



# **Offshore Special Area of Conservation: Darwin Mounds**

## **SAC Selection Assessment**



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**Version 4.0 (1<sup>st</sup> July 2008)**

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\* Cover photo illustrates cold water coral 'thicket' on the Darwin Mounds

## Introduction

This document provides detailed information about the Darwin Mounds site and evaluates its interest features according to the Habitats Directive selection criteria and guiding principles.

The advice contained within this document is produced to fulfil requirements of JNCC under Part 2 of the Offshore Marine Conservation (Natural Habitats, & c.) Regulations 2007, relating to the conservation of natural habitat types and habitats of species through identification of Special Areas of Conservation (SACs) in UK offshore waters. Under these Regulations, JNCC has an obligation to provide certain advice to Defra to enable the Secretary of State to fulfil his obligations under the Regulations, and to Competent Authorities to enable them to fulfil their obligations under the Regulations.

This document includes information required under Regulation 7 of the Offshore Marine Conservation (Natural Habitats, & c.) Regulations 2007 to enable the Secretary of State to transmit to the European Commission the list of sites eligible for designation as Special Areas of Conservation (SACs). JNCC have been asked by Defra to provide this information to Government.

Sites eligible for designation as offshore marine SACs are selected on the basis of the criteria set out in Annex III (Stage 1) to the Habitats Directive and relevant scientific information. Sites are considered only if they host a Habitats Directive Annex I habitat or Annex II species. Moreover, sites for Annex II species must contain a clearly identifiable area representing physical and biological factors essential to these species' life and reproduction to be eligible. Socio-economic factors are not taken into account in the identification of sites to be proposed to the European Commission<sup>1</sup>.

In addition to information on the Annex I habitats and/or Annex II species hosted within the site, this document contains i) a chart of the site, ii) its name, location and extent, and iii) the data resulting from application of the criteria specified in Annex III (Stage 1) to the Habitats Directive. This is in line with legal requirements outlined under Regulation 7. JNCC has adhered to the format established by the Commission for providing site information. This format is set out in the 'Natura 2000 Standard data form' (CEC, 1995) (prepared by the European Topic Centre for Biodiversity and Nature Conservation on behalf of the European Commission to collect standardised information on SACs throughout Europe).

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<sup>1</sup> Following European Court of Justice 'First Corporate Shipping' judgement [C-371/98](#) (7 November 2000)

## Document version control

Version and issue date	Amendments made	Issued to and date
DarwinMounds_SelectionAssessment_4.0.doc (1 <sup>st</sup> July 2008)	- New site map inserted (boundary unchanged)	Secretary of State (July 2008)
DarwinMounds_SelectionAssessment_3.1.doc (13 <sup>th</sup> November 2007)	- Draft SAC changed to possible SAC	Public consultation (December 2007)
DarwinMounds_SelectionAssessment_3.0.doc (25 <sup>th</sup> May 2007)	<ul style="list-style-type: none"> <li>- New introductory text, revised site summary (refers to corrected boundary of Rockall Trough and Bank Regional Sea) and map layout, heading &amp; text amendments</li> <li>- Revised site boundary and area</li> <li>- Additional guiding principles for site selection incorporated under Global Assessment</li> <li>- Conservation Objectives and Advice on Operations moved to separate document</li> </ul>	JNCC Committee (June 07) and UK Marine Biodiversity Policy Steering Group (September 07)
DarwinMoundsDossier_2.0_draft.doc (26 <sup>th</sup> August 2006)	<ul style="list-style-type: none"> <li>- Draft Conservation Objectives and (revised) Advice on Operations added.</li> <li>- Map layout revised</li> </ul>	Defra, Devolved Administrations, and other Govt. departments (25 <sup>th</sup> September 2006)
Darwin Mounds proposed Special Area of Conservation: JNCC 02 P10 (June 2002)		JNCC Committee (June 2002) and Defra (2002)

## Further information

This document is available as a pdf file on JNCC's website for download if required ([www.jncc.gov.uk](http://www.jncc.gov.uk))

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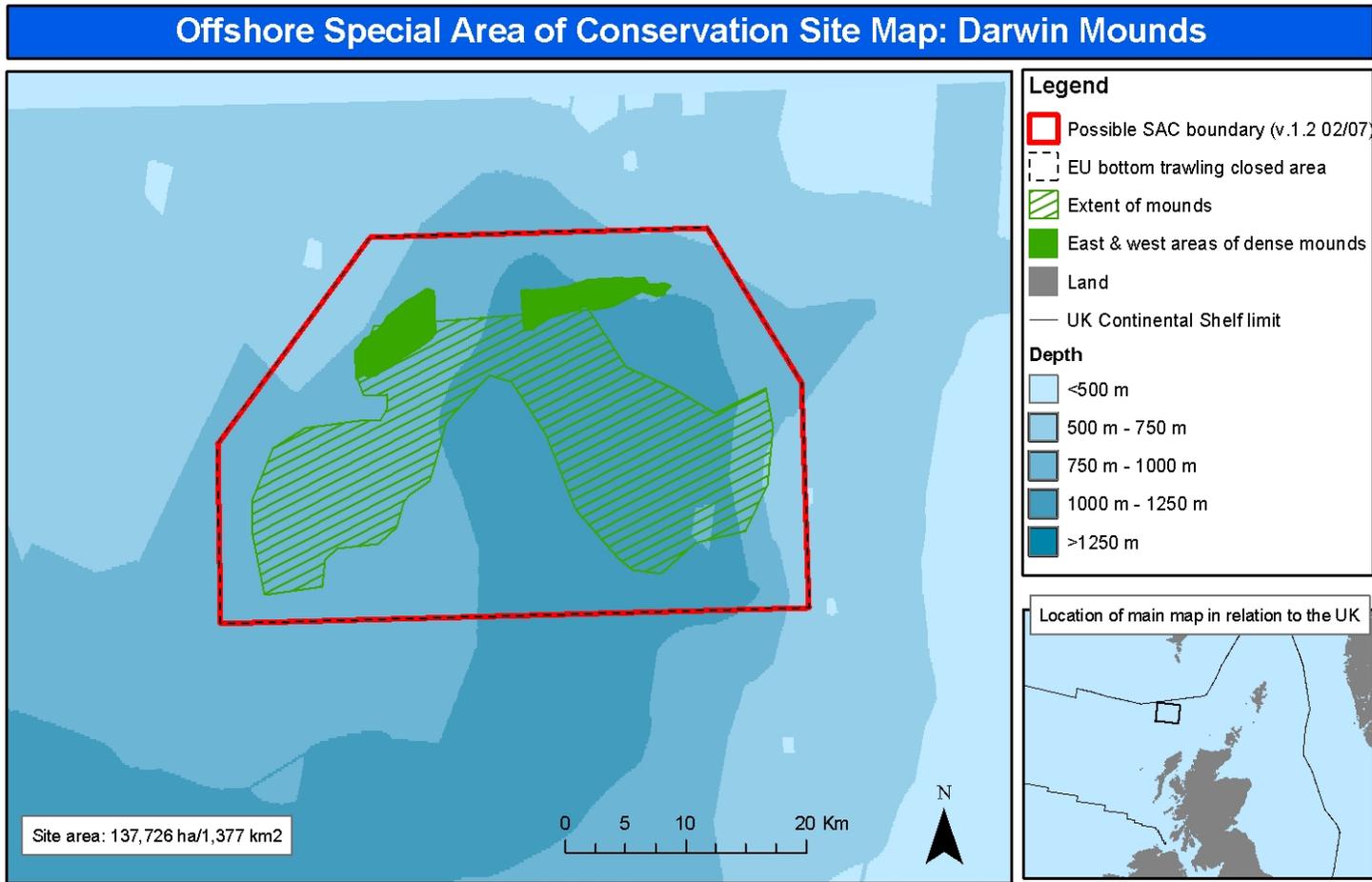
## Darwin Mounds: SAC Selection Assessment

<b>1. Site name</b> Darwin Mounds	<b>2. Site centre location</b> 59°45'30", -7°-13'0" (Datum: WGS 1984)
<b>3. Site surface area</b> 137,726 ha/1,377 km <sup>2</sup> (Datum: WGS 1984 UTM Zone 29 North, calculated in ArcGIS)	<b>4. Biogeographic region</b> Atlantic

### 5. Interest feature(s) under the EU Habitats Directive

1170 Reefs

## 6. Map of site



### Boundary coordinates:

1) 59°54'0", -6°55'0", 2) 59°47'0", -6°47'0" 3) 59°37'0", -6°47'0" 4) 59°37'0", -7°39'0" 5) 59°45'0", -7°39'0" 6) 59°54'0", -7°25'0"

EU fishing regulation 602/2004 aligns with the draft site boundary.

Site map projected in UTM (Zone 29N, WGS84 datum). Seabed habitat derived from BGS 1:250,000 seabed sediment maps ©NERC and SeaZone bathymetry. Bathymetry ©British Crown and SeaZone Solutions Limited. All rights reserved. Products Licence No. PGA042006.003. This product has been derived in part from material obtained from the UK Hydrographic Office with the permission of the Controller of Her Majesty's Stationery Office and UK Hydrographic Office ([www.ukho.gov.uk](http://www.ukho.gov.uk)). NOT TO BE USED FOR NAVIGATION. The exact limits of the UK Continental Shelf are set out in orders made under section 1(7) of the Continental Shelf Act 1964 (© Crown Copyright). Map copyright JNCC 2008.

## 7. Site summary

The Darwin Mounds is an extensive area of sandy mounds formed by seabed fluid expulsion, each of which is capped with multiple thickets of *Lophelia pertusa*, a cold-water coral. These thickets qualify as Annex I Reef according to the European Commission interpretation (CEC, 2007). The number of thickets vary per mound and may be between one and several metres wide and high. Hundreds of mounds lie within the site but two particularly dense fields of mounds are present to the north east and north west limit of the area (Bett, 2001). Each of the mounds is approximately 100m in diameter and 5m high, and distinguished by a 'tail' feature visible on sidescan sonar. The mounds support significant populations of the xenophyophore *Syringammina fragilissima* (a 15 cm diameter single celled organism) that is widespread in deep waters, but occurs in particularly high densities on the mounds and the tails (Bett, 2001). The occurrence of *Lophelia pertusa* reef as thickets capping sandy mounds is believed to be unique due to the particular geological processes which formed the mounds and the fact that the coral is growing on sand rather than a hard substratum (Masson *et al*, 2003). The individual reefs on each mound provide a habitat for various species of larger invertebrates such as sponges and brisingiid starfish.

The Darwin Mounds lie at the north end of the Rockall Trough at a depth of approximately 1000m. They are beyond the shelf break, approximately 160 km north west of Cape Wrath, Scotland.

This site occurs largely within the Rockall Trough and Bank Regional Sea, although a small part of the site extends into the Scottish Continental Shelf Regional Sea (JNCC, 2004a; Defra 2004). There are no other SACs within the Rockall Trough and Bank Regional Sea. However, the Wyville Thomson Ridge site, which lies close to the Regional Sea boundary, has been recommended to Defra for its reef features. This site is shown below with its characteristic features.

<b>Possible SAC</b>	<b>Notable characteristics of the Reef interest feature (Southampton Oceanography Centre, 2000)</b>
Wyville Thomson Ridge	Wyville Thomson Ridge comprises stony reef (iceberg ploughmarks) and bedrock reef, and is located in a transition area between three biogeographic regions. The reef habitats on the Ridge are unique due to the distinctive hydrographic regime. The faunal communities are composed of species representative of hard marine substrata in deep water such as sponges, brachiopods, octocorals, carpet forming featherstars and sedentary, filter-feeding holothurians.

The Wyville Thomson Ridge reefs differ substantially from those of the Darwin Mounds: they consist of iceberg ploughmarks and bedrock reef, and support different ecological communities due to both the hydrographic regime and substratum. Although hard corals are found at both sites, their growth as reefs on sandy mounds at the Darwin Mounds site differentiates the two sites.

## 8. Site boundary

The proposed boundary for the Darwin Mounds site has been defined using JNCC's boundary definition guidelines. These were agreed by the Joint Nature Conservation Committee and modified subsequent to public consultation in 2003 (JNCC, 2004b). The proposed boundary is a simple polygon defined by whole degrees and minutes, fully

enclosing the minimum area necessary to ensure protection. As bottom trawling is a significant threat to the interest feature the proposed boundary includes a margin to ensure its protection. The maximum depth of water around the feature is 1000-1100 m. Fishing vessels which are bottom trawling in the region need a minimum towline length of twice the depth of water in which they are fishing (SERAD, 2001). Therefore, assuming a ratio of 2:1 fishing warp length to depth, the proposed boundary is defined to include a margin of 2200 m from the *Lophelia pertusa* reefs. The location of the Annex I habitat is drawn from data provided courtesy of Southampton Oceanography Centre (Bett, 1999; Bett *et al.*, 2001).

Note that the boundary now proposed (2007) for the SAC has been aligned with the area permanently closed to bottom trawling through the EU's Common Fisheries Policy in 2004 (Reg 602/2004). This area now excludes the NW and NE corners of the simple box boundary proposed in 2002, following the above guidance on site boundary definition. There was no evidence for the presence of mounds or coral reef in these two corners of the initial boundary box.

## 9. Assessment of interest feature(s) against selection criteria

### 9.1 Reefs

#### Annex III selection criteria (Stage 1A):

##### a) *Representativity*

The Darwin Mounds site is located in the Rockall Trough and Bank Regional Sea, and represents biogenic reef formed by *Lophelia pertusa* on sandy substratum in a deep waters. The energy levels at this site are moderate, and the reef is subject to minimal coastal influence. The Darwin Mounds are considered to be an unusual example of cold coral reefs in UK waters due to the growth of *Lophelia* reefs on sandy mounds. The faunal communities are representative of those present on *Lophelia* reefs, and consist largely of sessile or hemi-sessile invertebrates such as sponges and brisingiid starfish. The mounds also support populations of the xenophyophore *Syringammina fragilissima*. However the site has been subject to some damage from bottom trawling (Bett *et al.*, 2001), therefore the grade for the feature is B: good representativity.

##### b) *Area of habitat*

The reef feature extends over an area of approximately of 57,200 hectares (Graham *et al.*, 2001). This area is small when compared to the combined extent of all types of reef in UK waters; however, it is one of the larger known areas of the *Lophelia pertusa* subtype of reef in the UK. An estimate of the entire Annex I reef resource (bedrock, cobble and biogenic reef) in UK waters is 5,723,600 hectares (UK Favourable Conservation Status Reporting 2007). This total extent figure gives the following thresholds for the grades of this criterion (CEC, 1995):

A – extents between 5,723,600 and 858,540 ha (15-100% of total resource)

B – extents between 858,540 and 114,472 ha (2-15% of total resource)

C – extents less than 114,472 ha (0-2% of total resource)

This site's feature therefore falls within the '0-2%' bracket for Area of Habitat and is graded C.

**c) Conservation of structure and functions**

*Degree of conservation of structure*

The biological and physical structure of the biogenic reef in this area is mainly intact although some areas have been damaged by bottom trawling. Evidence of damage was provided from sidescan sonar images in 1999 (Bett, 1999). New damage (smashed coral strewn on the seabed) was also visible over about a half of the Darwin Mounds East during summer 2000 (Bett, 2001). A trawler was operating nearby during the surveys. Reef damage means a loss of not only the habitat itself, but the species assemblages it supports. Assuming no further damage has occurred, the grading is II: structure well conserved.

*Degree of conservation of functions*

The prospects of this feature to maintain its structure in the future, taking into account unfavourable influences and reasonable conservation effort, are moderate. The European Commission, at the request of the UK, has adopted Common Fisheries Policy measures which prohibit the use of bottom trawling gear within the SAC boundary. However, it is possible that some further bottom trawling may have occurred in the months before these Common Fisheries Policy measures were in place. Equally, it is possible that illegal fishing activities take place on this site. Therefore this feature could be degraded by fisheries in spite of reasonable conservation effort. Regulations are in place to regulate oil and gas activity in and around SACs in the UK Continental Shelf Designated Area, and the laying of submarine cables and pipelines also requires regulatory consent. The site is distant from terrestrial sources of pollution. The grading is II: good prospects.

*Restoration possibilities*

Restoration methods in the offshore area focus on the removal of impacts which should allow recovery where the habitat has not been removed. However, due to the likely damage by bottom-trawling to the physical substratum on the site (the sand mounds), recovery of biogenic reef habitat is unlikely or impossible. This is because *Lophelia* appears to need (or favour) the elevation provided by the sand volcanoes for growth in this area. These mounds are likely to have formed originally under post-glacial conditions and cannot be restored. Therefore, the grade is III: restoration difficult or impossible.

*Overall grade*

When grade II for the first sub-criterion and grade II for the second sub-criterion are combined, the overall grade for the criterion is B: good conservation.

**d) Global assessment**

The suggested grades for Stage 1A criteria a)-c) are B, C and B respectively. Given these evaluations, and taking into account the rarity of this reef sub-type in UK waters, the Global Assessment grade is B ('good conservation value').

### Summary of scores for Stage 1a criteria

Area of habitat	Representativity (a)	Relative surface (b)	Structure and function (c)	Global assessment (d)
Darwin Mounds	B	C	B	B

#### 10. Sites to which this site is related

None

#### 11. Supporting scientific documentation

The Darwin Mounds were discovered using remote sensing techniques in May 1998, and have been further investigated by remote video and sampling in 1998, 1999 and 2000. These surveys were conducted by the Southampton Oceanography Centre, under contract to UK Department of Trade and Industry (Bett 1999, Bett and Jacobs 2000, B. Bett, pers. comm.). Video and photographic images taken during these surveys show the extent of the reef, and its associated species assemblages.

#### 12. Site overview and conservation interest

The Darwin Mounds consists of a large number of sand volcanoes composed of sand overlying mud. This site was the first record of *Lophelia* growing on a sand substratum (*Lophelia* has been found subsequently growing on sand at a site off Spain) (Masson *et al.*, 2003). The mounds are most elevated to the north of the site and diminish in height to the south. There are also two denser regions of mounds in the north east and north west of the site. The West field of the Darwin Mounds measures approximately 13km by 4km and contains approximately 75 mounds. The East field of the Darwin Mounds measures approximately 13km by 9km and contains approximately 150 mounds. On the majority of the mounds there are multiple colonies of *Lophelia pertusa* growing which in many cases has formed thickets which arise from the surface of the mound (Bett, 2001). Like the topography of the mounds, the frequency of coral communities diminishes towards the south of the mound field (Masson *et al.*, 2003). In addition to the mound features, mounds in the northern part of the site showed an acoustic signature of a "tail" which generally lies to the south west of the mound feature. The 'tail' feature of the mounds is thought to be unique globally. The tails are not topographically distinct from the surrounding seabed but are covered with a fine veneer of sand. They support substantial numbers of the xenophyophore *Syngammina fragilissima* (a 15 cm diameter single celled organism) in densities greater than the surrounding seabed (Bett, 2001). The reef habitat on top of the mounds is formed from *Lophelia pertusa* but, another cold water coral, *Madrepora oculata* is also present. The thickets of cold water corals provide a habitat for echinuran worms, brittlestars, brisingiid starfish and sponges (Bett *et al.*, 2001 & Masson *et al.*, 2003). Various fish have been observed on the mounds, but not apparently at significantly higher densities than the background environment.



Plate 1: Cold water coral 'thicket' on the Darwin Mounds (Photo courtesy Brian Bett, Southampton Oceanography Centre)

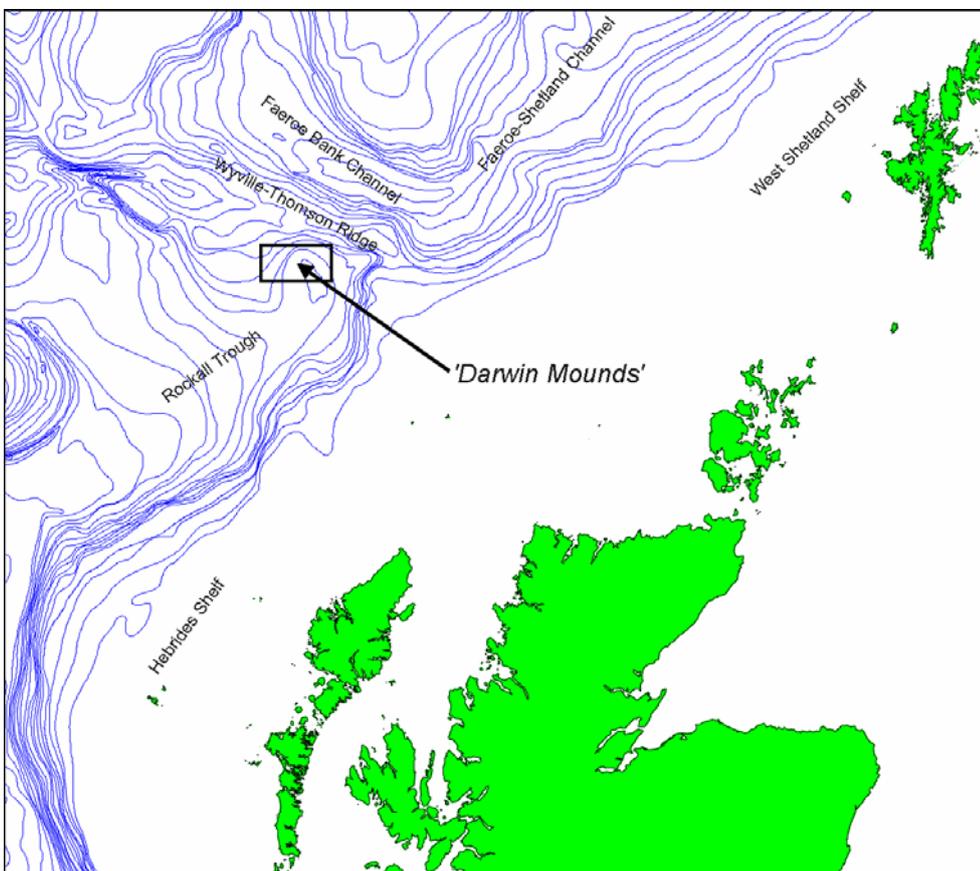


Plate 2: Location of the Darwin Mounds (courtesy Brian Bett, Southampton Oceanography Centre)

### The 'Darwin Mounds', west and east fields

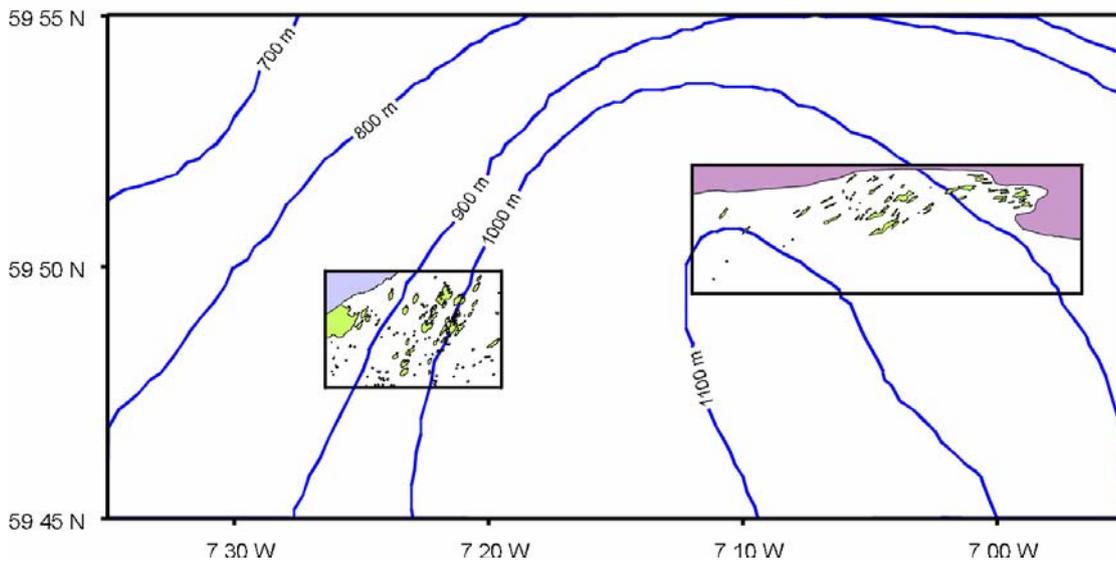


Plate 3: Detail of mound distribution in Darwin Mounds west and east fields (courtesy Brian Bett, Southampton Oceanography Centre)

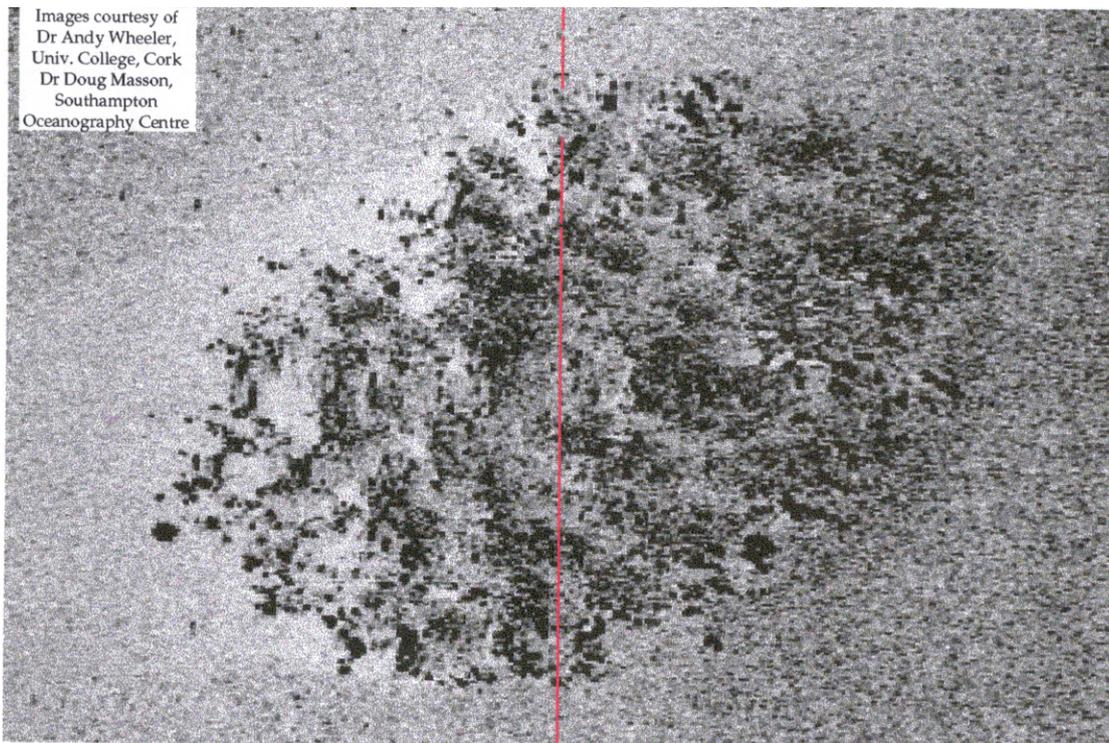


Plate 4: Sidescan image of individual mound (typically 100m diameter, 5m high). Dark areas represent *Lophelia* colonies. Vertical red line represents distance marker from centre of sidescan sonar image.

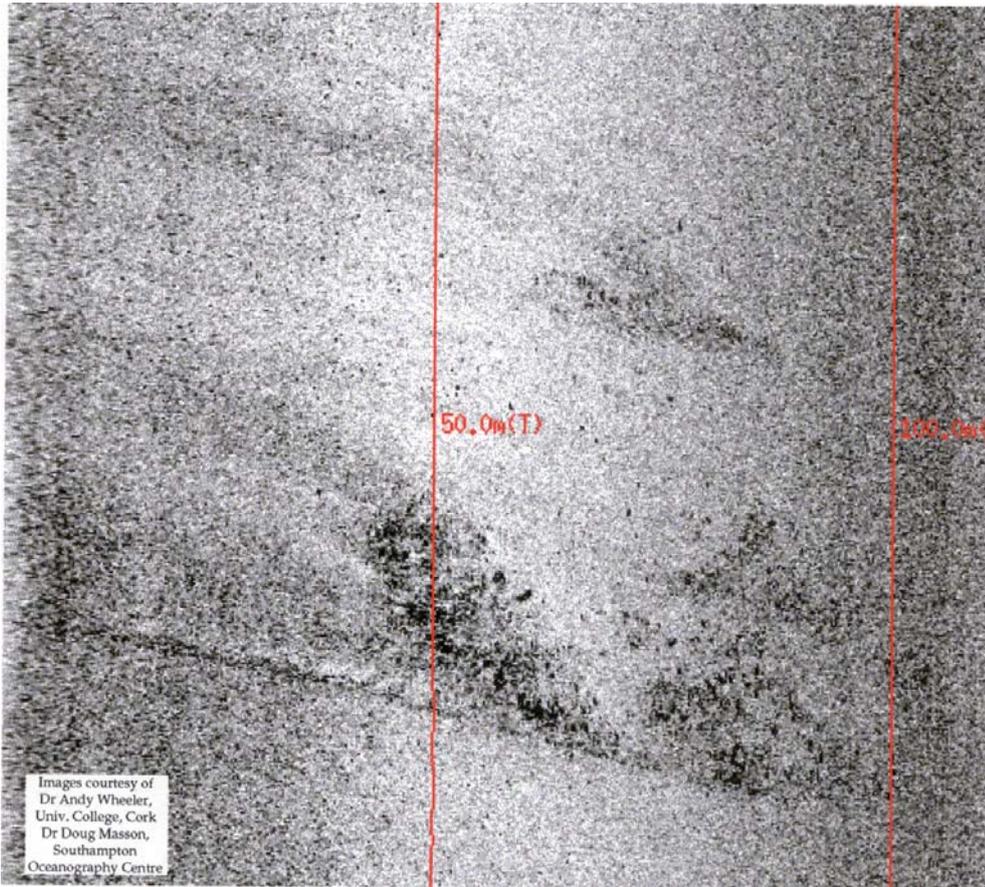


Plate 5: Sidescan image of individual mound (c. 70m diameter) believed to show the effects of deep sea trawling. Dark areas represent *Lophelia* colonies and are much reduced, and there are clear streak-like, linear marks believed to be left by a trawl being dragged across the seabed.

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