Habitat signature catalogue

Belgian Part of the North Sea
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BACKGROUND INFORMATION
INTRODUCTION

The Habitat Signature catalogue has been set-up in accordance with a European need for a better visibility of existing seafloor imagery. With 'signature', any record is meant that demonstrates a particular characteristic of a habitat feature, ideally with a biological connotation. Through the MESH project ('Mapping European Seabed Habitats'), a compilation was made on the scale of the NW European seas and its results can be consulted on-line (http://www.rebent.org/mesh/signatures).

The present publication comprises the Belgian contribution; however with additional examples and more site-specific information. Focus is on subtidal acoustic imagery, acquired using very-high resolution side-scan sonar and multibeam technology.

With the catalogue, it is aimed at providing existing knowledge of the seafloor to a wider community: from the professional surveyor up to the public at large. Each signature comprises its geographic location, the type of technique and, where possible, its interpretation in terms of the physical and biological nature of the seabed.

The catalogue does not comprise imagery of wrecks.

Ghent University, Renard Centre of Marine Geology acquired the acoustic imagery in the framework of the MAREBASSE project (Van Lancker et al., 2007), MESH (MESH Consortium, 2007) and the HABITAT project (Degraer et al., 2002; 2003). Data prior to 2000 is related to Van Lancker (1999). Some of the multibeam imagery originates from the Marine Sand Fund of the FPS Economy, SME’s, Self-Employed and Energy, Quality and Security, Quality and Innovation.

This publication contributes to the MESH project (Mapping European Seabed Habitats, http://www.searchmesh.net) that received European Regional Development Funding through the INTERREG III B Community Initiative (http://www.nweurope.org).

Reference:

The interpretation of subtidal habitats is not always straightforward and will depend directly on the quality of the signatures obtained. Generally, the higher the frequency used, the better resolution can be expected. However, the final quality of the imagery may be hampered by technical constraints, non-ideal survey design and above all weather conditions. In addition, imagery may vary from place to place and with bio-geographic conditions.

Mostly, images are interpreted in terms of their reflectivity, texture and patterns, which can be done in a more or less unbiased way. Delineations (e.g. bedforms) can be drawn 'by eye', based on expert judgement (direct interpretation) and dimensions can be estimated.

However, one should be aware that the acoustic signal return is in decreasing order determined by (Blondel and Murton, 1997): (a) the geometry of the sensor-target system (angle of incidence of each beam, local slope, etc.); (b) the physical characteristics of the surface (micro-scale roughness, etc.); and (c) the intrinsic nature of the surface (composition, density, relative importance of volume versus surface diffusion/scattering for the selected frequency).

Interpretation in terms of sediment nature and distribution remains difficult and requires good quality imagery. The most important parameters controlling the acoustic response of marine sediments, ranked in order of importance are: (a) porosity; (b) density; (c) the overburden stress; (d) the degree and type of lithification; and (e) the grain size and distribution. Most probable, one can distinguish between soft and hard grounds, but going beyond that might require extensive ground-truthing. When the occurrence of macrobenthic species or communities correlates highly with sediment nature, it might be attempted to interpret the imagery in terms of sediment nature first and then to link up with the biology (indirect interpretation). In this case, it will be most crucial to estimate variations in porosity/density first. As such, highly reworked areas, such as sandbank tops, might have a lower signal return, although the grain size is often coarser than its surrounding environments. Additionally, sediments with even minor silt-clay enrichment are more compacted and the area will have a higher signal return.

An overview of the strategies and processes involved in acoustic seabed mapping can be found in the MESH Guidance Framework for Habitat Mapping (www.searchmesh.net).
BACKGROUND INFORMATION

General

Belgian part of the North Sea


**Biotopes**


Morphological features

Large to very-large dunes

**Habitat description:** Large to very-large dunes have respectively a height between 0.75-3 m and more than 3 m. Depending on the regional conditions, small to medium dunes develop superimposed on the larger features. They can be symmetric or asymmetric in shape.

**Biotope description:** Dynamic, exposed sand habitats are occupied by opportunistic mobile fauna such as amphipods (*Bathyporeia* spp.), polychaetes (*Nephtys cirrosa*), sand eels (*Ammodytes* spp.) and mysids (*Gastrosaccus* spp.). These grade into the infralittoral sand communities as sediment disturbance decreases down the bank slopes as flow decreases and further into the mud communities (with *Fabulina fabula* and *Magelona* spp.) as the silt fraction increases in the least disturbed areas. This fauna typically classifies as the *N. cirrosa* or *O. Limacina* community or their transitional species assemblages.

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**Zone:** Goote Bank area  
**Lat:** 51° 24' 46"  
**Long:** 2° 42' 38"

**Acoustic technique:** Multibeam - Kongsberg Simrad Em1002 (95 kHz)  
**Description:** DTM, 2*2m  
**Campaign name:** St0426  
**Date:** November 2004  

**Data ownership, acquisition & processing:** Continental Shelf Department, Federal Public Service Economy, SMEs, Self-Employed and Energy, Quality and Security, Quality and Innovation

**Comments:** Large to very large dunes, with smaller dunes superimposed on their slopes.

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**Zone:** Area north of the Vlakte van de Raan  
**Lat:** 51° 30' 52"  
**Long:** 3° 7’ 8”

**Acoustic technique:** Multibeam - Kongsberg Simrad Em1002 (95 kHz)  
**Description:** DTM, 2*2m  
**Campaign name:** ST0624  
**Date:** 22-23 November 2006

**Comments:** Asymmetric large dunes with a height up to 2.5 m and an average wavelength of 150 m. Small dunes are superimposed on their slopes.
**Habitat description:** Small to medium dunes have respectively a height between 0.075-0.4 m and between 0.4-0.75 m. Depending on the regional conditions, they develop superimposed on the larger features. They can be symmetric or asymmetric in shape.

**Biotope description:** See biotope description of large- to very-large dunes.

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**Zone:** Sierra Ventana area, dumping place of dredged material, Bt&W SI
**Lat:** 51° 26' 42"
**Long:** 3° 2' 1"
**Acoustic technique:** Multibeam - Kongsberg Simrad Em1002 (95kHz)
**Description:** shaded relief map, 1*1m
**Campaign name:** St0303
**Date:** 13 February 2003

**Comments:** Field of small dunes.

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**Zone:** Middelkerke Bank area, southern part
**Acoustic technique:** Side-scan sonar - Klein towfish (500 kHz) and a digital sonar recorder model 595

**Description:** Uncorrected side-scan image
**Campaign name:** St9711
**Date:** 5 May 1997

**Comments:** Medium dunes are superimposed on large to very large dunes. They have a different strike compared to the larger dunes.
**Gravel and sand ribbons**

**Habitat description:** Highly linear ribbons of alternating gravel and sand, orientated parallel to the direction of the maximal tidal current. Sands ribbons have sharply defined margins. They can reach a length of 3-4 km and a width up to 100 m (length:width ratio up to ~ 40:1). Their surface can be smooth or may be superimposed with small to large dunes.

**Biotope description:** Very patchy. Usually gravel patches are associated with typical gravel fauna (see page “gravel”) while an impoverished fauna belonging to the *O. Limacina* community characterizes the sand patches (typical of mobile sands).

**Zone:** Hinder Banken area, swale west of the Westhinder

**Lat:** 51° 27’ 6” **Long:** 2° 25’ 49”

**Acoustic technique:** Multibeam - Kongsberg Simrad Em1002 (95 kHz)

**Description:** Multibeam backscatter image

**Campaign name:** St0030

**Date:** 27 November 2000

**Comments:**
The aligned features, interpreted as gravel ribbons, are parallel to the prevailing current (more than 1m/s) (NE-SW). These bedforms are known to occur where the substrate is coarse and where sand availability is low. They are characterised by a high backscatter and a coarse texture. The ribbon pattern is due to the alternation of high and low backscatter and the distance between the bands is 15-20 m. In this case, the length of the bands is at least 250-300 m long.
**Habitat description:** Barchans occur when not enough transportable sediment is available for the formation of fully developed ripples or dunes. This lack of sediment is due to the immobility of part of the seabed sediment. The sediment underlying the bedforms, may be a stable armor and the exchange of sediment between this armor and the bedforms may be small or non-existent. This habitat occurs in medium to high energy environments where tidal currents and storm-induced currents prevail. The current velocity for their formation falls within a range of 15-100 cm/s and controls their shape. The orientation of their longitudinal axis reflects the current direction. A barchan dune can be inactive or active; the latter witnessed by small dunes on the stoss slopes. An amalgamation of different barchan dunes forms a barchanoid.

**Zone:** Buiten Ratel area  
**Lat:** 51° 19’ 10”  
**Long:** 2° 33’ 24”  
**Acoustic technique:** Multibeam - Kongsberg Simrad Em1002 (95 kHz)

**Description:** Shaded relief map  
**Campaign name:** St0305  
**Date:** May 2002  
**Data ownership, acquisition & processing:** Continental Shelf Department, Federal Public Service Economy, SMEs, Self-Employed and Energy, Quality and Security, Quality and Innovation

**Comments:** Barchan dunes and barchanoids occur at the transition of the Buiten Ratel swale to the sandbank itself. The horns of the dunes point in a NE direction, corresponding with the regional sand transport. The barchanoids have a wavy crestline and a length up to 1 km. Their maximum height is 4.5 m. The wavelength ranges between 300 and 500 m. The substratum of the Buiten Ratel swale consists of gravel.

**Zone:** Hinder Banken area, swale cast of the Oosthinder  
**Lat:** 51° 27’ 55”  
**Long:** 2° 34’ 48”  
**Acoustic technique:** Multibeam - Kongsberg Simrad Em1002 (95 kHz)

**Description:** Multibeam backscatter  
**Campaign name:** St0404  
**Date:** 3-4-5 March 2004  
**Comments:** Typical shape of a submarine barchan dune. The orientation of the dune suggests a current direction from SSW to NNE. This barchan has a width of around 545 m with a small asymmetry between the two horns.
Sediment types

Boulders

Zone: Hinder Banken area, swale east of the Oosthinder
Lat: 51° 24’ 26” Long: 2° 30’ 17”
Acoustic technique: Side-scan sonar - GeoAcoustics 159D (410 kHz)
Description: Side-scan sonar images
Campaign name: St0424
Date: 20-21 October 2004
Comments: Details of side-scan sonar images showing blocks of 2 to 3 m in diameters.
**Habitat description:** Gravel beds are exposed at the seabed surface. They are associated commonly with paleovalleys. In dynamic areas, the gravel beds may be overlain with sand/silt veneers of \( \sim 40 \text{ cm} \) thick (causing local patchiness).

**Biotope description:** Attached epifauna can be sparse when gravel particles are small (\( \sim 30 \text{ mm} \)) and/or mobile, but abundant in areas characterised by cobble/boulder (soft corals, hydroids, encrusting sponges and bryozoans). The sand patches in between the boulders are typically inhabited by the \( O. \text{ Lutacina} \) community.

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**Zone:** Hinder Banken area  
**Acoustic technique:** Multibeam - Kongsberg Simrad Em1002 (95 kHz)

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**Comments:**  
The northern part of the swale between the Westhinder and Oosthinder, and the swale east of the Oosthinder are known to be characterized by coarse grained sediments. The multibeam images show the typical “hummocky” pattern, characteristic for gravel areas. The localised pits have a depth of 2 to 5 m and a spatial extension of more than 1 km.
<table>
<thead>
<tr>
<th>Zone: Hinder Banken area, swale east of the Oosthinder</th>
<th>Zone: Hinder Banken area, swale east of the Westhinder</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Acoustic technique:</strong> video - Inspector color camera</td>
<td><strong>Acoustic technique:</strong> video - Inspector color camera</td>
</tr>
<tr>
<td><strong>Description:</strong> video frames, with their location indicated on the multibeam image</td>
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</tr>
<tr>
<td><strong>Campaign name:</strong> St0424</td>
<td><strong>Campaign name:</strong> St0502</td>
</tr>
<tr>
<td><strong>Date:</strong> 8-9 February 2005</td>
<td><strong>Date:</strong> 8-9 February 2005</td>
</tr>
</tbody>
</table>

| Lat: 51° 27' 50" Long: 2° 38' 48"
HB22 | Lat: 51° 27' 44" Long: 2° 40' 32"
HB10 |
|------------------------------------------------------|------------------------------------------------------|

| Lat: 51° 26' 26" Long: 2° 39' 46"
HB43 | Lat: 51° 25' 45" Long: 2° 31' 8"
WO5 |
|------------------------------------------------------|------------------------------------------------------|

| Lat: 51° 24' 54" Long: 2° 29' 36"
WO9 | Lat: 51° 25' 45" Long: 2° 31' 8"
WO5 |
|------------------------------------------------------|------------------------------------------------------|
Sand gradients

Zone: Trapegeer-Potje-Broersbank area
Acoustic technique: Side-scan sonar - GeoAcoustics 159D (410 kHz)
Description: Side-scan sonar mosaic, 0.01 x 0.01 m
Campaign name: Ha9909
Date: 10 September 1999

Comments: A cross-shore transect with from left to right (distance of 500m): the top of a sandbank superimposed with medium dunes having a medium sand texture; a swale with fine sands with more than 5% silt-clay; and the extent of a very shallow sandbank, superimposed with wave ripples in coarse-grained sediments. The relatively low backscatter along the sandbank (left) is due to the high porosity of the sediments, the higher backscatter in the swale due to compaction induced by the silt-clay fraction and the high backscatter along the second sandbank (right) due to the compacted coarse sediments. This example illustrates clearly the importance of compaction effects on the backscatter intensities of acoustic imagery.

Zone: Smal Bank-Westdiep
Acoustic technique: Side-scan sonar - GeoAcoustics 159D (410 kHz)
Description: Side-scan sonar mosaic (50 m slant range)
Campaign name: HA9910
Date: 14 October 1999

Comments: A cross-shore transect with from left to right (distance of +/- 900m): the steep slope of a sandbank superimposed with medium dunes having a medium sand texture (~250 µm); a swale with fine sands (~200 µm) with +/- 4% silt-clay; and the foot of the gentle slope of a sandbank with medium dunes in shell rich medium sands (~300 µm, 40% shells). High current velocities have created striations in the swale.
Muddy deposits

Zone: Potje
Acoustic technique: Side-scan sonar - GeoAcoustics 159D (410 kHz)
Description: Side-scan sonar mosaic (75 m slant range)
Campaign name: HA0003
Date: 1-2 April 2000

Comments:
Detail of a side-scan sonar mosaic. Differences in backscatter correspond with differences in sediment composition. The lightest reflectivity in the swale is correlated with the presence of mud.

Zone: Potje area
Acoustic technique: Side-scan sonar, GeoAcoustics 159D (410 kHz)
Description: Side-scan mosaic, 0.01*0.01m
Campaign name: HA0003
Date: 1-2 April 2000

Comments:
Detail of a side-scan sonar mosaic of the southern branch of the Potje swale. Differences in backscatter correspond with differences in sediment composition. The lightest reflectivity in the swale is correlated with the presence of fluid mud. Trawl marks are visible clearly.
**Clay layers**

**Habitat description:** On the Belgian part of the North Sea, mostly massive, very heavy and hard, green-grey clay occur. In swales, where the Quaternary cover may be less than 2.5 m, Tertiary outcrops are to be expected.

**Biotope description:** Clay layers are typically inhabited by the *Borrea candida* community, in which only the bivalve *B. candida* can be found in moderately high densities. This community is currently described only from one sample.

<table>
<thead>
<tr>
<th>Zone</th>
<th>Acoustic technique</th>
<th>Description</th>
<th>Campaign name</th>
<th>Date</th>
</tr>
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<tbody>
<tr>
<td>Hinder Banken area, swale between the Westhinder and Oosthinder</td>
<td>Multibeam - Kongsberg Simrad Em1002 (95 kHz)</td>
<td>shaded relief map, 2*2m</td>
<td>St0424</td>
<td>20-21 November 2004</td>
</tr>
<tr>
<td>Westdiep area</td>
<td>Side-scan sonar - Klein towfish (500 kHz) and a digital sonar recorder model 595</td>
<td>Uncorrected side scan sonar image, 2*2m</td>
<td>St9621</td>
<td>23-26 September 1996</td>
</tr>
</tbody>
</table>

**Comments:**
The multibeam imagery shows a ridge-like feature along the axis of the swale, due probably to differential erosion of the clayey deposits of the Ypresian. In addition, SW-NE aligned features are observed; these are probably surface expressions of faulting phenomena in the Ypresian clay.

**Comments:**
Side-scan sonar imagery along the foot of the Nieuwpoort Bank, witnessing the sharp delineation between a sandbank-swale system. One channel shows small-scale bedforms, typical for the sandbank and the other channel shows the swale sediments. The lighter reflectivity facies is associated with muddy deposits; whilst the dark reflectivity corresponds with the outcrop of the compact clay. Trawling marks are also observed. Depths are around 10 m.
Biological features

*Lanice conchilega* reefs

**Habitat description:** In Belgian waters, dense *Lanice* bioherms can contain up to 10000 protruding (up to 4 cm) polychaete tubes per m². The tube consists of medium-sized to large sand grains with a characteristic fan shape at the top. Measurements in the lower intertidal of Belgian sandy beaches revealed that *Lanice* bioherms had a patch size of 1 to 10 m² and elevated 15 to 20 cm above the surrounding sediment. These high-density patches are scarcely spread throughout the lower intertidal and cover no more than 10% of the total area. Individual *Lanice* aggregations can thus be depicted as small-scale patches in a generally flat soft-sedimented environment. In the subtidal environment, high-density patches of *Lanice* (from 1500 to 10000 ind. *Lanice*/m²) are also found. *Lanice conchilega* is found in various types of sediments, but displays a preference for fine to medium-grained sands (100 to 500 μm) with a relatively high mud content (10 to 40%). Conditions may be tide-swept, and the sediment may be mobile, but the biotope usually occurs in areas sheltered from strong wave action.

**Biotope description:** The sediment supports dense populations of the tube-building polychaete *L. conchilega* or sand mason. The baltic tellin *Macoma balthica* may be present. In Belgian waters, *L. conchilega* is the key-species of the *Abra alba, Mysella-bidentata* community. The bioherm structures may further double to triple its biodiversity estimates (species richness: x 2; macrobenthic density: x 2-3) and often the term ‘*Lanice* reef’ or ‘sand reefs’ is used.

**Location:** Undisturbed reef under aquarium conditions. University of Ghent, Marine Biology (Marijn Rabaut).

**Zone:** Boulogne sur Mer (France)
**Description:** overview of a typical *Lanice* reef habitat
**Date:** 28 June 2006
**Comments:** Reefs occur in a patchy way; each reef having a different size, ranging from 1 m² to 10 m²; patches are visible because of the increased sedimentation that is triggered by the *L. conchilega* specimens.

**Comments:** The fringes at the top of the tube help to capture particles from the water column; the tentacles are visible between the fringes and bring the particles down to the mouth. Compared to sand flat areas without *Lanice*, it is clear from the picture that these organisms cause a high level of habitat complexity.
Zone: Trapegeer, het Potje
Lat: 51° 7’ Long: 2° 33’
Acoustic technique: Side-scan sonar, GeoAcoustics 159D (410 kHz)
Description: Side-scan sonar mosaic, 1*1m
Campaign name: HA9910
Comments: Well distinct acoustic facies are distinguished in the high density area of *L. conchilega*. Mostly, circular to elongated patches are observed with a different reflectivity than its surroundings.

Zone: Steep slope of the Baland Bank
Lat: 51°12’ Long: 2° 47’
Acoustic technique: Side-scan sonar, GeoAcoustics 159D (410 kHz)
Description: Side-scan sonar mosaic, 0.1*0.1m
Campaign name: Ha0011
Date: 14 October 2000
Comments: High reflectivity patches

Zone: Sierra Ventana
Lat: 51° 27” 17” Long: 3° 2’ 45”
Acoustic technique: Side-scan sonar, GeoAcoustics 159D (410 kHz)
Description: Side-scan sonar mosaic, 1*1m
Campaign name: St0309
Date: 26-27 March 2003
Comments: Remark the clear difference between the sand ripple field and the patches, formed by the tube-building polychaete worms, *L. conchilega*. They characterize a region on the side scan image with high backscatter values, a grainy texture and a mottled pattern.
**Habitat description:** In Belgian waters, dense *Owenia fusiformis* aggregations exists of up to 4000 tubes per m². This tube worm is a thin, cylindrical, segmented worm of maximum 10 cm long that builds a tube out of shell fragments that are arranged like tiles in an overlapping manner. This makes the tube very robust, though flexible. The tube is slightly longer than the worm and the top two centimeters protrude from the surface. There is little known about the construction of high density patches and their physical characteristics. The mechanisms of physical patch construction is certainly different compared with *L. condilega*, as the tube is shorter and as the organisms has a longer lifespan. However, the appearance of individual aggregations can for both species be depicted as small-scale patches in a generally flat soft-sedimented environment. *O. fusiformis* occurs in subtidal areas from near the shore up to 5000 m, but displays a preference for shallow soft-bottom areas with fine to medium-grained sands (100 to 500 µm). The biotope usually occurs in sheltered areas with a high load of organic matter.

**Biotope description:** In Belgium, the species is found in the *Abra alba-Mysella bidentata* community and in the English Channel in the *Abra alba-Pectinaria koreni* community. Aggregations of *O. fusiformis* have far reaching implications for the benthic community: There is a clear positive relationship between the occurrence of this tube builder, the species abundance and the species richness. Hence, *O. fusiformis* can be considered as an ecosystem engineer which shapes the benthic community locally.

**Zone:** Area north of the Vlakte van de Raan
**Lat:** 51° 30' 36"
**Long:** 2° 8' 18"
**Acoustic technique:** Multibeam - Kongsberg Simrad Em1002 (95 kHz)
**Description:** DTM, 1*1m
**Campaign name:** ST0703b
**Date:** 16 February 2007

**Comments:** Detail of the DTM revealing clearly the biogenic structures of *O. fusiformis* in between the dunes. The patches have an average area of 391 m² and elevates 18 to 40 cm above the surrounding sediment.
### Geological features

**Habitat description:**
On the Belgian part of the North Sea, deformations in the top Tertiary erosion surface occur mostly in 2 zones: the Noordhinder and the Goote-Raan deformation zones.

<table>
<thead>
<tr>
<th>Zone</th>
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<th>Long</th>
<th>Acoustic technique</th>
<th>Data ownership, acquisition &amp; processing</th>
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</thead>
<tbody>
<tr>
<td>Thornton Bank area, swale east of the Thornton bank</td>
<td>51° 28' 18&quot;</td>
<td>2° 49' 36&quot;</td>
<td>Multibeam - Kongsberg Simrad Em1002 (95 kHz)</td>
<td>Continental Shelf Department, Federal Public Service Economy, SMEs, Self-Employed and Energy, Quality and Security, Quality and Innovation</td>
</tr>
<tr>
<td>Goote bank area</td>
<td>51° 26' 27&quot;</td>
<td>2° 57' 28&quot;</td>
<td>singlebeam</td>
<td>Flemish Authorities, Agency for Maritime and Coastal Services, Maritime Access</td>
</tr>
<tr>
<td>Hinder Banken Area, swale between the Westhinder and Oosthinder</td>
<td>51° 28' 15&quot;</td>
<td>2° 33' 43&quot;</td>
<td>Multibeam - Kongsberg Simrad Em1002 (95 kHz)</td>
<td></td>
</tr>
</tbody>
</table>
Anthropogenic activities

Pipelines and telecommunication cables

**Habitat description:**
Along the Belgian part of the North Sea, there are 3 gas pipelines and 27 telecommunication cables (only 16 in use). The pipelines have a diameter of about 1 m. In sandbank areas, they are trenched usually into the seabed at a depth of 70 cm to 2 m. Where needed, they are covered with a protective gravel and/or sand layer.

**Zone:** Hinder Banken area, swale east of the Oosthinder  
**Lat:** 51°28'41"  **Long:** 2°37'12"
**Acoustic technique:** Multibeam - Kongsberg Simrad Em1002 (95 kHz)  
**Description:** DTM, 2*2m  
**Campaign name:** St0404  
**Date:** 3-4-5 March 2004

**Zone:** Hinder Banken area, swale between the Westhinder and Oosthinder  
**Lat:** 51°33'30"  **Long:** 2°37'31"
**Acoustic technique:** Multibeam - Kongsberg Simrad Em1002 (95 kHz)  
**Description:** DTM, 2*2m  
**Campaign name:** St0424  
**Date:** 20-21 October 2004  
**Comments:** The DTM shows a pipeline and a telecommunication cable.
Dumpspots of dredged material

**Habitat description:** Successive dumping of dredged material results in an irregular-shaped dump mound. On a smaller scale, depressions or topographic highs occur, resulting from individual disposal events.

**Biotope description:** The dumping areas are generally density and diversity poor. Biological communities are characterised by a combined presence of the *Abra alba*—*Mysella bidentata* community, mainly, the *Nephtys cirrosa* community and their transitional species associations. The *Macon/a balthica* community is found to a lesser extent. Quite often the samples are devoid of macrobenthic fauna.

**Zone:** Sierra Ventana, dumping place of dredged material, Br&W S1

**Comment:** The former dumping site was closed in 1999 and is situated on a sandy shoal, whilst the present one is located in a tidal gully.

**Lat:** 51° 26’ 18” **Long:** 3° 3’ 28”

**Acoustic technique:** Multibeam - Kongsberg Simrad Em1002 (95 kHz)

**Description:** Shaded relief map, 1°1m

**Campaign name:** St0303

**Date:** 13 February 2003

**Comments:** On the former dumping site, closed in 1999, two types of small depressions occur in the troughs of the sand dunes. They are thought to be remnants of single dumping events. The elongated depressions have a length in the order of 30 to 50 m, a width of 15 m and a depth of 0.30 to 0.50 m. They occur in groups and are aligned NE direction. The circular depressions have a diameter of 5 m and a depth of 0.25 m. They are not abundantly present.
Zone: Oostende, dumping place of dredged material, Br&W Oostende
Lat: 51° 16' 34" Long: 3° 54' 59"
Comment: The former dumping site, which was closed in 2002 due to reaching the maximum dumping capacity, was relocated to the SW.
Acoustic technique: Side-scan sonar - GeoAcoustics 159D (410 kHz)
Description: Side-scan sonar mosaic, 1*1m
Campaign name: St0309
Date: 27-28 March 2003

Lat: 51° 16' 34" Long: 2° 54' 59"
Comments: Dredge spoils near the present dumping site.

Lat: 51° 18' 8" Long: 2° 58' 36"
Comments: The high backscatter of the isolated dump spots is due to the dumping of bricks in the past.

Lat: 51° 17' 59" Long: 2° 58' 10"
Comments: These linear spots are thought to be remnants of single dumping events. Their linear nature can be explained by the way of dumping. The split hopper suction dredge vessels dump the dredged material by opening longitudinally their cargo while sailing.
**Habitat description:**
The aggregate extraction activities leave marks on the seafloor, in the form of dredge furrows. Dredge furrows on sandbanks may disappear within 2-3 tidal cycles whereas in areas with low sediment mobility, dredge furrows may be visible for up to a decade. Their depth varies from 10 cm to a maximum of 50 cm.

**Zone:** Kwinte Bank area

**Acoustic technique:** Multibeam - Kongsberg Simrad Em1002 (95 kHz)

**Description:** DTM, 2x2m

**Campaign names:** St0131 & St0203

**Data ownership, acquisition & processing:** Continental Shelf Department, Federal Public Service Economy, SMEs, Self-Employed and Energy, Quality and Security, Quality and Innovation

Lat: 51° 17’ 15” Long: 2° 39’ 41”

Lat: 51° 16’ 45” Long: 2° 39’ 42”
# Trawling marks

**Habitat description:**
Beam trawling activities leave marks on the seafloor. The depth of the trenches varies between 5 and 10 cm and their width between 2 and 8 m.

<table>
<thead>
<tr>
<th>Zone</th>
<th>Acoustic technique</th>
<th>Description</th>
<th>Campaign name</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Potje area</td>
<td>Side-scan sonar, GeoAcoustics 159D (410 kHz)</td>
<td>Side-scan sonar mosaic, 0.01*0.01m</td>
<td>HA0003</td>
<td>1-2 April 2000</td>
</tr>
<tr>
<td><strong>Comments:</strong></td>
<td>Trawl marks are visible clearly in the muddy deposits of the southern branch of the Potje swale.</td>
<td></td>
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<tr>
<td>Potje</td>
<td>Side-scan sonar - GeoAcoustics 159D (410 kHz)</td>
<td>Side-scan sonar mosaic (75 m slant range)</td>
<td>HA0003</td>
<td>1-2 April 2000</td>
</tr>
<tr>
<td><strong>Comments:</strong></td>
<td>Detail of a side-scan sonar mosaic showing a trawl mark in a muddy environment</td>
<td></td>
<td></td>
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</table>