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Report of the Working Group on the Effects of Extraction of Marine Sediments on the Marine Ecosystem (WGEXT)

31 May–4 June 2010

Djurönäset, Sweden



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Executive summary

The Working Group on the effects of extraction of marine sediments on the marine ecosystem (WGEXT) met at Djurönäset, Sweden between 31 May and 4 June 2010. The meeting was due to take place between 19 and 22 April but had to be postponed at short notice as a result of the Icelandic ash cloud which prevented members from travelling. WGEXT members moved to nominate David Carlin as the chair elect and as such the meeting was chaired by David Carlin. Thanks were offered to Gerry Sutton the outgoing chair for his work over the previous years and significant effort to finalize the recent WGEXT Co-operative Research Report. Fourteen participants from eight ICES Member Countries attended the meeting.

The objective of WGEXT is to provide a summary of data on marine sediment extraction, marine resource and habitat mapping, changes to the legal regime, and research projects relevant to the assessment of environmental effects.

Clear differences in extraction activities are identifiable across member countries both against the pattern of extraction identified over recent years but also against traditional national activities. Significant infrastructure projects substantially increase extraction amounts in some member countries whilst the economic downturn affects others. WGEXT discussed different approaches to the control of marine sediment extraction across member countries with particular reference to compliance monitoring through EMS / black box systems and approaches to environmental monitoring. It is clear that the requirements for EIA are similar across member countries and in most cases take account of the guidance produced by WGEXT however differences in the regulatory mechanisms are evident. Efforts to coordinate approaches to mapping differ across member countries and are generally more broadly focused than marine sediment extraction. Research into the impacts and effects of marine sediment extraction differ in intensity across member countries but a mix of national / regional focused and multinational programmes exist. Work continues to better integrate skills to undertake such studies in a multidisciplinary way.

Reports were reviewed from thirteen (of 21) member countries. Although eight member countries did not provide reports, the available data are thought to provide a representative assessment of the overall total of material extracted from the member states.

ICES WGEXT agreed to meet again in the Netherlands in April 2011 as guests of the Ministry of Transport, Public Works and Water Management, Rijkswaterstaat North Sea.

1 Opening of the meeting

The Working Group on the Effects of Extraction of Marine Sediments on the Marine Ecosystem (WGEXT) was welcomed to Sweden by Professor Ingemar Cato of the Swedish Geological Survey (SGU). The chair elect of WGEXT thanked SGU for hosting the annual meeting and all countries for providing national reports. The meeting included an inspection tour of the immediate areas of Djurano as guests of SGU.

The group moved to elect David Carlin as the new WGEXT chair and as such Mr Carlin took the role of Chair elect with immediate effect. Laura Weiss was welcomed as the new Rapporteur of the group. The chair elect thanked all WGEXT members who had contributed to the cooperative report throughout the year and those who had provided electronic submissions for the annual report in advance of the meeting. He also offered thanks on behalf of the group to the outgoing chair, Gerry Sutton, for his work as chair over the last three years and efforts to finalize the Co-operative Research Report.

Brigitte Lauwaert (Belgium), Carlos Hernandez (Spain), Poul Eric Neilsen (Denmark), Jochen Krause (Germany), Laure Simplet (France), Henry Bockenewicz (USA) and Mark Russell (UK) all sent their apologies for being unable to attend.

2 Adoption of the agenda

The agenda was duly adopted by WGEXT members, together with the inclusion of additional Terms of Reference I and J.

3 Provide a summary of data on marine sediment extraction for the OSPAR Region that seeks to fulfill the requirements of the OSPAR request for extraction data to be provided by ICES and evaluate any feedback or comments from OSPAR from the information submitted by WGEXT 2009 (ToR a)

ICES WGEXT have again attempted to provide information for all ICES countries on the annual amounts of sand and gravel extracted but have still found difficulty in obtaining information from countries not regularly represented in person at ICES WGEXT meetings. It is notable that a representative from Portugal attended the meeting this year and provided historical information on extraction statistics for Portugal, however data from 2009 was unavailable. Similarly, Estonia submitted historical data for the first time in recent years although data for 2009 was unavailable. Information was received, following a lengthy period of no reports, from Germany. Contact was also made with Iceland and as such it is hoped information on Iceland will be made available in future reports.

Available information is included in Table 3.1 below.

Table 3.1. Summary Table of National Aggregate Extraction Activities in 2009.

| COUNTRY | A) CONSTRUCTION / INDUSTRIAL AGGREGATES (M³) | B) BEACH REPLENISHMENT (M³) | C) CONSTRUCTION FILL / LAND RECLAMATION (M²) | D) NON-AGGREGATE (M³) | E) TOTAL EXTRACTED (M3) | F) AGGREGATE EXPORTED (M³) | NEW MAPS AVAILABLE | NEW LEGISLATION | NEW POLICY | EIA INITIATED | EIA ONGOING | EIA FINISHED | EIA PUBLISHED |
|-------------------------------|--|-----------------------------|--|-----------------------|-------------------------|----------------------------|--------------------|-----------------|------------|---------------|-------------|--------------|---------------|
| Belgium (OSPAR) | 1,673,696 | 288,480 | 0 | 0 | 1,962,176 | 385,000 | Yes | 1 No | No | Yes | Yes | Yes | Yes |
| Canada | N/d | N/d | N/d | N/d | N/d | N/d | N/d | N/d | N/d | N/d | N/d | N/d | N/d |
| Denmark ² (HELCOM) | 1,700,000 | 100,000 | 1,100,000 | 3,000 | 2,903,000 | 500,000 | Yes | Yes | No | N/d | N/d | N/d | N/d |
| Denmark ² (OSPAR) | 1,400,000 | 2,100,000 | 800,000 | | 4,303,000 | | Yes | Yes | No | N/d | N/d | N/d | N/d |
| Estonia (HELCOM) ³ | N/d | N/d | n/d | N/d | N/d | N/d | N/d | N/d | N/d | N/d | N/d | N/d | N/d |
| Finland (HELCOM) | 0 | 0 | 0 | 0 | 0 | 0 | Yes | No | No | No | Yes | No | Yes |
| France (OSPAR) ⁴ | 7,496,588 ⁵ | N/d | N/d | 501,000 ⁵ | 7,997,588 | N/d | Yes | No | No | Yes | Yes | Yes | No |
| Germany (HELCOM) | 212,273 | 230,406 | n/d | N/d | 442,679 | N/d | N/d | N/d | N/d | N/d | N/d | N/d | N/d |
| Germany (OSPAR) | 19,049,878 | 1,065,993 | n/d | n/d | 20,115,871 | n/d | N/d | N/d | No | No | Yes | Yes | No |
| Greenland and Faroes (OSPAR) | N/d | N/d | N/d | N/d | N/d | N/d | N/d | N/d | N/d | N/d | N/d | N/d | N/d |
| Iceland (OSPAR) | 374,885 | 0 | 0 | 81,205 | 456,090 | 0 | N/d | N/d | N/d | N/d | N/d | N/d | N/d |
| Ireland (OSPAR) | 0 | 0 | 0 | 0 | 0 | 0 | Yes | 1 No | No | No | No | No | No |
| Latvia (HELCOM) | N/d | N/d | N/d | N/d | N/d | N/d | N/d | N/d | N/d | N/d | N/d | N/d | N/d |
| Lithuania (HELCOM) | N/d | N/d | N/d | N/d | N/d | N/d | N/d | N/d | N/d | N/d | N/d | N/d | N/d |
| Netherlands (OSPAR) | 2,531,790 | 30,934,121 | 86,013,759 | 263,283 ⁶ | 120,700,339 | 2,403,264 ⁷ | Yes | 1 No | No | Yes | Yes | No | No |
| Norway (OSPAR) | <10,000? | 0 | 0 | <10,000? | <20,000? | 0 | No | No | No | N/d | N/d | N/d | N/d |
| Poland (HELCOM) | N/d | N/d | N/d | N/d | N/d | N/d | N/d | N/d | N/d | N/d | N/d | N/d | N/d |
| Portugal (OSPAR) ⁸ | N/d | N/d | n/d | N/d | N/d | N/d | No | N/d | N/d | N/d | N/d | N/d | N/d |
| Spain (OSPAR) | 0 | 0 | 0 | 0 | 0 | 0 | n/d | n/d | Yes | 10 No | No | No | No |
| Spain (Mediterranean) | N/d | 617,492 | N/d | N/d | 617,492 | N/d | n/d | n/d | Yes | 10 No | No | No | No |
| Sweden (OSPAR) | 0 | 0 | 0 | 0 | 0 | 0 | Yes | No | No | No | No | No | No |
| Sweden (HELCOM) | 0 | 0 | 0 | 0 | 0 | 0 | Yes | No | No | No | Yes | No | No |
| UK(OSPAR) ⁹ | 9,457,522 | 498,349 | 2,208,396 | 0 | 12,164,267 | 3,409,953 | Yes | No | No | Yes | Yes | Yes | Yes |
| United States | 666,397 | n/d | n/d | n/d | 3,853,826 ¹¹ | n/d | n/d | n/d | n/d | n/d | n/d | n/d | n/d |

Table Definitions

A. Construction/industrial aggregates - marine sand and/or gravel used as a raw material for the construction industry for building purposes, primarily for use in the manufacture of concrete but also for more general construction products.

B. Beach replenishment/coastal protection – marine sand and/or gravel used to support large-scale soft engineering projects to prevent coastal erosion and to protect coastal communities and infrastructure.

C. Construction fill/land reclamation – marine sediment used to support large-scale civil engineering projects, where large volumes of bulk material are required to fill void spaces prior to construction commencing or to create new land surfaces.

D. Non-aggregates – comprising rock, shell or maerl.

E. Total Extracted – total marine sediment extracted by Member Countries

F. Aggregates Exported - the proportion of the total extracted which has been exported i.e. landed outside the country where it was extracted.

¹Data continually updated and new maps available on demand from database

²The OSPAR area and the HELCOM area are overlapping in Denmark. The Kattegat area from Skagen to north of Fyn-Sjælland is included in both Conventions. Therefore the figures from the two Convention-areas cannot be added.

³ Some known extraction activity but quantities unknown

⁴Data relates to licensed amount rather than amount extracted, no information is available for extraction quantities in the Mediterranean although sand extraction for beach replenishment is likely to have occurred.

⁵Quantity licensed for extraction not necessarily quantity extracted

⁶Total shell extraction including Western Scheldt and Wadden Sea

⁷ Quantity estimated based on feedback from licensees

⁸Only historical data to 2008 is available for Portugal

⁹Conversion from reported tonnes to M³ achieved using density / specific gravity conversion factor of 1.66

¹⁰During 2009 Spain has approved and published the Technical Information for the environmental management of marine sand extraction

¹¹Total extraction figures include 3,187,429 m³ of marine aggregate material used to cap an open-water disposal site

WGEXT will again circulate a copy of the WGEXT 2010 annual report to contact points provided by OSPAR BDC so that the accuracy of the information presented can be assured.

Similar to previous years, a number of countries (summarized in the following table) did not provide data to the WGEXT 2009 annual report.

Table 3.2 Specific matters highlighted in response to OSPAR request for ICES WGEXT to supply national data.

| OSPAR COUNTRIES FOR WHICH DATA HAS NEVER BEEN RECEIVED (As of 2010) | |
|--|--|
| GREENLAND AND FAROES (DENMARK) – Data for Denmark is reported separately | |
| DATA ADJUSTMENTS FOR SPECIFIC COUNTRIES NECESSARY TO DISTINGUISH DATA FOR THE OSPAR REGION | |
| SPAIN | Atlantic coast activities only (note separation of Mediterranean data) |
| GERMANY | North Sea activities only (exclude Baltic) |
| FINLAND | Exclude Baltic activities |
| SWEDEN | Delineate activities in the Baltic area which fall within the boundaries of the OSPAR 1992 |
| DENMARK | As for Sweden |

In response to an earlier OSPAR request to provide data on the area dredged compared with the area licensed, Table 3 has been updated in 2010. Table 3 summarizes information where available for ICES WGEXT member countries. Although the data are incomplete at this time, it is important to note that the areas in which extraction occurred were much smaller than the areas licensed and, of course, the actual, spatial footprint should be used to assess impacts.

Table 3.3 Licensed area and actual areas over which extraction occurs.

| COUNTRY | LICENSED AREA KM ² * | | | | AREA IN WHICH EXTRACTION ACTIVITIES OCCUR KM ² | | | |
|-----------------------------|---------------------------------|--------------------|--------------------------|---------|---|------------------|-------------------------------------|-----------------|
| | 2004 | 2006 | 2007/08 | 2009 | 2004 | 2006 | 2007/08 | 2009 |
| Belgium (Extraction Zone 1) | 300 | No data | No data | No data | 9 | No data | No data | No data |
| Belgium (Extraction Zone 2) | 228 | No data | No data | No data | 19 | No data | No data | No data |
| Belgium Total | 528 | No data | No data/230 ¹ | 256 | 28 | No data | No data/100 ¹ | 40 |
| Denmark | 800 | No data | 429 | 430 | 30 | No data | No data | 800 |
| France ² | 35.43 ³ | 73.08 ³ | 72.97/74.97 | 74.87 | N/a | No data | No data | No data |
| Germany (OSPAR) | N/a | No data | No data | No data | N/a | No data | No data | No data |
| Germany (Non OSPAR) | N/a | No data | No data | No data | N/a | No data | No data | No data |
| Netherlands | 484 | 453 | 456/585 | 564 | 41 | 47 ⁴ | 38 ⁴ / 35.3 ⁴ | 86 ⁴ |
| UK | 1,257 | 1,316 | 1,344 | No data | 134 ⁵ | 140 ⁵ | 134.7 | No data |

¹ In 2008 extraction in Belgium was allowed in zones 1, 2a, 2c and 3a. The area on which effectively extraction occurs is an approximate value, as not all black box data have yet been processed.

² Not all French dredging vessels are fitted with EMS.

³ Includes 26.59 sand-and-gravel extraction area and 8.84 non-aggregate extraction area in 2004 , and 58.46 sand-and- gravel extraction area and 14.62 non aggregate extraction area in 2006, 51.89 sand-and-gravel extraction area and 21.08 non-aggregate extraction area in 2007, 53.89 sand-and-gravel extraction area and 21.08 non-aggregate extraction area in 2008

⁴ 90% of material extracted in the Netherlands is taken from 7.5 km² (2006) and 9.2 km² (2007) and 8.3km² (2008) and 23 km² (2009).

⁵ 90% of material extracted in UK is taken from 46km² (2003) and 43km² (2004) and 49.2 km² (2006) 49.95 (2007)

WGEXT again noted that this type of information has to be taken from an analysis of electronic monitoring data and this is not a straightforward task to achieve. WGEXT also noted and welcomed the OSPAR request to continue to provide data on sand and gravel extraction.

4 Review data on (b1) marine extraction activities, (b2) developments in marine resource and habitat mapping taking into account some of the outputs of ICES WGMHM as appropriate, (b3) information on changes to the legal regime (and associated environmental impact assessment requirements) governing marine aggregate extraction including a review of black box and electronic monitoring systems by member countries (ToR b)

4.1 Extraction Activities (b1)

WGEXT members reported very different pictures of extraction levels across member countries. Some reported substantial increases in extracted amounts, driven principally by large-scale infrastructure and coastal defence projects whilst markets de-

pendent on general demand for construction aggregates saw declines in the amount of material extracted.

A substantial increase in the amount of marine sediment extracted was reported by the **Netherlands**. In 2009 30 million m³ alone was extracted for beach nourishment to address large projects to nourish beaches that are at potential risk in future due to sea level rise. The project involves targeting beach nourishment to ensure they are protected for at least the next 50 years. In addition, a large increase in extraction levels was as a result of the Maasvlakte 2 port development project, which in its first phase will require 210 million m³. It was reported that one to two more years of high extraction levels are likely in Dutch waters however, significant coastal defence work, such as the Sand Engine project, are likely to keep demand for Dutch marine sand high for some time. To address this demand, licences will now run over 5 years rather than 3 years. **Germany** reported data for the first time in a number of years and identified a similar large increase in extraction amounts against recently reported levels, again as a result of ongoing development of a port at Jade Weser.

The **UK** reported a different situation, with an overall reduction in annual total amounts extracted (excluding that used for contract fill and beach replenishment). This is principally as a result of reduced demand for construction aggregate as a consequence of the economic downturn. Despite the downturn in demand for construction aggregate, the UK reported demand for both new licenses and for renewals of existing licences to extract was likely to increase as a result of the expiry of existing long-term production licences. The UK industry is currently gearing up for this by preparing EIA's and conducting REA's.

Of note this year were submissions of information from **Estonia, Portugal and Iceland**. In recent years neither country has provided information to WGEXT however this year submissions of historical data were received, but data for 2009 remained unavailable for Portugal and Estonia. Estonia reported historic data related to the HELCOM area suggesting extraction levels of 2.2 million m³ in 2003 falling to below 1 million m³ per year in the period between 2004 and 2008. Portugal indicated that extraction takes place in a number of regions but data were unavailable reflecting the total picture of Portuguese extraction activity. In the Azores region, between 1999 and 2007 a total of 1 million m³ was extracted with similar amounts coming from Madeira and used for construction purposes. Extraction also takes place on the Portuguese mainland shelf to provide material for beach nourishment. Between 1998 and 2008 around 100,000 m³ was extracted from the southern region of Portugal (Algarve) and in 2006 around 370,000 m³ was extracted from the northern shelf. Iceland extracted 456,090 m³ the majority of which was used for construction purposes.

Sweden reported that Sweden a new extraction outside Trelleborg in Southern Sweden has recently been permitted for extraction up to 300,000 m³.

4.2 Developments in Marine Resource and Habitat Mapping (b2)

No new significant mapping programmes were reported by WGEXT this year, however a number of coordinated and ad-hoc programmes are taking place. In many countries, the marine aggregate sector continues to undertake mapping to address their own resource management requirements.

In **France**, *Ifremer* published a new Atlas of the Bay of Biscay including geological and fisheries data. Maps continue to be available on demand in the Netherlands using an online database. It was reported that **Portugal** have no national mapping programme but maps are produced on an ad-hoc basis to meet regional enterprise requirements.

Sweden reported information on the ongoing mapping programme of Swedish waters. Ongoing fieldwork, particularly in North West and South West waters was reported together with an overview of how this will fit with the existing spatial coverage of mapping in Swedish waters. New maps are likely to be produced as a result of recent fieldwork over the coming months. **Ireland** reported the continuation of the national mapping programme, Infomar operated as a joint venture between the *Marine Institute* and *Geological Survey of Ireland*. Mapping of the continental shelf ongoing, supplemented with LiDAR data were reported as ongoing as was the introduction of new vessels to the fleet to target inshore mapping. Ireland also reported that, in studying the cost benefit of investment in the national mapping programme, a 7:1 return on investment was anticipated on the annual 4 million EURO budget. Ongoing work to provide context data to key aggregate extraction sites, through a programme of Regional Environmental Characterisation, was reported by the **UK**. The **Netherlands** reported that resource mapping has focused on a pilot resource-information model for the Netherlands continental shelf which allows an efficient and reproducible determination of sand quality and quantity. **Belgium** reported ongoing work on resource mapping and especially for resource assessment at the Hinderbanken area. **Estonia** reported information relating to a national seabed mapping programme undertaken by the national Geological Survey and **Spain** submitted information on national, regional and international mapping programmes including the LIFE and INDEMARES programmes at the international scale and regional habitat mapping initiatives.

4.3 Review of Developments in National Authorization and Administrative Framework and Procedures (b3)

The majority of WGEXT countries, with the exception of Denmark, reported no significant changes to their approaches to regulating marine aggregate extraction through legislative or administrative mechanisms.

Denmark submitted information relating to a new Mining Code which has relevance to the management of marine sediment extraction in Danish waters. The **UK** also reported information on changes to the administrative framework relating to the regulation of marine sediment extraction in relation to the new Marine and Coastal Access Act. It was outlined that new legislation affecting marine sediment extraction would be forthcoming in 2010/11. Similarly **Sweden** reported likely forthcoming changes to the administrative framework affecting marine sediment extraction in 2010/11.

Information summarizing aspect of the process of regulation of marine sediment extraction in **Portugal** was presented for the first time to WGEXT. It was identified that Portugal regulates marine sediment extraction on a regional basis with no federal system of control.

A number of WGEXT members reported the instigation of new EIA's but no fundamental differences in the application of EIA.

No reports were received from Canada, Estonia, Iceland, Latvia, Norway, Poland or Russia.

Review of the Use of Black Box and Electronic Monitoring Systems

WGEXT discussed the utilization of EMS / Black Box systems in Belgium, France, the Netherlands and the UK. It is clear that there are great similarities in some aspects of how the different systems operate, principally the use of GPS to identify the location of vessel operations and GIS software to analyse data generated by these systems, but also that there are differences. The systems operating in Belgium and the Netherlands are of most similarity. The following table provides a summary of data presented by WGEXT members present and who had submitted reports in advance of the meeting.

| COUNTRY | REQUIREMENT FOR BLACK BOX SYSTEM | RESPONSIBILITY AND COST | ENFORCEMENT PROVISIONS/PENAL TIES | DETERMINATION OF DREDGING AND INTERPRETATION | DATA STORAGE AND AVAILABILITY |
|---------|---|---|--|---|--|
| UK | Since 1993 The Crown Estate Commissioners have required that all vessels dredging Crown Estate minerals be fitted with an Electronic Monitoring System (EMS). More recently the use of EMS has become a legislative requirement under 2007 EIA regulations. The system is currently only used to monitor aggregate extraction activities. | The operator is responsible for the installation and maintenance of the system. The Crown Estate is responsible for the software and data collection. | A person who commits an offence under The Environmental Impact Assessment and Natural Habitats (Extraction of Minerals by Marine Dredging) (England and Northern Ireland) Regulations 2007 shall be liable— (a) on summary conviction, to a fine not exceeding the statutory maximum; or (b) on indictment, to a fine. The Dredging Permission may be revoked, suspended or varied. | Determination of dredging activity is obtained from typically draghead sensors and a density meter or vibration sensor. The number and type of sensors vary between operators and ships. The dredging status indicator set up is agreed by both the operator and The Crown Estate. Data is processed to convert into a usable format to view in ArcGIS to identify potentially illegal dredging activity based on a number of predetermined factors. | The Crown Estate owns the data. The EMS records are analysed and processed by The Crown Estate as landowner and unprocessed data are shared with The Regulator (MMO) and Welsh Assembly Government (WAG) who conduct their own interpretation (through Cefas). |

| COUNTRY | REQUIREMENT FOR BLACK BOX SYSTEM | RESPONSIBILITY AND COST | ENFORCEMENT PROVISIONS/PENALTIES | DETERMINATION OF DREDGING AND INTERPRETATION | DATA STORAGE AND AVAILABILITY |
|-------------|---|---|--|---|---|
| Denmark | Legislative requirement in dredging licences. The system is also used by the agency to monitor disposal of dredged materials | Operator is responsible for system onboard. Data concerning dredging vessels are online downloaded from the Danish Maritime Safety Administration and stored in the agency. | Penalties in accordance to the Raw Materials Act. Standard administrative procedures according to the law are applied for enforcement. | Information from a Standard UAIS system is transmitted via VHF. No additional sensors are used on-board the vessel to identify whether dredging is taking place. Mapinfo is used to gather and interpret data. Vessel speed is used as the method to determine any irregularities. | Data concerning dredging vessels are online downloaded from the Danish Maritime Safety Administration and stored in the agency. |
| Netherlands | Legislative requirement in dredging licences. The system is also used by the agency to monitor disposal of dredged materials if a commercial enterprise. The system is used both for enforcement and to report area of seabed disturbance to OSPAR. | The government pays for the installation of black boxes and the data must be made available by the operator to the government. The operator is responsible for the running costs of the system. | Can withdraw licence and impose a fine as a penalty method. The ministry of financial affairs can also impose further penalties. | Data (dredging tracks) is projected as a GIS layer over dredging area. Determination of dredging activity depends on individual vessel speed. Large ships may also have sensors on pipes and drag head that also inform interpretation. Data can also be projected over bathymetric data to show dredge tracks. | Data is transmitted from the vessel straight to the government office. |

| COUNTRY | REQUIREMENT FOR BLACK BOX SYSTEM | RESPONSIBILITY AND COST | ENFORCEMENT PROVISIONS/PENALTIES | DETERMINATION OF DREDGING AND INTERPRETATION | DATA STORAGE AND AVAILABILITY |
|---------|--|--|---|--|---|
| Belgium | <p>Legislative requirement in dredging licences. The legislative requirement for regulation (See article 34 § 1, 2, 3 and 4 of the “Koninklijk besluit betreffende de voorwaarden, de geografische begrenzing en de toekenningsprocedure van concessies voor de exploratie en de exploitatie van de minerale en andere niet-levende rijkdommen in de territoriale zee en op het continentaal plat”, 1 September 2004.</p> <p>The system is currently only used to monitor aggregate extraction activities.</p> | <p>The operator is responsible for installation and maintenance of vessel bound equipment and the state is responsible for data collection and interpretation. This is further defined within the legislation.</p> | <p>The FPS Economy is charge to take decision (warning to the companies, eventual retraction of permit and penalties according to the “Koninklijk besluit betreffende de voorwaarden, de geografische begrenzing en de toekenningsprocedure van concessies voor de exploratie en de exploitatie van de minerale en andere niet-levende rijkdommen in de territoriale zee en op het continentaal plat”, 1 September 2004) .</p> <p>The enforcement procedure is detailed analysis of the infraction (removing minor infraction and corrupted data). Explanation asking to the company and warning. After multiple infractions of the same type: starting the procedure or the retraction of the permit and if applicable, transmission to the court.</p> | <p>Cartographic analysis + volumetric/time analysis.</p> <p>Sensors on pumps on/off also inform interpretation.</p> <p>The FPS Economy and the Management Unit of the North Sea (MUMM) are also responsible to analyse in details the BB data with a GIS, crossing these data with the extraction registers data and the bathymetrical data to evaluate the impact of the extraction on the bathymetry of the sandbanks.</p> | <p>The Continental Shelf Service of the FPS Economy is the exclusive owner of the data generated by the BB systems. According to an official agreement between the Continental Shelf Service of the FPS Economy and the MUMM is in charge of the management of the BB systems (control of the BB systems on the ships, regular “manual” uploading of the data from the memory card of the BB systems, preprocessing of the data, regular infraction reporting). The MUMM transmits all the BB preprocessed information and the reports to the Continental Shelf Service of the FPS Economy.</p> |
| France | <p>Legislative requirement in dredging licences. The system is also used to monitor dredging activity within large ports.</p> | <p>The operator is responsible for buying and maintaining the system.</p> | <p>No penalties currently imposed.</p> | <p>Data is obtained used a standard AIS system. Some vessels also have pump sensors.</p> | <p>Data is reported either quarterly or annually to the Ministry of Environment.</p> |
| Spain | <p>In Spain there's no any obligation to use black boxes, it depends on the control and mitigation plans from the EIA and local laws</p> | | | | |

| COUNTRY | REQUIREMENT FOR BLACK BOX SYSTEM | RESPONSIBILITY AND COST | ENFORCEMENT PROVISIONS/PENAL TIES | DETERMINATION OF DREDGING AND INTERPRETATION | DATA STORAGE AND AVAILABILITY |
|----------|---|-------------------------|-----------------------------------|--|-------------------------------|
| Portugal | New legislation in Azores requires dredging vessels to have a gps system – detail unavailable at present. | | | | |

To continue to better understand different approaches to electronic compliance monitoring across ICES countries, WGEXT decided that the template on the application of Black Box / EMS systems will again be circulated in advance of the meeting, alongside existing data templates, to capture information on systems in member countries who were unable to contribute to the completion of the table above.

5 Review scientific programmes and research projects relevant to the assessment of environmental effects of the extraction of marine sediments including the interaction with the cost programme and developments in the application of EIA (ToR c)

National scientific programmes with relevance to marine sediment extraction were summarized by WGEXT members and a number of presentations were given on specific projects. Of note is the SIEGMA project being undertaken in the Baie de Seine region of **French** waters. The project aims are to increase understanding of the effects of extraction, design optimal monitoring survey methods for post dredge surveys and propose impact indicators and tools for sustainable management. In the **UK**, funded by the Marine Aggregate Levy Sustainability Fund (Marine ALSF) considering cost benefits analysis of post dredging restoration and the publication of a second edition of the 2002 Guidelines for the Conduct of Benthic Studies at Aggregate Dredging Sites, WGEXT members kindly offered to provide comments in the form of peer review to this report once an advanced draft version is available.

In addition to providing reports on national programmes of relevant research, presentations were offered by a number of WGEXT members on projects of relevance to marine sediment extraction at both a national and multinational level.

The following projects were presented during the WGEXT meeting (further information is available by contacting the relevant ICES WGEXT member).

- SIEGMA Project (**France** – Michel Desprez)
- Trophic links and dynamics – impact of aggregate extraction (**France** and **UK** - Jean-Paul Delpech)
- Exploration Zone 4 of the BCS: Seabed Cartography (**Belgium** - Kris Hostens)
- Hinderbanken (**Belgium** – Kris Hostens)
- Benthic Guidelines refresh project (**UK** – David Carlin)
- Sand Engine (**Netherlands** – Jan van Dalssen)
- Building with Nature (**Netherlands** – Jan van Dalssen)

- Modeling the ecological potential of sand extractions in the southern part of the North Sea (**Netherlands** – Maarten de Jong)

In addition to the presentations, overviews of two FP7 programmes were also provided to WGEXT.

MESMA

The project, through case studies, will analyse activities that have spatial impacts on the marine area, looking at interactions with other activities, includes aggregate extraction. The project is already using WGEXT information as the key information source on marine sediment activities in Europe.

Geo-Seas

The project, through access to 26 geological centres across Europe, allows users to access pan-European, standardized datasets from a single portal. It also provides financial support for data centres to provide and standardize data. Geo-Seas is also aligned with European directives and recent large-scale framework programmes on global and European scales, such as GEOSS and GMES, EMODNET and INSPIRE. It will expand the existing SeaDataNet marine and ocean data management infrastructure to handle marine geological and geophysical data, data products and services, creating a joint infrastructure covering both oceanographic and marine geoscientific data.

COST MAGNET Programme

WGEXT were provided with an overview of the progress of the COST MAGNET programme which will be ending in October 2010. It was clear that one of the benefits of the programme was to disseminate information on marine sediment extraction activities to countries outside ICES membership. Much of this information is that produced by WGEXT. As the COST programme is coming to an end, WGEXT agreed to provide an open invitation to those countries who sit outside ICES and have an interest in or are developing marine sediment extraction industries to attend future WGEXT meetings as observers.

Recommendation

- WGEXT Chair be permitted to invite, parties within an interest in marine sediment extraction from non-ICES countries such as those identified through the COST MAGNET programme to attend future WGEXT meetings in the capacity of observer.

EMSAGG

The European Marine Sand and Gravel Group (EMSAGG), provides the marine aggregate industry with the opportunity to discuss the issues affecting this sector.

EMSAGG, established in 1998 by European professionals, is an independent body which draws together stakeholders from across industry, including dredging organizations, European Government departments and agencies, regulators, economists, resource planners, environmental bodies and academic as well as research bodies. EMSAGG provides a forum for the exchange of ideas and learning across Europe by:

- meeting formally twice a year to discuss innovation and developments within the industry

- initiate (research) activities on topics concerning marine aggregate extraction like the EU COST action MAGNET
- produce a biannual bulletin including articles highlighting work of interest to its contacts and the latest information from across the industry
- organize a popular information sharing conference every three years

EMSAGG has a website hosted by CIRIA which includes downloadable bulletins, conference reports and papers, details of members, details of relevant CIRIA publications, projects and proposals and also useful links to industry stakeholders (www.ciria.org/emsagg)

No reports were received from Canada, Estonia, Iceland, Latvia, Norway, Poland or Russia.

6 Continue to review and evaluate on the scope and implementation of monitoring programmes instigated in relation to marine sediment extraction activities (ToR d)

In order to better understand the approaches to control and monitoring of the effects of marine sediment extraction WGEXT members present at the meeting discusses approaches to monitoring adopted in each country. With the exception of Portugal and Ireland (from which no information was available as yet), all members provided information to complete the following table.

| | BELGIUM | FINLAND | FRANCE | NETHERLANDS | SWEDEN | UK |
|---|----------------|---|---|---|---|---|
| Is monitoring obligatory (e.g. licence condition) | Yes | Yes | Yes | Yes if licence is based on EIA | Yes | Yes if licence is based on EIA |
| Organisation / body responsible for monitoring (state / operators) | State | State must ensure monitoring is undertaken by licence holder | State must ensure monitoring is undertaken by licence holder | State must ensure monitoring is undertaken | State must ensure monitoring is undertaken by licence holder | National regulator must ensure monitoring is undertaken by licence holder |
| Organisation(s) / bodies undertaking monitoring (licence holder / state organizations) | State | Licence holder and / or consultants appointed by the licence holder | Licence holder and / or consultants appointed by the licence holder | Licence holder and / or consultants appointed by the licence holder | Licence holder and / or consultants appointed by the licence holder | Licence holder and / or consultants appointed by the licence holder |
| Organisation / body that pays for monitoring | Licence holder | Licence holder | Licence holder | Licence holder | Licence holder | Licence holder |

| | BELGIUM | FINLAND | FRANCE | NETHERLANDS | SWEDEN | UK |
|---|--|--|---|--|--|---|
| Organisation(s) / bodies that design(s) / revise(s) / approve(s) / monitoring programmes | Advisory committee comprising state and licence holder | Designed by licence holder and approved by the state. | Designed by licence holder based on recommendations from Ifremer, the state and consultation with stakeholders. Approved by the state. Revisions can be suggested by any party but must be approved by the state. | Designed by licence holder and approved by the state. Revisions can be suggested by either party but must be approved by the state. | Designed by licence holder and approved by the state. Revisions can be suggested by either party but must be approved by the state. | Designed by licence holder and approved by the regulator. Revisions can be suggested by licence holder or regulator (and their advisors) but must be approved by the regulator. |
| Organisation / body responsible for reporting monitoring | State | Licence holder | Licence holder | Licence holder | Licence holder | Licence holder |
| Organisation(s) / bodies responsible for evaluating monitoring | State | Local Environmental Authorities | State and Ifremer | State | State | Regulator (and their advisors) |
| How are the results of monitoring used | To ensure compliance with licence conditions, enable management action (compliance monitoring), to assist management of future licensing and adapting policy | To ensure compliance with licence conditions, enable management action, to assist management of future licensing and adapting policy | To ensure compliance with licence conditions, enable management action, to assist management of future licensing and adapting policy | To ensure compliance with licence conditions, enable management action (compliance monitoring), to assist management of future licensing and adapting policy | To ensure compliance with licence conditions, enable management action, to assist management of future licensing and adapting policy | To ensure compliance with licence conditions, enable management action, to assist management of future licensing and adapting policy |
| How is monitoring data owned / stored / disseminated | Data stored by state and published in most cases | Held by licence holders and published. Data is provided to State and made public. | Data is held by the licence holder but provided to the State and a summary of the EIA made available to the public | Not well organized at present | Data is archived at the Swedish Geological Survey and EPA | Held by the licence holder and provided to the regulator who hold a public register. |

To continue to better understand different approaches to monitoring across ICES countries, WGEXT decided that the following tables will be circulated in advance of the meeting, alongside existing data templates, to capture information on the approaches to monitoring undertaken in member countries who were unable to contribute to the completion of the table above. WGEXT wants to collect information on the regulatory aspects of monitoring (Table 1) and scientific details of specific monitoring programmes (Table 2).

Following a review of the data received, WGEXT will decide at the 2011 meeting if similar information will be collected in future years.

| PLEASE PROVIDE DETAILS ON THE APPROACHES TO HOW MONITORING PROGRAMMES ARE ORGANIZED INCLUDING DETAIL ON: |
|---|
| Is monitoring obligatory (e.g. licence condition) |
| Organisation / body responsible for monitoring (state / operators) |
| Organisation(s) / bodies undertaking monitoring (contractors / state organizations) |
| Organisation / body that pays for monitoring |
| Organisation(s) / bodies that design(s) / revise(s) / approve(s) monitoring programmes |
| Organisation / body responsible for reporting monitoring |
| Organisation(s) / bodies responsible for evaluating monitoring |
| How are the results of monitoring used |
| How is monitoring data owned / stored / disseminated |

| PLEASE PROVIDE SCIENTIFIC DETAILS ON SPECIFIC MONITORING PROGRAMMES UNDERTAKEN INCLUDING DETAIL ON: |
|--|
| Types and conditions of monitoring: equipment, parameters to be measured, frequency of measurement |
| Numbers of sampling points, spacing of sampling points, replicates, geographic spread |
| Reporting frequency, format, requirement for publication |
| Revision processes i.e. how is the scope of monitoring revised (e.g. on a phased basis based on initial results, if at all). |

7 Continue work on a new Co-operative Research Report to cover the period 2005–2010 with a view to producing a final draft within six months of the 2011 WGEXT Annual Meeting (ToR e)

WGEXT discussed the production of the next Co-operative Research Report. The group considered it would be more appropriate to produce a report which covered the period 2005 to 2010 and submit a final draft to ICES for publication following the 2012 WGEXT annual meeting. The report will be titled “Effects of Extraction of Marine Sediments on the Marine Ecosystem” and be published in 2012 in the *ICES Co-operative Research Report* series. The estimated number of pages is 150 and the report will be edited by the WGEXT chair.

Suggested chapters within the report will be (with lead and contributing authors):

Chapter 1. Executive Summary

WGEXT Chair

Chapter 2. Review of Quality, Quantity, Location and Uses of Marine Sediments Extracted.

Mark Russell (Chris Dijkshoorn, Carlos Hernandez)

Chapter 3. Seabed Sediment (Resource) Mapping Programmes of ICES Member Countries

Ingemar Cato (Henry Bokuniewicz, Ad Stolk, Gerry Sutton, Rui Quartau, Johan Nyberg)

Chapter 4. Effects of Extraction Activities on the Marine Ecosystem

David Carlin (Kris Hostens, Simone Pfeifer, Jouko Rissanen, Michel Desprez, Jan van Dalfsen, Maarten de Jong, Jean-Paul Delpeche, Laura Weiss)

Chapter 5. Approaches to Monitoring and Mitigation of the Effects of Extraction Activities

Jan van Dalfsen (David Carlin, Laura Weiss, Michel Desprez, Maarten de Jong, Kris Hostens)

Chapter 6. Aggregate Resource Management, Policy, Legislative Frameworks

Ad Stolk (Gerry Sutton, Brigitte Lauwaert, David Carlin, Laura Weiss)

Chapter 7. Conclusions and Recommendations

WGEXT Chair

Chapter 8. References and Annexes

Carlos Hernandez (Chapter leads)

8 Continue to review and evaluate the use and application of the ICES WGEXT 2003 Guidelines across member countries and formulate a draft resolution to ICES regarding the adoption by OSPAR of an amended version of the guidelines (ToR f)

WGEXT discussed the implementation of the 2003 Guidelines across member countries. All countries who provided information reported the Guidelines to be used within their national procedures for marine sediment extraction. Some countries implement the Guidelines through their own guidance in support of these procedures or through acceptance of OSPAR recommendations. France and Finland do not officially apply the 2003 Guidelines however Finland has adopted HELCOM Recommendation 19/1 (1998).

The following information was provided by WGEXT members present at the meeting.

| | DENMARK | SWEDEN | NETHERLANDS | BELGIUM | FRANCE | FINLAND | UK |
|---|--|---|---|--|--------|---|---------------------------------------|
| Has your country adopted the Guidelines? | No formal adoption | Yes | Accepted and used as recommendation of OSPAR | Accepted and used as recommendation of OSPAR | No | No but Finland has formally adopted the HELCOM Recommendation 19/1 (1998) | Accepted and used |
| If so how are they implemented – as guidelines (informally) or through legislation / policy (formally)? | The principles in the ICES guidelines are integrated in the legislation. | Through legislation | Through formal Guidelines for conduct of EIA's and by licensing authority | Used by state and licensing authority | N/A | N/A | Implemented through Guidelines (MMG1) |
| Does your country take account of all the recommendations made in the Guidelines? | The recommendations are considered during the evaluation of an application for dredging licence. | Yes where appropriate | Yes where appropriate | Yes where appropriate | N/A | N/A | Yes where appropriate |
| If not which sections are not relevant and why? | No data | N/A | N/A | N/A | N/A | N/A | N/A |
| Are there any additional guidance your country offers which is in addition to that outlined in the ICES Guidelines? | No data | Additional requirement under Swedish Environmental Code | Dutch policy on marine sand extraction | No | No | No | |

| | | | | | | | |
|--|---------|--|---------------------|-----|-----|-----|---|
| If so what is the additional guidance? (A copy can be appended to this report where appropriate) | No data | Meetings with local people and authorities and Environmental Court | National Water Plan | N/A | N/A | N/A | Marine Minerals Guidance Note 2, Interim Marine Aggregate Dredging Policy (Wales), Guidelines on Regional Environmental Assessment, Guidance on Coastal Impact Studies, Benthic Survey Guidelines |
| Does your country consider the Guidelines to be clear and up to date? | | Yes | Yes | Yes | N/A | N/A | Yes |
| If not what specific amendments are suggested? | | N/A | N/A | N/A | N/A | N/A | N/A |

To continue to better understand different the use of the ICES 2003 Guidelines across ICES countries, WGEXT decided to again circulate the reporting template on the use of the Guidelines in advance of the next meeting, alongside existing data templates, to capture this information from member countries who were unable to contribute to the completion of the table above. Following a review of the data received, WGEXT will decide at the 2011 meeting if similar information will be collected in future years.

WGEXT member countries generally consider the guidelines to be appropriately detailed, clear and up to date. However, building on the work begun by WGEXT at the 2009 meeting (see Annex 10 of the 2009 WGEXT Annual Report), and in line with the development of the Marine Strategy Framework Directive (see below and recommendations), WGEXT will continue to review the text of the Guidelines with a view to finalizing a revised version for submission to ICES and OSPAR for adoption following the 2011 WGEXT meeting.

9 Marine Strategy Framework Directive

At the request of WGEXT members, the group again discussed the implications of the EU Marine Strategy Framework Directive (MSFD) with regard to the extraction of marine sediment. WGEXT members felt it important to raise with ICES SSGHIE the potential implications of MSFD for the Marine Aggregate sector and recommend ICES take forward recommendations from WGEXT when advising the European Union on MSFD and the benefits of use of the 2003 ICES WGEXT Guidelines by OSPAR countries when assessing Good Ecological Status (GES) descriptors under MSFD.

Of the MSFD descriptors ICES have been requested to advise upon, the following are considered of direct relevance to the work of WGEXT.

(6) Sea floor integrity is at a level that ensures that the structure and functions of the ecosystems are safeguarded and benthic ecosystems, in particular, are not adversely affected .

(11) Introduction of energy, including underwater noise, is at levels that do not adversely affect the marine environment

With respect to descriptor (6) WGEXT recognizes that direct changes to the function and structure of ecosystems, particularly physical parameters, will occur as a result of the extraction of marine sediments.

However, the group are content that in the context of appropriate consent regimes which provide for rigorous environmental assessment and evaluation of each proposal to extract sediment, these impacts may be considered to be within environmentally acceptable limits and therefore not adverse. These assessments should take account of the 2003 "ICES Guidelines for the Management of Marine Sediment Extraction", as adopted by OSPAR, which provide for the adoption of appropriate extraction site locations, and implementation of mitigation and monitoring programmes.

WGEXT suggest that in defining "adverse" it should be accepted that direct changes to the physical structure of the seabed will result from the extraction of marine sediments. Defining "adverse" as being no environmental change from existing (pre-dredge) conditions would, in the opinion of the group, be inappropriate and detrimental to the continued ability of member countries to extract marine sediments from their seabed.

With respect to descriptor (11) WGEXT recognizes that extraction of marine sediment does generate underwater noise, however the impacts of this on the marine ecosystem are currently being investigated.

WGEXT also recognizes that extraction of marine sediments may in combination with other anthropogenic activities have impacts on the marine environment that are relevant in the context of other MSFD descriptors, and that these are being considered by other ICES WG's under the ICES/JRC contract with DG ENV/DG MARE for scientific input to the Marine Strategy Framework Directive.

Recommendations

- ICES bring forward this interpretation of Good Ecological Status descriptors 6 and 11 to the EU.
- WGEXT review the 2003 ICES Guidelines on Marine Aggregate Extraction, specifically in relation to GES descriptors under MSFD.

10 Review the outputs of other relevant ICES working groups relevant to the work of WGEXT and Term of Reference (J): Report to SSGHIE on your plans to promote cooperation between EGs covering similar scientific issues (ToR g)

WGEXT consider the following ICES EG's to cover similar scientific issues:

10.1 Working Group on Integrated Coastal Zone Management (WGICZM)

The overall objective of the WGICZM is defined (2009) as to provide scientific advice on the key issues related to the implementation of ICZM to improve the management objective to achieve sustainability in the coastal zone. ICZM is an essential concept for bringing together multidisciplinary, multi-sectoral and interacting processes (social, ecosystem, economic, governance) in the coastal zone in a practical decision-making framework. ICZM allows for the harnessing of the complexity that makes up the coastal zone and should provide a forum where the work of many of ICES WGs can find a common, mutually beneficial platform. In this context the group provide a useful synthesis of approaches and aspects of ICZM for the contributing countries which can provide useful contextual information to support the sectorally specific information that is dealt with by WGEXT. In some existing cases notably Belgium and Netherlands, emerging special planning frameworks and associated zonation planning directly influence the spatial distribution and regulation of extractive activities through specific planning policy provisions. It may be that the relatively mature nature of policy frameworks, practices, and general governance arrangements concerning MA extraction can be considered by WGICZM as providing useful examples of sound practices with wider applicability.

WGEXT wish to invite chairs and members of other EG's where similar scientific issues are discussed to attend future annual meetings. WGEXT members would also be happy to contribute to other EG's as appropriate and for chairs and members of other EG's to access the WGEXT SharePoint site. WGEXT would wish to recommend that ICES circulate the recent Co-operative Research report as widely as possible around existing EG's through chairs.

10.2 Working Group on Marine Habitat Management (WGMHM)

After BALANCE (Baltic Sea) and MESH programmes, WGMHM members recommend coordination of actors involved in ongoing programmes to provide maps fully compatible and readily accessible via a web portal. The use of EUNIS classification is enhanced.

Habitat mapping is useful for marine management and policy, so demand is increasing in EU, i.e. within the Marine Strategy Framework Directive and a proposal for an Atlas of the Oceans in its Marine Strategy. A network of marine habitat modellers could develop valuable procedures, protocols and standards.

10.3 ICES/HELCOM Working Group on Integrated Assessments of the Baltic Sea (WGIAB)

WGIAB held its meeting 2009 in 16–20 March 2009 Rostock, Germany. WGIAB was setup in 2007 as a forum for developing and combining ecosystem-based management efforts for the Baltic Sea. WGIAB has given itself 3 main tasks: 1) to conduct holistic ecosystem assessments based on large multivariate datasets; 2) to consider the use of ecosystem modelling in the assessment framework; 3) to develop adaptive management strategies for the different Baltic Sea eco-systems.

During the 2009 meeting WGIAB concentrated developing and conducting ecosystem modelling and based on his developing a strategy for the use of ecosystem modelling in the Baltic Sea assessment framework. Toward this goal WGIAB performed comparative analyses of a set of cod population dynamics, multispecies and foodweb models using an approach that is known as “ensemble model-ling” in climate research. In this approach the different models are forced with the same scenarios (e.g. of future climate development) and their projections are collected in an ensemble. By this WGIAB evaluated alternative fisheries management scenarios for cod and sprat under alternative scenarios of future climate change. Based on the experience of the “ensemble modelling” WGIAB started to develop a strategy on the use of ecosystem modelling in future assessment framework, which will be continued in 2010.

WGIAB conducted two major exercises, i.e. (i) conduct the planned ensemble modelling study, and (ii) also update and analyse datasets for the holistic ecosystem assessments. WGIAB managed to update and analyse the dataserries of four subsystems, i.e. Central Baltic Sea, Gulf of Riga, Gulf of Finland, and a coastal ecosystem (for info on subsystems see ICES 2008). The datasets of the 3 remaining subsystems will be updated intersessionally.

In 2010 WGIAB intends to bring together the results and experiences from the IEAs and the “ensemble modelling” in order to develop adaptive management strategies for the Baltic Sea ecosystems.

WGIAB supports the ICES Baltic Fisheries Assessment Working Group (WGBFAS), the ICES Baltic Salmon and Trout Assessment Working Group (WGBAST) and Transition Group of Integration Activities in the Baltic (TGBALT); but also support related HELCOM assessment efforts such as HELCOM BIO and FISH.

10.4 Working group for Regional Ecosystem Description (WGRED)

The interest of this working group is to provide the characteristics of the different ecosystems in the ICES zones and the impact affecting each of them.

In 2008 WGEXT reviewed the WGRED report from 2008. In 2009 and 2010 no additional report of WGRED is available for inclusion in this report. After consulting Jake Rice it became clear that the regional overviews were sufficiently mature that all they would need was updating from year to year. Updated regional overviews are not found at the moment.

10.5 Working Group on Marine Habitat Mapping WGMHM

The ICES Working Group on Marine Habitat Mapping (WGMHM) met in France at Stareso, Calvi, Corsica from 3 to 7 May 2010. The WGMHM reviewed methods for accuracy and confidence assessment on modelled maps and interpreted maps as well as the practise about the use of habitat maps in different countries for various purposes. They stress the need to have reliable habitat maps that also include sensitivity (related to MSFD GES 1). The group recognizes a growing need to make habitat maps available for spatial planning. The group recommends that the soon-to-be formed WG on Marine Spatial Planning work with mapping pressures on habitats (MSFD GES 6) along with the Benthic Ecology Working Group, (already contacted). It is suggested to liaise with three EG's on this topic, WGICZM, WGEXT and Marine Spatial Planning Group. An informal meeting could be organized during ASP 2010 in Nantes, with a view to enhancing collaboration.

Habitat mapping demand is increasing because of MSFD (Marine Strategy Framework Directive), Natura 2000 on sea and MPA (Marine Protected Area) concerns. Habitat modelling: modelling studies (based on EUNIS classification) are increasing, mainly applied to single species/habitat; an improvement in source data layers resolution is needed. Few international programmes in connection with these topics are ongoing, as CHARM 3 (France-UK), CoralFish, Prehab and EuSeaMap. Reporting on national programmes: for a global vision of such programmes, a webGIS with map outlines and associated metadata has been created, with adequate tools developed by the ICES data management team. Protocols and standards for habitat mapping: the group wishes to go to more explicative maps with source data layers and how these can be combined. Use of habitat mapping in a management context: a matrix has been produced with various types of marine human activities vs. the range of scales of habitat maps and this process should be improved.

10.6 Benthic Ecology Working Group (BEWG)

The Benthos Ecology Working Group (BEWG, chaired by Steven Degraer) met in Askö (Sweden) with 20 participants from 12 countries. The Group reviewed the small-scale box approach and the possible impact of climate change on benthos (based on WKCBNS 2008) and proposed the creation of an *ad hoc* study group to further explore the research ideas in close cooperation with other EG's with expertise on habitat mapping. The group also reviewed new developments and challenges in environmental metrics. They decided that metric development, adjustment and intercalibration are beyond the scope of the BEWG, but a viewpoint document on the lessons-learned from the application of environmental metrics within the Water Framework Directive will be written, as a starting point for an optimized use within the Marine Strategy Framework Directive.

There were several reports and presentations on new developments in benthic research in the ICES area, with emphasis on marine management, impact studies (Florida, Netherlands) and types (fisheries, dredging), benthic habitat mapping (Mareano project in Norway), and new initiatives like WISER (Water bodies in Europe: Integra-

tive Systems to assess Ecological status and Recovery) and the Spanish research activities in the high seas of the South-West Atlantic Ocean. Also five presentations were given on long-term changes in benthos. Appropriate datasets should be selected and analysed for sudden changes (i.e. regime shifts), gradual long-term changes and oscillations with an agreed set of parameters to enable further comparisons. This will be achieved through an informal network.

The group agreed upon a structure for the possible contribution of the BEWG to the ICES position paper on Climate Change, which will be elaborated further in their 2010 meeting. They also reported on the methodologies to estimate annual blue mussel production in the Danish part of the Wadden Sea and in other relevant Danish NATURA 2000 sites. In the framework of implementing an ecosystem approach to marine management on the indicator "Areas not impacted by mobile bottom gear" five suggestions were made, related to the necessity for VMS data, fisheries intensity data, VMS data from small vessels, the geographic consistency of areas not impacted by mobile bottom gear. The BEWG proposed the establishment of a new study group on fjord ecosystems, based on a Chilean request. The BEWG planned to meet in USA in April 2010.

10.7 Study Group on Working Hypotheses Regarding Effects on Climate Change (SGWRECC) and Study Group on Climate related Benthic processes in the North Sea (SGCBNS)

SGWRECC has published their report in 2008 and is dissolved in 2009.

The Study Group was established to carry out preparatory work to position the Expert Groups meeting in 2008 to conduct analyses that can be presented and interpreted in a consistent and systematic manner across Expert Groups, for integration as a response by ICES to a request of OSPAR regarding "an assessment of the changes in the distribution and abundance of marine species in the OSPAR maritime area in relation to changes in hydrodynamics And sea temperature".

Ten aspects of the response of temperate marine ecosystems to climate change were identified from published summaries. For each, the evidence of current change is listed, together with likely future changes and the level of confidence that we can have in these based on hypotheses concerning the underlying mechanisms.

The ICES SGWRECC report 2008 focuses mostly on plankton and fish.

The main message for WGEEXT is that due to climate change the abundance and composition of seabed faunal communities can change. This has to be taken into account when formulating monitor strategies and monitoring programmes for the determination of the ecological effects of marine sand extraction. Especially in the comparison between the pre-dredging and after- dredging situation this must be taken into account. For this reason it is important not only to compare pre-dredging and after-dredging populations of e.g. benthic species, but do measurements in reference areas that are comparable with the extraction areas and have the same influence of the climate change.

In this aspect, WGEEXT will be interested to follow the results of the Study Group on Climate related Benthic processes in the North Sea (SGCBNS). The SGCBNS was initiated by the ICES Benthos Ecology Working Group (BEWG) as a follow up initiative of former North Sea Benthos Surveys. The aim was to discuss and initiate future research activities concerning benthic ecosystem processes related to climate regime and to establish a network of benthic long-term series. The work is mainly focused on

the key processes, parameters, drivers and methodology to be considered in helping to identify specific benthic processes affected by climate change, both by modelling and field studies.

Case studies are aimed at studying the temporal and spatial variation of bioturbation, also on a North Sea wide scale. The objectives are to assess spatial patterns in bioturbation across the North Sea in reaction to habitat variability and environmental forcing and to investigate potential vulnerability of benthic bioturbation potential to climate changes across the North Sea.

Both aspects can be of interest for WGEXT to compare the natural changes due to climate change with the changes induced by extraction of marine sediments.

10.8 Promoting Cooperation between ICES EG's

As outlined above, WGEXT members recognize there are a number of other ICES Expert Groups which discuss topics of mutual interest. WGEXT wish to invite chairs and members of other EG's where similar scientific issues are discussed to attend future annual meetings. WGEXT members would also be happy to contribute to other EG's as appropriate and for chairs and members of other EG's to access the WGEXT SharePoint site. WGEXT would wish to recommend that ICES circulate the recent Co-operative Research report as widely as possible around existing EG's through chairs.

Recommendation

ICES to circulate the recent WGEXT Co-operative Research (No. 297) report as widely as possible around existing EG's through chairs.

11 Election of WGEXT Chair (ToR h)

WGEXT members moved to nominate David Carlin as the Chair elect of the group, subject to the approval of ICES.

12 Report to SSGHIE on potential and current contributions of your EG to the Strategic Initiative on Coastal and Marine Spatial Planning (SICMSP; ToR i)

Whilst this objective has been "parked" by ICES, WGEXT members felt it important to still discuss the potential proactive contribution the group could make to future initiatives as they develop.

WGEXT members discussed where the group could contribute to Coastal and Marine Spatial Planning, with specific reference to the text on Marine Spatial Planning as found in the ICES Science Plan 2009-2013. The group consider the application of Marine Planning to be an important tool for the effective management of marine resources, including Marine Aggregate and are keen to contribute to the SICMSP. In doing so WGEXT can offer both our annual reports and recent Co-operative Research report as useful data sources which include information and data on:

- Identification of extraction sites
- National mapping activities including maps, and links to source data
- Pressure data in the form of extraction amounts across member countries

- Information on existing legislative regimes which already use elements of Marine Planning
- Information of spatial approaches to monitoring Marine Aggregate Extraction activities

To assist SICMSP, WGEXT would be happy to include an additional term of reference which relates to the areas outlined above or alternatively amend our existing term of references which include collection of data on national mapping initiatives.

WGEXT members would be pleased to act as stakeholders to SICMSP and provide access to our own networks in the same capacity. A number of WGEXT members and the organizations they represent are already participating in numerous Marine Planning initiatives on a national and multinational scale (e.g. MESMA, PISCES, KNOWSEAS, COREPOINT, WINDSPEED).

13 Closure of the Meeting and Adoption of the Report

The group moved to adopt the final draft report and the meeting was formally closed by the chair. He thanked members of WGEXT for attending and again offered thanks to Professor Cato and SGU for hosting the meeting.

Annex 1: List of participants

| NAME | ADDRESS | PHONE/FAX | EMAIL |
|---------------------------------------|--|--|----------------------------------|
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|---|---|--|-----------------------------|
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| | | | |
|--|--|--|-------------------------------|
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Annex 2: Agenda

| | |
|---------------------------|--|
| Monday 31 May 2010 | |
| 1900 onwards | Informal gathering, meet and greet. (consider ToR H) |
| Tuesday 1 June | |
| 09.00 – 09.10 | Welcome by representative of SGU |
| 09.10 – 10.30 | Welcome by WGEXT Chair |
| | Terms of reference (h) election of chair |
| | Apologies for absence |
| | Adoption of Agenda |
| 10.30 – 10.45 | Coffee |
| 11.00 - 12.30 | Terms of reference item (a) and OSPAR Summary of Extraction Statistics |
| 12.30 – 13.30 | Lunch |
| 13.30– 15.30 | Complete Terms of reference items (a) and (j) |
| 15.30 – 15.45 | Coffee |
| 15.45 – 18.00 | Terms of reference (b1), (b2) and (i) Discussion of Marine Strategy Framework Directive |
| | <i>Aim to complete (a) and begin (b) by the end of day 1</i> |
| Evening session | Presentations by WGEXT members |
| Wednesday 2 June | |
| 08.30 – 10.30 | Terms of reference item (b3) |
| 10.30 – 10.45 | Coffee |
| 10.45 – 12.30 | Complete Terms of Reference item (b) and (c) |
| 12.30 – 13.15 | Lunch |
| 13:30 onward | Field Trip |
| | <i>Aim to complete (b), by the end of day 2</i> |
| Evening session | Presentations by WGEXT members |
| Thursday 3 June | |
| 08.30 – 10.30 | Term of Reference (d) |
| 10.30– 10.45 | Coffee |
| 10.45 – 11.45 | Term of Reference (d) and revisit EMS / Black box information |
| 11.45 – 12.30 | Presentations |
| 12:30-13:30 | Lunch |
| 13.30 – 15:30 | Term of Reference (f) |
| 15.30-15.45 | Coffee |
| 15.45 – 16:30 | TOR (f) |
| 16:30 – 18:00 | TOR (e) update on progress |
| 18:00 – 20:00 | Break |
| 20:00 – 22:00 | Evening – option for additional session to complete outstanding TOR's |
| | <i>Aim to complete (c), (d), (e) and (f) by end of day 3</i> |

| | |
|----------------------|---|
| Friday 4 June | |
| 08.30 – 11.00 | TOR (g) Completion of outstanding agenda items and Recommendations Agree initial text of Working Group Annual Report for 2010 Draft Council Resolutions and suggested TOR's for 2011 meeting |
| 11:00 | Close of meeting |

Annex 3: WGEXT Terms of Reference for the next meeting

The **Working Group on the Effects of Extraction of Marine Sediments on the Marine Ecosystem (WGEXT)**; Chair elect: D. Carlin, UK) will meet in the Netherlands from 11 to 15 April 2011 to:

- a) Provide a summary of data on marine sediment extraction for the OSPAR region that seeks to fulfil the requirements of the OSPAR request for extraction data to be provided by ICES and evaluate any feedback or comments from OSPAR on the information submitted by WGEXT 2010;
- b) Review data on (b.1) marine extraction activities, (b.2) developments in marine resource and habitat mapping taking into account some of the outputs of the ICES WGMHM as appropriate, (b.3) information on changes to the legal regime (and associated environmental impact assessment requirements) governing marine aggregate extraction
- c) Review approaches to the management and control of marine sediment extraction including a review of approaches to monitoring the effects of this activity and the use of compliance monitoring (e.g. EMS / black box) by member countries;
- d) Review and report on the outputs of national and multinational scientific programmes, research projects and monitoring programmes relevant to the assessment of environmental effects of the extraction of marine sediments;
- e) Continue work on a new Cooperative Research Report to cover the period 2005 to 2010;
- f) Evaluate the use and application of the ICES WGEXT 2003 Guidelines across member countries. Continue to review and revise the Guidelines, as appropriate, with specific regard to the Marine Strategy Framework Directive. Formulate a draft resolution to ICES regarding the adoption by OSPAR of any subsequently amended version of the guidelines;
- g) Report to SSGHIE on potential and current contributions of your EG to the Strategic Initiative on Coastal and Marine Spatial Planning (SICMSP).
- h) Review the outputs from other relevant ICES EG's relevant to the work of WGEXT and report to SSGHIE on your plans to promote cooperation between EGs covering similar scientific issues.

WGEXT will report by 30th June 2011 to the attention of the SSGHIE Committee.

It is proposed by WGEXT that the 2012 meeting would provisionally be held in France, as guests of the University of Rouen.

Supporting Information

| | |
|-----------|---|
| Priority: | Current activities are concerned with developing the understanding necessary to ensure that marine sand and gravel extraction is managed in a sustainable manner, and that any ecosystem (and fishery) effects of this activity are better understood so that mitigative measures can be adopted where appropriate. These activities are considered to have a very high priority. |
|-----------|---|

| | |
|---|---|
| Scientific justification and relation to action plan: | <p>Links to following high priority research topics from ICES Science Action Plan 2009 - 2013:</p> <ul style="list-style-type: none"> • Understanding of Interactions of Human Activities with Ecosystems • Development of Options for Sustainable Use of Ecosystems <p>(a) This work responds to a request from OSPAR to gather data for the entire OSPAR region on aggregate extraction activities. This information is to be provided and collated in advance of the meeting and reviewed in relation to item (b). We aim to seek the support of existing WGEXT members and participants in an attempt to improve and extend reporting of national data to WGEXT in order to satisfy the OSPAR request.</p> <p>(b) and (c) An increasing number of ICES Member Countries undertake sand and gravel extraction activities and others are looking at the potential for future exploitation. Each year relevant developments under these headings are reviewed and summarized. This provides a useful forum for information exchange and discussion. National reports are submitted electronically prior to the meeting.</p> <p>(d) To respond to any feedback received to ensure the report accurately reflect the needs of ICES and OSPAR.</p> <p>(e) WGEXT wish to begin to review the 2003 WGEXT Guidelines to ensure they remain fit for purpose across member countries and take account of developments in the underpinning science.</p> <p>(f) An increasing amount of monitoring activity takes place in connection with licensed aggregate extraction across ICES Member Countries. WGEXT wish to consider the scientific robustness and rationale behind the design, implementation and effectiveness of such monitoring activities.</p> |
| Resource requirements: | Most countries collect data and information routinely on aggregate extraction activities. The additional work in presenting these data in a standardized form for the new electronic template is considered small, but in the long term should result in a reduction in effort. Reviews of research activity are of programmes that are already underway and have resources committed. |
| Participants: | The Group is normally attended by some 20–25 members and guests. |
| Secretariat facilities: | None required other than services of chair and rapporteur |
| Financial: | No financial implications. |
| Linkages to advisory committees: | SSGHIE, SCICOM |
| Linkages to other committees or groups: | BEWG, WGMHM, WGMHM, WGRED, WGICZM, SGCBS, WGIAB |
| Linkages to other organizations: | Work is of direct interest to OSPAR and HELCOM. |

Annex 4: Recommendations

WGEXT move to make the following recommendations:

| RECOMMENDATION | FOR FOLLOW UP BY: |
|---|---------------------------------|
| 1. ICES bring forward the interpretation identified within Section X, ToR F of Good Ecological Status descriptors 6 and 11 to the EU. | ICES SSGHIE Committee |
| 2. WGEXT review the 2003 ICES Guidelines on Marine Aggregate Extraction, specifically in relation to GES descriptors under MSFD | WGEXT sub-group led by Ad Stolk |
| 3. ICES circulate the recent Co-operative Research report as widely as possible around existing EG's through chairs | ICES Secretariat |
| 4. WGEXT chair be permitted to invite, parties within an interest in marine sediment extraction from non-ICES countries such as those identified through the COST MAGNET programme to attend future WGEXT meetings in the capacity of observer. | ICES SSGHIE Committee |

Annex 5: Review of National Marine Aggregate Extraction Activities

A detailed breakdown of each country's sediment extraction dredging activities is provided below:

1 Belgium

In Belgium the sectors of the Belgian continental Shelf where sand can be extracted are defined and limited by law. In 2009 extraction was granted in sectors 1a, 1b (March to May), 2b (excluding central depression), 2c and 3a (see Figure 1.1). However, no extraction is taken place in 1b since long time, nor in 3a, although the sand of the latter is cheaper, but probably of less quality for industrial purposes as it close to a dredge dumping area. Sector 2a was closed for extraction from 2009 onwards; sector 3b is closed as in that sector dumping of dredged material is still taking place. Sector 4 is still in an exploration status, but this will change from 2011 onwards. This limits the extraction to zones 1a, 2b and 2c in 2009.

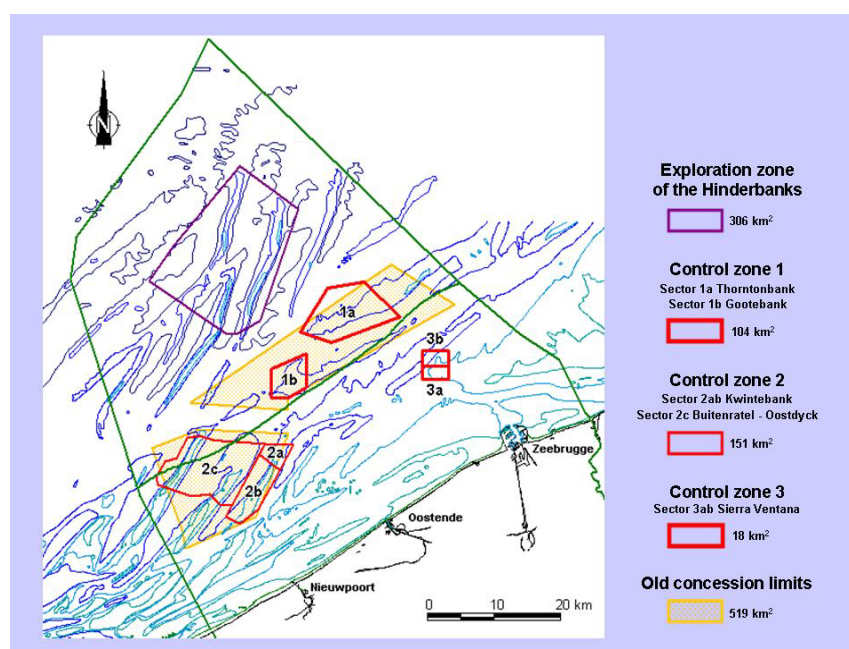


Figure 1.1. Map of permitted exploitation (and exploration) areas for sand and gravel on the Belgian continental shelf as defined in KB of 1 September 2004.

In 2009, 1 673 696 m³ sand and no gravel was extracted from sectors 1 and 2 by 12 private license holders. This sand is mainly used for industrial purposes. Two licenses were also granted to the Flemish Region, although in 2008 only Afdeling Kust was extracting, while Afdeling Maritieme Toegang did not extract anything again. The licenses for the Flemish Region have the same conditions (reporting, black-boxes, etc.) as licenses for the private sector with the exception that they are exempted from the fee system. The Flemish Region extracted 288 480 m³ sand, which was used solely for beach nourishment.

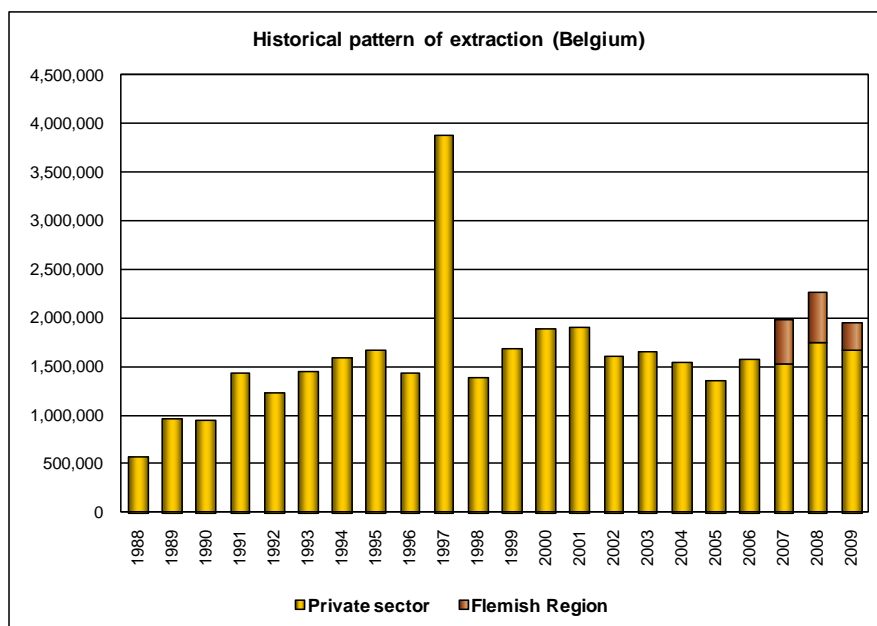


Figure 1.2. Volumes of sand and gravel extracted from the Belgian Continental Shelf between 1988 and 2009.

Although sand extraction on the Belgian continental Shelf started in 1976 and data are available since then, Figure 1.2 only includes data from 1988 onwards. From 2007 onwards the extra quantities extracted by the Flemish Region are included in the graph. The total amount of almost 2 mm³ sand extracted in 2009 from the Belgian Continental Shelf is a decrease of 13 % compared to 2008 and comparable with 2007 (Figure 1.2).

Of this volume 66 % was allocated for the Belgian industrial market, 15 % for coastal defense and 20 % was exported to foreign markets (157000 m³ to France, 70000 m³ to the UK and 158000 m³ to the Netherlands). Most of the sand allocated to Belgian market was landed in the coastal harbours of Brugge (including the harbour of Zeebrugge), Oostende and Nieuwpoort.

The total area of the sectors where extraction was allowed in 2009 together comprised 256 km². Most of the sand is extracted from the tops of the banks on an area of only 40 km². Most of the sand extracted in 2009 came from the Buitenratel in sector 2c (72%), while the importance of Kwintebank (sector 2a) and the Oostdyck (2c) dropped to 5% and 3%, respectively (Figure 1.3). The importance of the Thorntonbank (sector 1a) further increased to almost 20%. While most of the sand is extracted on the tops of the sandbanks, in Kwintebank area 2a most of the sand was taken from the slopes. (Figure 1.4)

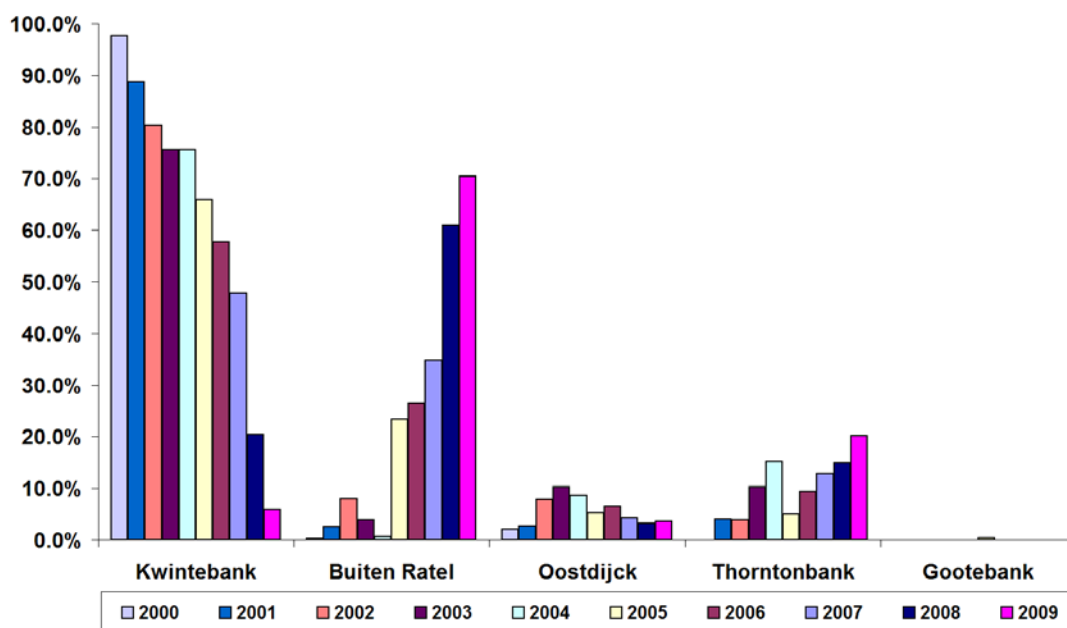


Figure 1.3. Extraction pattern on different sandbanks in zones 1 and 2 on the Belgian Continental Shelf between 2000 and 2009.

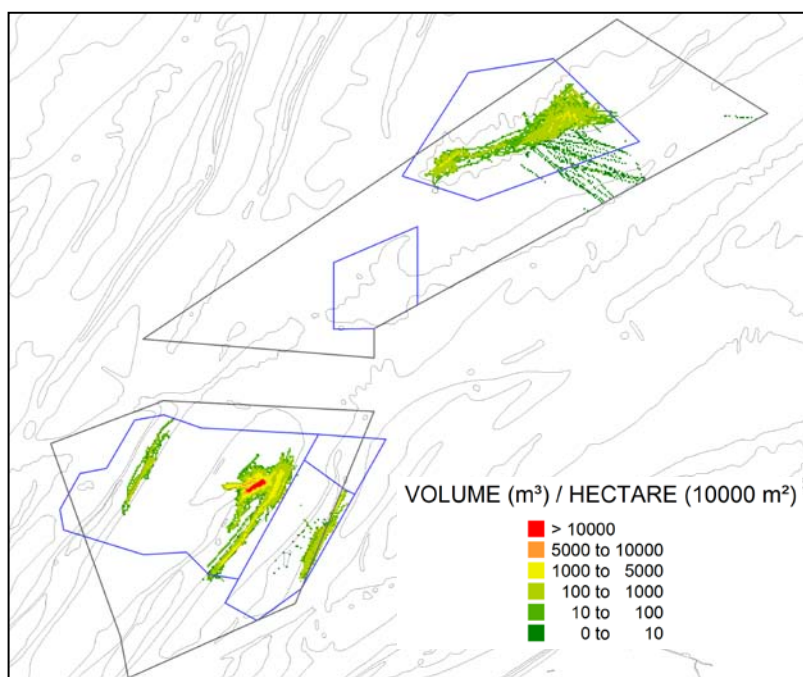


Figure 1.4. Sand extraction intensity in zones 1 and 2 on the Belgian Continental Shelf, based on processed black box data for 2009.

2 Denmark

Table 2.1 Construction industrial aggregate (sand and gravel) extraction figures for 2008.

| DREDGING AREA | AMOUNT |
|----------------|-------------------------|
| Denmark total | 3,1 mio. m ³ |
| (1)OSPAR area | 1,8 mio. m ³ |
| (1)HELCOM area | 2,3 mio. m ³ |

(1) The OSPAR area and the HELCOM area are overlapping in Denmark. The Kattegat area from Skagen to north of Fyn-Sjælland is included in both Conventions. Therefore the figures from the two Convention-areas cannot be added.

Table 2.2 Amount of material extracted for beach replenishment projects in 2008.

| DREDGING AREA | MATERIAL | AMOUNT |
|----------------|----------|--------------|
| Denmark total | sand | 2,1 mio. m3 |
| (1)OSPAR area | sand | 2,1 mio. m³ |
| (1)HELCOM area | sand | 0,05 mio. m³ |

(1) The OSPAR area and the HELCOM area are overlapping in Denmark. The Kattegat area from Skagen to north of Fyn-Sjælland is included in both Conventions. Therefore the figures from the two Convention-areas cannot be added.

Table 2.3 Construction fill/ land reclamation (m³) extraction figures for 2008.

| DREDGING AREA | MATERIAL | AMOUNT |
|---------------|----------|-------------------------|
| Denmark total | sand | 1,2 mio. m ³ |
| (1)OSPAR area | sand | 0,5 mio. m ³ |

Table 2.4. Non-aggregate (e.g. shell, maerl, boulders etc) extraction figures for 2008.

| DREDGING AREA | MATERIAL | AMOUNT |
|---------------|----------|---------------|
| Kattegat | Shells | 0,002 mio. m³ |

Table 2.5. Exports of marine aggregate in 2008.

| PORT (LANDING) | AMOUNT |
|----------------|-------------|
| Sweden | 0,2 mio. m³ |

Table 2.6. Historical patterns of marine aggregate extraction.

[illegible]

Summary of current licence position and forecasts for future exploitation of marine aggregates: There are currently ~100 dredging areas in Denmark. Only ~60 areas are dredged on an annual basis.

3 Estonia

Table 3.1 Historic patterns of marine aggregate extraction (m3).

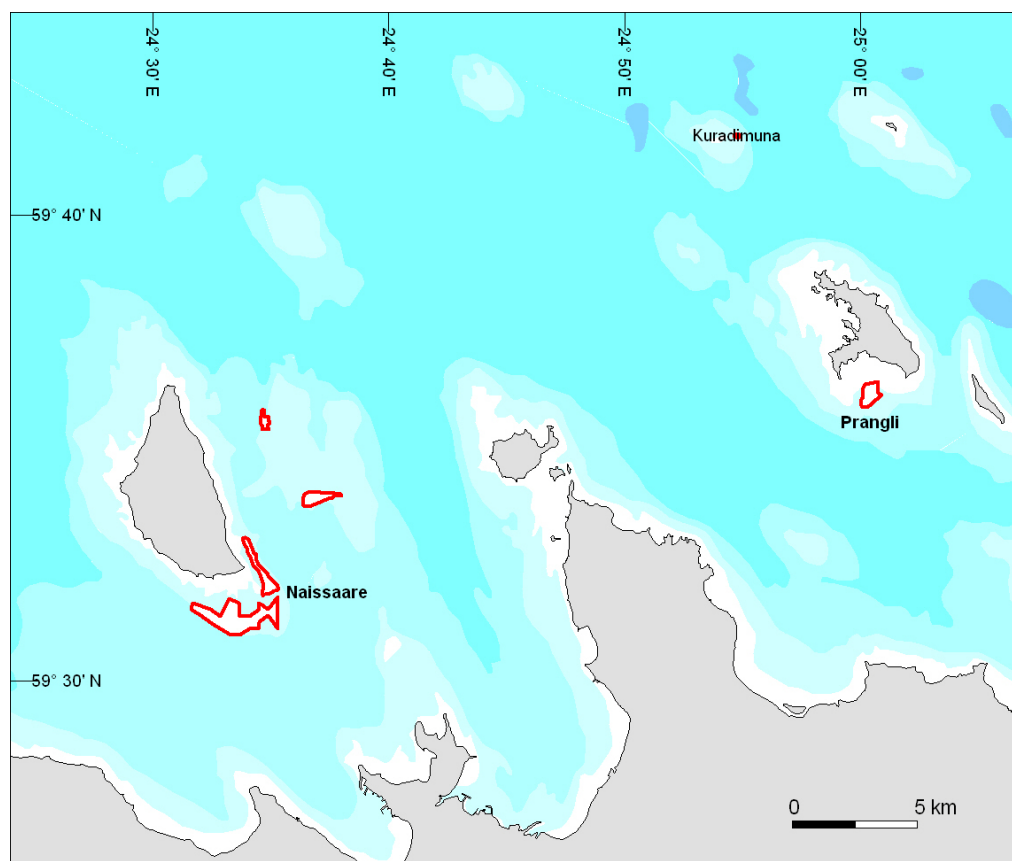
| EXTRACTION AREA | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | TOTAL 2003–2008 |
|-----------------|-----------|---------|------|------|------|---------|------|--------------------|
| Gulf of Finland | | | | | | | | |
| Naissaare | 1,745,000 | 609,100 | 0 | 0 | 0 | 732,700 | n/d | |
| Pragli | 492,000 | 0 | 0 | 0 | 0 | 0 | | |
| Total | 2,237,000 | 609,100 | 0 | 0 | 0 | 732,700 | n/d | 3,578,800 |

Extraction information is gathered from the Estonian Land Board Deposits Register

(<http://geoportaal.maaamet.ee/est/Andmed-ja-kaardid/Geoloogilised-andmed/Maardlad/Maavaravarude-koondbilansid-p193.html>).

Sand extraction was continued in 2009 at Tallinn Bay but the data are not yet available.

Figure 3.1. Estonian extraction areas.



4 Finland

No aggregate extraction activities, or non-aggregate (e.g. shell, maerl, boulders, etc.), conducted during 2009.

Table 4.1 Historical patterns of marine aggregate extraction (m3).

| EXTRACTION AREA | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | TOTAL 1996–2009 |
|-----------------|------|------|------|------|-----------|-----------|-----------|------|------|------|--------------------|
| Gulf of Finland | 0 | 0 | 0 | 0 | 1,600,000 | 2,388,000 | 2,196,707 | 0 | 0 | 0 | 6,184,707 |

Description of historical extraction activities for 1995–2008:

Sand and gravel extraction from Finnish coastal areas between 1996 and 2004 was negligible. The Port of Helsinki extracted 1.6 million m³ off Helsinki (Gulf of Finland) in 2004, 2.4 million m³ in 2005 and 2.2 million m³ in 2006. No extraction activities have been undertaken since 2006.

Summary of current licence position and forecasts for future exploitation of marine aggregates

Loviisa Area, eastern part of Gulf of Finland

A permission to extract 8 million m³ of marine sand from the Loviisa-Mustasaari area was accepted in April 2007 by the Environment Permit Authority to Morenia, Metsähallitus. However there was a complaint against the decision and the case was under hearing of the Administrative Court of Vaasa. The decision on 31.12.2008 was favourable for the extraction. Extraction has not yet started.

Pori Area, Bothnian Sea

EIA in the Pori area was completed in 2007 by Morenia, Metsähallitus, but the EIA authority required additions to the assessment. These additions are now included to the EIA. The license application for extraction sand 3.5 Mm³ was sent to Environment Permit Authority on 7.1.2009. Decision is expected during 2010, but plans for the new Selkämeri (Botnian Sea) national park will probably prevent the project.

Bay of Bothnia

Morenia, Metsähallitus has selected four areas in the Bay of Bothnia where EIAs has now been started which aims to exploit marine sand resources: Suurhiekkä-Pitkämatala (Ii and Simo municipalities), Merikallat (Hailuoto), Tauvo (Siikajoki and Raahe) and Yppäri (Pyhäjoki) <http://www.morenia.fi/binary.aspx?Section=239&Item=209>. The EIA procedure was completed during 2009 and the report is now under examination by authorities. The planned extraction is about 20 mm³.

Helsinki

There is a further application for extraction of 5 mm³ sand.

Porvoo

There is a new area off Pori undertaking preliminary environmental studies.

5 France

Table 5.1. Construction industrial aggregate (sand and gravel) extraction figures for 2008/2009.

| DREDGING AREA | AMOUNT ¹ |
|----------------------|----------------------------|
| Channel | 1,172,588 m ³ |
| Atlantic | 5,969,000 m ³ |
| Brittany | 325,000 m ³ |

¹ These figures are not extracted quantities but licence quota figures (maximum permitted).

Amount of material extracted for beach replenishment projects in 2008/2009

No data available for beach replenishment.

Construction fill/ land reclamation (m³) extraction figures for 2008/09

There is no activity of construction fill or land reclamation in France.

Table 5.2. Non-aggregate (e.g. shell, maerl, boulders, etc.) extraction figures for 2008/2009.

| DREDGING AREA | MATERIAL | AMOUNT ¹ |
|----------------------|-----------------|----------------------------|
| Brittany | Maerl | 285,250 m ³ |
| Brittany | Shelly sand | 210,250 m ³ |

¹ These figures are not extracted quantities but licence quota figures (maximum permitted).

Exports of marine aggregate in 2008/2009

No data available for exports of marine aggregate.

Table 5.3. Historical patterns of marine aggregate extraction.

| DREDGING AREA | NAME | EXTRACTED VOLUMES (m ³) | | | | | | | | | |
|---------------|--|-------------------------------------|---------|-----------|---------------|---------|---------|---------|-----------|---------------|-------------------|
| | | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 |
| Atlantic | Le Piliér | 2124326 | 2271760 | 2092038 | 2163848 | 2491514 | 2465909 | 2358107 | 2466751 | 2239033 | 2267000 |
| | Les Charpentiers | 149851 | 199041 | 1500000 | 1500000 | 1500000 | 1500000 | 1500000 | 1500000 | 1500000 | 1500000 |
| | Sables d'Olonne | No extraction | | 2349 | No extraction | | 3387 | 330000 | 330000 | 330000 | 330000 |
| | Chassiron B | Non permitted | | | 330000 | 330000 | 330000 | 330000 | 330000 | 330000 | 330000 |
| | Chassiron C | 330000 | 330000 | 330000 | 330000 | 330000 | 330000 | 330000 | 330000 | 330000 | 330000 |
| | Chassiron D | Non permitted | | | 330000 | 330000 | 330000 | 330000 | 330000 | 330000 | 330000 |
| | Chassiron E | Non permitted | | | | | | | 482000 | 482000 | 482000 |
| Channel | Platin de Grave | 117000 | 143000 | 174000 | 103000 | 400000 | 400000 | 400000 | 400000 | 400000 | 400000 |
| | Graves-de-l'estuaire | 330000 | 330000 | 330000 | 330000 | 330000 | 330000 | 330000 | 330000 | 330000 | 330000 |
| | Granulats Marins de Dieppe (Graves-de-mer) | 179575 | 193673 | 167690 | 314857 | 161477 | 165850 | 347828 | 471200 | 470588 | 470588 |
| | Griz Nez | 64287 | 51266 | 36260 | 35746 | 39388 | 72000 | 72000 | 72000 | 72000 | 72000 |
| Brittany | Baie de Seine | Non permitted | | | | | 330000 | 330000 | 330000 | 330000 | 330000 |
| | Golfe de Saint-Malo | No extraction | | | | | | | | | |
| | Illet Saint-Michel | 78081 | 76360 | 76644 | 75553 | 76680 | 68364 | 56780 | 75048 | 74955 | 79000 |
| | Lost Pic | 130000 | 129625 | 130598 | 131346 | 123654 | 124077 | 60300 | 130515 | 129329 | 169500 |
| | Phare de la Croix | 15100 | 12500 | 11300 | 12700 | 11500 | 11500 | 11750 | 12308 | 10461.5 | 11500 |
| | La Houraine | 76150 | 68600 | 86205 | 75450 | 76590 | 71154 | 76754 | 75261.5 | 76558 | 83000 |
| | La Cormorandière | 19066 | 21454 | 22322 | 16067 | 24370 | 22259 | 16126 | 18885 | 15308 | 22000 |
| | Le Paon | No extraction | | | | | | | | | |
| | Jaudy | | 18580 | 9370 | 7500 | 7900 | 9200 | 11100 | | 0 | End of extraction |
| | Beg an Fry | | 15308 | 22111.5 | 22231 | 34446 | 31400 | 6440 | 20100 | 0 | 16500 |
| | Les Duons | 23031 | 19825 | 25465 | 27801 | 20271 | 28940 | 10732 | 20913 | 22807 | 30000 |
| | Le Petit Minou | | 21808 | 21496 | 19315 | 22275 | 19300 | 22700 | 2272 | 20450 | 33000 |
| | Le Grand Minou | | | | | | | | | | |
| | Kafarnao | 7700 | 12100 | 7300 | 8500 | 5249 | 6900 | 6100 | 4140 | 1292 | 20000 |
| | Les Pourceaux | | 8050 | 1700 | 6385 | 3000 | 2600 | 600 | 0 | 300 | 6000 |
| | Les Glénan | 87000 | 80710 | 67000 | 63000 | 55195 | 52000 | 46140 | 35700 | 39900 | 25000 |
| | Aber Benoît | 21600 | 17058 | | | | | | | | |
| | Aber Ildut | No extraction | | | | | | | | | |
| | Plateau des Fourches | | 1230 | 667 | 1500 | 1000 | 667 | 500 | | No extraction | |
| | | 3752767 | 4021948 | 5114515.5 | 5904799 | 6377896 | 7032120 | 6983957 | 7767093.5 | 7534981.5 | 7667088 |

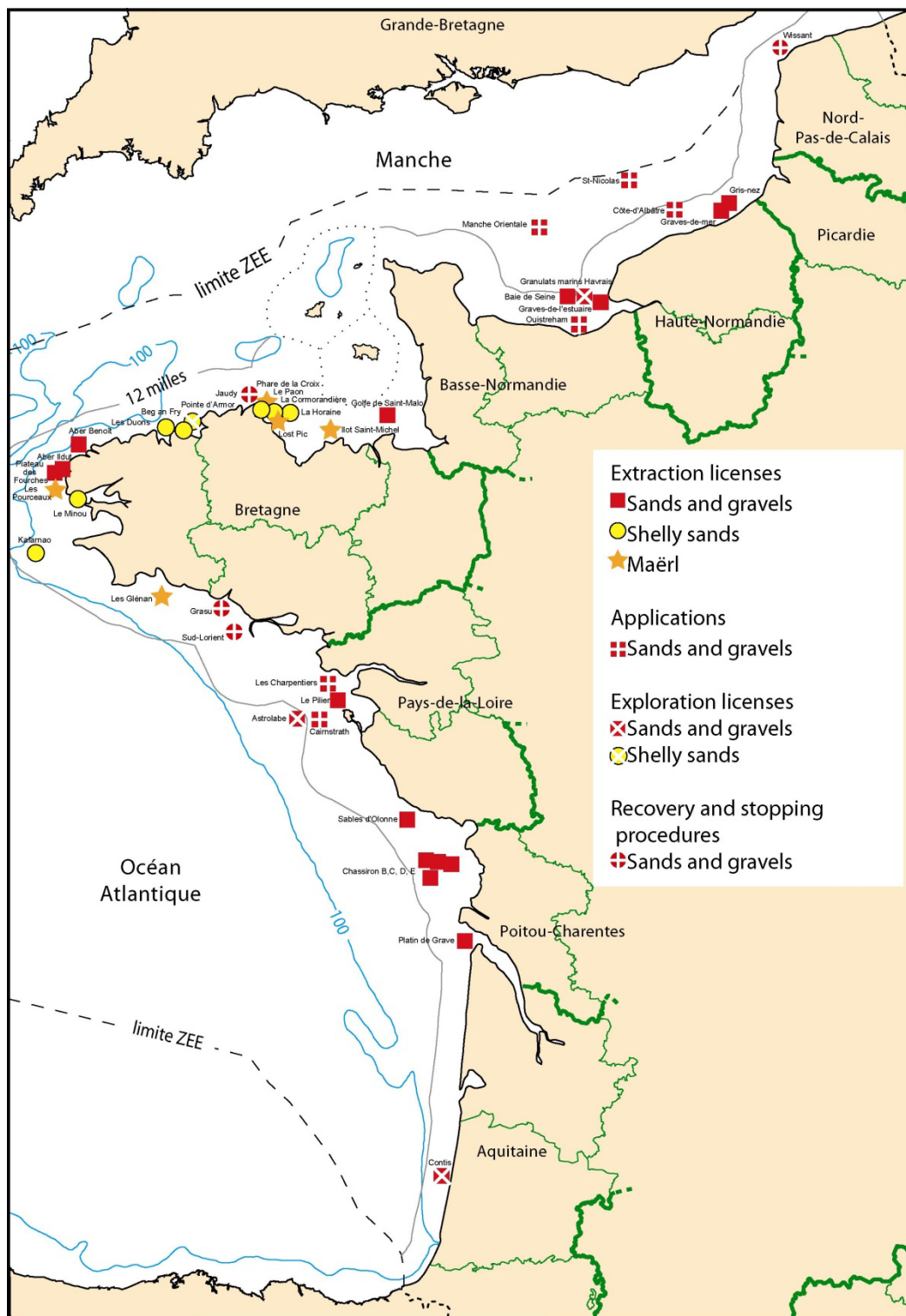
in red Quotas data, Amount in m³

TOTAL 2000-2009 :

62 157 166

Summary of current licence position and forecasts for future exploitation of marine aggregates

18 applications (1 for exploration, 10 on actual extraction area for a new extraction perimeter, 7 on new extraction perimeter) for aggregate extraction are being considered by Environment Ministry (MEEDDM), 29 licences and 3 prospection authorizations have been issued by local administration (Préfectures).



6 Germany

Aggregate extraction activities for both construction and beach replenishment uses have been conducted during 2009. This demonstrates a marked increase in volumes required for construction projects due to the Jade Weser port, harbour construction project.

Table 6.1 Patterns of marine aggregate extraction (m³).

| EXTRACTION AREA | | 2008 | 2009 | TOTAL 2008–2009 |
|--------------------------|---------------|---------|------------|--------------------|
| Germany – HELCOM area | Construction | 131,591 | 212,273 | 343,864 |
| | Replenishment | 581,018 | 230,406 | 811,424 |
| | Total | 712,610 | 442,679 | 1,155,289 |
| Germany – OSPAR area | Construction | N/d | 19,049,878 | 19,049,878 |
| | Replenishment | N/d | 1,065,993 | 1,065,993 |
| | Total | N/d | 20,115,871 | 20,115,871 |

7 Iceland

Construction industrial aggregate (sand and gravel) extraction figures for 2008/2009.

Table 7.1 Patterns of marine aggregate extraction (m³).

| DREDGING AREA | AMOUNT * |
|--|---|
| SW-Iceland: Faxaflói Bay: Kollafjörður | 2008 Sept.–Dec.: 75.160 m ³ 2009: 100.800 m ³ |
| SW-Iceland: Faxaflói Bay: Hvalfjörður | 2008 Sept.–Dec.: 114.820 m ³ 2009: 210.000 m ³ |
| SW-Iceland: Faxaflói Bay: Syðra-Hraun | 2008 Sept.–Dec.: 2.400 m ³ 2009: 49.100 m ³ |
| NW-Iceland: Ísafjörður: Alftafjörður | 2008: None 2009: 14.985 m ³ |

No material extracted for beach replenishment projects in 2008/2009.

In Iceland marine aggregates are not extracted for beach replenishment, rocks from land are used to prevent coastal erosion, but in small scale.

No extraction for construction fill/ land reclamation (m³) for 2008/09.

Table 7.2 Non-aggregate (e.g. shell, maerl, boulders, etc.) extraction figures for 2008/2009.

| DREDGING AREA | MATERIAL | AMOUNT * |
|---------------------------------------|------------|--|
| NW-Iceland: Arnarfjörður | maerl | 2008: 50.445 m ³ |
| | | 2009 (part of the year): 11.845 m ³ |
| SW-Iceland: Faxaflói Bay: Syðra-Hraun | shell sand | 2008 Sept.–Dec.: 42.600 m ³ |
| | | 2009: 69.360 m ³ |

None marine aggregate were exported from Iceland 2008–2009, but most of the non-aggregate material, maerl, were exported, maybe part of it as raw material. The extraction of maerl in Arnarfjörður in NW-Iceland started 2005, so it seems that at 2005–2006, all maerl materials were exported as raw material, but landed first at the town Bildudalur in the Arnarfjörður area in NW-Iceland. In 2006 some of the maerl was exported to Castletownbere in Ireland. The maerl factory at the town Bildudalur

started in April 2007, and after that the raw material proportion that were exported decrease. The Irish company, Celtic Sea Minerals, is the biggest owner of the maerl factory at Bildudalur.

8 Ireland

No aggregate extraction activities or non-aggregate (e.g. shell, maerl, boulders, etc.) conducted during 2009.

9 The Netherlands

Table 9.1. Marine aggregate (sand) extraction figures for 2009.

| DREDGING AREA | AMOUNT MM ³ |
|--|------------------------|
| Euro-/Maas access-channel to Rotterdam | 1,221,669 |
| IJ-access-channel to Amsterdam | 0 |
| Dutch Continental Shelf | 40,677,068 |
| Dutch Continental Shelf / Maasvlakte 2 project | 78,598,271 |
| Total | 120,700,339 |

Most of reported quantities are in m3. If reported in tonnes, 1 T = 0.667 m³.

Table 9.2. Non-aggregate (shell) extraction figures for 2009.

| DREDGING AREA | MATERIAL | AMOUNT M3 |
|----------------------------|----------|-----------|
| Wadden Sea | Shells | 91,060 |
| Wadden Sea inlets | Shells | 61,343 |
| Western Scheldt | Shells | 3,600 |
| Voordelta of the North Sea | Shells | 25,920 |
| North Sea | Shells | 81,360 |

Description of non-aggregate extraction activities in 2009:

On basis of the Second National Policy Note and EIA for shell extraction (31 august 2004) there are maximum permissible amounts defined from 2005 until 2013.

These permissible amounts (in m³) of shells to be extracted yearly from:

- the Wadden Sea max. 85,000
- (but no more than 50 % of the total quantity (The Wadden Sea and Sea Inlets)
- the Sea Inlets between the isles until a distance of 3 miles offshore 85,000 up to 2013
- the Voordelta 40,000
- the Western Scheldt 40,000
- the rest of the North Sea until a distance of 50 km offshore unlimited

Table 9.3. Exports of marine aggregate in 2009.

| DESTINATION/(LANDING) | AMOUNT (M³)* |
|------------------------------|--------------------------------|
| Belgium | 2,400,000 |
| Luxembourg | 12,000 |

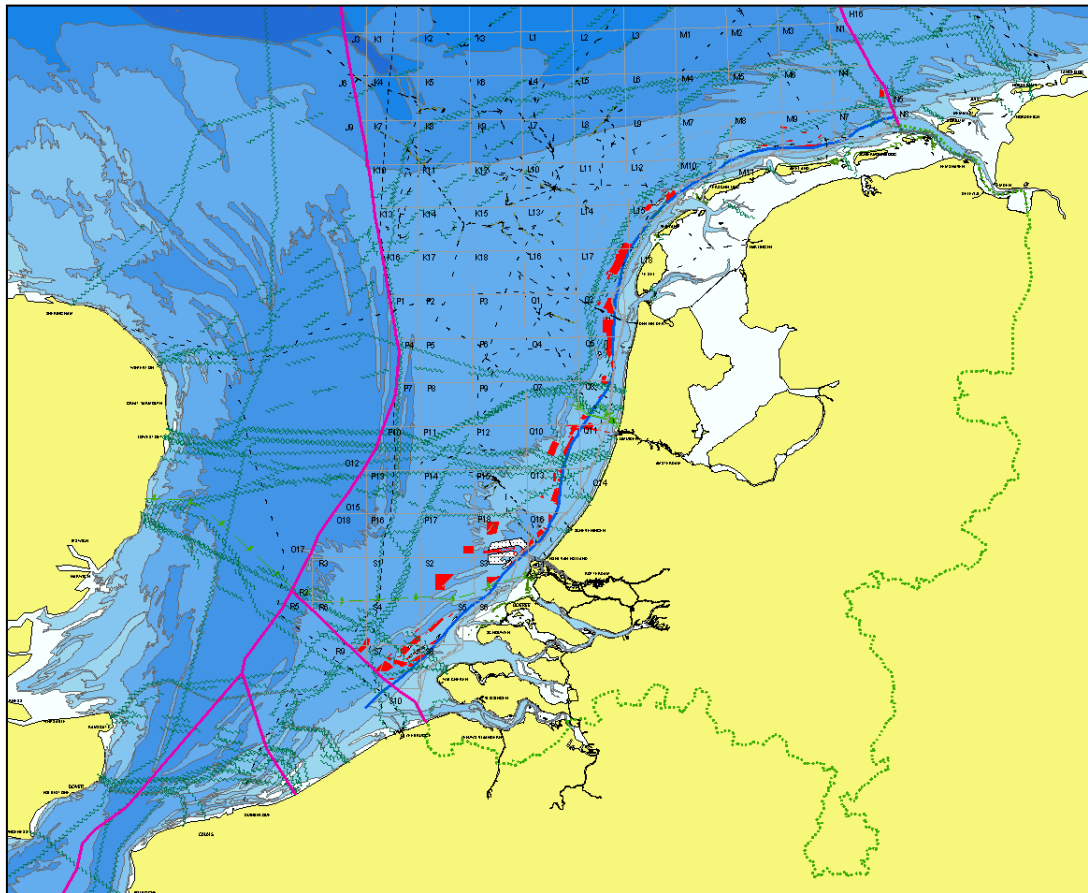
* Approximate figures.

There is a continuous flow of sand extracted out of the extraction areas in the southern part of the Dutch sector of the North Sea, used for landfill and for concrete and building industries.

Table 9.4. Amount of material extracted for beach replenishment projects in 2009.

| DREDGING AREA | MATERIAL | AMOUNT IN MM3 |
|------------------------------|-----------------|----------------------|
| L12H (coast of Friesland) | sand | 2,071 |
| L14D (coast Noord-Holland) | sand | 1,501 |
| P18F (coast of Zuid-Holland) | sand | 4,614 |
| P18K (coast of Zuid-Holland) | sand | 3,324 |
| Q2D (coast of Noord-Holland) | sand | 0,460 |
| Q2K (coast of Noord-Holland) | sand | 1.434 |
| Q5F (coast of Noord-Holland) | sand | 0,608 |
| Q5G (coast of Noord-Holland) | sand | 0,589 |
| Q16G (coast of Zuid-Holland) | sand | 0,009 |
| Q16H (coast of Zuid-Holland) | sand | 2,186 |
| S3C (coast of Zeeland) | sand | 1,103 |
| S7U (coast of Zeeland) | sand | 0,341 |
| S7W (coast of Zeeland) | sand | 12,694 |
| Total | sand | 30,934 |

Figure 9.1. Licensed sand extraction areas March 2007.

Table 9.5. Historical patterns of marine aggregate extraction in mm³.

| EXTRACTION AREA | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | TOTAL |
|-------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|--------|
| Euro-/Maas channel | 6,83 | 10,32 | 3,90 | 2,94 | 1,23 | 2,32 | 0,49 | 0,65 | 1,94 | 1,22 | 31,84 |
| IJ-channel | 4,78 | 2,31 | 1,41 | 0,87 | 1,06 | 4,31 | 0 | 0 | 0 | 0 | 14,74 |
| Dutch Continental Shelf | 13,82 | 23,81 | 28,53 | 20,07 | 21,31 | 22,13 | 22,88 | 28,25 | 24,53 | 119,59 | 324,92 |
| Total extracted | 25,43 | 36,44 | 33,84 | 23,88 | 23,59 | 28,76 | 23,37 | 28,90 | 26,47 | 120,81 | 371,50 |

Table 9.6. Dutch sand extraction 1974–2009.

| YEAR | TOTAL EXTRACTED m3 |
|------|--------------------|
| 1974 | 2.787.962 |
| 1975 | 2.230.889 |
| 1976 | 1.902.409 |
| 1977 | 757.130 |
| 1978 | 3.353.468 |
| 1979 | 2.709.703 |
| 1980 | 2.864.907 |
| 1981 | 2.372.337 |
| 1982 | 1.456.748 |
| 1983 | 2.252.118 |
| 1984 | 2.666.949 |
| 1985 | 2.724.057 |
| 1986 | 1.955.491 |
| 1987 | 4.346.131 |
| 1988 | 6.954.216 |
| 1989 | 8.426.896 |
| 1990 | 13.356.764 |
| 1991 | 12.769.685 |
| 1992 | 14.795.025 |
| 1993 | 13.019.441 |
| 1994 | 13.554.273 |
| 1995 | 16.832.471 |
| 1996 | 23.149.633 |
| 1997 | 22.751.152 |
| 1998 | 22.506.588 |
| 1999 | 22.396.786 |
| 2000 | 25.419.842 |
| 2001 | 36.445.624 |
| 2002 | 33.834.478 |
| 2003 | 23.887.937 |
| 2004 | 23.589.846 |
| 2005 | 28.757.673 |
| 2006 | 23.366.410 |
| 2007 | 28.790.954 |
| 2008 | 26.360.374 |
| 2009 | 120.700.339 |

Figure 9.2. Historical patterns of marine aggregate extraction from 1974 in the Netherlands.

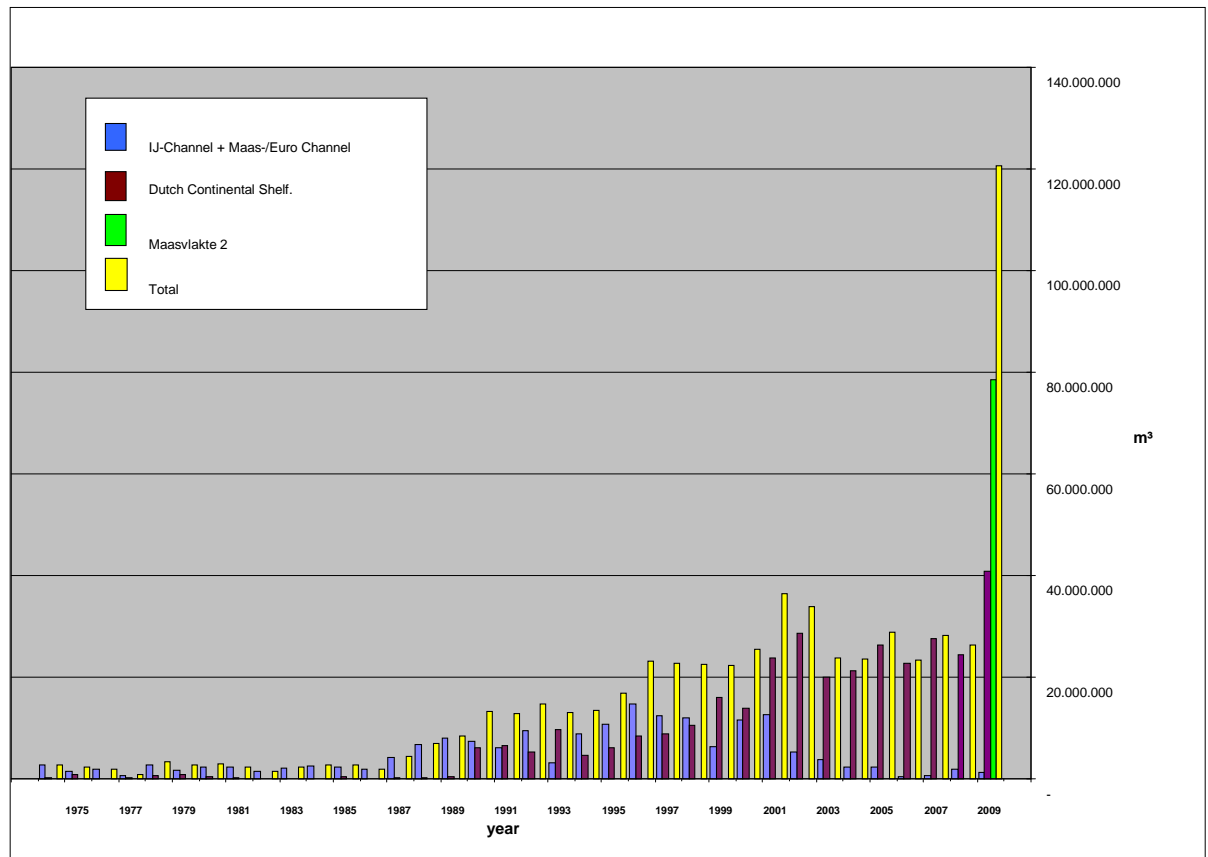


Table 9.7. Licences considered and issued licences Rijkswaterstaat North Sea.

| IN THE YEAR: | AMOUNT |
|--------------|--------|
| 1998 | 35 |
| 1999 | 30 |
| 2000 | 25 |
| 2001 | 25 |
| 2002 | 42 |
| 2003 | 26 |
| 2004 | 20 |
| 2005 | 33 |
| 2006 | 33 |
| 2007 | 24 |
| 2009 | 38 |
| 2009 | 23 |

Table 10.1 Marine aggregate (sand and gravel) extraction figures for 2009.

| EXTRACTION | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 |
|--|---------|------|------|------|------|------|------|------|--------|------|
| Administração da região hidrográfica do Alentejo (southern continental shelf) ¹ | | | | | | | | | | |
| Administração da região hidrográfica do Algarve (southern continental shelf) | 1285000 | | | | | | | | 370000 | |

¹No data available at the moment. It does not mean that there has not been extraction on these areas.

In the Madeira and Azores archipelagos it is common practise aggregate extraction for all uses. In the mainland continental shelf extraction is forbidden, therefore figures in Algarve (southern continental shelf) for instance refer only to extraction for beach nourishment.

Table 11.2. Further detailed historical extraction statistics for the Azores.

| YEAR | VOLUME EXTRACTED (M3) | | | | | | | | AÇORES TOTAL |
|-------|-----------------------|------------|----------|----------|-----------|-------|-------|--------|--------------|
| | SANTA MARIA | SÃO MIGUEL | TERCEIRA | GRACIOSA | SÃO JORGE | PICO | FAIAL | FLORES | |
| 1999 | 0 | 6083 | 0 | 0 | 0 | 0 | 0 | 0 | 6083 |
| 2000 | 0 | 57482 | 82040 | 5997 | 0 | 0 | 0 | 0 | 145519 |
| 2001 | 3077 | 56822 | 81200 | 5692 | 0 | 0 | 0 | 0 | 146791 |
| 2002 | 6298 | 19380 | 82426 | 7509 | 0 | 0 | 0 | 0 | 115613 |
| 2003 | 3600 | 55907 | 79266 | 4304 | 745 | 7369 | 25094 | 0 | 176285 |
| 2004 | 6326 | 55628 | 84572 | 4562 | 1918 | 17699 | 26931 | 0 | 197636 |
| 2005 | 6920 | 22235 | 80268 | 5290 | 2009 | 24418 | 17178 | 1650 | 159968 |
| 2006 | 7502 | 36844 | 84464 | 4221 | 998 | 19004 | 20858 | 7800 | 181691 |
| 2007 | 3550 | 25734 | 77936 | 1560 | 1224 | 17582 | 12955 | 1450 | 141991 |
| Total | | | 65217 | | | 8607 | 1030 | 1090 | |
| Geral | 37273 | 336115 | 2 | 39135 | 6894 | 2 | 16 | 0 | 1271577 |

12 Sweden

No aggregate extraction activities, or non-aggregate (e.g. shell, maerl, boulders etc) conducted during 2009.

Trelleborgs port in southern Sweden intends to expand the port to meet future capacity and environmental requirements. An application has been given in to the Authority. Expansion will take place in two stages. Phase 1 includes construction of new breakwaters and deepening of parts of the new port area in combination with filling up other parts of the port. Stage 2 includes the continued deepening and filling of

new port plan. Contaminated surface sediment will be placed on land for dewatering in purpose-built special basins. During Phase 1 it is estimated that 990 000 t_{fm}³ (theoretically solid cubic meters) will be dredged, these included 13 000 t_{fm}³ on public water. During phase 2 it is expected that 440 000 t_{fm}³ will be dredged away, these are approximately 57 000 t_{fm}³ on public water. For the volumes extracted from public water the state takes charge if the volumes will be of use, i.e. in this case for the filling of new port plans.

13 United Kingdom

Table 13.1. Marine aggregate (sand and gravel) extraction figures for 2009 from The Crown Estate Ownership (Includes aggregate and material for beach replenishment and fill contract).

| DREDGING AREA | AMOUNT (TONNES) |
|--------------------------|------------------------|
| Humber | 3,069,455 |
| East Coast | 6,938,147 |
| Thames Estuary | 2,294,381 |
| East English Channel | 2,256,919 |
| South Coast | 3,774,557 |
| South West | 1,019,174 |
| North West | 747,788 |
| Rivers and Miscellaneous | 92,263 |
| TOTAL | 20,192,684 |

Extraction tonnages for fill contracts and beach replenishment were as follows:

| | |
|---------------------|------------------|
| Contract Fill | 3,665,937 tonnes |
| Beach Replenishment | 827,260 tonnes |

Non-aggregate (e.g. shell, maerl, boulders etc.) extraction figures for 2009:

None during 2009 from The Crown Estate ownership.

Table 13.2. Exports of marine aggregate in 2009 from The Crown Estate ownership.

| PORT (LANDING) | AMOUNT (TONNES) |
|----------------|------------------|
| Amsterdam | 1,635,212 |
| Antwerp | 356,835 |
| Brugge | 372,638 |
| Calais | 77,161 |
| Dieppe | 9,515 |
| Dunkirk | 268,438 |
| Fecamp | 22,565 |
| Flushing | 1,189,874 |
| Gent | 298,563 |
| Harlingen | 165,741 |
| Honfleur | 66,716 |
| Le Havre | 27,660 |
| Le Treport | 14,595 |
| Ostend | 414,614 |
| Rotterdam | 455,947 |
| Vatteville | 25,514 |
| Zeebrugge | 258,934 |
| TOTAL | 5,660,522 |

Table 13.3. Amount of material extracted for beach replenishment and contract fill projects in 2009 from The Crown Estate ownership.

| DREDGING AREA | AMOUNT (TONNES) |
|----------------|------------------|
| Bournemouth | 111,288 |
| Bulverhythe | 8,373 |
| Felixstowe | 3,189,747 |
| Hayling Island | 111,969 |
| Lincshore | 545,127 |
| Pevensey | 35,311 |
| Ronaldsway | 476,190 |
| Seaford | 15,192 |
| TOTAL | 4,493,197 |

Table 13.4 Historical patterns of marine aggregate extraction (tonnes) from The Crown Estate ownership (Figures exclude beach replenishment and fill contracts):

| EXTRACTIO N AREA | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | TOTAL |
|-----------------------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|--------------|
| Humber | 2,351,233 | 2,694,977 | 2,840,261 | 3,122,080 | 2,933,623 | 2,710,881 | 2,928,366 | 3,031,699 | 3,392,015 | 3,521,737 | 3,184,814 | 3,154,070 | 2,524,328 | 37,139,692 |
| East Coast | 9,397,705 | 8,923,562 | 9,131,512 | 9,129,635 | 9,636,697 | 9,011,323 | 8,611,199 | 8,538,073 | 7,881,670 | 8,006,736 | 7,715,428 | 6,075,899 | 5,637,296 | 110,927,756 |
| Thames Estuary | 1,125,921 | 862,834 | 971,960 | 854,483 | 909,141 | 1,291,103 | 838,185 | 758,257 | 696,012 | 899,852 | 977,027 | 1,735,141 | 405,485 | 11,705,857 |
| East English Channel | 1,636,930 | 2,180,099 | 1,958,476 | 1,387,450 | 875,030 | 1,163,892 | 1,212,951 | 457,102 | 474,553 | 323,824 | 1,961,035 | 2,443,367 | 2,256,919 | 17,390,009 |
| South Coast | 3,096,895 | 3,641,602 | 3,926,856 | 4,226,088 | 4,752,978 | 4,235,188 | 4,445,311 | 4,691,857 | 4,914,793 | 5,127,989 | 4,752,843 | 3,934,692 | 3,492,424 | 54,541,477 |
| South West | 2,048,014 | 1,886,289 | 1,719,803 | 1,602,394 | 1,549,431 | 1,467,122 | 1,515,241 | 1,633,383 | 1,591,610 | 1,545,275 | 1,769,197 | 1,470,719 | 1,019,174 | 21,366,238 |
| North West | 284,497 | 275,590 | 355,044 | 316,090 | 421,068 | 482,270 | 470,962 | 558,398 | 611,983 | 608,314 | 652,303 | 432,889 | 271,598 | 5,595,368 |
| Rivers and Misc | 18,587 | 6,238 | 6,273 | 46,120 | 73,047 | 78,597 | 85,153 | 99,079 | 124,506 | 111,687 | 109,399 | 87,787 | 92,263 | 872,733 |
| Yearly Total | 19,959,782 | 20,471,191 | 20,910,185 | 20,684,340 | 21,151,015 | 20,440,376 | 20,107,368 | 19,767,848 | 19,687,142 | 20,145,414 | 21,122,046 | 19,336,572 | 15,699,487 | 259,539,130 |

Table 13.5 Summary of current licence position and forecasts for future exploitation of marine aggregates within The Crown Estate ownership.

| TYPE | STATUS | No. | AMOUNT (TONNES) |
|--------------|------------------------------|-----|---|
| Licences | Extraction licences | 74 | 228 million (proven primary reserve aggregate (i)) |
| | Permitted awaiting licensing | 3 | (ii) Not available |
| Applications | New applications | 29 | (ii) Not available |
| | Renewal applications | 9 | (ii) Not available |
| | Pre applications | 9 | (ii) Not available |
| Prospecting | Prospecting licences | 0 | Not applicable |

(i) Primary reserve now includes all proven reserves of primary sand and gravel.

(ii) Tonnage not available due to a new standard method of measurement.

14 United States

| DREDGING AREA | AMOUNT |
|------------------|---|
| New York Harbour | 666,397 m ³ (construction aggregate) |
| | 3,187,429 m ³ (cap material) |

Construction aggregate was recovered by Amboy Aggregates of South Amboy, New Jersey. They have held a license to dredge aggregates since 1985 from the Ambrose Channel, the entrance to New York Harbour. Amboy Aggregates is the only East coast aggregate producer to mine sand from the seabed. The company uses the *Sandy Hook*, a 7,500-tonne capacity, trailing suction hopper dredge and is the largest supplier of aggregates to the New York City area. No other vessel of this type operates in the US. Mining operations are performed pursuant to permits granted to Amboy by the federal government and the states of New York and New Jersey. Sand is dredged from the outer reaches of the main shipping channel into New York Harbour (the Ambrose Channel), washed and mixed with crush stone, if needed, at a shore side facility.

In 2009, about 3.2million m³ of dredged material was used to cap an open-water disposal site, six miles offshore referred to as the Historic Area Remediation Site (HARS) site.

< <http://www.nan.usace.army.mil/business/prjlinks/dmmp/benefic/hars.htm> >

Non-aggregate (e.g. shell, maerl, boulders etc) extraction figures for 2009: None

Exports of marine aggregate in 2009. None.

Amount of material extracted for beach replenishment projects in 2009:

| DREDGING AREA | MATERIAL | AMOUNT * |
|-------------------|----------|------------------------|
| Strathmere, NJ | sand | 729,466 m ³ |
| Sea Island, NJ | sand | 323,529 m ³ |
| Cape May City, NJ | sand | 178,906 m ³ |
| Long Branch, NJ* | sand | 557,360 m ³ |

* This amount of sand spanned 2008-2009. It was reported in 2008 and it is estimated that about half was actually placed in 2009. Additional amounts of sand were placed at Stone Harbour, NJ (244,406 m³) and at North Wildwood, NJ (1,009,431 m³) but the dates are uncertain (2009-2010?).

Long Island, NY

| | | |
|-------------------------------------|------|--------------------------|
| Hampton Bays, NY (Shinnecock Inlet) | sand | 372,495 m ³ |
| Fire Island Communities, NY | sand | 1,452,447 m ³ |
| Smith Point, NY (Moriches Inlet) | sand | 351,695 m ³ |

Description of beach replenishment schemes in 2009

Given some uncertainty about the dates of operations, between about 3.7 and 5.3 million m³ were used for beach nourishment in the region in 2009. The amounts tabulated above are for the north US Atlantic coast only (north of 38 degrees 27 minutes N, the starting point of the Mason-Dixon Line). Major renourishment projects continue in New York and south especially along the New Jersey shoreline.

The majority of beach dredging operations take place in State waters, within the 3-mile territorial jurisdiction, although that is changing as resources in State waters are being depleted. Beach nourishment is the preferred method of coastal protection in the US mainly because it preserves the aesthetic and recreational values of protected beaches by replicating the protective characteristics of natural beach and dune systems.

Table 14.1. Historical patterns of marine aggregate extraction in the NE Atlantic of the USA Excluding beach nourishment (millions of cubic meters).

| YEAR | TOTAL EXTRACTED M3 |
|------|--------------------|
| 1990 | 0.2 |
| 1991 | 0.8 |
| 1992 | 0.8 |
| 1993 | 1.5 |
| 1994 | 1.7 |
| 1995 | 1.4 |
| 1996 | c1.4 |
| 1997 | c1.4 |
| 1998 | c1.3 |
| 1999 | 1.3 |
| 2000 | 1.1 |
| 2001 | 1.3 |
| 2002 | 1.1 |
| 2003 | 1.4 |
| 2004 | 1.6 |
| 2005 | 1.4 |
| 2006 | 1.2 |
| 2007 | 1.2 |
| 2008 | 1.0 |
| 2009 | 0.7 |

Annex 6: Review of National Seabed Resource Mapping Programmes

1 Belgium

Development of Maps by the Belgian Sand Fund

The Sand Fund of the Ministry of Economic Affairs in the framework of their monitoring program for sand and gravel extraction are producing maps of the extraction areas on a regular basis. For all explored areas, data on bathymetry, backscatter and acoustic sediment classification are available. With the new multi beam system EM3002D on the R.V. Belgica (since 2008) detailed maps can be produced rapidly. As a new EIA is on its way to exploit sand from exploration zone 4 on the Belgian continental Shelf, new mapping of this zone has got priority (see presentation by Marc Roche in annex). In 2009 new maps have been published, mainly for exploration zone 4 (Figure 1.1 and 1.2).

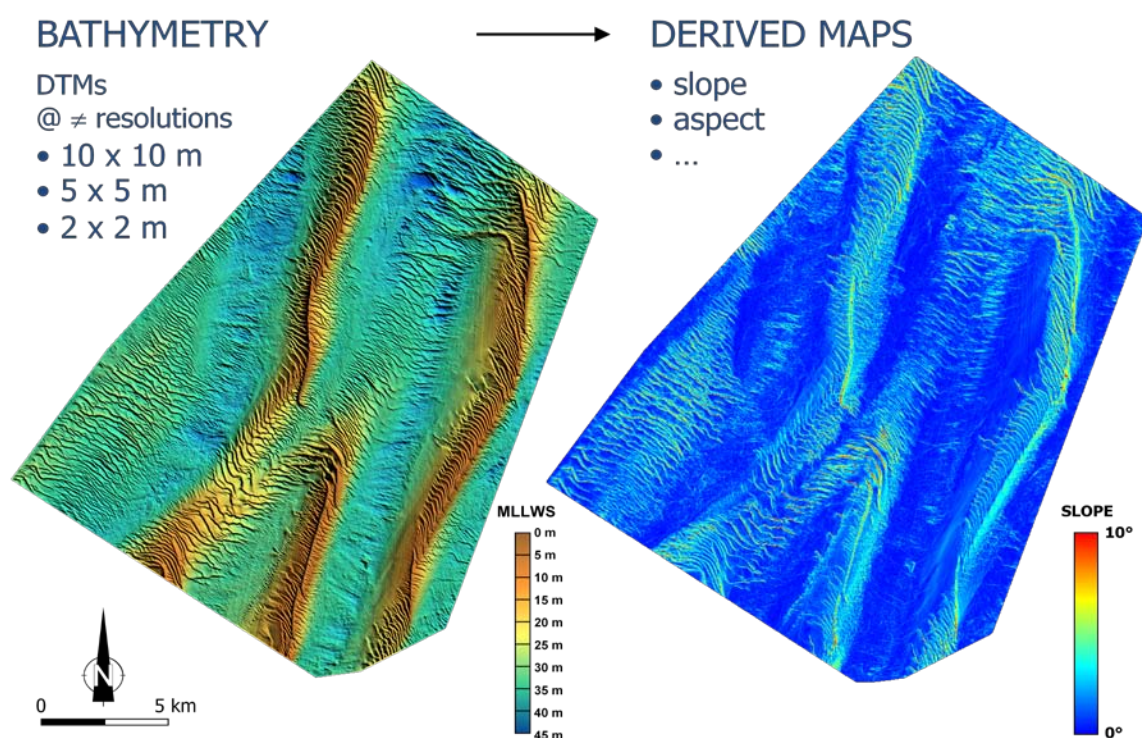


Figure 1.1. Detailed multibeam maps for exploration zone 4 on the Belgian continental Shelf (kindly provided by Marc Roche from FPS).

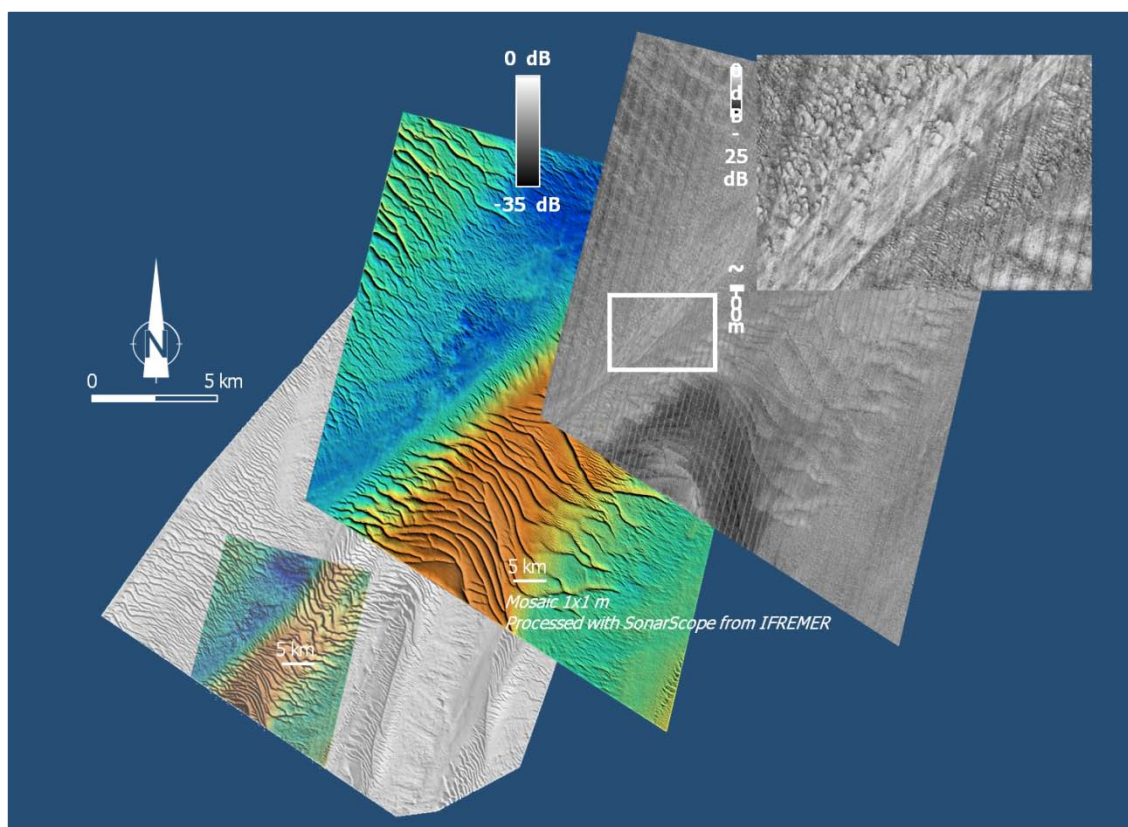


Figure 1.2. Backscatter strength of the Simrad E3002D multibeam/echosounder used on the exploration zone 4 on the Belgian continental Shelf (pictures provided by Marc Roche, FPS).

For more information the Sand Fund can be contacted directly (See address below).

Marc Roche, SERVICE PUBLIC FEDERAL ECONOMIE, P.M.E, CLASSES MOYENNES ET ENERGIE, Qualité et Innovation, Service Plateau Continental- Fonds pour l'Extraction de Sable WTC III - 6^{ème} Etage - Bureau 31, Avenue Simon Bolivar 30, B-1000 Bruxelles , Belgique Tel : 02 277 77 47, GSM : 0475 73 05 71, Fax : 02 277 54 01, Email : Marc.Roche@economie.fgov.be

Developments in marine resource mapping in other institutes in Belgium

In 2009 several seabed mapping programmes were ongoing at the Management Unit of the North Sea Mathematical Models (MUMM). Also, Ghent University, Renard Centre of Marine Geology (UG-RCMG) continued working on seabed mapping. A major contribution was given in the PhD thesis of Mieke Mathys on 'The Quaternary geological evolution of the Belgian Continental Shelf, Southern North Sea'. The Institute for Agricultural and Fisheries Research (ILVO) is mainly cooperating with projects concerning benthic habitat mapping. Related to the new EIA for exploration zone 4, several maps are produced in 2009 and more will be produced in 2010, based on high resolution multibeam data, vibre coring, sediment analyses and the benthic habitat (see further).

The habitat mapping activities of MUMM relate to the following nationally and internationally funded programmes (information delivered to WGEXT by Vera Van Lancker):

QUEST4D: Quantification of Erosion/Sedimentation patterns to Trace the natural vs. anthropogenic sediment dynamics (<http://www.vliz.be/projects/quest4D/>)

Project funded through the Belgian Science Policy Research Programme - Science for a Sustainable Development (2006-2011)

Within the project, observations and modelling are combined to reconstruct ecosystem evolution - induced both by nature and humans - along the Belgian part of the North Sea over the last 100 years. The sediment and sediment transport system is targeted, but also its contribution towards the prediction of the occurrence of macrobenthos. One of the results indicates that changes in the amount of suspended particulate matter, through time, caused shifts in the occurrence and characteristics of macrobenthic communities. Furthermore, aggregations of the tubeworm and ecosystem engineer *O. fusiformis* were mapped with very-high resolution multibeam data (RV *Belgica*, Kongsberg Simrad EM3002, 300 kHz). From the imagery and sampling, it is hypothesized that those aggregations are able to stabilize sand dunes that normally migrate 12 metres a year. Further bio-geomorphological modelling is attempted.

EnSIS: Ecosystem sensitivity to invasive species

Project funded through the Belgian Science Policy Targeted Action - Science for a Sustainable Development (2009-2011)

The introduction of invasive species is considered a major problem to marine ecosystems. The American jackknife clam *Ensis directus* represents a well-investigated and well-documented example of such invasion in North-West European coastal waters. The species has been extensively sampled by different institutes (ILVO, MUMM) and in different campaigns. Distribution maps for *Ensis directus* have been created, but also its habitat has been acoustically characterized in areas where high densities prevail. Very-high resolution multibeam data were acquired during 3 periods (RV *Belgica*, Kongsberg Simrad EM3002, 300 kHz) and will allow to characterize the habitat in detail (< 2 m resolution). The measurements relate to the depth and the backscatter of the acoustic signal. Full-coverage recordings were obtained to situate the occurrence of *E. directus* in its broader spatial environment. Seabed samples were taken for validation purposes. Results will assist in the setup of habitat suitability modelling of the species.

Habitat: Study on selecting areas in the Belgian part of the North Sea under EC's Habitat Directive

Project funded by FPS Environment, Department of Marine Environment (2008-2009)

Apart from habitat suitability modelling, this project aimed at habitat mapping related to a revision of a seabed map of gravel occurrences, based on acoustic imagery, sampling, video and diver observations.

Geo-Seas: Pan-European Infrastructure for management of marine and ocean geological and geophysical data (<http://www.geoseas.eu/>)

Project funded through EU-FP7 - Infrastructure (2009-2012)

Within Geo-Seas, one of the subtasks will focus on standardization in seabed habitat mapping (lead by RBINS-MUMM). Efforts will focus on sediment and topography parameterization and classification.

EMODNET: Partim Geology European Marine Observation and Data Network

(http://ec.europa.eu/maritimeaffairs/emodnet_en.html)

Project funded through EU-DG MARE (2009-2012)

Pilot project aiming at delivering geologically related GIS data layers. One of the deliveries is a continuous seabed substrate map for the Baltic Sea, Greater North Sea and Celtic Sea, on a scale of 1:1 million. The map includes an index map that identifies initial data layer patches and provides information on metadata: variation in remote observation, interpretation and ground-truthing methods. The current map is collated from 208 separate seabed substrate maps. The existing substrate classifications were reclassified/translated to a system that is supported by EUNIS. The EMODNET reclassification scheme consists of four substrate classes defined on the basis of the modified Folk triangle (mud to sandy mud; sand to muddy sand; coarse sediment; mixed sediment) and three additional substrate classes (boulder, diamicton, rock). This map feeds into EMODNET-Habitat (EUSeaMap).

It can be added that EMODNET also includes projects that aim at delivering biological and chemical related GIS data layers for the European seas at different spatial (and eventually) temporal scales.

Relevant publications and reports in relation to marine habitat mapping in Belgium

- G-Tec., 2009. Seismisch onderzoek in exploratiezone 4 op het Belgisch Continentaal Plat. Research carried out for Vlaamse Overheid – Afdeling Kust. 08D_005_Depret_SeisVibro/MA/GP/RE001
- Fettweis, M., Houziaux, J.-S., Du Four, I., Van Lancker, V., Baeteman, C., Mathys, M., Van den Eynde, D., Francken, F., and Wartel, S. 2009. Long-term influence of maritime access works on the distribution of cohesive sediment: Analysis of historical and recent data from the Belgian nearshore area (southern North Sea). *Geo-Marine Letters*, 29: 321–330. doi: 10.1007/s00367-009-0161-7.
- Mathys, M. 2009. The Quaternary geological evolution of the Belgian Continental Shelf, southern North Sea, PhD thesis, Ghent University, Belgium. 454 p.
- Mathys, M., Van Lancker, V., Versteeg, W., and De Batist, M. 2009. Wetenschappelijke begeleiding en geïntegreerde interpretatie van seismisch onderzoek en trilboringen in Exploratiezone 4 op het Belgisch Continentaal Plat. Report by UGent – RCMG, commissioned by Vlaamse overheid – Agentschap voor Maritieme Dienstverlening en Kust en Afdeling Kust.
- Verfaillie, E., Du Four, I., Van Meirvenne, M., and Van Lancker, V. 2009. Geostatistical modelling of sedimentological parameters using multi-scale terrain variables: application along the Belgian Part of the North Sea. *International Journal of Geographical Information Science*, 23(2): 135–150.
- Verfaillie, E., Degraer, S., Schelfaut, K., Willems, W., and Van Lancker, V. 2009. A protocol for classifying ecologically relevant marine landscapes, a statistical approach. *Estuarine, Coastal and Shelf Science*, 83: 175–185.
- Van Lancker, V., Du Four, I., Degraer, S., Fettweis, M., Francken, F., Van den Eynde, D., Devolder, M., Luyten, P., Monbaliu, J., Toorman, E., Portilla, J., Ullmann, A., Verwaest, T., Janssens, J., Vanlede, J., Vincx, M., Rabaut, M., Houziaux, J.-S., Mallaerts, T., Vandenberghe, N., Zeelmaekers, E., and Goffin, A. 2009. QUantification of Erosion/Sedimentation patterns to Trace the natural vs. anthropogenic sediment dynamics (QUEST4D). Final Report Phase 1. Brussels: Belgian Science Policy 2009 – 63p + 81p Annexes. (Research Programme Science for a Sustainable Development) (<http://www.belspo.be/belspo/ssd/science/Reports/QUEST4D%20FinRep%20PH%201.DEF.pdf>)

2 Denmark

Organisation(s) undertaking seabed mapping programmes:

Danish Ministry of the Environment, Agency for spatial and Environmental Planning is responsible for the mapping of marine aggregates.

The mapping projects are carried out by contractors.

Scope of seabed mapping programmes being undertaken in 2008/2009: Only commercial exploitation programmes have been carried out in the period.

No seabed resource maps have been published in 2008/2009

Future marine resource mapping programmes:

A resource mapping project will be carried out in the Jyske Rev area in the North Sea during 2010.

3 Estonia

Developments in marine resource mapping

Organisation(s) undertaking seabed mapping programmes:

Geological Survey of Estonia

Scope of seabed mapping programmes being undertaken in 2008/2009:

In 2008, seabed mapping was carried out by Geological Survey of Estonia in the Kohtla-Järve, Sillamäe and Narva Base Map sheets (432 sq km) in order to get more information for the Estonian Geological Base Map (at the scale of 1:50 000).

EdgeTech 3200 XS and ~5 km profiling interval was used for seismic data acquisition. Altogether 217 km of seabed was studied, in 59 points sediments were taken with a grab dredger for the laboratory investigations.

Published seabed resource maps in 2008/2009:

On the basis of seabed mapping in 2008, three thematic maps of the Estonian Geological Base Map (Map of Quaternary Deposits, Map of Bedrock Relief and Map of Thickness of Quaternary Deposits) were supplemented. This data are also available in the geoportal of the Estonian Land Board (<http://geoportaal.maaamet.ee>)

2 Finland

Organisation(s) undertaking seabed mapping programmes:

Geological Survey of Finland (GTK)

Scope of seabed mapping programmes being undertaken in 2009:

A study of marine geology by the Geological Survey of Finland (GTK) concerning late-Quaternary deposits on the seabed is being conducted using acoustic and seismic methods: echosounders, single-channel seismic and sidescan sonar and multibeam sonar equipment. Investigations are supplemented with seabed sampling and visual observations. The basic scope of the study is to acquire data on the distribution and thickness of various types of sediments and information on stratigraphy, mineralogy

and geochemistry of the deposits. New methods of sounding and sampling as well as data processing and analyses of samples are also developed and tested.

The aim of the study is also to increase knowledge of the physical properties and the geochemical variations in seabed sediments induced by both nature and human activity. Also the demand of various practical and scientific needs arising in a surrounding community should be met.

In context of the EU project BALANCE (Baltic Sea Management – Nature Conservation and Sustainable Development of the Ecosystem through Spatial Planning), GTK combined the Marine Landscape maps from different bottom quality, depth, etc. datasets.

The Finnish Inventory Programme for the Underwater Marine Environment (VELMU) collects data on the diversity of underwater marine biotopes and species. The inventories are being conducted in the Archipelago Sea, the Quark area, the Gulf of Finland, the Bothnian Bay and the Bothnian Sea. VELMU is a cooperation programme between seven ministries (internal affairs, defence, education, communication, agriculture and forestry, trade and industry and environment) (<http://www.ymparisto.fi/default.asp?contentid=210670&lan=fi&clan=en>).

Some information on survey methods and data processing can be found from

<http://en.gtk.fi/mapping/marine.html>

Published seabed resource maps in 2009:

In the year of 2009 about 106 km² was surveyed in the exclusive economical zone of western part of Gulf of Finland and about 185 km² in the eastern part of Gulf of Finland. Geological seabed maps published 2009 covered about 100 km² in the Gulf of Finland. The mapping situation is shown in the index map available in the address <http://www.gtk.fi/domestic/arkisto/MeriIndex.pdf>.

Future marine resource mapping programmes:

The annual goal of seabed survey is 500–700 km². In the year 2010 the main focus areas are Bay of Bothnia and Kvarken Archipelago.

5 Ireland

Highlights for the Year 2009 included

Original INFOMAR project approval was received in 2006 for €12m for the first three years (2006 – 2008), and despite the economic climate, further approval was received in Q4 2008 for project continuance at the same level of funding for the life of NDP to 2013. A final 2009 budget allocation of €3.363m was received, enabling a significant programme of work to be undertaken.

INFOMAR 2009 survey operations included R.V. Celtic Voyager data acquisition in the Shannon Estuary, Dingle and Wexford, as well as the SW, SE & E Priority Areas (Fig 1). A ground-truthing programme was undertaken in Donegal / Sligo, and the R.V. Keary was commissioned and undertook completion of Dublin Bay for inclusion in the forthcoming revised UKHO Admiralty Chart.

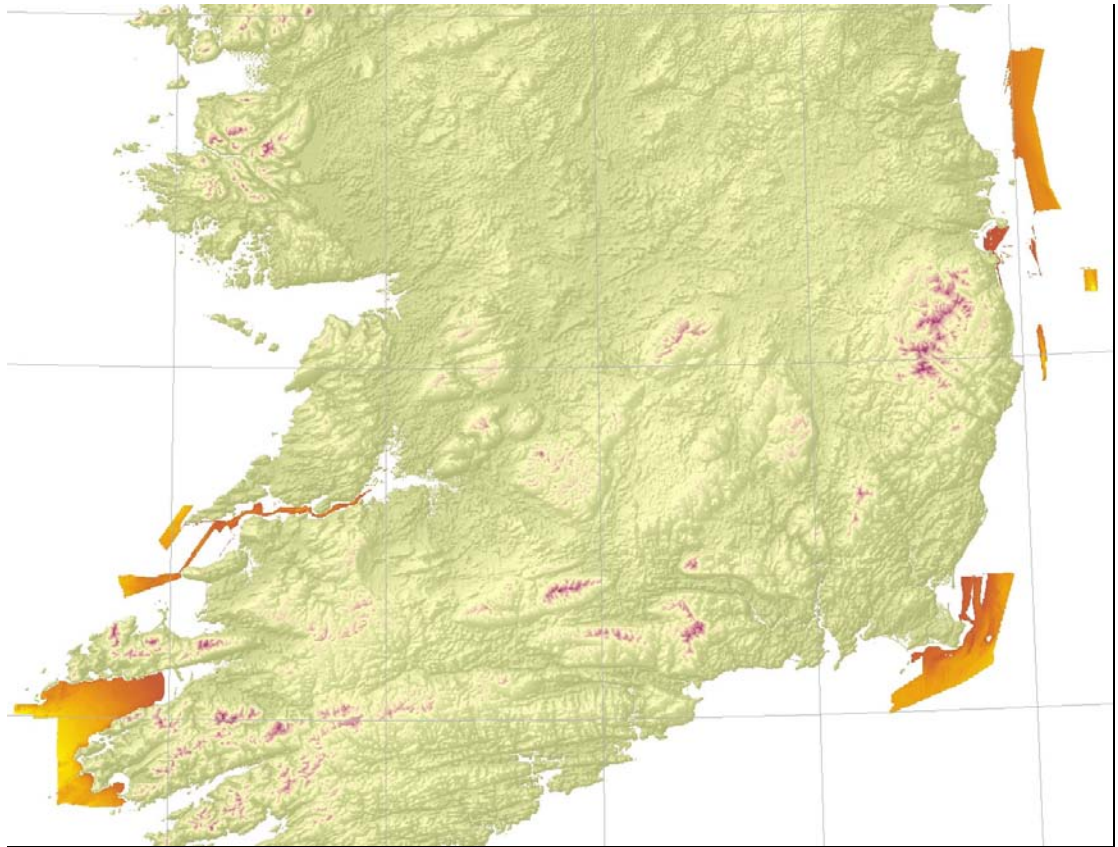


Figure 5.1. 2009 INFOMAR Survey Coverage.

Advanced Mapping Services undertook and coordinated a significant work programme during 2009 in collaboration with National Parks & Wildlife Services, and GSI, involving mapping of offshore geogenic reef habitat. AMS mobilized the R.V. Celtic Explorer, ROV Holland, Deep Ocean Underwater Video Camera, and with the assistance of an international research team, undertook survey operations on the Rockall Bank, the Porcupine Bank, and the Celtic Margin Canyons.

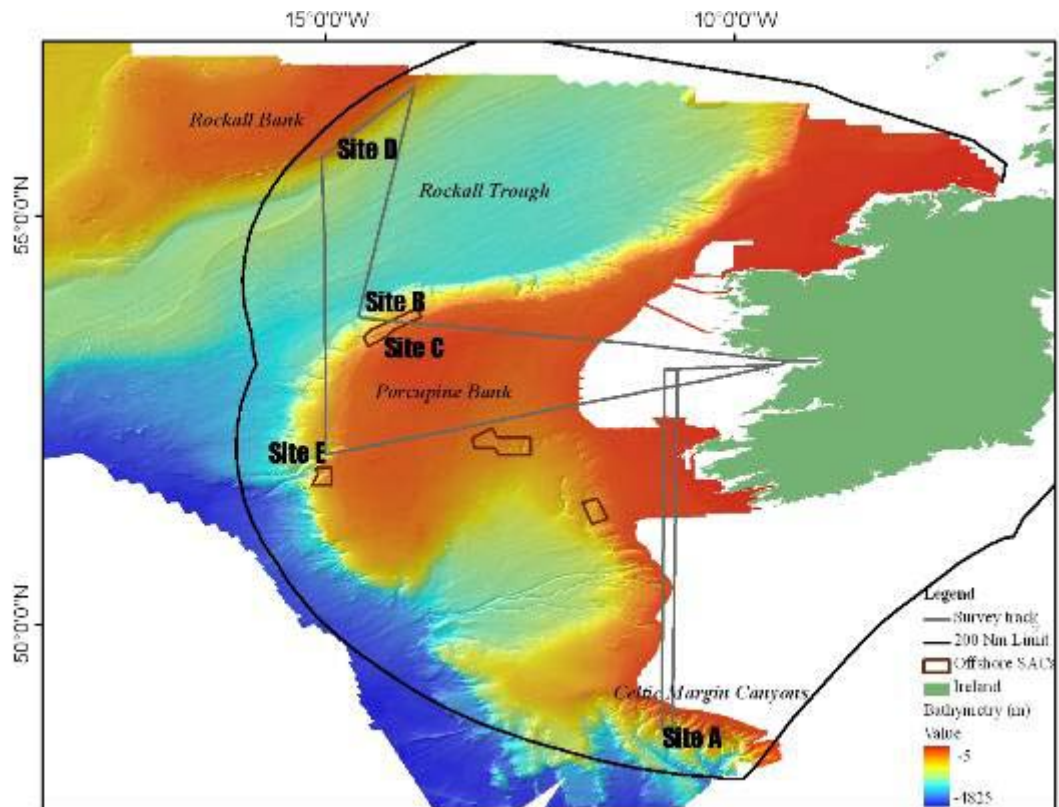


Figure 5.2. MI / NPWS / GSI Offshore Geogenic Reef Habitat Mapping Sites



Figure 5.3. NPWS Offshore Reef Geogenic Habitat Mapping Project – Transect C1.

INFOMAR issued an open call for Irish Partner lead applied research proposals in Q4 2009, and received a strong and varied response, with 29 proposals received, and 14 funded. In addition to the research contracts awarded, INFOMAR is also a partner on successful 2009 SSTI proposals for surveys to be undertaken in 2010.

In Q4 of 2009 AMS were advised that the MESH Atlantic Area INTERREG IVB project has been approved, with Marine Institute as a key Partner. The habitat mapping project sets out to draw on the former INTERREG IIIB NW MESH project by extending it to the Atlantic Area marine space and enhancing some of the outputs.

Following the launch of www.INFOMAR.ie in May 2008, significant work has been undertaken during 2009 to improve data and product delivery, including launch of the new web map interface (<http://geos.marine.ie/Infomar/>), and upload of charts and coverage maps on the INFOMAR website (<http://www.infomar.ie/data/>)

In May, AMS hosted a stand at the Volvo Ocean Event in Galway Docks with NUIG and Galway Atlantaquaria, through the Explorer's Education Programme, which attracted over 6000 students, 300 teachers, and an estimated 21,000 general public. AMS in partnership with GSI hosted a two day Seabed10 seminar in Dublin in October, which coincided with the official ministerial launch of the R.V. Keary. The event had an excellent attendance, and achieved national TV and radio media coverage. Other outreach included pre-operations field meetings with local media, harbour authorities, and stakeholders, which proved a very effective mechanism to gain local support and interest in the programme. This will be expanded upon and integrated as part of the formal INFOMAR Outreach Strategy currently being drafted.

The R.V. Celtic Explorer and R.V. Celtic Voyager were successfully fitted with bridge based fisheries navigation software, OLEX, with all INSS multibeam data embedded. This enables 3D seabed visualization during fisheries surveys, as well as automated (unmanned) live capture of multibeam and seabed classification data during these operations. Fisheries programmes were further supported in 2009 through additional acquisition of INFOMAR data during the Aran Grounds survey.

6 Netherlands

Maps are produced on a continuous basis as demand requires from data held in a central database. They are used for licensing, monitoring and prospecting purposes.

Resource mapping is the responsibility of two organizations: the Geological Survey of the Netherlands and Deltares, a new institute that joins the forces of Delft Hydraulics, GeoDelft, parts of Rijkswaterstaat, and part of the Subsurface and Groundwater unit of TNO. The Geological Survey manages, queries and analyses the central geological database, whereas Deltares has extensive expertise in the areas of geophysical monitoring and numerical modelling.

The present mapping program for the Dutch part of the North Sea covers the entire Netherlands EEZ and the territorial sea. New data include detailed bathymetric grids, side-scan-sonar images, cores and grab samples.

The following grids are available:

- Bathymetry,
- Seabed-sediment grain size,
- Folk classification,
- Holocene formations,

- Thickness of the Holocene,
- Lithostratigraphy of the top of the Pleistocene, and
- Base of various Holocene and Pleistocene lithostratigraphic units (not all full coverage).

In 2009, the resource mapping has concentrated on a pilot regarding a resource-information model for the Netherlands Continental Shelf. Such a model will allow an efficient and reproducible determination of sand quantity and quality. It consists of a 3D model that can be queried to produce 2D maps with information on total and exploitable sand thicknesses for any location. From this thickness information, volumes can be calculated.

The reliability of the model, both laterally and vertically, is a function of data density and geological complexity. As a rule of thumb, the model and the 2D maps will be useful on national and regional scales. Thus, they are appropriate to strategic decision-making but not for site studies.

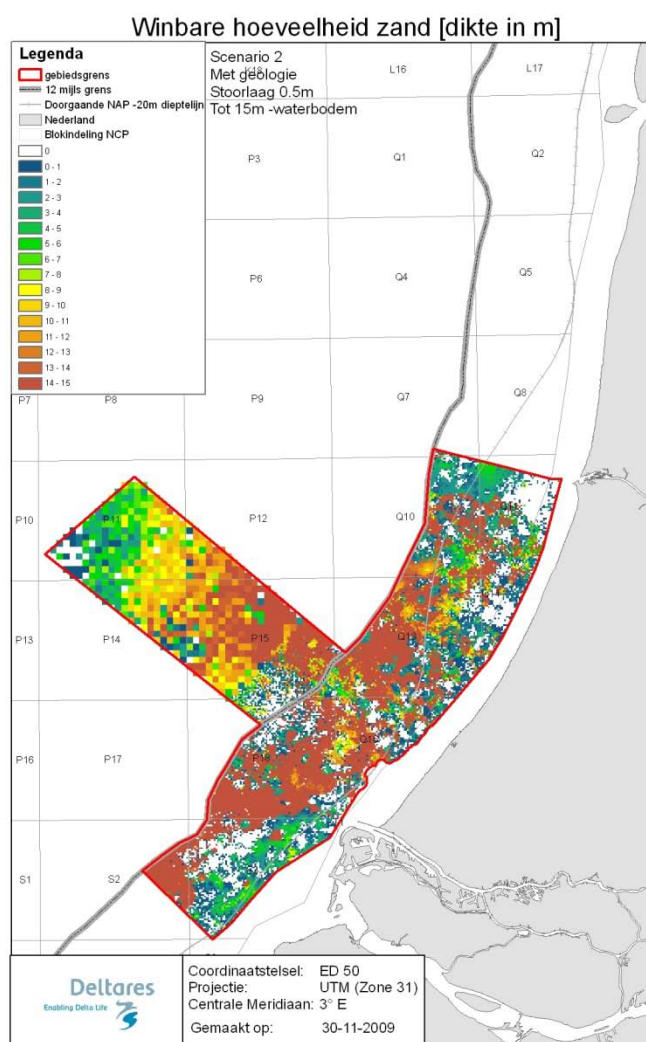


Figure 6.1. Exploitable sand quantities to a depth of 15 m below the seabed (no qualitative requirements) when cover of unsuitable material such as clay or peat is no thicker than 0.5 m.

7 Portugal

Organisation(s) undertaking seabed mapping programmes:

Laboratório Nacional de Energia e Geologia (LNEG). This is the Portuguese Geological Survey institute. Within the marine area it is responsible to do the geological mapping and assess the mineral resources of the submerged area under national jurisdiction (EEZ);

Instituto Hidrográfico (IH). This is the Portuguese Hydrographic Institute. It is responsible to provide the national, defence and civil, information for navigational and other hydrographic purposes (e.g. tidal previsions, marine weather forecast, nautical and hydrographical charting).

Estrutura de Missão para a Extensão da Plataforma Continental (EMEPC). This is the Task Group for the Extension of the Portuguese Continental Shelf beyond the 200 nautical miles.

Scope of seabed mapping programmes being undertaken in 2008/2009

LNEG has been preparing the geological map of the continental margin at the scale 1:1.000.000 that will be published in 2010.

IH is doing superficial sediment mapping at the scale of 1:150.000 of the mainland continental shelf (8 maps). It is based on sediment sample database with samples spaced every mile in the continental shelf up to -200 m. It has already published the southern part of the shelf (4 maps) and is finishing the 4 remaining northern maps (Figure 1).

EMEPC is doing multibeam mapping (Figure 2) of the Portuguese EEZ and also outside EEZ for the Portuguese programme of the extension of the continental shelf.

SUPERFICIAL SEDIMENT MAPPING AT THE SCALE 1:150.000

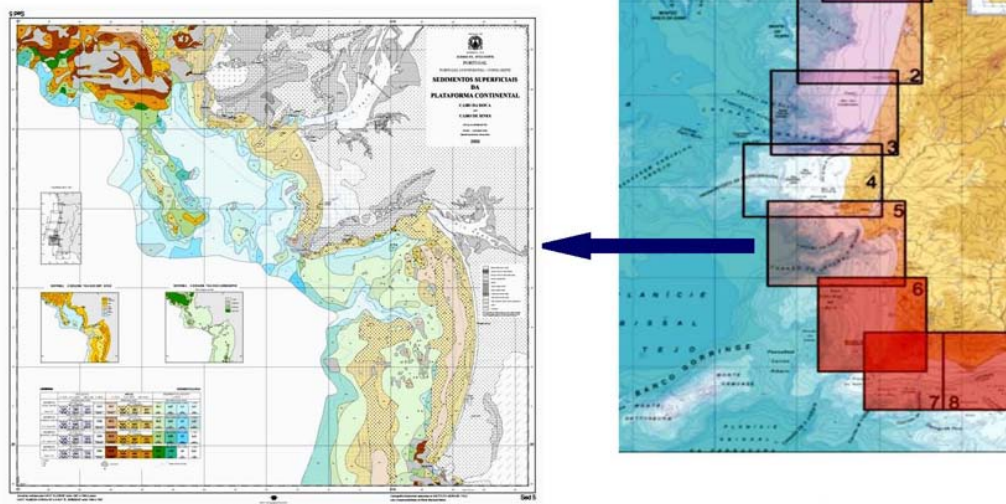


Figure 7.1. Superficial sediment mapping at the scale of 1:150.000 published by IH (from <http://www.hidrografico.pt/>).

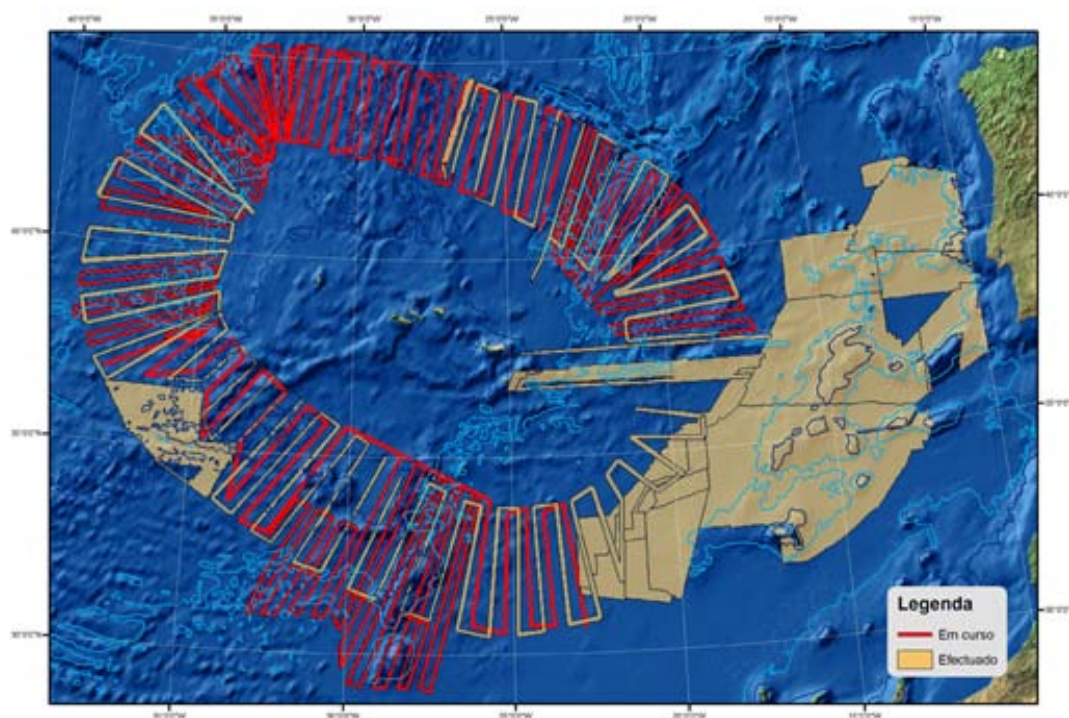


Figure 7.2. Multibeam mapping of the EEZ and outside EEZ for the extension of the Portuguese Continental Shelf (<http://www.emepc.pt/>).

No seabed resource maps have been published in 2008/2009.

Future marine resource mapping programmes

There is no comprehensive resource mapping programme. Just local research projects in LNEG, Science Faculty of Lisbon University and the University of Aveiro related to:

- Sulphide formation in the Portuguese EEZ hydrothermal fields in the Mid-Atlantic Ridge;
- Formation of manganese and ferromanganese (Fe-Mn) nodules and crusts in seamounts near Madeira Island of the Portuguese EEZ;
- Mud volcanism and gas hydrates in the Portuguese EEZ of the Gulf of Cadiz

8 Spain

International programmes

Habitat mapping in the Hendaye and Txingudi bays

This habitat mapping programme was co-funded by the Regional Governments of Aquitania and Basque Governments in the period 2006 to 2008. The partnership was composed by Ifremer, AZTI-Tecnalia, Laphy and IMA. Main of the projects was the biological characterization of the Basque continental shelf; for that, Txingudi bay was established as training site (Figure 1). The specific objectives were: (i) habitat classification and mapping using integrated methodologies; MBES, LiDAR, grab sampling,

video, diving and (ii) the analysis of the EUNIS applicability (adaptation of the description-species, new habitats, etc.).



Figure 8.1. Study area.

Main results of the project includes final habitat map at different EUNIS classification up to level 5 (Figure 8.2) and the description of the habitats including the characteristics species of the study area and that there were not included in the EUNIS habitat descriptions. Moreover, characteristic habitats not included in EUNIS were found. This project resulted in a publication by G. Chust, I. Galparsoro, Á. Borja, J. Franco, A. Uriarte, 2008. Coastal and estuarine habitat mapping, using LIDAR height and intensity and multi-spectral imagery. Estuarine, Coastal and Shelf Science (78) 633-643.

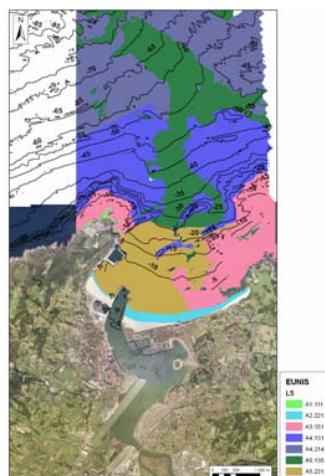


Figure 8.2. Classified habitat map.

National programmes

LIFE+ INDEMARES

LIFE+ "Inventory and designation of marine Natura 2000 areas in the Spanish sea"

The main objective of the LIFE+ INDEMARES project is to contribute to the protection and sustainable use of the biodiversity in the Spanish seas through the identification of valuable areas for the Natura 2000 Network. The project actions will be carried out from 1 January 2009 to 31 December 2013. The budget is € 15.4 million, and the European Commission will co-finance 50% of the project. Coordinated by Biodiversity Foundation, the project will have a participatory approach, and will include all of

the relevant institutions in management, research and conservation in marine environments: Environmental, Rural and Marine Affairs Ministry, (through the Secretary General of Sea Affairs), the Spanish Institute of Oceanography (IEO), the Spanish Council for Scientific Research, ALNITAK, the Coordinator for the Study of Marine Mammals, OCEANA, the Society for the Study of Cetaceans in the Canary Archipelago, SEO/BirdLife and WWF Spain.

The project will study 10 areas in the Atlantic, Mediterranean and Macaronesic regions with the aim of including them in the Marine Natura 2000 Network. These areas are: Cañón de Avilés, Banco de Galicia, Chimeneas de Cádiz, Seco de los Olivos, Isla de Alborán y conos volcánicos, Delta del Ebro-Columbretes, Cañón de Creus, Canal de Menorca, Banco de la Concepción y Sur de Fuerteventura.



Figure 8.3. Study area location.

Study of the Spanish Continental Shelf and Slope

This Project started in 1999 by the Secretaría General del Mar and, at present, is being conducted by TRAGSATEC. Surveyed area includes Atlantic and Mediterranean continental shelf between 10–130 m water depths (Figure 8.4).



Figure 8.4. Surveyed area in the Study of the Spanish Continental Shelf and Slope.

The main objective of the programme is to produce base cartographic information for nature conservation, fisheries and other activities management such as pipelines installation.

The techniques used include swath bathymetry, backscatter, seismic, ground-truthing with grab samples and underwater photo and video.

Final results were in GIS format and paper maps are being edited at 1/50000 and 1/100.000 scales.

Marine Information Web Map Service

Developed and hosted by Spanish Institute of Oceanography In IEO (in IEO web: http://mapserver.ieo.es/website/WMS_IEO/viewer.htm) there is a compilation of thematic information such as: administrative borders, bathymetry, fishing grounds, etc.

Regional programmes

Habitat mapping and seafloor characterization of the Basque continental shelf

This programme was funded by the Department of Environment, Regional Planning, Agriculture and Fisheries of the Basque Government. It started in 2005 and finished in 2009 (Galparsoro *et al.*, 2009). The main objective was to generate seabed cartography, defining and delimitating marine habitats, and identifying the main species associated to each habitat type, within the continental shelf up to 100 m water depth. The specific objectives were:

- obtain high resolution bathymetric data;
- characterize different seabed types (including geologic and geomorphologic features);

- determine habitat distribution pattern, in relation to environmental factors;
- produce habitat maps (intertidal and subtidal zones);
- classify habitats (European Natural Information System (EUNIS)); and
- identify and locate habitats of Community Interest.

This investigation integrates different remote sensing techniques, such as multibeam echosounder (operating from approximately 10 to 100 m water depth), topographic LiDAR (terrestrial land to mid-intertidal zone), bathymetric LiDAR (up to 20 m water depth) (Galparsoro *et al.*, 2010), and aerial photography (Chust *et al.*, 2007; 2008), to cover a continuum from land to deep-water environments.. *In situ* samples correspond to biological benthic data which includes 423 grabs from soft-bottoms in the period 2003-2008, and 405 samples from rocky seabed, taken by divers.

Habitat modelling assessment was carried out to relate the sedimentological and oceanographical conditions to the species distribution. Most of the variability on species composition was explained by the sedimentary composition and the sedimentary resuspension produced by wave action. This result was used for habitat classification and their spatial delimitation by environmental information layer combination in a GIS environment. Moreover, the Pan-European EUNIS habitat classification was used as base classification for management and conservation purposes, but it was adapted to the specific characteristics of the Basque continental shelf biological communities and habitats.

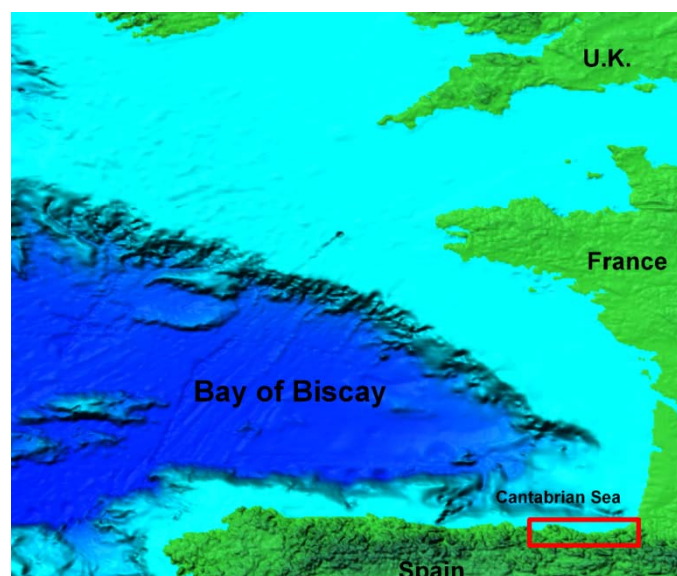


Figure 8.6. Study area within the Bay of Biscay.

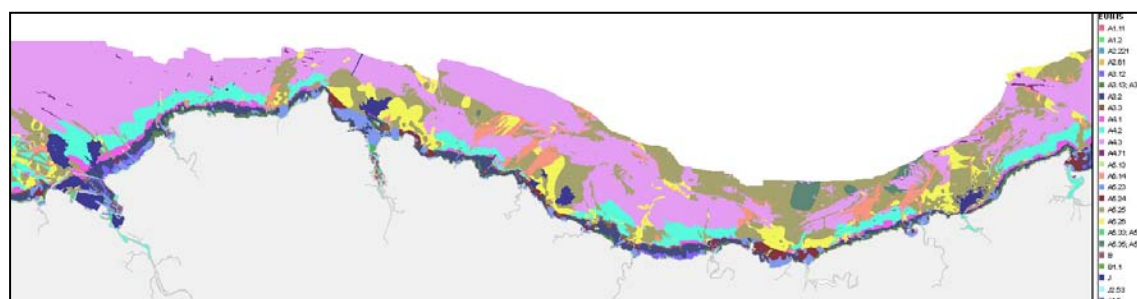


Figure 8.7. Intertidal and subtidal benthic habitat map distribution based on EUNIS classification.

9 Sweden

The Overview Mapping Programme 1999–2008 (presentation scale 1:500,000)

The Regional Marine Geological Mapping Programme, i.e. the overview mapping for presentation in the scale 1:500,000, launched in 1999, was, regarding to fieldwork, completed in 2008. The programme was run with the same technique as the mapping in the scale 1:100,000 (see, below), but the grid is less dense (c. 10-13 km distance between the track lines) and fewer samples have been analysed. This means that the outcome of the project is corridors, about 1 km wide, showing the distribution of seabed sediments, stratigraphy, the distribution of elements and organic micro-pollutants in the topmost sediments of the corridors and the sedimentation rate. The sampling technique used was the same as in the mapping programme aimed for scale 1:100,000 (see below and Figure 9.1a). The overview mapping covers about 80 % of the Swedish territorial water and EEZ. The only part that has not been mapped in this way is the area east of Gotland and the areas mapped in the scale 1:100,000.

In order to compile a seabed sediment map over the Baltic Sea, Kattegat and Skagerrak, the above mentioned mapping results together with other available material on sediment composition and distribution in various parts of the sea areas have been evaluated and used (e.g. the Bottom Sediment Map of the Central Baltic Sea, the Map over the Bottom sediments around Denmark and Western Sweden and other various maps and reports). The result was presented at the WGEXT meeting in Sweden 2010.

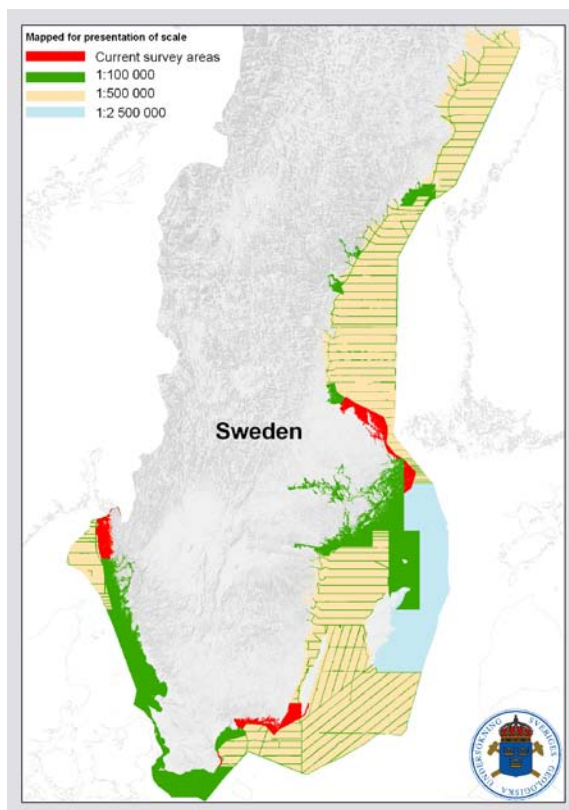


Figure 9.1 Seabed sediment map of the Baltic Sea, Kattegat and Skagerrak.

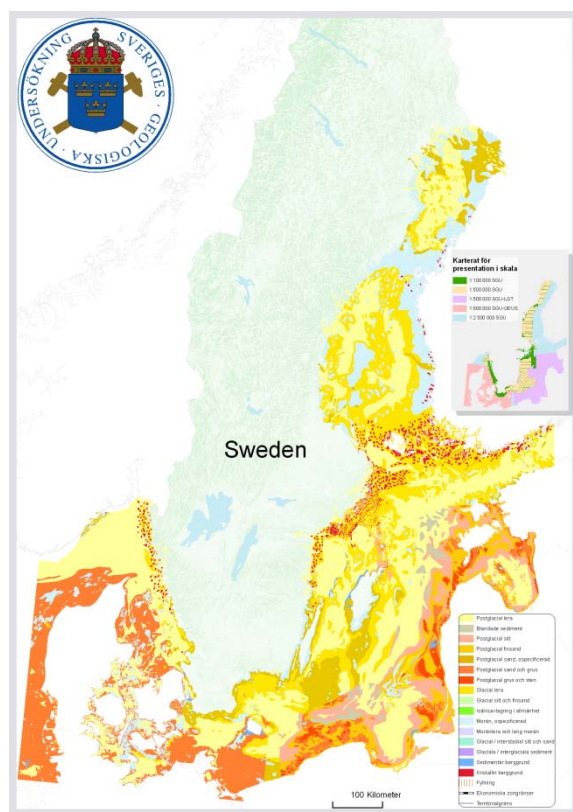


Figure 9.2 Current survey status in Sweden.

The Swedish Marine Geological Mapping Programmes (presentation scale 1:100,000)

The northeastern Skagerrak coast of Sweden, 2007–2010

This sea area was mapped in 2007 and the map production process was finalized in 2009. Part of the mapped area covers the first Swedish marine national park (The Koster Sea National Park).

The Blekinge Coast and the southern Kalmar Sound 2009–2011

The fieldwork of the Swedish Marine Geological Mapping Programme was in 2009 carried out in two areas in southern Sweden:

- a) along the coast of Blekinge in the northern Hanö Bay and
- b) in the southern Kalmar Sound between the mainland and the Öland Island;

These works will continue in 2010. The aim of the programme is to produce a map for presentation in the scale 1:100 000 in 2011; showing the distribution of the seabed sediments and the stratigraphy of the bottom area all the way from the shoreline of the mainland to about 2 km off the baseline. The area has been completely covered with a side scanning sonar mosaic and along the track lines shallow reflection seismic (air-gun) and sub-bottom profiling (3.5 kHz) records have been performed. In addition the distribution of 57 elements and 30 organic micro-pollutants has been investigated in the topmost sediments. The sedimentation rate has been determined by ^{137}Cs -profiles analysed on board the survey vessel, S/V Ocean Surveyor. Several 0.8 m long, very soft cores also have been recorded and analysed with digital X-ray technique (ITRAX sediment scanner, developed by I. Cato and A. Rindby) placed on

board the survey vessel. This is a quality control of the sediment used for geochemical analyses.

The Uppland Coast, southern Bothnian and Åland Seas 2009

Fieldwork was also carried out in a third area; along the north coast of Uppland between Gävle and Norrtälje in the southern Bothnian Sea, the western Åland Sea and the northern-most part of the Baltic proper. The projects started in 2008 and will continue during 2010. The programme was run with the same technique as the mapping described above. The Swedish EPA has plans to make a second marine national park in the Gräsö Archipelago.

Substrate classification according to EUNIS based on Marine geological maps

During 2008-2010 SGU made an extensive study on the possibility to convert seabed sediment maps into the EUNIS system. Approximately 3000 visual observations (video/digital camera) taken by SGU were analysed and described with EUNIS-terminology. Observed substrates coverage is given in percentages of the observed seabed at 5% intervals. The observation net was nation-wide, but hard bottom and very shallow areas as well as areas in Kattegat are not that well represented. The final production of substrate classes were based on this information together with information on the marine geology of the seabed, the wave exposure, bottom currents, and bathymetry. The reclassification of the marine geological maps was then done by using statistical models, as GRASP (Generalized Regression and Spatial Prediction), for the prediction of a specific substrate; and by CART (Classification and Regression Trees). The latter method aiming, with the help of regression trees, to predict the class for a statistic observation. The reclassification of the marine geological maps resulted in 8 classes of substrates.

However, the results clearly show that modelling with several parameters (wave exposure, currents, depth) give a lot of correction-work due to misleading predictions. A direct translation from the marine geological maps gives the best result, due to the fact, that the marine geological maps reflect all this, i.e. the original material and the hydrodynamic processes such as depth, wave exposure and currents in each "point" of the seabed.

10 United Kingdom

There are no coordinated national mapping programmes taking place on the UK continental shelf at present. Aggregate companies undertake their own ad-hoc prospecting surveys, under licence, as appropriate to identify new resources. However, a number of discrete habitat mapping programmes associated with aggregate extraction have been commissioned as a result of stand alone research initiatives funded through the Marine Aggregate Levy Sustainability Fund (Marine ALSF). Progress with and outputs from these programmes are available from www.alsf-mepf.org.uk.

Four Regional Environmental Characterisation (REC) data collection surveys commissioned through the Marine Aggregate Levy Sustainability Fund (MALSF) to augment aggregate industry-led Regional Environmental Assessments (REA). Initially these were commissioned for the Thames Estuary and Isle of Wight regions with data gathering being undertaken during summer / autumn 2007 and follow-on projects to interpret and report the data gathered commissioned during 2008. Both reports will be available during 2010 (see www.alsf-mepf.org.uk for more details). Following these initial REC surveys, the Marine ALSF commissioned further surveys

for the Anglian and Humber regions, again to augment industry led Regional Assessments.

The purpose of the REC surveys is to provide industry, regulators and stakeholders in general with a document which provides a regional environmental context for those areas of the sea where marine aggregate extraction is focused. In conjunction with industry led REA's, the REC's will help to identify key issues which need to be addressed within site-specific Environmental Impact Assessments to support specific applications to extract marine aggregate.

The data and outputs from the REC programme are to be made publicly available through the Internet from the following sites, [www. www.alsf-mepf.org.uk](http://www.alsf-mepf.org.uk) and www.marinealsf.org.uk.

11 United States

Regional mapping is carried out by the US Geological Survey, Woods Hole (MA) Science Center < <http://woodshole.er.usgs.gov/project> >

The US Geological Survey has a specific program for Marine Aggregate Resources and Processes (MARP) which can be found at < <http://woodshole.er.usgs.gov/project-pages/aggregates/overview.htm> >

and an overview of the The Marine Aggregates (Sand and Gravel Assessment) Project can be found at

<http://woodshole.er.usgs.gov/project-pages/aggregates/index.htm>.

Continuing efforts between the US Geological Survey and the Minerals Management Service can be found at:

http://geology.usgs.gov/connections/mms/landscapes/sand_gravel.htm

Recently, several efforts have been underway to create databases particularly for beach nourishment. The US Geological Survey has been cooperating with Western Carolina University to compile a database of beach nourishment projects, including cost and volume of sand < <http://www.wcu.edu/1038.asp> >. "The Marine Aggregates Resources and Processes group at the US Geological Survey

< <http://woodshole.er.usgs.gov/projectpages/aggregates/beachnourish.htm> > has compiled this information into a GIS file and is preparing an open-file report. Currently, Google Earth files are available for New York (see image below), New Jersey, Massachusetts, North Carolina and Louisiana. Additional states will be added, and the file expanded, as time permits".

The US Army Corps of Engineers is continuing a program of Regional Sediment Management. < <http://www.wes.army.mil/rsm/> > to catalogue and coordinate dredging, sand extraction, beach nourishment and habitat creation. In New York, a database referred to as the "Long Island Needs Assessment" (LISNA) is in development which will inventory projects using GoogleEarth, and New Jersey has a similar inventory in development called the New Jersey Intercoastal Waterways (NJIWW)

Annex 7: Review of Developments in National Authorization and Administrative Framework and Procedures

1 Belgium

New legislation was already reported in previous reports and entered into force 1 September 2004. No changes were made to legislation in Belgium for exploitation zones 1, 2 and 3. Some minor changes to the existing KB's (like inconsistent periods etc.) are in the running, but still not implemented. For the end of 2010 or more probably beginning of 2011, several extraction zones will be assigned in exploration zone 4 on the Belgian continental shelf (see further), which will lead to a major update of the legislation in Belgium.

No major new developments in the authorization and administrative framework and procedures are to be reported for 2009.

The implementation of black box data already started at the beginning of 2000.

2 Denmark

Denmark has announced the introduction of a new Mining Code, the full legislation can be found at the following link:

<https://www.retsinformation.dk/Forms/R0710.aspx?id=127110>

3 Finland

No changes to report.

4 France

No changes to report.

5 Ireland

No changes to report.

6 Netherlands

The most recent developments are described in the Annual Report of 2009.

7 Portugal

This document is an overview of the Portuguese Legislation regarding the extraction of Marine Aggregates. There are two types of legislation, one concerning the exploitation of geological resources and another concerning the protection of the natural environment:

Exploitation of Geological Resources:

Decreto-Lei 90/1990, Decreto-Lei 89/1990 and Decreto-Lei 88/1990. These three laws define the different types of geological resources and their rules for exploitation. Five main types of geological resources were defined in the law 90/1990:

- a) Mineral deposits (all the minerals that contain metals, minerals that contain radioactivity, coals, pyrites, phosphates, asbestos, talc, kaolin, diatomite, barite, quartz, feldspar, precious and semiprecious stones)

- b) Hidromineral resources (mineral natural waters and industrial mineral waters)
- c) Geothermal resources (fluids and geological formations of high temperature)
- d) Minerals masses (all the rocks and minerals not considered mineral deposits)
- e) Spring waters

The first three are considered strategic geological resources because whether they are rare and/or very valuable for the national economy and are therefore owned by the state. At this stage no reference was made to marine aggregates because they were not defined in any these laws. Later in 2005, the Despacho nº 10 320/2005 considered Marine Aggregates as mineral deposits. Any exploitation of geological resources requires EIA studies.

Environmental protection laws:

Environment sensitive areas are protected by the REN (National Ecological Reserve). Defines all the sensitive areas needed to maintain the ecological equilibrium as well as the rules for the permitted human uses of these areas. These consist on a serie of legislation that was first defined in 1983 and has been updated throughout the years:

- Decreto-Lei nº 321/83
- Decreto-Lei nº 93/90
- Decreto-Lei nº 180/2006
- Decreto-Lei nº 166/2008
- Portaria nº 1356/2008 e Declaração de Rectificação nº 63-B/2008 (exceções)

The Decreto-Lei nº 166/2008 defines an area of coastal protection between the coastline and the 30m depth contour. In the Portaria nº 1356/2008 it is very clear stated that in the area of coastal protection is not allowed the exploitation of geological resources. Marine aggregate extraction is only allowed for beach nourishment. Below the -30 m contour depth aggregates extraction is allowed.

Until 2010 no marine aggregate extraction has occurred except for beach nourishment. At the moment there is one dredging enterprise that has license for exploration in eight areas of the mainland continental shelf between the -20 and -50 m contour. Exploration studies have occurred in 6 of the 8 areas

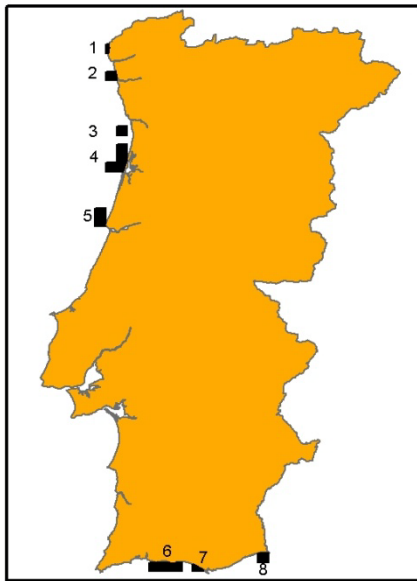


Figure 7.1 Enterprise license areas for exploration in eight areas of the mainland continental shelf

The islands (Madeira and Azores archipelago) have already been doing marine aggregate dredging for some years (at least from the nineties) and they have autonomy to prepare their own legislation about it:

Madeira Legislation

The more recent regulating marine aggregate extraction law in Madeira is the Decreto Legislativo Regional n.º 28/2008/M (12 August 2008). The following is a resume of it:

From the coastline to 200 m onshore or 200m offshore it can be explored for coastline nourishment and protection. However, artisanal exploitation of round pebbles and cobbles is allowed for in the construction of house façades' and for patrimonial buildings.

200 m offshore the coastline marine aggregates can be explored but requires EIA (sediment characterization and studies of sedimentary dynamics).

In Pnorto Santo Island exploitation is only allowed for beach nourishment.

In the Desertas and Selvagens Islets the exploitation is forbidden.

Azores Legislation

The more recent regulating marine aggregate extraction law in Madeira is the Decreto Legislativo Regional n.º 9/2010/A (8 March 2010). The following is a resume of it:

From the coastline to 50 m onshore or 250m offshore aggregates can be extracted for coastline nourishment and protection.

Beyond the 250 m offshore aggregates can be extracted as long as environments impacts over the ecosystems and coastal and beach erosion are taken into account;

Exploitation of round pebbles and cobbles is allowed as long as the volumes do not exceed 100 m³ for each 1000 m of stretch of coastline and not occur negative impacts over the coastline (e.g. beach or cliff erosion).

There have been detailed exploration studies of the insular shelves for aggregate evaluation in Madeira and Azores archipelago asked from the Regional Government of each archipelago.

In the Azores four islands shelves (Faial, Pico, S. Miguel and Flores) have been studied in detail by doing bathymetric, high-resolution seismic reflection and sediment sampling mapping

In Madeira, all the southern insular shelf have been studied in detail by doing bathymetric, high-resolution seismic reflection and sediment sampling mapping.

8 Spain

Spain has approved and published the current year the Technical Instruction for the environmental management of marine sand extraction.

The Instruction regulates from an environmental point of view those projects of marine extraction undertaken in the coastal public domain intended to obtain sand for beach restoration and creation. It establishes the general criteria that contribute to the goal of ensuring environmental integration of such actions for the sake of better preservation of the marine environment. The instruction is divided into 21 articles and is preceded by an analysis that sets the terms of reference of the document. The overall content includes a first part of the procedural framework for such actions: administrative procedure, legal framework and technical/environmental documentation necessary for marine sediment extraction. All the extraction activities should be correctly justified, and environmental impact assessment is compulsory in Spain for extractions above 3,000,000 m³ or when affected areas are protected by the Birds or Habitat Directives or the Ramsar Convention.

A Spanish version of this Technical instruction is available at the following link http://www.mma.es/secciones/acm/aguas_marinas_litoral/directrices/pdf/directrices_arena.pdf

9 Sweden

No changes to report.

10 United Kingdom

Key legislation governing the extraction of Marine Minerals (Aggregates) in the UK remain to be:

- The Environmental Impact Assessment and Natural Habitats (Extraction of Minerals by Marine Dredging; England and Northern Ireland) Regulations 2007
- The Environmental Impact Assessment and Natural Habitats (Extraction of Minerals by Marine Dredging; Wales) Regulations 2007
- The Environmental Impact Assessment and Natural Habitats (Extraction of Minerals by Marine Dredging; Scotland) Regulations 2007

In England, the regulations are accompanied by procedural guidance in “Marine Minerals Guidance Note 2” which supplements the existing “Marine Minerals Guidance Note 1”. These documents contain procedural guidance explaining the application process for marine minerals extraction in British waters together with guidance on environmental assessment, mitigation and monitoring criteria, based in part on the 2003 ICES WGEXT Guidelines.

In 2009, the Marine and Coastal Access Act received royal assent.

The key areas of interest of the Act focus on:

- Instigation of a Marine Management Organisation
- Implementation of Marine Planning
- Rationalisation of Marine Licensing
- Marine Nature Conservation
- Fisheries Management and Marine Enforcement
- Environmental Data and Information
- Migratory and Freshwater Fisheries
- Coastal Access
- Coastal and Estuary Management

Secondary legislation will follow in 2011 which is likely to replace the *The Environmental Impact Assessment and Natural Habitats (Extraction of Minerals by Marine Dredging; England and Northern Ireland) Regulations 2007* with the aim of incorporating the requirements of this legislation with those of other environmental permitting regimes, such as the *Food and Environment Protection Act 1985* which is currently the main instrument for regulating the disposal of navigational and capital dredged material and the *Coast Protection Act 1949* which is the main instrument for regulating non-mineral dredging of ports and harbours. These Acts and other similar legislation will be brought together and rationalised to for a Single Marine Licence covering a large number of marine related activities.

One of the aims of the Marine and Coastal Access Bill was, in England, to introduce a Marine Management Organisation (MMO) to take on the role of delivering much of the ambition of the Act. This organization was established in Newcastle in April 2010 and takes on the role of the now defunct Marine and Fisheries Agency. Included in this is the responsibility for regulating Marine Minerals extraction under *The Environmental Impact Assessment and Natural Habitats (Extraction of Minerals by Marine Dredging; England and Northern Ireland) Regulations 2007*. The MMO will be responsible for delivery of the Single Marine Licence in English waters, implementation of Marine Planning and a number of other delivery responsibilities although Marine Policy will remain within the remit of central Government Departments and managed through a Marine Policy Statement. Similarly in Scotland, Marine Scotland has been established by the Scottish Government to undertake a similar delivery role to the MMO but in addition take forward so policy functions. In Wales, the Welsh Assembly Government has taken those responsibilities devolved under the Act, centrally into the Government structure.

Further information on these regulations and the changed responsibilities as a result of the Marine and Coastal Access Act can be found at www.marinemanagement.org.uk, for Wales at www.wales.gov.uk and for Scotland at www.scotland.gov.uk/marinescotland.

11 United States

The legal authority for the issuance of negotiated noncompetitive leases for OCS sand and gravel is give by Section 8(k) of the Outer Continental Shelf Lands Act (OCSLA). Public Law 103-426, enacted in 1994, allows the MMS to convey, on a noncompetitive basis, the rights to OCS sand, gravel, or shell resources funded in whole, part, or authorized by the Federal Government.

< <http://www.mms.gov/sandandgravel/index.htm> > <
<http://www.mms.gov/sandandgravel/MarineMineralProjects.htm> > <
<http://www.mms.gov/sandandgravel/NonEnergyLegalFramework.htm> >.

A summary of US code for submerged lands can be found at:
<http://www4.law.cornell.edu/uscode/43/ch29.html>

In 2009, the state of Massachusetts has promulgated an ocean comprehensive ocean management plan to deal broadly with marine issues of renewable energy, deep-water aquaculture, offshore sand mining, and other activities. Sediment data from the USGS publication, usSEABED: Atlantic Coast Offshore Surficial Sediment Data Release (USGS Data Series 118) were augmented by seabed sediment data from DMF lobster surveys, DMF trawl surveys, EPA/EMAP grab samples, MWRA grab samples and SPI data, National Coastal Assessment grab samples, and USGS Open File Reports. Siting and performance standards for the extraction of sand and gravel were summarized in the following table:

| ALLOWED USE | SITING STANDARD | PERFORMANCE STANDARD | NATURAL RESOURCE OR WATER- DEPENDENT USE |
|----------------------------------|---|--|--|
| Sand and gravel extraction | Presumptively excluded from SSU resource areas; exclusion rebuttable by determinations of LEDPA, no significant alteration, or inaccurate data | Public benefit Determination Avoid damage to SSU resources No significant alteration | <ul style="list-style-type: none"> • North Atlantic Right whale core habitat • Roseate tern core habitat • Fin and humpback whale core habitat • Areas of hard/complex seabed • Eelgrass • Inter-tidal flats • Important fish resource area |
| | Avoid, minimize, and mitigate impacts | Meet all applicable permitting standards | <ul style="list-style-type: none"> • Areas of concentrated recreational fishing • Areas of high commercial fishing effort and value |

http://www.mass.gov/?pageID=eoeaterminal&L=3&L0=Home&L1=Ocean+%26+Coastal+Management&L2=Massachusetts+Ocean+Plan&sid=Eoea&b=terminalcontent&f=eea_oceans_mop&csid=Eoea

Annex 8: Review of Approaches to Environmental Impact Assessment and Related Environmental Research

1 Belgium

The EIA that was published in 2008 is still valid for Belgium for extraction zones 1, 2 and 3. Since marine sand and gravel extraction started in Belgium (1978), continuous monitoring has been carried out by the three responsible governmental institutes, i.e. Fund for sand extractions of the Federal Public Service Economy (FPS), Management Unit of the North Sea Mathematical Models (MUMM) of the Belgian federal public planning service Science Policy, and Institute for Agriculture and Fisheries Research (ILVO-Fisheries) of the Flemish Government. These monitoring programmes are funded by the fees which concession holders have to pay per m³ extracted.

For exploration zone 4, the procedure for a new EIA started in 2009, which will be finished in 2010. This new EIA is paid for by Flemish Government – Afdeling Kust and the industry itself and is carried out partly through a consultancy company, in close cooperation with the 3 above mentioned governmental institutes. The assignment of 46 km² of potential exploitation area in this zone 4 will be based on multi-beam, vibre coring, sediment analyses and an evaluation of baseline data on the benthic ecosystem components. In future this new EIA might be used for all new concession demands in all exploitation zones.

Two presentations were given by Kris Hostens on the WGEXT meeting, one based on the work done by FPS (Koen Degrendele *et al.*, originally presented on an EMSAGG meeting in Brussels on 7 May 2010) and the work done by ILVO (Annelies De Backer *et al.*). A brief summary is included here.

Degrendele K., Roche M., Schotte P. and Vandenreyken H. 2010. Exploration Zone 4 of the BCS: Seabed Cartography. Belgian FPS Economy, Quality & Innovation, Service Continental Shelf (presented by Kris Hostens)

Since 2005–2006 extraction is more and more spatially dispersed over the different sandbank systems and exploitation zones on the Belgian Continental Shelf (BCS). In 2008 a new multibeam instrument (Kongsberg EM3002 Dual) was mounted on the R.V. Belgica to get high resolution data (10*10 m and even 2*2 m bathymetry maps) for exploration zone 4. Also several derived maps on slopes, aspects and the backscatter strength have proven to be of a very high quality. Based on a geological synthesis of Zone 4, through high-resolution seismic data and vibrocores on sedimentology (also see Annex IV), 4 new extraction zones may be appointed to cover an area of 46 km² that might be exploited from 2010 onwards. Based on the geological and legislative surfaces (i.e. the actual surface -5 m), it was calculated that approximately a total volume of 230 Mm³ can potentially be extracted from these potentially new zones on the Hinderbanken (Figure 1.1).

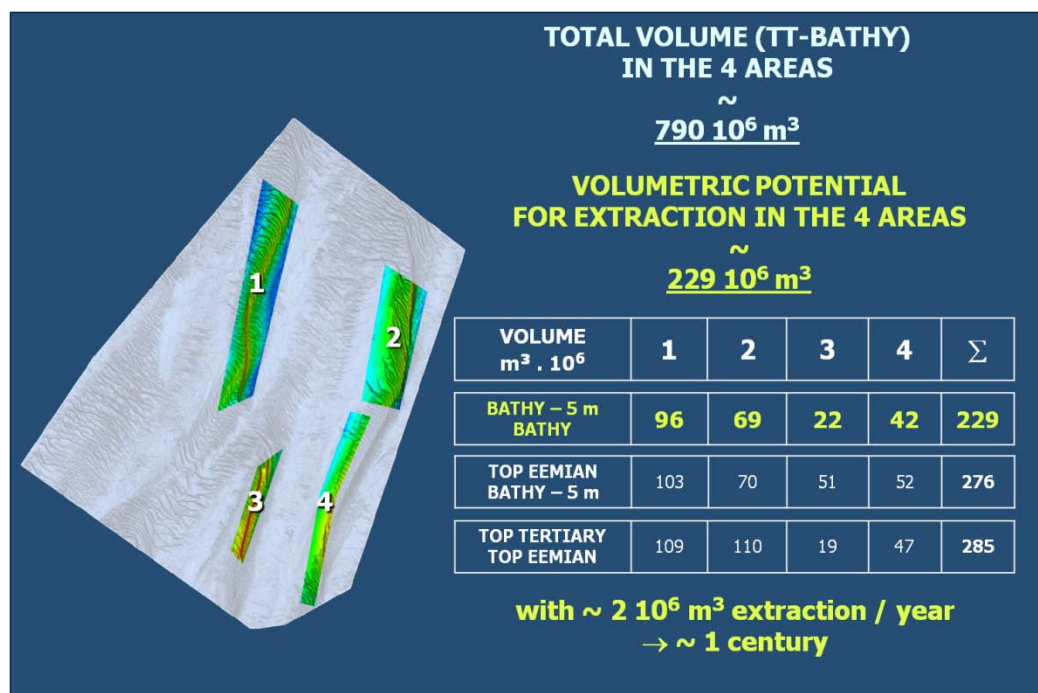


Figure 1.1. Potential extraction areas in exploration zone 4; based on multibeam and vibrocore data, and potential total volumes that may be legally extracted in these areas.

De Backer A., Moulaert I., and Hostens K. 2010. Hinderbanken – Benthos Base line study. Institute for Agricultural and Fisheries Research (ILVO-Fisheries).

Based on ca. 130 van Veen grab samples for macrobenthos and 8 (+ 8 reference) beam trawl samples for epibenthos and demersal fish, exploration zone 4 on the Belgian part of the North Sea was characterized in a baseline study. Some 116 macrobenthic taxa were identified with typical species that are interstitial or prefer coarse sands. The differences in benthic community mainly depends on the position on tops, slopes or gullies, with depth as best explaining factor (positive correlation between depth vs. density, diversity and species richness) and median grain size to a lesser extent. For the epibenthos 31 species were noted in the area, with hermit crab, swimming crab and brittlestars as dominant species (and abnormal high densities of shrimp in 2005/06). For demersal fish 25 species were noted in the area with dominance of lesser weever, dab, whiting and reticulated dragonet. Although topography was of secondary importance as structuring factor, also for epibenthos and fish a relation between density and depth was found, with significant lower epibenthos densities on tops and a high dominance of lesser weever on tops. As the gullies are the richest zones for all 3 ecosystem components, it is recommended to avoid extraction in gullies, which will probably be the case as the best sands are found on the tops and slopes, comparable with the extraction regime in the other zones on the BCS. To exclude the seasonal and interannual variation, the need for simultaneous sampling in at least one season (preferably autumn for macrobenthos, after the recruitment period) in both impact and reference zones is stressed. Also a Before/After Control/Impact (BACI) design is needed for monitoring purposes. As such, in autumn 2009 benthic samples were taken according to a BACI design, in the potential exploitation areas in zone 4, with references on Bligh Bank. However, for the future it is recommended to have a reference area in the exploitation zone itself, preferably on the northern part of the OostHinder and Noordhinder banks.

(relevant report: De Backer A, Moulart I, Hillewaert H, Vandendriessche S, Van Hoey G, Wittoeck J and Hostens K (2010) Monitoring the effects of sand extraction on the benthos of the Belgian Part of the North Sea. ILVO-report 2010-02, 117p.)

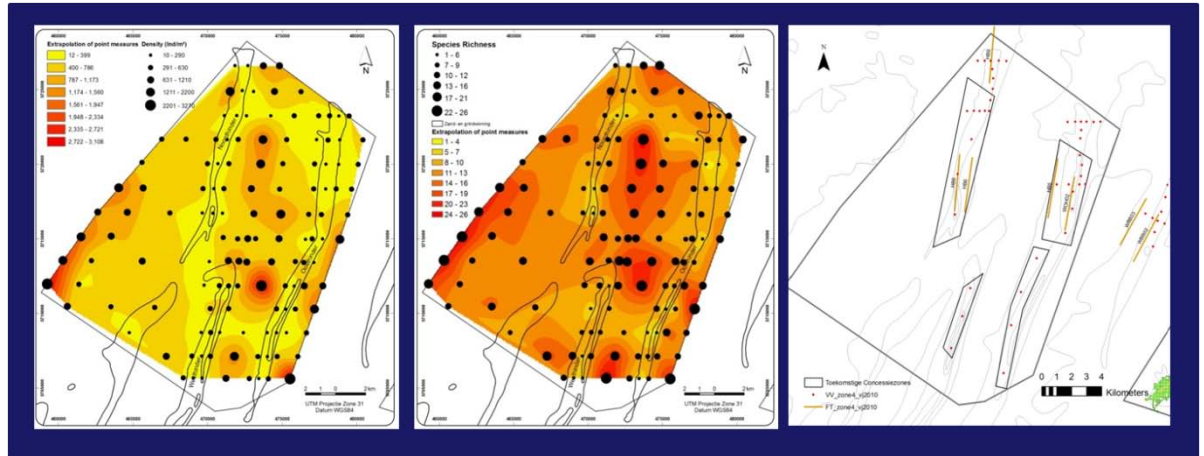


Figure 1.2. Macrobenthos density (left) and species richness (middle) in exploration zone 4, and new BACI-sampling design for macrobenthos, epibenthos and demersal fish in the potential new extraction zones on the BCS.

2 Estonia

Ministry of the Environment is responsible for environmental impact assessment management and to start extracting any resource the company has to provide information about the scope and rate of potential environmental impact. Thus, we don't have any general project for the whole marine sediment extraction area.

3 Finland

Approaches to environmental impact assessment of the effects of marine sediment extraction

Oulu–Haukipudas area, Bay of Bothnia

Date project commenced:

Duration of project: 2007-2009

Organisation(s) undertaking research project: FCG Planeco Oy

Funding bodies: Morenia, Metsähallitus

Description of research project

Morenia, Metsähallitus has several years studied eight coastal areas in the Bay of Bothnia: Vaasa, Kokkola, Lotaja, Kalajoki, Tauvo, Hailuoto, Haukipudas and Kemi. The aim of these studies is to enable the exploitation of the marine sand resources of these areas. All of these water areas are administered by Metsähallitus (National Board of Forestry) and situate 10-30 km off the coast.

In June 2007 Morenia started EIAs in four areas: Suurhiekkä-Pitkämäntala (Ii and Simo municipalities), Merikallat (Hailuoto), Tauvo (Siikajoki and Raase) and Yppäri (Pyhäjoki) in the bay of Bothnia. After that the organization undertaking research project has changed. The program includes studies on birds, fish and fishery and habitat

surveys. (<http://www.ymparisto.fi/download.asp?contentid=113641&lan=fi>). The EIA procedure was completed in November 2009 and the report is now under examination by authorities.

4 France

Approaches to environmental impact assessment of the effects of marine sediment extraction:

Experimental site in Baie de Seine (Eastern English Channel)

Date project commenced: 2006 (Demersal fish baseline survey)

Duration of project: 6 years (2006–2011)

Organisation(s) undertaking research project: GIS "SIEGMA" (Monitoring of impacts of extraction of marine aggregates)

Funding bodies: European Union, French Ministry of Research, Regional Council Haute-Normandie, dredging local companies (GMN) and national association (UNICEM), Ifremer and University of Rouen

Description of research project:

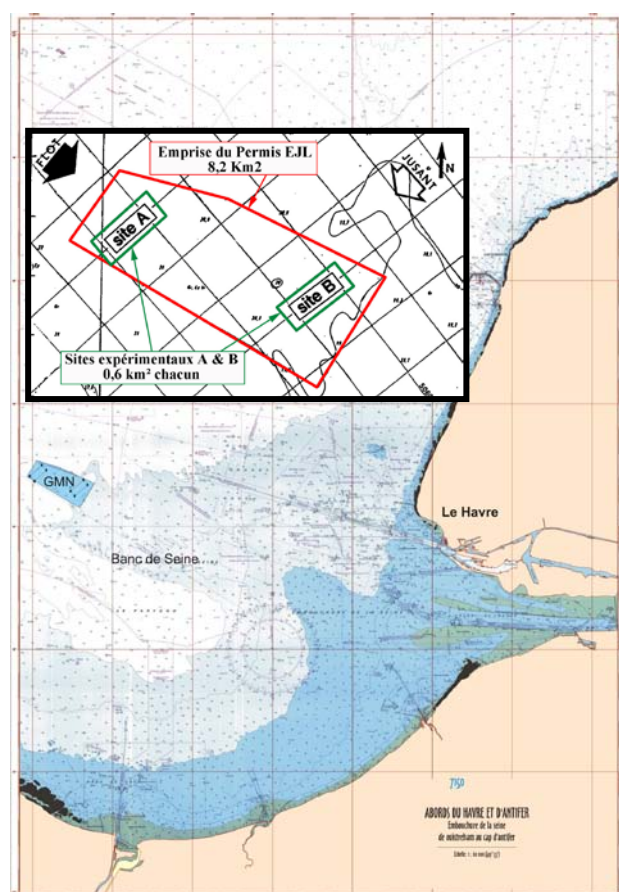
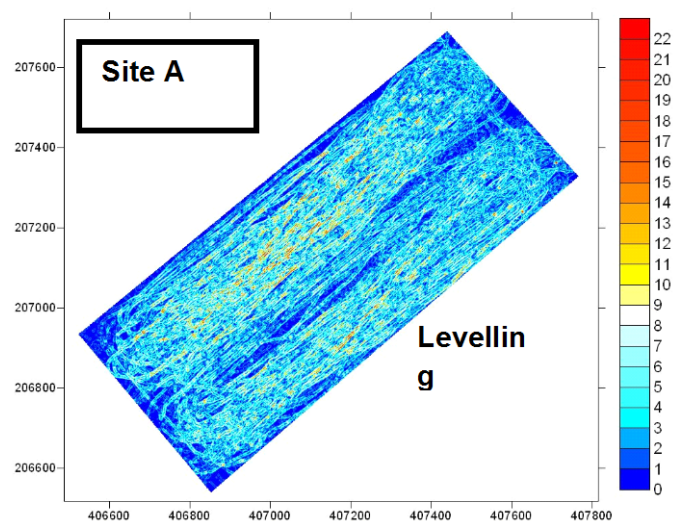


Figure 4.1. Location of the experimental site.

Monitoring of impacts is concerning:

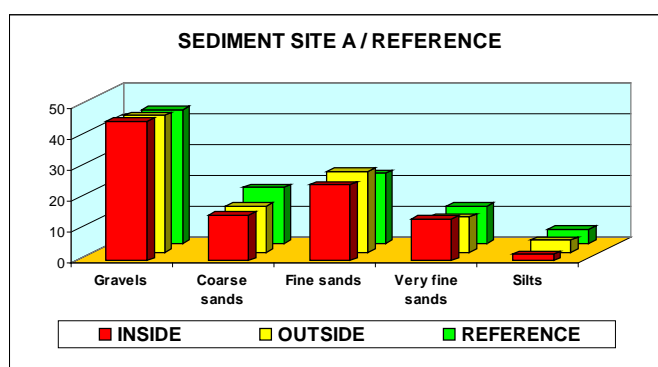
- the dispersion of the turbid plume (ADCP) and the analysis of the deposition area ;



4.3. Sediments and associated benthic communities : impact and early restoration:

The first steps of the recovery monitoring were done in early 2009 with the sampling of sediment and associated macrofauna of site A after cessation of extraction.

No significant evolution of sediment could be observed:



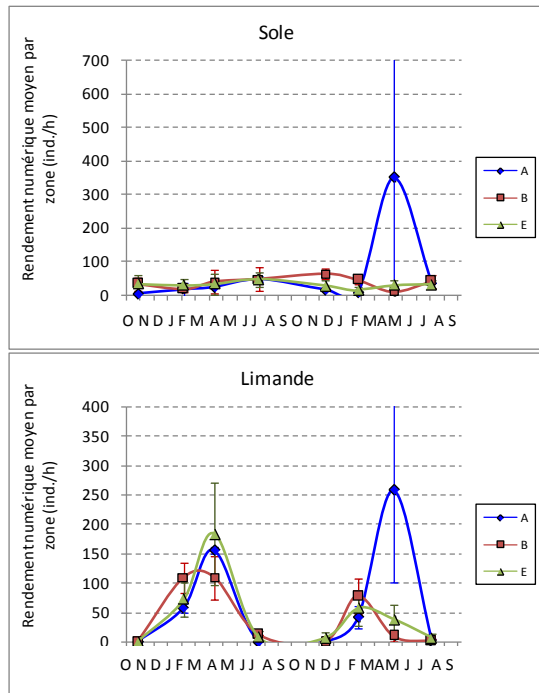
- Impact of extraction activity on biological parameters was mainly observed in the most recently dredged area (autumn 2008) with abundance and biomass ; an opportunistic recolonization (up to 50% of the total abundance) was observed in the initial extraction area (spring 2008) leading to densities higher than reference values, whereas biomass value is still halfway from the reference one.

| SITE A | REFERENCE | DREDGING | FALLOW | OUTSIDE |
|---|-----------|----------|--------|---------|
| Number of species (0.3 m ²) | 73 | 57 | 69 | 54 |
| Abundance (ind.m ⁻²) | 2550 | 865 | 3190 | 1900 |
| Biomass (g.m ⁻²) | 6,2 | 1,5 | 3,3 | 3,2 |

- Site B will be dredged during three years (2008-2011) to study the spatial impact of pluriannual extraction activity. Baseline survey of benthos and sediment was done in February 2008 and the first step of monitoring in February 2010.

4.4. Demersal fish communities

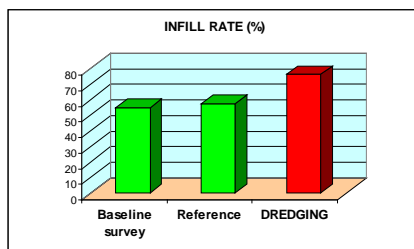
Monitoring of the benthic and demersal fish communities (4 seasonal campaigns with trawling and fixed nets) showed a global decrease of species richness and of abundances for most species. Nevertheless, an attractive effect was observed for sole and dab with an immediate, localized and temporary increase of densities for these two flatfish species.



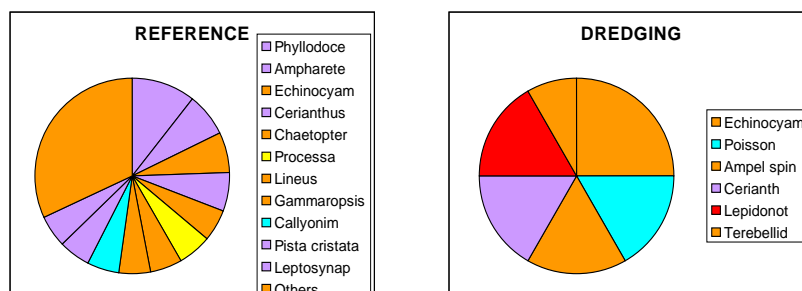
4.5. Trophic relationships between fish and benthos:

Analysis of stomach contents of soles was the opportunity to see a modification of trophic relationships in this context of increased abundances (deposition of crushed benthos with overflow):

- The infill rate is increased by 50% in the extraction area, as a consequence of crushed benthos deposition from overflow:



- Characteristic preys of sands are becoming dominant in the stomachs of soles trawled in the extraction area, whereas species characteristic of silty sediments are dominant in the reference area:



Bibliographic review on “Biodiversity and Marine sediment extraction”

Date project commenced: March 2008

Duration of project: 2 years (2008-2010)

Organisation(s) undertaking research project: University of Rouen (UMR M2C)

Funding bodies: French national aggregate producers association (UNPG) ; COST Action 638 “MAGGNET”.

Description of research project:

This review and our own expertise allowed to propose the following grid of sensitivity, measuring the response of “international” indicators (threatened species, communities and habitats) to the different impacts generated by extraction.

Table 4.51. Sensitivity to key habitats and species to various levels of impact of marine aggregate extractions (Extraction/Turbidity/Deposition).

| SENSITIVITY TO EXTRACTIONS | | | PRESSURE LEVELS | | | |
|----------------------------|--------------------------------------|-------|-----------------|------------|------|---------------|
| Impact indicators | | High | Medium | Low | Null | Positive |
| OSPAR species | Cod | T/D | | <i>E ?</i> | | <i>Zoning</i> |
| | Rays | | | E/T | D | |
| OSPAR habitats | <i>Sabellaria reefs</i> | E | | | T | D |
| | Maërl beds | E/T/D | | | | |
| | Hard substrates with <i>Modiolus</i> | E | D | T | | |
| ICES habitats | Spawning areas | E/T/D | | | | |
| | Nurseries | E/D | | | T | |
| | Shell beds | E/D | | | T | |
| NATURA 2000 | 1110.2 (gravelly sands) | | E/T/D | | | |
| | 1110.3 (medium sands) | | | E/T | D | |

Extraction of marine aggregates will potentially be a serious threat to biodiversity only when exploitation projects will affect gravelly areas either of small size or under-represented in the geographical area (loss of habitat), and/or when functional impacts can affect sensible and threatened species (e.g. loss of spawning areas).

This identification of sensitive habitats implies ambitious mapping programmes of biological characteristics of marine habitats at regional scales, much bigger than research permits and extraction areas.

The Working Group for Marine Habitat Mapping (ICES, 2008) points out the importance of this objective in the selection process of extraction areas in order to protect benthic threatened communities and allow a good resources management.

5 Netherlands

The general procedure for Environmental Impact assessments (EIA) in the Netherlands is described in the Annual Report of 2007.

Actual EIA's

Sand Engine

The province of South-Holland initiated a plan for a large-scale coastal nourishment of 20 Mm³ marine sand under the name "Sand Engine" as an alternative for long-term nourishment needs in order to protect and develop a part of the South-Holland coast. The plan is briefly described in the Annual Report of 2009.

The EIA for this plan is published in February 2010 and was under public consultation till the beginning of April. As marine sand extraction was only a part of this EIA, that mainly was focused on the effects of the dumping of the sand at the coast, only few comments were on sand extraction. The comments of the Authorities on Cultural Heritage points to a new approach, where not only research is executed towards the presence of historical wrecks, but also to the prehistoric landscape. The licence for extraction is expected in September 2010. The sand extraction areas are partly earlier used areas that are now deepened from 2 to 6 meter below the original seabed.

At present a monitoring programme is under discussion including some nature building in the extraction area. This is in order to evaluate the proposed gain in nature values due to the sand engine, and the possible loss at the extraction site.

Westerschelde Container Terminal

An update of the existing EIA for the renewal of the sand licence for the extraction of 20 Mm³ sand for the Westerschelde Container Terminal in Vlissingen.

Maasvlakte 2

The construction of Maasvlakte 2, the enlargement of Rotterdam harbour, is going on successfully. Each week an amount of 3 Mm³ marine sand is extracted from the seabed. By the end of April 2010 already 120 Mm³ was brought into the reclamation area. That is half the total amount for the first phase of the construction.

During the extraction the bathymetry of the changing seabed is measured to control the work. The measuring will continue after the extraction. After several years the reaction of the seabed on the extraction will show if there is any migration of the pit and if there are new bed forms developing in the pit.

To anticipate on this development the sand wave will be constructed in the pit as an experiment in the framework of "Building with Nature" research programme. As part of this programme the possibility to execute operations at the seabed in a way that nature benefits from the beginning is studied. This includes also the ecological monitoring of the man made sand wave.

Monitoring of the effects of the sand extraction for Maasvlakte 2 are in full operation. Measurements are done at bathymetry and composition of the seabed, diversity and biomass of benthic fauna, underwater noise, changes in the amount of suspended matter in a broad area and the influence of changes of suspended matter on the time of the yearly algae blossom.

Unexpected was the large amount of fossil bones from mammoths and other ice-age mammals that were found in the area. The extraction activities have resulted in the exposure of a large quantity of bones, which are of high scientific interest and can now be collected.

For more information on the extraction for Maasvlakte 2 see the paper by Stolk and Dijkshoorn (2009) in Annex 9.

Research

Studies on the availability of sand in the Dutch part of the North Sea have shown that in the area between the established NAP – 20 meter depth contour (NAP= Dutch Ordnance Level) and the 12 miles boundary an amount of 20 Gm³ sand is present within the first 5 meter of the seabed and 40 Gm³ within the first 12 meter (Van Heteren and Doornenbal, 2009; Maljers *et al.*, 2010).

When sea level rise goes on in the next centuries in a rate that is (much) higher than at present, the Dutch coast will need to be nourished by huge amounts of marine sand by the generations to come. In that case at the long term the succeeding extractions might result in a very large trench.

The effects of such a trench on morphology, sand transport, coastal sand balance and even on changes in the tidal system of the southern North Sea are studied (De Boer *et al.*, *subm.*; De Boer *et al.*, 2010; Van der Werf and Giardino, 2009; Van der Werf *et al.*, 2010)

The effects, even when the trench is deepened to 12 meter are in the order of changes of a few cm in tidal amplitudes and a few cm/s in tidal currents at the coasts of the Southern Bight of the North Sea. Nevertheless, such small changes can have influence on sediment transport on the long term.

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6 Portugal

No EIA is currently being undertaken in Portugal, Annex 7 provides a detailed history of Environmental Legislation and extraction development in Portugal.

7 Sweden

No EIA is currently being undertaken in Sweden.

8 United Kingdom

EIA remains the responsibility of the operator / developer in the UK. No national programmes of EIA are undertaken in relation to marine aggregates.

National and industry specific programmes of research have been commissioned over the course of several years. Of particular note are:

Aggregate Levy Sustainability Fund

In 2009 a significant amount of marine aggregate related research has again been funded through the Aggregates Levy Sustainability Fund (ALSF). The current round of the fund will end on 31 March 2011 and any future round(s) are subject to review.

To date, a range of new projects have been commissioned including four Regional Environmental Characterisation surveys covering the South coast, Anglian, East coast and Humber regions, data collection on dredging noise, an ongoing programme to refresh the 2002 Benthic Guidelines report and cost benefit analyses of restoration of habitats post dredging.

By the end of the current round of funding (March 2011), the Marine ALSF programme will have supported over £25 million worth of projects focussing on marine mapping, assessment of environmental impacts, monitoring / mitigation associated with improving the way marine aggregate extraction is planned, assessed and managed.

Details on commissioned projects can be accessed via www.alsf-mepf.org.uk. A meta-database of project outputs for MALSF funded projects is available at www.marinealsf.org.uk

Other Programmes

The UK Department of Environment, Food and Rural Affairs (Defra) continue to fund research programmes focussing on their areas of interest, including the marine environment. Further information on projects can be found at <http://randd.defra.gov.uk/>

The Marine Management Organisation (www.marinemangement.org.uk) are currently producing guidance related to the conduct of Coastal Impact Studies for aggregate extraction sites.

Industry Led Initiatives

Regional Environmental Assessments

To support a forthcoming large number of licence and renewal applications, the UK marine aggregate industry, in conjunction with The Crown Estate, have commissioned a series of Regional Environmental Assessments to address regional scale cumulative and in-combination issues. Four such projects are now underway, with the South coast (Isle of Wight) and Thames Estuary REA's well advanced, and the East coast (Norfolk) and Humber REA's running 12 and 18 months behind. Each is progressing independently of, but in parallel with, the REC projects being funded through the Marine ALSF programme.

Guidance funded jointly by Defra, the Crown Estate and BMAPA, on the content of REA's has been published by the Regulatory Advisors Group (RAG). RAG consists of organizations who provide advice to the regulator on marine aggregate issues, specifically Cefas, the UK JNCC, Natural England and English Heritage. This information is available from www.cefas.co.uk

The intention is that the outcome of both the REA and REC processes will directly feed into the site-specific environmental impact assessments for individual licence applications and renewals, allowing a more robust and consistent approach to consideration of regional scale cumulative and in-combination effects.

Eastern English Channel Regional Monitoring Programme

A programme of regional monitoring covering aspects of a number of licensed marine aggregate extraction sites in the Eastern English Channel is being undertaken by a number of aggregate companies who have formed the East Channel Association. Further details of this regional programme can be found at www.eastchannel.info

BMAPA and the Crown Estate continue to fund numerous programmes including the Area Dredged Annual report and Area Dredged 10 year review.

Reports are available on the websites of both BMAPA (www.bmapa.org) and The Crown Estate http://www.thecrownestate.co.uk/marine_aggregates

9 United States

The US Minerals Management Service Guideline for obtaining offshore sand sources can be found at:

<http://www.csc.noaa.gov/beachnourishment/html/human/law/borrow.htm>

A continuing issue is the possible deflation of shoal features which may result in adverse changes in sand transport patterns, shoreline erosion, and accretion rates. In addition to possible adverse effects on the physical environment, subsequent habitat changes and effects on local biology could be encountered should the shoal morphology drastically be altered.

In 2009, MMS had added a "full text" search option to their Environmental Studies database. Details can be found at

< <http://www.gomr.mms.gov/homepg/whatsnew/newsreal/2009/090211.pdf> >

Annex 9: Detailed Responses to ToR (f) in Relation to Monitoring Programmes Carried out by Member States

1 France

Consideration of the scope and implementation of monitoring programmes instigated in relation to marine sediment extraction activities.

The outline of processes (who, what, when, how, circumstances, conditions, stages, cost allocation models) employed to establish the scope and detailed specifications for monitoring programmes are as follows:

- a) Ifremer recently updated their methodological recommendations for baseline and monitoring surveys (2006). The detailed description is available at http://www.ifremer.fr/drogm/ressources_minerales/materiaux_marins/protocole_pour_l_etat_de_reference
N.B. ICES recommendations have been used to perform this new protocol.
- b) The above methodological recommendations also refer to numbers of sampling points, spacing of sampling points, replicates and geo-graphic spread.
- c) No information is available on reporting frequency and requirement for publication.
- d) No information is available on how the scope of monitoring is revised.

The outline of implementation processes (who, what, when, under what circumstances, terms and conditions) employed in relation to the implementation of monitoring programmes, are as follows:

- a) Ifremer is officially mandated as expert to give his opinion to public decision-makers (Ministries of Industry and Environment, Prefecture) on the quality of licence inquiry documents
- b) Monitoring programmes are undertaken by private companies and/or university laboratories. Results are assessed by the Regional Direction for Industry, Research and Environment (DRIRE)
- c) The Regional Direction for Industry, Research (DRIRE) assesses maximal annual tonnage and maximal dredging depth allowed
- d) DRIRE requests that a new environmental impact study is undertaken if the company wants to increase the annual tonnage or maximal depth allowed. The frequency of monitoring is increased in proportion to the annual extracted tonnage.
- e) DRIRE records the results of each (1, 2, or 5 years) monitoring phase.

2 Spain

2.1. Scope

Outline of processes (who, what, when, how, circumstances, **conditions**, stages, **cost allocation models**) employed in your country to establish the scope and **detailed specifications** for monitoring programmes e.g. with respect to the following headings types and conditions of monitoring: equipment, parameters to be measured, frequency of measurement:

Environmental aspect: Biological communities

- Equipment: sediment bottoms, van Veen grab sampler; rocky bottoms: diving and towed video.
- Parameters to be measured: diversity, richness y density
- Frequency of measurement: preview status, 1 month after the works are completed, 6 months, 1 year y 2 years.

Environmental aspect: Fishing resources

- Equipment: local fishing methods
- Parameters to be measured: Resource biomass and annual captures
- Frequency of measurement: preview status, 1 month after the works are completed, 6 months, 1 year y 2 years.

Environmental aspect: Water Quality Monitoring

- Equipment: Multiparameter data sonde and hydrographical water sampler
- Parameters to be measured: T[°], salinity, ORP, pH, Dissolved Oxygen, turbidity y Concentration of matter in suspension
- Frequency of measurement: preview status, 1 month after the works are completed, 6 months, 1 year y 2 years.

Environmental aspect: Sediments Quality Monitoring

- Equipment: van Veen grab sampler; rocky bottoms: diving and towed video.
- Parameters to be measured: granulometry, Organic matter, D₅₀, MODE, % under 63 microns, gravels and organic matter, Sorting y Skewness.
- Frequency of measurement: preview status, 1 month after the works are completed, 6 months, 1 year y 2 years.

Outline of numbers of sampling points, spacing of sampling points, replicates, geographic spread:

Environmental aspect: Biological communities

- Numbers of sampling points and spacing of sampling points: proportional to the studied surface y and the complex of the affected community.
- Replicates: 2 with a minimum surface of 600 cm².
- Geographic spread: depending on the communities founded

Environmental aspect: Water Quality Monitoring

- Numbers of sampling points and spacing of sampling points: proportional to the work surface.
- Replicates: 1 per sample.
- Geographic spread: depending on the local currents.

Environmental aspect: Sediments Quality Monitoring

- Numbers of sampling points and spacing of sampling points: proportional to the studied surface

- Replicates: enough to be able to complete the analysis established
- Geographic spread: depending on the local currents.

Outline of reporting frequency, format, and requirement for publication:

Reporting frequency: Partial Reports: Once is finished each sampling survey.

Final Report: Once are finished all the monitoring surveys.

Outline of scope revision processes, i.e., how is the scope of monitoring revised, e.g. on a phased basis based on initial results – if at all?:

- Reviews past every partial report

Annex 10: Sand extraction Maasvlakte 2 Project: License, Environmental Impact Assessment and Monitoring. Ad Stolk and Chris Dijkshoorn

European Marine Sand and Gravel Group
– a wave of opportunities for the marine aggregates industry
EMSAGG Conference, 7-8 May 2009
Frentani Conference Centre, Rome, Italy
1 Paper 5

Sand extraction Maasvlakte 2 Project: License, Environmental Impact Assessment and Monitoring.

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Abstract

In September 2009 the construction of Maasvlakte 2, an enlargement of Rotterdam harbour with 20 km², started. For the first phase of the project an amount of 290 million m³ of marine sand is needed, about fifteen times the currently yearly amount of marine sand extraction in the Netherlands. This largest extraction of marine sand in North Western Europe will take place outside the 20 m depth contour off the Dutch coast.

The construction of Maasvlakte2 and the sand extraction is a large project that requires an extensive and careful communication with all actors involved. An EIA study is made which describes the influence of the construction and sand extraction on nature and other uses of the sea. Monitoring on benthic fauna, suspended matter and underwater noise is started to examine the effects of this large-scale (15 km²) and deep (10 - 20 m below seabed) marine sand extraction.

1. Enlargement Rotterdam harbour:

Maasvlakte 2

For the enlargement of the harbour of Rotterdam land reclamation of 20 km² is needed. This new harbour area is called Maasvlakte 2 (Figure 1). Half of this area will be used for harbour related activities like container terminals, distribution of goods and chemical industry. All of these activities need a deep-water harbour with a depth of 20metres.

The other half is used for dikes, roads and harbour basins. To construct the land reclamation an amount of about 290 million cubic meters of marine sand is needed for the outer contour, the southern part of the harbour area and the coastal defence in the first ten years. The most intensive sand extraction will take place in the first 4 years. Later on another 75 million cubic metres are needed for the northern part. The total amount is about fifteen times the currently yearly amount of marine sand extraction in the Netherlands part of the North Sea.



Figure 1: Maasvlakte 2 Artist impression (source: Harbour Company Rotterdam)

The construction of Maasvlakte 2 is a large project that requires a lot of communication between governmental authorities, Harbour Company Rotterdam, ngo's and the general public as the new harbour plans will have a large impact on the natural and industrial environment.

Licenses are required for the reclamation of a sea area, for the seawall and for the extraction of sand. Besides this licenses also are needed for nature laws. The project started more than ten years ago.

The primary objective of the project is finding a solution to the space problems of the Rotterdam harbour. Two other projects are connected with the enlargement of the harbour: the existing harbour will be rearranged and a nature area of 750 ha will be planned inland nearby Rotterdam. This last project is needed due to an agreement between (local) government and non-governmental organizations (ngo's) in the region that every major development for economic purposes should have a counterpart development for nature and liveability in the region.

Having obtaining all of the required licenses, the Harbour Company Rotterdam started the construction of Maasvlakte 2 in September 2009 by the dumping of sand along the old coast. This sand originates from the existing harbour area. From January 2009 onwards large trailer suction hopper dredgers will extract sand from the seabed to construct the outer contour of the Maasvlakte 2. A small island will be constructed ca. 3 km from the coast as the first step of the outer contour. From there a connection with the old land will be made. Following this, the outer contour, the quays and industrial areas will be build. Only the northern part of the outer contour is a solid seawall. The western and southern part will be a sand dike, looking as a coastal dune. In this way the new coast is similar to the natural coast south of the area.

Should all be completed on to schedule, the first container ships will enter the new enlargement of the harbour in 2013.

2. New nature

The enlargement of the Rotterdam harbour is planned in a Natura 2000 area. (figure 2) Therefore, according to the European Habitat Directive compensation is necessary for the nature values which have been lost. To compensate for the lost 20 km² of shallow sea habitat an improvement of the nature values of 10% in an area of 200 km² will be reached by measurements in another part of the Natura 2000 area. Here, strong restrictions will be enforced to seabed disturbing activities like fishing and extraction of shells. For birds and seals specific areas are declared as 'quiet' areas, where recreational access is restricted.

Furthermore, a new dune area is build north of Rotterdam to compensate for lost nature values in dunes near Maasvlakte 2.

The EU requires that the compensation must be arranged before the work on the enlargement of the harbour starts, so a management plan to formally regulate the measures has been made and came into force in July 2008.



Figure 2. Location of Maasvlakte 2 and Natura 2000 area Voordelta.

The new harbour area Maasvlakte 2 is situated south of the Maasgeul, within the Natura 2000 area Voordelta indicated by the yellow dotted line. The solid red line gives the location of the restriction area for activities that disturb the seabed.

3. The management of marine sand extraction in the Netherlands

Most coastal countries in North Western Europe and the Baltic are involved in the extraction of marine sand and gravel. Large amounts of marine sediments are extracted by the UK, the Netherlands and Denmark. Extraction of marine sand has impacts on the seabed and its fauna. It takes several years before total recovery of the fauna is reached. The international Working Group on the effects of extraction of marine sediments on the marine ecosystem (WGEXT) of the International Council for

the Exploration of the Sea (ICES) has published guidelines for the management of marine sediment extraction (ICESWGEXT annual).

The Oslo-Paris Convention (OSPAR) as a recommendation to the OSPAR countries accepts these guidelines. Part of the guidelines is a checklist for the issues that should be part of Environmental Impact Assessment (EIA) studies. These guidelines are taken into account for the licenses for marine sand extraction in the Dutch part of the North Sea.

From the Netherlands Continental Shelf a considerable amount of marine sand is also extracted. The last years an average of 26 million cubic meters per year is taken from the seabed (Figure 3). In general, half of the amount of this marine sand is used for coastal nourishment. The other half is used as fill sand on land. Nearly half the fill sand used in the Netherlands is marine sand. Hardly any marine sand is used for industrial purposes like fabrication of concrete. In future a further increase of extraction of marine sand is expected, especially for coastal nourishment to counteract the expected sea level rise due to global warming.

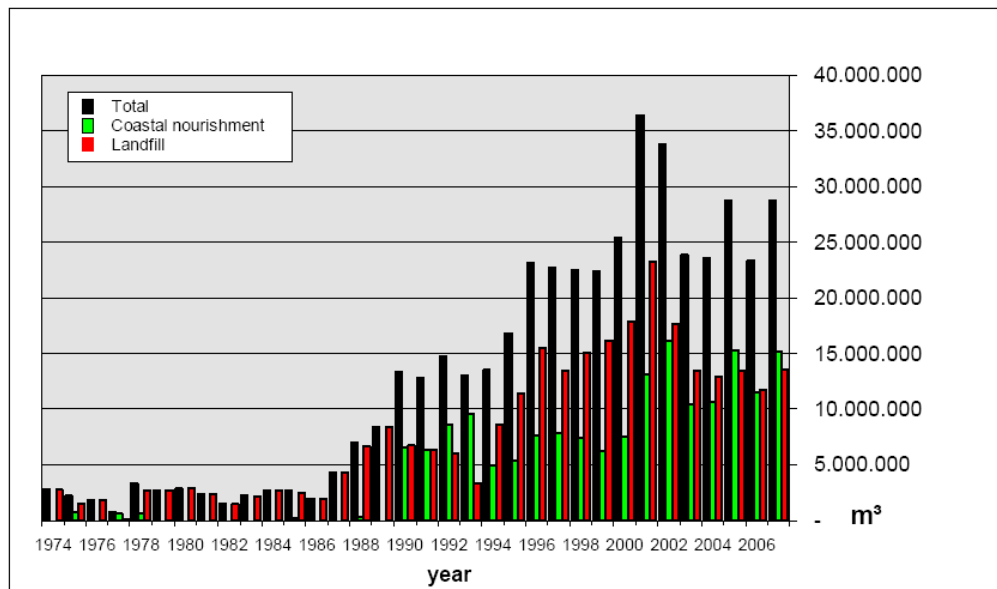


Figure 3. Historical pattern of marine sand extraction from 1974 out of the Dutch part of the North Sea.

The extraction of marine sand and gravel is subject to regulations to ensure recovery of benthic fauna and to avoid negative influence on coastal defence and other uses of the sea.

The most important restriction is that extraction is not allowed in areas along the coast where the water depth is less than 20 meters, both for ecological as for coastal defence reasons. Therefore, landwards of the established NAP -20 m depth contour sand extraction is not allowed, except for some specific reasons, e.g. maintenance dredging. The established contour is given in coordinates and is a simplification of the real depth contour line. NAP is the Dutch Ordnance Level and close to mean sea level.

Large scale and deep extractions are a great challenge for the managing authorities due to the ecological and morphological effects these may introduce. Due to the license procedures set out for large-scale extractions an EIA is required.

Some criteria for the extraction are given by the policy documents (e.g. The Integrated Management Plan for the North Sea 2015. (IDON, 2005). After large-scale extraction the sediments of the new seabed should not differ too much from the original sediments. The design of the pit must be so that the water exchange near the bottom of the pit is enough to be sure that there will be no oxygen depletion. This will allow the benthic fauna to recover. Besides minimizing the effects on the ecosystem, there should be minimal influence on other uses of the sea.

4. Environmental impact assessment

For the coastal area, the enlargement of the Rotterdam harbour is a large intervention. The consequences of the reclamation and the sand extraction for nature and other activities at sea are described in detail in the EIA. For this EIA much research is done or earlier research results are re-examined (Van Dalfsen, 1999; Boers, 2005).

The EIA procedure begins with a starting document in which the planned activity is described. This document is published. From the public views on this document and the official advice for guidelines from the independent Committee for Environmental Impact Assessments, the authorities that are responsible for the permits, in this case the national government, makes guidelines for an EIA. They also use the ICES guidelines.

For the Maasvlakte 2 project, an EIA is made of more than 6000 pages, describing all the effects of the project. From effects of sand extraction from the seabed to effects on traffic by the time the area will be in use (figure 4; (Maasvlakte 2, 2008)



Figure 4. Environmental Impact Assessment Maasvlakte 2.

For sand extraction the following themes are taken into account:

- Coast and Sea: morphology, geology, coastal defence, currents, nautical effects, etc.

- Nature and Environment: primary production, benthic fauna, fish, birds, marine mammals, archaeological values, nature areas, emissions, energy, etc.
- Other uses: fishery, pipelines, cables, small-scale sand extraction, etc.

In this EIA a choice is made for alternatives that minimize the effects. The EIA is also published for public consultation. During spring 2007, there was the opportunity to give reactions on the EIA via a public consultation exercise. The results of this consultation and the advice of the independent Committee for Environmental Impact Assessments on the EIA itself are then incorporated in the licenses for the reclamation and for the extraction of the sand from the seabed.

5. License for sand extraction

Licenses for sand extraction are given by Rijkswaterstaat North Sea, as part of the Ministry of Transport, Public Works and Water Management in the Netherlands, on the basis of the Extraction Law (1997) and the Spatial Planning Policy Document (2006). The consequences of these documents for sand extraction from the seabed are described in the Integrated Management Plan for the North Sea 2015 (2005). The concept license was published for public consultation in January 2008. In April 2008, the definite licenses were permitted.

The license for sand extraction was focused on demands on location of the extraction area, sand quality, designs of the sandpit, intensity of dredging, technique of dredging and monitoring and evaluation.

Figure 5 shows the area of which sand extraction for Maasvlakte 2 is allowed. This area is on both sides of the Euro/Maas channel, The approaching channel to Rotterdam harbour. From this area of 60 km² only 15 km² is needed for the actual extraction.

Within the allowed area south of the Euro/Maaschannel, a subarea is appointed where sand extraction is not allowed due to a high percentage of mud. When the sand is extracted from areas where the seabed contain little mud the effects of the overflow on the ecology of the coastal zone, like primary production, eye catching fish, birds and benthic fauna (and the fauna that eat them), are limited. Therefore, areas that contain too much mud or even clay layers are excluded from extraction, as is the case in this subarea. To limit the yearly amount of overflow the intensity of the extraction is limited to 150 million m³ per year.

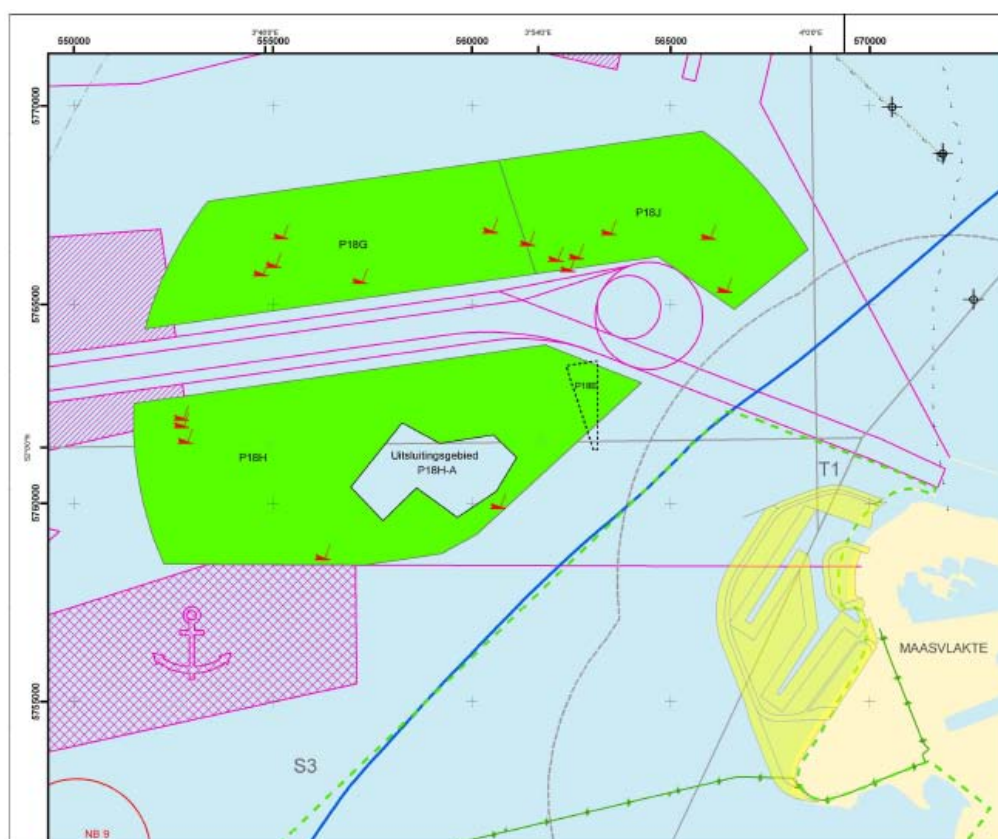


Figure 5. Sand extraction area.

West of 'Maasvlakte' the new harbour area Maasvlakte 2 is shown. Northwest of Maasvlakte 2 are the extraction areas north (P18P/P18J) and south (P18H) of the approaching channel to the harbour. In the southern part the subarea where extraction is not allowed is indicated as P18H-A. Extraction is planned in the east of P18H and in P18J. The Nature 200 area Voordelta is indicated by the dotted green line.

Most of the sand will be extracted from the area south of the Euro/Maas channel. In principle, the extraction starts in the eastern part and extended westwards. North of the channel, sand will be extracted from an area where at a depth of about 8 meters coarser sand is present suitable for extraction later on for industrial use, e.g. concrete.

The direct elimination of benthic fauna can be decreased by the construction of extraction pits deeper than the usual depths of 2 meters beneath the seabed. A larger extraction depth leads to less disruption by the hopper dredgers. The extraction pits will have a depth between 10 to 20 metres below the original seabed.

The pit must be designed with slopes of less than 1:7. This enables the oxygen rich seawater to reach the bottom of the pit and for the benthic fauna to re-colonize within a few years.

Regarding dredging equipment used the EIA states that trailer suction hopper dredgers must undertake the extraction and not stationary dredgers. This is to avoid a very irregular new seabed. Furthermore, the overflow must enter the water system under the ship. Also, the dredging must be done in a way that allows the overflow to reach the seabed in the pit instead of outside the pit.

To avoid a further deepening of the pits the orientation of the pits should be not on a positive angle of 15–35° with the dominant tidal current.

The marine sand will be extracted in an area outside the established NAP -20 meter depth contour. Negative effects on the coastal defence are not expected from an extraction so far from the coast.

6. Monitoring

Monitoring and evaluation are required by the license to get an insight into the morphological and ecological effects of this large-scale of deep sand extraction. Also, it is necessary to check if the actual effects are within the range expected in the EIA.

An extensive monitoring programme is formulated in which the measurements, analyses and reporting are regulated. The monitoring is focused on:

Bathymetry

To determine the effects on currents and sand transport and to estimate the influence on other construction on the sea bed, it is necessary to know the morphological behaviour of the seabed during and after extraction. Therefore, the bathymetry of the sandpits and surroundings will be determined with echosounding with multibeam. This will take place once a year during the extraction. After the extraction is finished first once a year and later on once per 5 years till the seabed is comparable with the natural seabed.

Composition of seabed

To determine if the seabed composition is comparable with the composition before the extraction, the seabed will be sampled with boxcores for grain size analysis and mud content. During the extraction this will be done once per year around the pits. After the extraction once per year and later on once per 5 years in and around the pits until the seabed is comparable with the natural seabed.

Suspended matter

A measuring programme that combines satellite measurements and ship-born measurements will be carried out along a broad area along the west coast of the Netherlands.

The focus is on any increases of the amount of suspended matter due to sand extraction and on the patterns of suspended matter in the coastal area. The monitoring programme will also examine impacts on algae blossoms and benthic fauna, and from there on species higher in the food chain.

Benthic fauna

The influence of the extraction on benthic fauna in the vicinity of the pit and the recovery of the benthic fauna within the pits are studied by sampling in influenced areas and reference areas to determine biomass and species until total recovery is reached. It is expected that the benthic fauna will recover within 6 years.

Under water noise

The underwater noise of the process of sand extraction, transport and dumping will be measured. The results of these measurements will be compared with existing knowledge of the effects of underwater noise on marine mammals to check if the worst case assumption as used in the EIA is valid.

7. Final remarks

A sand extraction of this large-scale and this deep as for the Maasvlakte 2 project has never been carried out in the Dutch part of the North Sea. Therefore, the procedure around the formulation of the EIA, the license and the monitoring programme is executed with utmost carefulness.

From the beginning, the cooperation between Rijkswaterstaat North Sea as the authority for the licensing and Harbour Company Rotterdam as initiator of Maasvlakte 2 has been very close. Within this cooperation careful consideration was given to the different responsibilities of these parties.

In the EIA often a worst-case scenario is used to be sure that certain effects could be excluded or minimized by conditions in the license.

The parties has worked together to produce a well-defined formulation of the license and the compulsory realization and monitoring plans.

Also, due to the close and clearly structured working relationship, should any new information lead to possible changes in future or result in necessary deviations of these plans, the framework for such actions is well defined.

Although the cooperation between government and harbour companies has been intensive, the interest of nature organizations, NGO's and of other users of the sea was fully taken into account. The views on the EIA and the draft license from public consultations were used in the definitive formulation of the license. No appeals against the extraction license were brought forward.

Ngo's and other users of the sea will be regularly informed about the results of the monitoring of the effects of this large-scale sand extraction.

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Annex 11: OSPAR National Contact Points for Sand and Gravel Extraction

| LIST OF NATIONAL CONTACT POINTS FOR OSPAR REPORTING ON SAND AND GRAVEL EXTRACTION | |
|---|---|
| Belgium | <p>Ms Brigitte Lauwaert Management Unit of the North Sea Mathematical Models Gulledelle 100 B-1200 Brussels BELGIUM Tel: 00 32 2 773 2120 Fax: 00 32 2 770 6972 E-mail: B.Lauwaert@mumm.ac.be</p> |
| Denmark | <p>Poul Erik Nielsen Danish Forest and Nature Agency Haraldsgade 53 DK-2100 Copenhagen DENMARK Email: pen@sns.dk</p> |
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