bristol Channel*. London: HMSO for the British Geological Survey.

B17. Sea Mounds

Reference number: 19

Assessment Position: 25

Location: Southern North Channel

Latitude 54° 20' 00 - 54° 30' 00

Longitude 05° 00' 00 - 05° 25' 00

These features are located at the southern end of the North Channel and rise up over 20m above the surrounding sea-floor. The outcrops tend to be covered with a thin veneer of unconsolidated sediment.

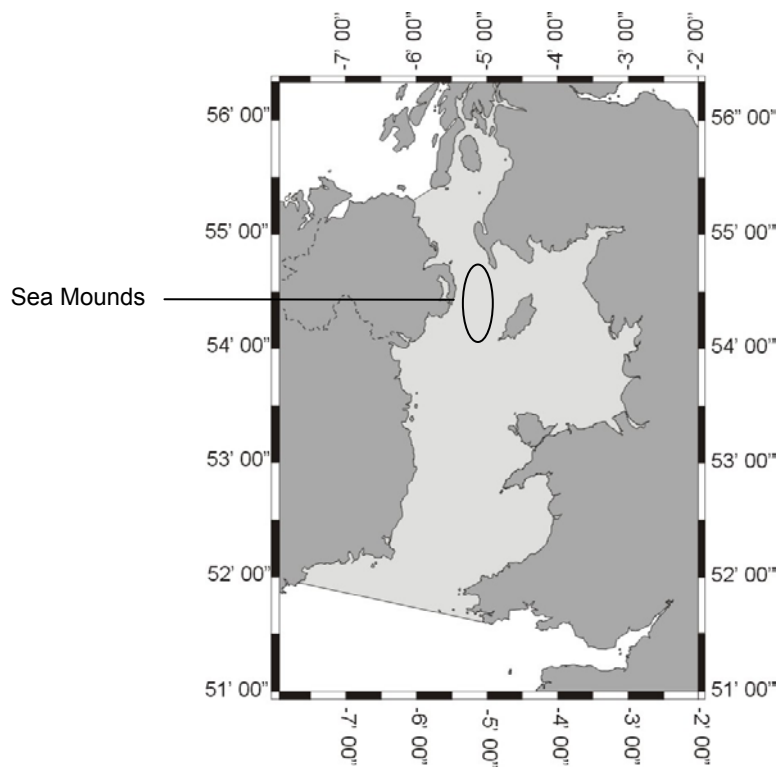


Figure 1. Sea Mound locations

Marine Thematic Block: Quaternary geology and geomorphology.

Prospective Status: 1st order M.E.C.A.

Numerical assessment

The site scores poorly (26%) in terms of the assessed scientific criteria; this result is associated with a low confidence rating of 49%. It is thought that the result would not be greatly influenced given additional data. Both near and far-field threats are confidently considered to be low. A very high score (90%) is attained within the integrity and conservability section, coupled with a high confidence rating of 70%.

Scientific value – 26%
Confidence – 49%

Near-field Threats – 2
Confidence – 37
Far-field Threats - 1
Confidence – 38
Total Threat – 3%
Total Confidence – 75%

Site Preservation – 30/40
Confidence – 20/40
Conservability – 30/30
Confidence – 25/30
Regenerative Ability – 30/30
Confidence – 25/30

Source

Mr E. I. Rees. School of Ocean Sciences, University of Wales, Bangor.

B18. Concretions

Reference number: 20

Assessment Position: 16

Location: Llanbedrog, Llŷn Peninsula

Latitude 52° 48' 00 - 52° 50' 00

Longitude 04° 27' 00 - 04° 30' 00

The features are located on the shoreline and just offshore, south of the village of Llanbedrog. The origin of these unusual rock formations may be attributable to an emergent aquifer proximal to the sea or shoreline and officially recognised as such in 2003. The site has already been designated an S.S.S.I. and the adjoining land is owned by the National Trust.

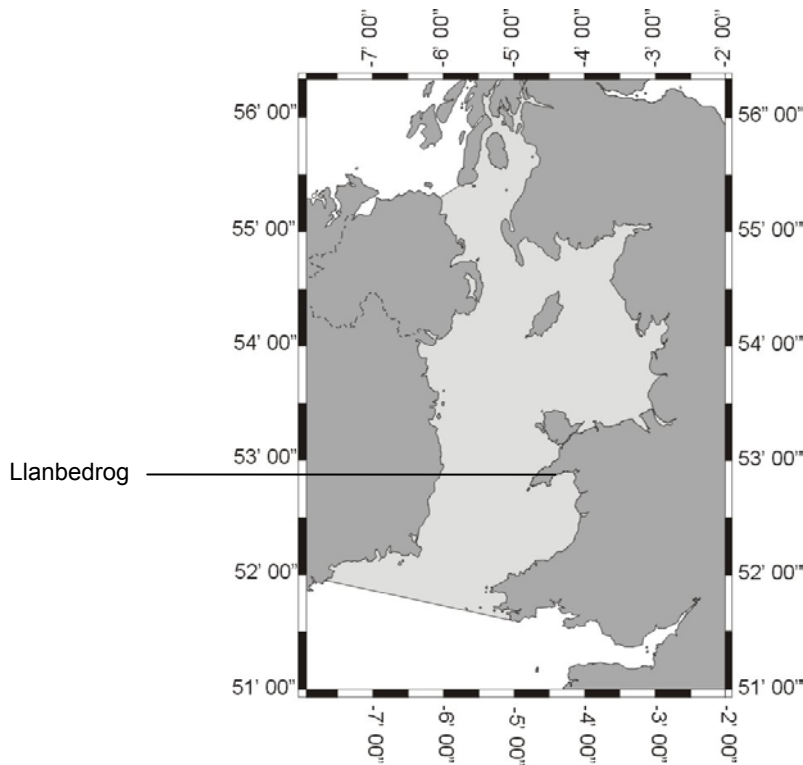


Figure 1. Llanbedrog Concretions

Marine Thematic Block: Quaternary geology and geomorphology.

Prospective Status: 1st order M.E.C.A.

Numerical assessment

The site scores a moderately confident 43% in terms of the scientific criteria. This relatively low score may be primarily attributable to the difficulty in assessing potential future research and teaching values, which in this case are deemed to be at best moderate, or low. Near and Far-field threats are confidently considered to be low, given the sites location, which can be described as intertidal, possibly extending into the sub-tidal environment. The integrity and conservability section scores highly with an associated high confidence rating.

Scientific value – 43%
Confidence – 68%

Near-field Threats – 3
Confidence – 36
Far-field Threats - 1
Confidence – 39
Total Threat – 4%
Total Confidence – 75%

Site Preservation – 20/40
Confidence – 30/40
Conservability – 25/30
Confidence – 25/30
Regenerative Ability – 30/30
Confidence – 25/30

Source

Mr E. I. Rees. School of Ocean Sciences, University of Wales, Bangor.

B19. Submerged Forest

Reference number: 21

Assessment Position: 4

Location: Borth, West Wales

Latitude 52° 25' 00 - 52° 32' 00

Longitude 04° 00' 00 - 04° 10' 00

The site contains the remains of a Holocene forest system dating back to the Mid-Holocene (Campbell & Bowen 1989) and as a result of marine transgression, is now located around the low-water mark. Although there are numerous such examples located all along the coast of Wales, this site was selected as it has been the subject of research conducted under the auspices of the University of Wales, Aberystwyth. The site also falls within the existing Irish Sea Coastal Geomorphology G.C.R. site - Ynyslas.

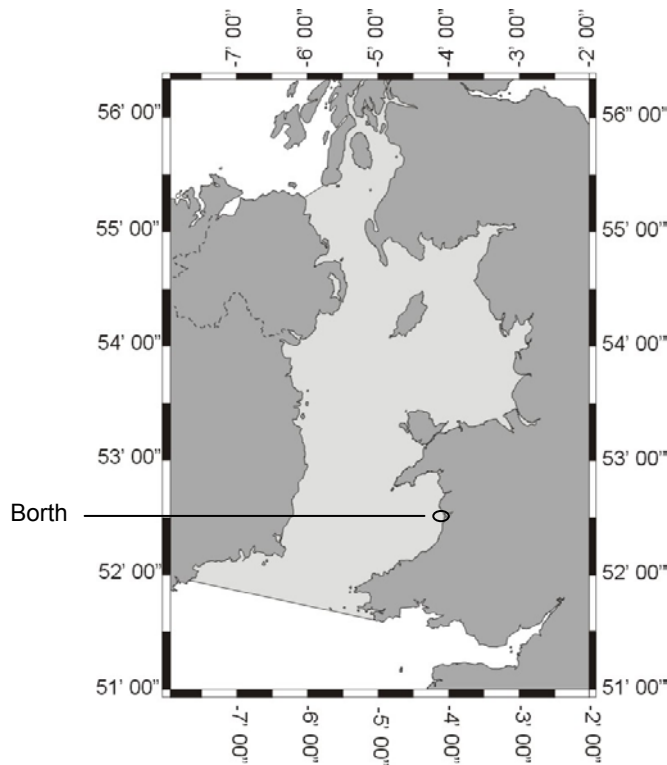


Figure 1. Submerged forest location, Borth, Cardigan Bay

Marine Thematic Block: Quaternary geology and geomorphology: Quaternary of Wales

Prospective Status: 1st order M.E.C.A.

Numerical assessment

The site scores a reasonably confident 57% in terms of the scientific criteria, whilst the potential threat to the site is also confidently deemed high. Near-field threats are considered significant whilst far-field threats are considered to be negligible. The lack of available data does not seem to affect the confidence values and consideration with regard to the respective weighting of individual threat criteria may be necessary. Degradation of the site is deemed to be moderate, although this is confidently attributed to natural contemporary processes.

Scientific value – 57%

Confidence – 68%

Near-field Threats – 7

Confidence – 31

Far-field Threats - 2

Confidence – 38

Total Threat – 9%

Total Confidence – 69%

Site Preservation – 11/40

Confidence – 25/40

Conservability – 12/30

Confidence – 17/30

Regenerative Ability – 30/30

Confidence – 30/30

Key References

Campbell, S. and Bowen, D.Q. (1989). *Quaternary of Wales*, Geological Conservation Review Series, 2. Nature Conservancy Council.

Heyworth, A. (1985). *Submerged forests: A dendrochronological and palynological investigation*. Unpublished PhD thesis. University of Wales, Aberystwyth.

May, V.J. and Hansom, J.D. (2003). *Coastal Geomorphology of Great Britain*. Geological Conservation Review Series. J.N.C.C. Peterborough.

Wilks, P.J. (1977). *Holocene sea-level change in the Cardigan Bay area*. Unpublished PhD thesis, University of Wales, Aberystwyth.

B20. Menai Strait

Reference number: 22

Assessment Position: 1

Location: North West Wales

Latitude 53° 00' 00 - 53° 20' 00

Longitude 04° 00' 00 - 04° 25' 00

The Menai Strait separates the Isle of Anglesey from mainland North Wales and is orientated in a northeast–southwest direction along the line of an ancient fault system. The Strait has a complex and diverse geological structure which has been subsequently modified by both glacial and fluvial processes during various glacial and interglacial stages. The resulting elongated depression contains a raised central section separating what was, during the early Holocene, two river valley systems. During the Flandrian marine transgression these river valleys were gradually flooded from either end resulting initially in the formation of two estuarine systems, followed by the development of the contemporary tidal channel.

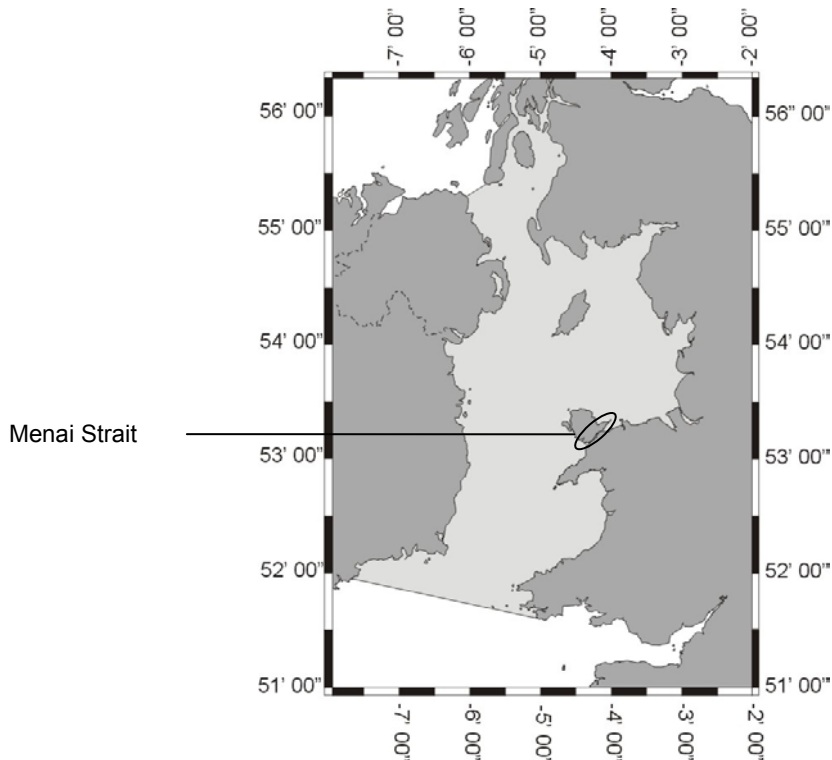


Figure 1. Menai Strait

Marine Thematic Block: Quaternary geology and geomorphology:

Prospective Status: Tidal Strait System: 2ND Order Marine Geotope, enclosing potentially important 1st order Marine Earth-science Conservation Areas.

Numerical assessment

In terms of scientific value the Menai Straits return the highest score of all the potential sites assessed, with a rating of 80% coupled with a 78% confidence rating. The high scores are primarily driven by the large volume of data currently available; although an element of the data was acquired through industrial companies that have operated within the northeastern region of the strait, most studies, have in the past been carried out under the auspices of the School of Ocean Sciences based at Menai Bridge. Both near and far field threats are considered to be moderate and to be predominantly associated with either impacts from fishing or on changes imparted upon the existing sediment transport system. The Menai Strait is considered to be an excellent example of a potential marine geotope type system, incorporating both contemporary and relict features of potentially first order status; such as the ebb tidal delta system and sand spits located toward the south west, as well as the relict bed-forms from the Early-Mid Holocene located to the northeast.

Important Features:

Solid Geology
Ebb Tidal Delta
Sand Spits
Devensian Glacial Deposits
Holocene sediments
Post Glacial Deposits
Early-Mid Holocene Bed-forms
Existing Coastal GCR Site Newborough Warren & Morfa Dinlle

Scientific value – 80%

Confidence – 78%

Near-field Threats – 7

Confidence – 37

Far-field Threats - 4

Confidence - 34

Total Threat – 11%

Total Confidence – 71%

Site Preservation – 30/40

Confidence – 35/40

Conservability – 15/30

Confidence – 25/30

Regenerative Ability – 15/30

Confidence – 20/30

Key References

- Ali, A. (1992). *Sedimentological, geophysical and oceanographic studies of postglacial and contemporary sedimentary processes of the NE Menai Strait and Conwy Bay (Wales, U.K.)*. Unpublished PhD thesis, University of Wales, Bangor.
- Allan, D. (1985). *Seismic stratigraphic analysis of the northeast Menai Strait*. Unpublished MSc thesis, University of Wales, Bangor.
- Butcher, J.A. (1997). *Seismic stratigraphy of shallow water Quaternary sediments around the U.K.* Unpublished PhD thesis, University of Wales, Bangor.
- Cook, M.R. (1980). *Geophysical/Hydrographic investigation of part of the Menai Strait southwest of Bangor Pier – with regard to it's feasibility for use as a pleasure craft marina*. Unpublished MSc thesis, University of Wales, Bangor.
- Jones, S.J. (1978). *The sedimentary history of Gallows Point*. Unpublished MSc thesis, University of Wales, Bangor.
- Osiris Seaway Ltd. (1986). *Marine Site Investigation, Garth Outfall, Bangor*. Report No. D86032. Osiris Seaway Ltd., Clwyd.
- Project Engineering and Management Services Ltd. (1971). *Report on the Menai Straits and Lavan Sands feasibility study*. Contract 171. Project Engineering and Management Services Ltd., London.
- Smart, P.D.N. (1984). *A seabed and sub-bottom survey of the northeast Menai Strait*. Unpublished MSc thesis, University of Wales, Bangor.
- Solangi, S.H. (1991). *Geophysical/Sedimentological studies of a Quaternary tidal delta system*. Unpublished PhD thesis, University of Wales, Bangor.

B21. Shingle Beach

Reference number: 23

Assessment Position: 20

Location: Cemlyn Bay, Anglesey

Latitude 53° 24' 00"

Longitude 04° 30' 00"

The site is located at Cemlyn Bay on the northern coast of Anglesey; this particular beach is a good example of a storm/gravel ridge with an isolated lagoon system to its rear. Another similar site can be found located between Criccieth and Black Rock Sands.

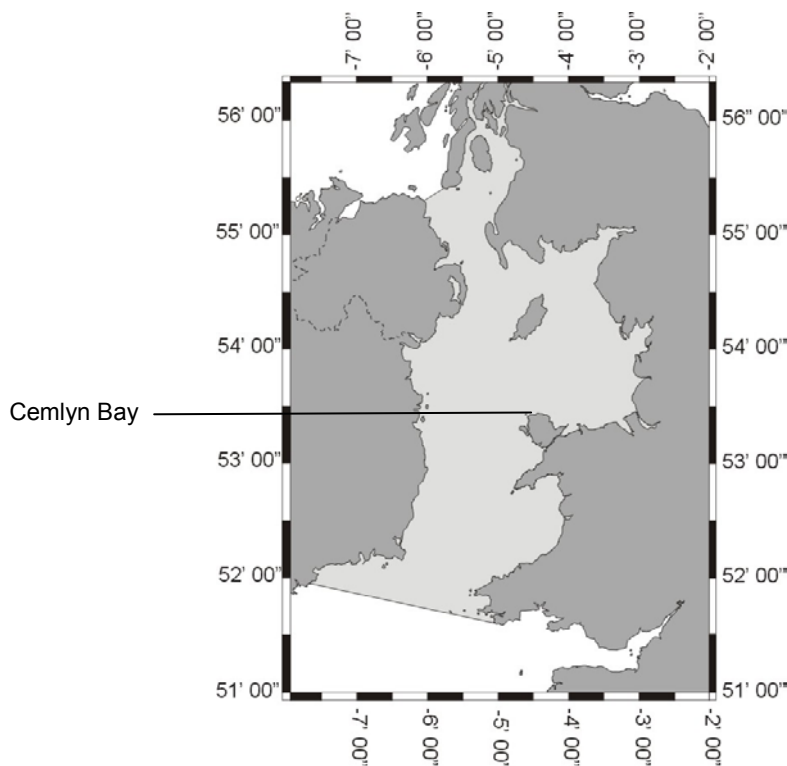


Figure 1. Shingle Beach location

Marine Thematic Block: Quaternary geology and geomorphology.

Prospective Status: 1st order M.E.C.A. nested within a 2nd order conservation zone

Numerical assessment

The site scores 36% in terms of the scientific criteria with an associated confidence rating of 70%. The site scores poorly in terms of both existing and potential future research, together with a low score associated with teaching values and historical interest. It is however, acknowledged that the site is a good example of this particular type of geomorphological feature. Although the beach does not fulfil the criteria of being located entirely below the low-water mark, additional data may demonstrate its relationship to the immediately adjacent sub-tidal area. Both near and far-field threats are confidently assessed as being negligible. The integrity and conservability of the site is deemed as moderate, due primarily to the sites regenerative ability.

Scientific value – 36%
Confidence – 70%

Near-field Threats – 1
Confidence – 39
Far-field Threats - 1
Confidence – 38
Total Threat – 2%
Total Confidence – 77%

Site Preservation – 26/40
Confidence – 35/40
Conservability – 20/30
Confidence – 20/30
Regenerative Ability – 10/30
Confidence – 22/30

Source

Mr E. I. Rees. School of Ocean Sciences, University of Wales, Bangor.

B22. Overflow Channel

Reference number: 24

Assessment Position: 27

Location: Mid-Irish Sea Basin
Approximate Latitude 52° 45' 00"
Approximate Longitude 05° 27' 00"

The feature is located within the Western Basin of the Irish Sea and consists of a very narrow channel approximately 50m lower than the surrounding deep water basin.

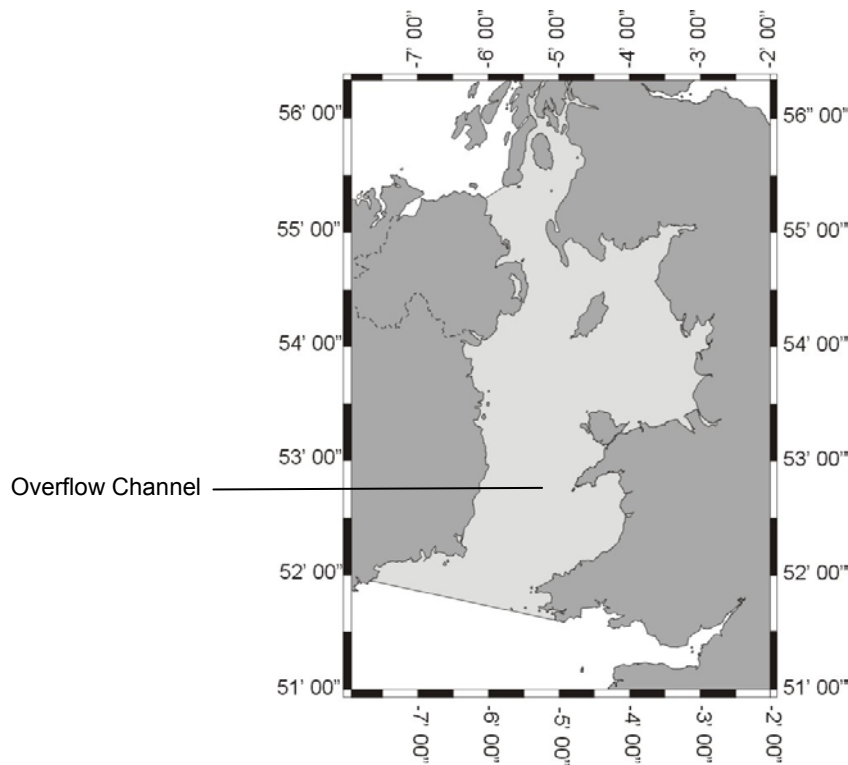


Figure 1. Overflow Channel location

Marine Thematic Block: Quaternary geology and geomorphology.

Prospective Status: 1st order M.E.C.A.

Numerical assessment

The site scores poorly (23%) in terms of the assessed scientific criteria; this low score is due in part to the lack of data associated with the site, and this subsequently results in a low-moderate confidence rating of 48%. It is thought that the scientific criteria would not be altered to any significant degree by the acquisition of additional data. Both near and far-field threat values are confidently assessed as being either low or negligible. A moderate score of 60% is attained within the integrity and conservability section, coupled with a similarly moderate confidence rating of 55%.

Scientific value – 23%

Confidence – 48%

Near-field Threats – 2

Confidence – 36

Far-field Threats - 1

Confidence – 38

Total Threat – 3%

Total Confidence – 74%

Site Preservation – 20/40

Confidence – 15/40

Conservability – 10/30

Confidence – 15/30

Regenerative Ability – 30/30

Confidence – 25/30

Source

Mr E. I. Rees. School of Ocean Sciences, University of Wales, Bangor.

B23. Rock Pinnacle

Reference number: 25

Assessment Position: 21

Location: Western Irish Sea

Latitude 53° 59' 00"

Longitude 05° 35' 00"

The feature consists of an isolated rock pinnacle located within the western Irish Sea and has what appears to be a near vertical wall on its southern side extending upwards for approximately 30m. The feature also appears to have unconsolidated sediment banked up on its northern side.

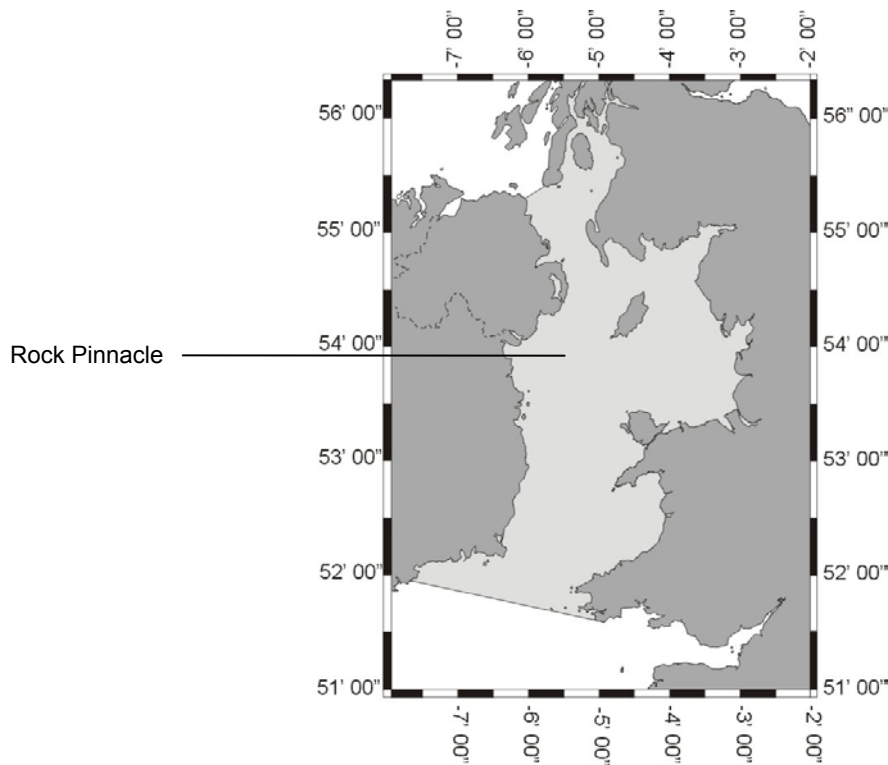


Figure 1. Rock Pinnacle location

Marine Thematic Block: Quaternary geology and geomorphology.

Prospective Status: 1st order M.E.C.A.

Numerical assessment

The site scores 34% in terms of the scientific criteria with a low associated confidence rating of 42%. The site scores poorly in terms of all the assessed scientific criteria, even allowing for the absence of any data relating to it. Both near and far-field threat values are deemed to be effectively either negligible or non-existent. The integrity and conservability section results in high scores with respect to both the assessed criteria and the associated confidence.

Scientific value – 34%
Confidence – 42%

Near-field Threats – 1
Confidence – 38
Far-field Threats - 0
Confidence – 40
Total Threat – 1%
Total Confidence – 78%

Site Preservation – 30/40
Confidence – 30/40
Conservability – 25/30
Confidence – 25/30
Regenerative Ability – 30/30
Confidence – 25/30

Source

Mr E. I. Rees. School of Ocean Sciences, University of Wales, Bangor.

B24. Loch Striven

Reference number: 26

Assessment Position: 9

Location: Firth of Clyde

Latitude 55° 50' 00 - 55° 55' 00

Longitude 05° 00' 00 - 05° 05' 00

Located toward the northern extreme of the pilot study area, this Sea-Loch can be defined as a sediment basin containing both Devensian and Holocene unconsolidated sediments.

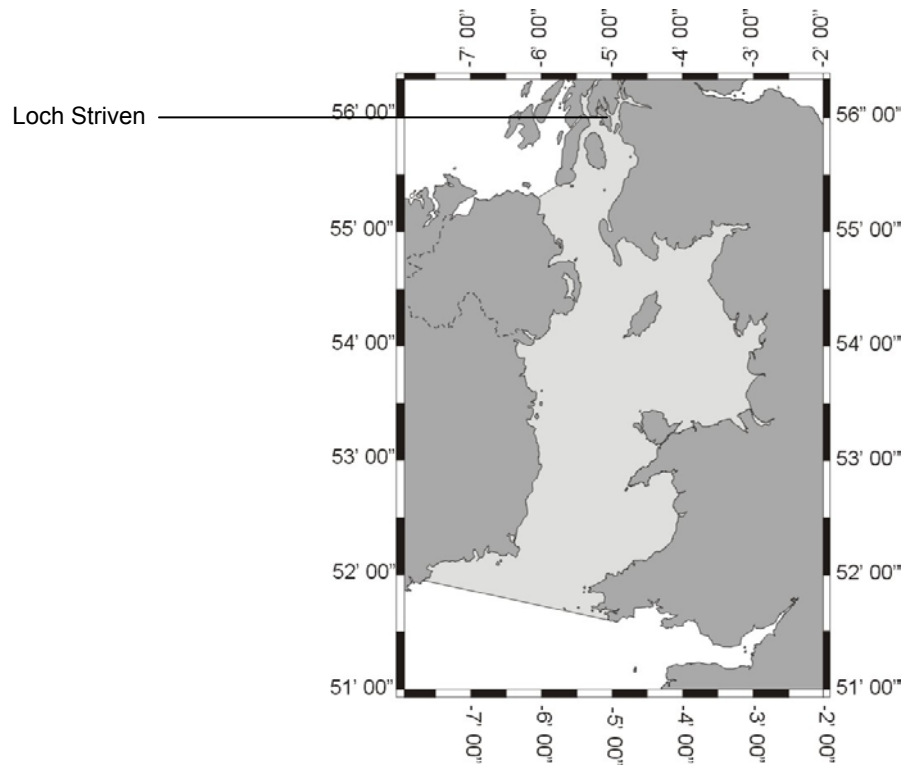


Figure 1. Loch Striven

Marine Thematic Block: Quaternary geology and geomorphology. Quaternary of Scotland.

Prospective Status: 1st order M.E.C.A.

Numerical assessment

The site scores a moderately confident 54% in terms of the scientific criteria, however it must be noted that the assessment is based on having no data currently available. The moderate score simply reflects the potential importance of the site assuming that it contains sequences of sediment that can be related to local environmental changes that have taken place during the Quaternary. The potential near and far-field threat components to the system seem relatively high and more data would be required in order to justify this rating. Section D of the numerical assessment seems to demonstrate a moderate value with a very low confidence value, primarily attributable to the lack of available data.

Scientific value – 54%

Confidence – 47%

Near-field Threats – 9

Confidence – 29

Far-field Threats - 4

Confidence – 33

Total Threat – 13%

Total Confidence – 62%

Site Preservation – 20/40

Confidence – 15/40

Conservability – 15/30

Confidence – 10/30

Regenerative Ability – 15/30

Confidence – 10/30

Source

Mr E. I. Rees. School of Ocean Sciences, University of Wales, Bangor.

B25. Buried River Channels

Reference number: 28

Assessment Position: 10

Location: Liverpool Bay

Latitude 53° 50' 00 - 53° 55' 00

Longitude 03° 45' 00 - 03° 52' 00

Located within Liverpool Bay are several examples of features which may probably represent former river channels, which have been infilled with undivided Devensian and Holocene sediments. These broad incisions within the Devensian sediments of the region are apparent on geophysical profiles taken throughout Liverpool Bay and are found to be generally orientated in an east-west direction. The lack of data currently available inhibits a more accurate description of these features.

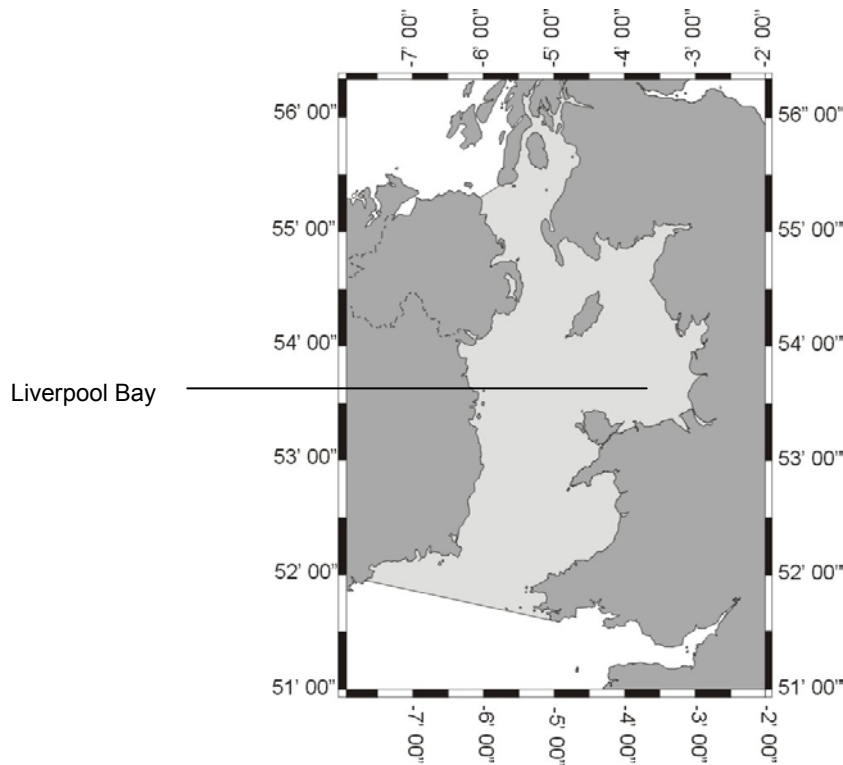


Figure 1. Liverpool Bay

Marine Thematic Block: Quaternary geology and geomorphology.

Prospective Status: 1st order M.E.C.A.

Numerical assessment

The site scores 52% in terms of the scientific criteria, however it must be noted that the assessment is based on very little available data and as a consequence the associated confidence value is a moderate 61%. Near-field threat values are found to be moderate, primarily attributable to anthropogenic activity within the local area; however, far-field threats are deemed to be zero given the fact that these features are in effect protected by overlying sediment and only large-scale direct disturbance would alter them to any significant degree. The assessment seems to confidently assess aspects associated with the integrity and conservability of the features, even though there seems to be an inadequate volume of data available.

Scientific value – 52%
Confidence – 61%

Near-field Threats – 8
Confidence – 31
Far-field Threats - 0
Confidence – 40
Total Threat – 8%
Total Confidence – 71%

Site Preservation – 30/40
Confidence – 30/40
Conservability – 25/30
Confidence – 22/30
Regenerative Ability – 30/30
Confidence – 25/30

Key Reference

Jackson, D.I., Jackson, A.A., Evans, D., Wingfield, R.T.R., Barnes, R.P. & Arthur, M.J. (1995). *United Kingdom offshore regional report: The geology of the Irish Sea*. London: HMSO for the British Geological Survey.

B26. Dyke Pinnacle

Reference number: 29

Assessment Position: 26

Location: Beauforts Dyke
Approximate Latitude 54° 30' 00"
Approximate Longitude 05° 05' 00"

The feature is located at the southern end of Beauforts Dyke and rises from approximately 100m to 43m in 0.5km (E. I. Rees, pers. com. 2004).

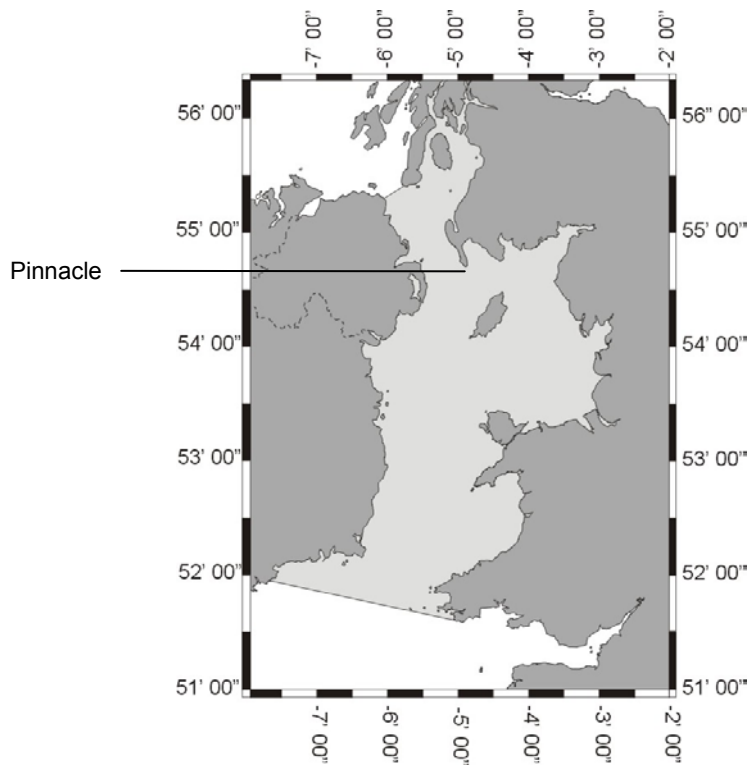


Figure 1. Pinnacle location

Marine Thematic Block: Quaternary geology and geomorphology.

Prospective Status: 1st order M.E.C.A.

Numerical assessment

The site scores poorly (24%) in terms of the assessed scientific criteria; this result is associated with an equally low confidence rating of (46%). It is thought that this particular result would not be enhanced if additional data were to be obtained. Near and far-field threats are confidently considered to be either low or negligible. A high score of 75% is attained within the integrity and conservability section, coupled with a moderate confidence rating of 60%.

Scientific value – 24%

Confidence – 46%

Near-field Threats – 2

Confidence – 37

Far-field Threats - 0

Confidence – 40

Total Threat – 2%

Total Confidence – 77%

Site Preservation – 30/40

Confidence – 15/40

Conservability – 15/30

Confidence – 15/30

Regenerative Ability – 30/30

Confidence – 30/30

Source

Mr E. I. Rees. School of Ocean Sciences, University of Wales, Bangor.

B27. Linear Troughs

Reference number: 30

Assessment Position: 12

Location: Southern Irish Sea

Latitude 51° 00' 00 - 53° 00' 00

Longitude 05° 00' 00 - 07° 00' 00

These features are located within the southern region of the Irish Sea and St Georges Channel, although they also occur further to the north towards North Wales and also south of the pilot study area. They consist of a series of major incisions within the Quaternary deposits of the area, which have subsequently been infilled by younger overlying sequences. The incisions were thought by Wingfield (1989) to indicate the positions of former meltwater channels proximate to long-term ice fronts.

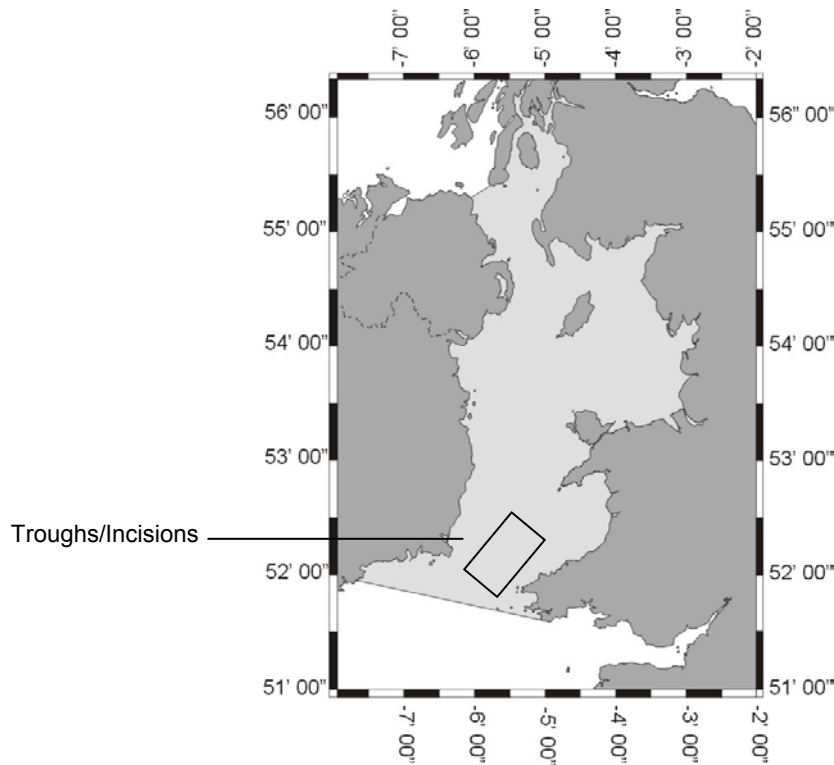


Figure 1. Linear Troughs and Incisions

Marine Thematic Block: Quaternary geology and geomorphology.

Prospective Status: 1st order M.E.C.A.'s

Numerical assessment

The site scores 49% in terms of the scientific criteria, however it must be noted that the assessment is based on very little available data and as a consequence the associated confidence value is a low-moderate 52%. Near-field threat values are found to be confidently rated as very low, with far-field threats confidently rated at zero. Given the nature of the features being assessed and their location within the pilot study area, these values are to be expected, even accounting for the lack of available data. The section that accounts for the sites integrity and conservability results in a very high value with an associated high confidence rating.

Scientific value – 49%
Confidence – 52%

Near-field Threats – 2
Confidence – 38
Far-field Threats - 0
Confidence – 40
Total Threat – 2%
Total Confidence – 78%

Site Preservation – 30/40
Confidence – 30/40
Conservability – 25/30
Confidence – 25/30
Regenerative Ability – 30/30
Confidence – 25/30

Key References

Tappin, D.R., Chadwick, R.A., Jackson, A.A., Wingfield, R.T.R. & Smith, N.J.P. (1994). *United Kingdom offshore regional report: The geology of Cardigan Bay and the Bristol Channel*. London: HMSO for the British Geological Survey.

Wingfield, R.T.R. (1989). Glacial incisions indicating Middle and Upper Pleistocene ice limits off Britain. *Terra Nova*, 1, 538-548.

B28. Muddy Hollow

Reference number: 31

Assessment Position: 14

Location: Tremadoc Bay

Latitude 52° 38' 00 - 52° 43' 00

Longitude 04° 30' 00 - 04° 38' 00

The feature is located approximately 20km south of the Llŷn Peninsula and consists of an elongated depression over 10km in length along the sea-floor. The feature attains a maximum width of 3km with a maximum depth of 20m below that of the surrounding sea-bed. Muddy Hollow contains a range of fine-grained Holocene deposits, which may possibly include sequences of sediment that reflect the local environmental changes that took place during the early-mid Holocene, marine transgression. Seismic data indicate that the basin contains a Devensian Late-glacial sequence of potential significance for constraining the timing of deglaciation, and for palaeoenvironmental research.

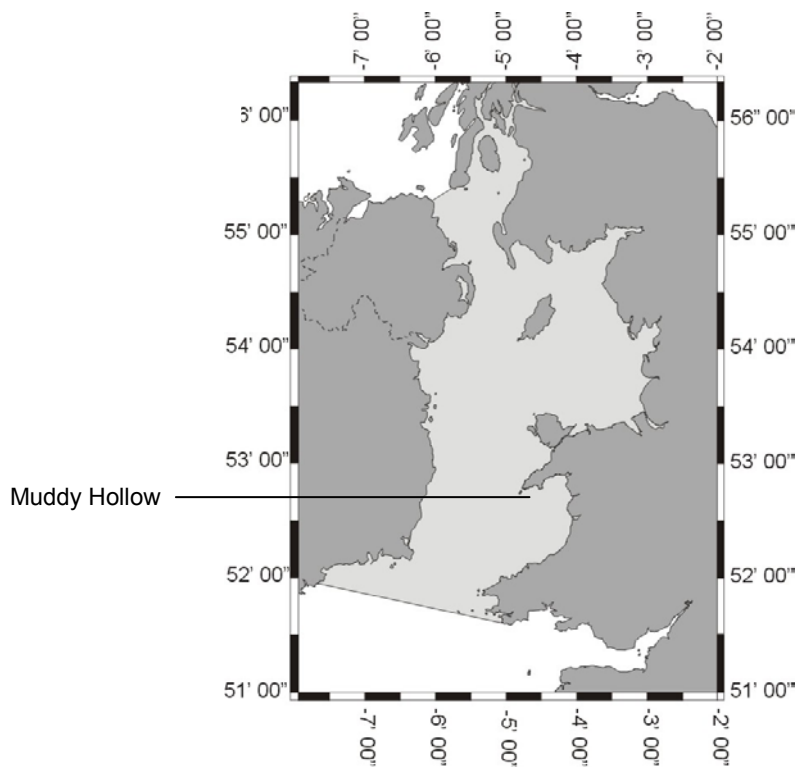


Figure 1. Muddy Hollow

Marine Thematic Block: Quaternary geology and geomorphology.

Prospective Status: 1st order M.E.C.A.

Numerical assessment

The site only scores 44% in terms of the scientific criteria, however it must be noted that the assessment is based on very little available data and this is reflected in the associated low confidence rating. Near-field threats are deemed to be moderately low given the nature and extent of the feature this is to be expected, even allowing for the lack of available data. Far-field threat values are confidently found to be zero. A very confident high value (80%) is obtained with respect to the sites integrity and conservability.

Scientific value – 44%

Confidence – 50%

Near-field Threats – 4

Confidence – 34

Far-field Threats - 0

Confidence – 40

Total Threat – 4%

Total Confidence – 74%

Site Preservation – 30/40

Confidence – 30/40

Conservability – 25/30

Confidence – 25/30

Regenerative Ability – 25/30

Confidence – 25/30

Key References

Tappin, D.R., Chadwick, R.A., Jackson, A.A., Wingfield, R.T.R. & Smith, N.J.P. (1994). *United Kingdom offshore regional report: The geology of Cardigan Bay and the Bristol Channel*. London: HMSO for the British Geological Survey.

Beggs, T.R. (1974). *The movements of water and sediment in Tremadoc Bay*. Unpublished MSc. Thesis, University of Wales Bangor.

Earle, D.A. (1974). *Consolidation and related properties of some sediments from Tremadoc Bay, North Wales*. Unpublished MSc. Thesis, University of Wales Bangor.

Fenemore, P.R. (1976). *Reflexion and refraction acoustics, Tremadog Bay (North Wales)*. Unpublished MSc. Thesis, University of Wales Bangor.

Jackson, P.D. (1976). *Geotechnical Mapping of the Sea-bed. Final Report, Part II – Electrical Measurements*. N.E.R.C. Contract No. F60/4/22.

Patterson, J. (1975). *Analysis of sidescan sonar records taken in Tremadoc Bay, North Wales*. Unpublished MSc Thesis, University of Wales Bangor.

Simpkin, P.G. & Taylor-Smith, D. (1976). *Geotechnical Mapping of the Sea-bed. Final Report, Part III & IV – Acoustics & General Conclusions*. N.E.R.C. Contract No. F60/4/22

Sommerville, J.H. (1973). *A continuous seismic profiling survey of Tremadoc Bay*. Unpublished MSc Thesis, University of Wales Bangor.

B29. Gas Seeps

Reference number: 32

Assessment Position: 7

Location: Muddy Hollow & Tremadoc Bay

Latitude 52° 30' 00 - 52° 55' 00

Longitude 04° 00' 00 - 04° 40' 00

Within areas of Tremadoc Bay, specifically Muddy Hollow, an area west of Barmouth and also south of Criccieth, side-scan and geophysical surveys have indicated characteristics within the sediments that can be associated with the production of gas. Surveys within the area have previously been conducted under the auspices of the University of North Wales, Bangor, School of Ocean Sciences. It is also known that the area has been subjected to surveys conducted by the University of Wales, Aberystwyth and by The Countryside Council for Wales.

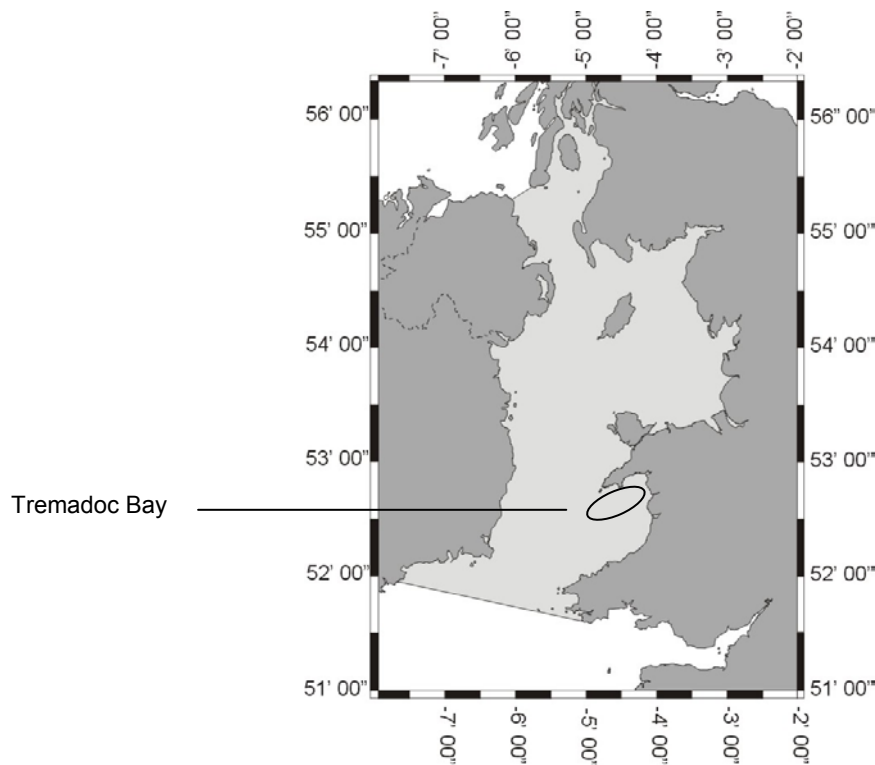


Figure 1. Location of Muddy Hollow, Tremadoc Bay

Marine Thematic Block: Quaternary geology and geomorphology: Quaternary of Wales

Prospective Status: 1st order M.E.C.A.

Numerical assessment

The site scores 54% in terms of the scientific criteria, although there have been numerous surveys carried out in the recent past, there seems to be an absence of data specific to the identification of individual seeps and the justification or potential for future research is consequently deemed to be high. Both near and far-field potential threat values are confidently considered to be low.

Scientific value – 54%

Confidence – 64%

Near-field Threats – 3

Confidence – 34

Far-field Threats - 1

Confidence – 39

Total Threat – 4%

Total Confidence – 73%

Site Preservation – 20/40

Confidence – 20/40

Conservability – 15/30

Confidence – 20/30

Regenerative Ability – 30/30

Confidence – 25/30

Key References

Beggs, T.R. (1974). *The movements of water and sediment in Tremadoc Bay*. Unpublished MSc. Thesis, University of Wales Bangor.

Earle, D.A. (1974). *Consolidation and related properties of some sediments from Tremadoc Bay, North Wales*. Unpublished MSc. Thesis, University of Wales Bangor.

Fenemore, P.R. (1976). *Reflexion and refraction acoustics, Tremadoc Bay (North Wales)*. Unpublished MSc. Thesis, University of Wales Bangor.

Jackson, P.D. (1976). *Geotechnical Mapping of the Sea-bed. Final Report, Part II – Electrical Measurements*. N.E.R.C. Contract No. F60/4/22.

Patterson, J. (1975). *Analysis of sidescan sonar records taken in Tremadoc Bay, North Wales*. Unpublished MSc Thesis, University of Wales Bangor.

Simpkin, P.G. & Taylor-Smith, D. (1976). *Geotechnical Mapping of the Sea-bed. Final Report, Part III & IV – Acoustics & General Conclusions*. N.E.R.C. Contract No. F60/4/22

Sommerville, J.H. (1973). *A continuous seismic profiling survey of Tremadoc Bay*. Unpublished MSc Thesis, University of Wales Bangor.

B30. Mud Banks

Reference number: 34

Assessment Position: 22

Location: North of Anglesey

Latitude 53° 28' 00 - 53° 34' 00

Longitude 04° 20' 00 - 04° 35' 00

These features appear to consist of a range of banks orientated in an east-west direction and extending northward out from the coastline 14km off northern Anglesey. They seem to undulate between 10 and 20m off the sea-floor and are primarily composed of fine grained muddy sediments.

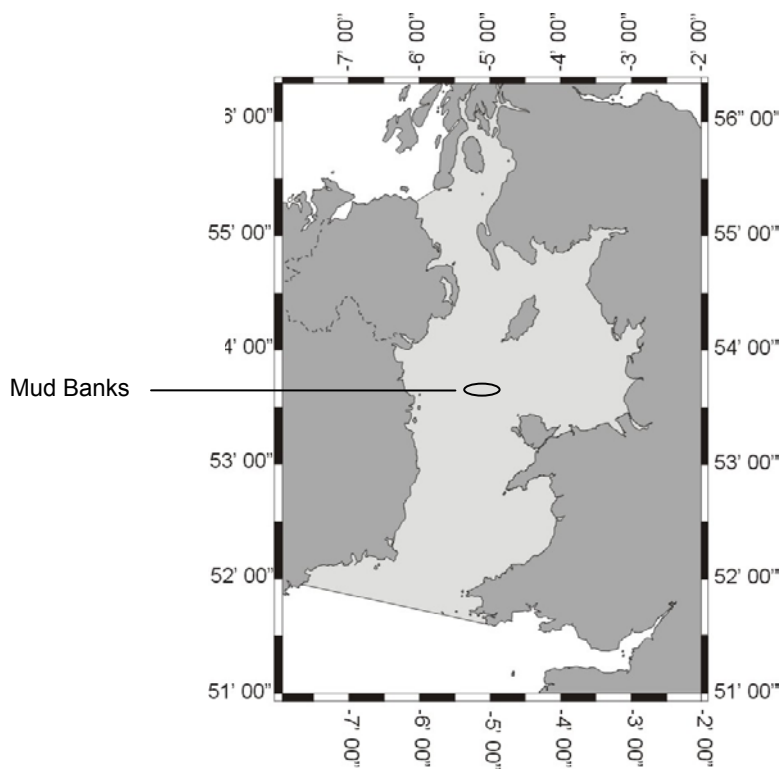


Figure 1. Mud Bank locations

Marine Thematic Block: Quaternary geology and geomorphology.

Prospective Status: 1st order M.E.C.A.

Numerical assessment

The site scores poorly (32%) in terms of the assessed scientific criteria with a moderate or low confidence rating of 45%. The site scores poorly in terms of all the assessed scientific criteria, particularly within the research and teaching criteria. Although there is little data available in order to make the assessment, it is considered highly improbable that an improvement with respect to this result could be attained if additional data were to be made available. Near-field threats are confidently considered to be very low, whilst far-field threats are confidently deemed to be negligible. A moderate score is attained within the integrity and conservability section, however, there is a low confidence rating associated with this section of the assessment.

Scientific value – 32%

Confidence – 50%

Near-field Threats – 3

Confidence – 36

Far-field Threats - 0

Confidence – 40

Total Threat – 3%

Total Confidence – 76%

Site Preservation – 25/40

Confidence – 15/40

Conservability – 10/30

Confidence – 10/30

Regenerative Ability – 15/30

Confidence – 10/30

Source

Mr M.J. Roberts. School of Ocean Sciences, University of Wales, Bangor.

Acknowledgements

The authors gratefully acknowledge the advice and information given to them by Mr Ivor Rees during the initial search for prospective sites within the study area.

Many thanks also to Dr James Scourse for his advice and supervision during the compilation of the report.