REPORT OF THE WORKING GROUP ON
THE EFFECTS OF EXTRACTION OF MARINE SEDIMENTS ON FISHERIES

Keyworth, England, 3–6 May 1994

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1. INTRODUCTION

The Working Group was welcomed to BGS Headquarters in Keyworth by the Director, Dr Peter Cook.

The meeting was opened by the Chairman, Dr S J de Groot, who welcomed the participants.

The participants appointed Peter Bide as rapporteur.

The Terms of Reference of the Working Group (WGEXT) were confirmed (see (2) below). The agenda (Annex I) was adopted.

The Working Group welcomed the interest of the advisory Committee on the Marine Environment and noted that the primary ACMP contact person is Dr J Olafsson of the Marine Resource Institute, Reykjavik, Iceland and the secondary contact person is Dr (Ms) C Lima of the INIP, Lisbon, Portugal. Their names will be added to the mailing list for the Working Group.

Dr Michel Desprez informed the WGEXT that last year's report of the Group (ICES 1993/E:7) was, with permission of the General Secretary ICES, translated into French and published by GEMEL/IFREMER.
2. TERMS OF REFERENCE

The Terms of Reference of the Working Group on the Effects of Extraction of Marine Sediments on Fisheries as stated in ICES Cooperative Research Report 182 are given in Annex II.

The Working Group on the Effects of Extraction of Marine Sediments on Fisheries was requested to carry out the following tasks at a meeting in Keyworth, Nottingham, England from 3-6 May 1994 by ICES Council Resolution 2:22.

a) consider further the content of the environmental impact assessments which, according to the "Code of Practice for the Commercial Exploitation of Marine Minerals", may have to be carried out prior to the extraction of such deposits, with a view to producing guidelines for consideration at the 1994 ACME meeting;

b) review the results of the environmental impact assessments related to the marine aggregate extraction operations;

c) consider standards for marine geological surveying and sampling;

d) review developments in legal and administrative frameworks and procedures in accordance with ICES Cooperative Research Report No. 182;

e) review the status of marine aggregates extraction activities in ICES Member Countries and related environmental research;

f) compile and present marine extraction and dredging statistics for the period 1983 - 1993 including comparison with published statistics for capital and maintenance dredging;

g) review the development of seabed resource mapping in ICES Member Countries;

h) examine the scope for coordination of and correlation between geological and biological mapping.
3. REVIEW OF NATIONAL MARINE AGGREGATE EXTRACTION ACTIVITIES

The Working Group received the following reports of marine extraction activity.

3.1. Belgium

In 1993, 1,448,409 m³ of sand were extracted from zone 2 on the Belgian continental shelf. In zone 2 there are three sand banks: the Kwintebank, the Oost Dijck bank and the Buiten RateI. About 2/3 of the total quantity extracted comes from the Kwintebank.

Three new applications were made in 1993. The government asked for an environmental impact assessment. The report "Effets sur l'environement marin des extractions de sable et de gravier sur le plateau continental Belge" (Annex V) was made for that purpose. Three new licences were then granted. This means that there are now nine licences for the extraction of sand and gravel. This increasing demand for marine sand is related to the fact that it becomes more and more difficult to obtain a permit on land and to the fact that the quality of marine sand seems to be good enough for use in the construction industry.

3.2. Canada

At present there continues to be no active marine mining in the Canadian offshore, other than normal channel dredging and maintenance. However, two activities are noteworthy, and there is a movement within the federal government to revisit the possibility of marine mining in the near future. This is partially in response to the downturn in the offshore Canadian fishery and the virtual closure of the cod fishery, with associated losses in employment.

The Canadian Geological Survey of Canada is involved in a program called the "Canadian-Nova Scotia Cooperation Agreement on Mineral Development" commonly termed MDA-3, to conduct an assessment of the offshore aggregate potential of the Scotian Shelf and adjacent areas off Nova Scotia. Funded for three years, and under the direction of Gordon Fader of the Atlantic Geoscience Centre, it will conduct large and small vessel surveys to map and collect large volume samples of potential aggregate. The samples will be tested to determine their characteristics for a wide variety of asphalt and concrete applications.

A previously completed MDA, designed to assess the placer gold potential of the area off southern Nova Scotia was completed in 1992 and drew the following conclusions. Additional gold placer deposits and potential placer areas have been identified on the inner Scotian Shelf in new depositional environments. This suggests the lode deposits also occur on the inner shelf. These findings provide new models for the genesis of placer gold, defining the role of sea level and glaciation and will encourage exploration to be focused in these areas.

The discovery that auriferous till, the source of the beach gold placer deposits along the south coast of Nova Scotia, extends across the inner Scotian Shelf to the moraine complex approximately 60 km offshore, substantially increases the area for potential gold placers, to include zones between the present shoreline and moraines. A further refinement of
the area of potential occurrence is associated with the late Wisconsinan 
low sea level stand, determined to occur at a present depth of 
approximately 70 m. This is an important lower limit for the distribution 
of placers and aggregates.

Small localized deposits of sand have been found mostly in the nearshore or 
in shelf channels. Mining for aggregates in these areas may have the 
additional benefit of the presence of placer gold.

The recent collection and presentation of swath bathymetric data off 
Halifax demonstrated the great value of this type of detailed bathymetry to 
a study of placers and aggregates. Future exploration programs should 
try to collect this information in a first survey step.

In the nearshore, most lag gravels are very thin overlying subsurface 
tills. Beneath the lag, the till contains a high percentage of silt and 
clay particles, which suggests that through the removal of the lag through 
marine mining, these fine grained sediments may be exposed at the seabed: a 
possible negative environmental characteristic for the marine fishery. This 
information concerning the thinness of the lag gravels, could result in the 
development of new technologies for effective mining. Potential areas for 
the mining of lag gravels are more likely associated with areas of ripples 
formed in gravel, where the deposits are up to 0.5 m in thickness.

In the Province of Newfoundland, C-CORE is involved in an environmental 
assessment of a test placer gold mining project off the northeast coast of 
Newfoundland. This project involves various industry and government 
departments and will be conducted during the summer of 1994 with continued 
monitoring for the following two years.

Two very large megaprojects are under way in eastern Canada which will 
dredge areas of the seabed in a similar fashion to seabed mining projects. 
These are the Fixed Link to Prince Edward Island, and the Hibernia Oilfield 
development on the Grand Banks of Newfoundland. They are both employing 
large numbers and will continue for the next three to five years. For the 
Fixed Link bridge to Prince Edward Island, concrete caissons will be placed 
on bedrock at the seabed, after removal of surficial sediment and the 
emplacement of suitable foundation materials. Each will be filled with 
ballast when in place. Although materials have been identified on the 
seabed that could be used as backfill, marine sediments are not planned to 
be used.

3.3. Denmark

The extraction of marine sand and gravel represent 10-13% of the total 
production of materials for construction and reclamation. The amount of 
materials dredged for construction has been more or less stable over the 
last 5 years due to the very low house building activity.

The dredging of sand fill for land reclamation has increased markedly over 
the last 10 years due to several large construction works in coastal areas.

In the last 4 years more than 9 m. m$^3$ of sand fill and till have been 
dredged for the construction of the Great Belt bridge and tunnel project.
About 3 m. m$^3$ of sand have been dredged for beach nourishment each year.

No detailed forecast for the future extraction has been prepared but it is expected that the exploitation of marine sand and gravel will increase at the expense of land materials. This is mainly based on the future termination of a number of permissions on land and increasing environmental conflicts in potential excavation areas on land.

In 1995-1998 4-6 m. m$^3$ sand fill is expected to be dredged in connection with the construction of the fixed link in The Sound between Denmark and Sweden.

3.4. Finland

No new information since 1991.

3.5. France

Approximately 5 million tonnes per annum of spoil is dredged from six harbours along the French Channel coast and dumped at licensed sites off Caen-Ouistreham, Grandcamp, Maisy, Rouen, Le Havre, Dieppe, le Tréport and Boulogne. More than half of the total tonnage comes from the navigation channel of the Seine estuary.

In recent years, requests have multiplied for the exploitation of marine aggregate resources offshore from the Seine and Loire mouths. This increase is not only due to the wish significantly to reduce the extraction from land-based alluvial deposits, but also to be able to meet sustained demand. Currently about 600,000 t/y of marine aggregates are extracted from the Seine Bay, but the predicted figure for the year 2000 is 7 million tonnes.

Such requests for exploitation concern areas where the ecological equilibrium has already been disturbed through direct or indirect discharges of pollutants into the sea. The impact of such extraction today is not fully known. As part of the common interest, the authorities must ensure that an equilibrium is maintained between aggregate extraction from the sea bottom and all other economic activities, including the fishing industry, which is becoming concerned about the increasing scarcity of fish stocks.

In 1994 BRGM committed itself, as part of a multidisciplinary effort that intimately involved local technical and scientific staff of the Seine Bay area, to design a GIS that should provide the necessary knowledge and

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<table>
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<tr>
<th>YEAR</th>
<th>SAND 0-2mm</th>
<th>GRAVEL 0-2mm</th>
<th>GRAVEL/STONES 6-300mm</th>
<th>SANFILL</th>
<th>MISC (T/yr)</th>
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<td>1990</td>
<td>1.0 m$^3$</td>
<td>0.2 m$^3$</td>
<td>0.6 m$^3$</td>
<td>3.9 m$^3$</td>
<td>0.1 m$^3$</td>
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<tr>
<td>1991</td>
<td>1.1 m$^3$</td>
<td>0.5 m$^3$</td>
<td>0.9 m$^3$</td>
<td>4.4 m$^3$</td>
<td>1.0 m$^3$</td>
</tr>
<tr>
<td>1992</td>
<td>0.7 m$^3$</td>
<td>0.5 m$^3$</td>
<td>0.9 m$^3$</td>
<td>1.2 m$^3$</td>
<td>0.6 m$^3$</td>
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<tr>
<td>*1993</td>
<td>0.6 m$^3$</td>
<td>0.1 m$^3$</td>
<td>0.9 m$^3$</td>
<td>1.4 m$^3$</td>
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* The figures from 1993 cover only 9 months.
documents for managing user conflicts along this (densely settled) part of the French coastline. The work includes the collecting of available data on marine aggregate resources, on the volume, quality and spatial distribution of such aggregates, and of all data that conflict with or hinder such exploration. Among the last are fishing, oyster and mussel farming, shipping routes, port facilities and their access and military areas. Another point to be studied was whether such work would disturb spawning areas or benthic flora and fauna.

Once completed the authorities will have a tool that will enable the management of so-called "least-constraint" exploitation areas, using known and validated data. However, such information needs to be further developed in the areas of interest, so as to define the exploitable deposits and to rank them on the basis of their qualities and constraints. Such complimentary work will be carried out in a later phase.

3.6. Germany

Dredging statistics:

The sediment extraction activities in the FRG consisted mainly of dredging operations of harbours and ship lanes for navigational purposes.

In the past decade total dredging volume in the Baltic Sea has been between 10,000 and 95,000 m$^3$ per year. Due to the increasing problem of disposal of dredged material in the sea the annual quantity has decreased considerably in the past years (1993: 4,000 m$^3$).

From 1980 to 1988 an average of 14,000,000 m$^3$ has been dredged annually in the Elbe estuary, and an annual average of 8,000,000 m$^3$ in the Kiel Canal.

Planned operations are:

- sand extraction near the island of Sylt, North Sea;
- sediment extraction in the Southern Baltic ("Adlergund");
- Europipe in the Wadden Sea, North Sea;
- there are a large number of projects in planning, including harbours, tourism facilities and shipbuilding works along the coast of the (former east german) state of Mecklenburg-Vorpommern.

3.7. Netherlands

The amount of sand extraction is given for the three main sources:

- Euro-Maas Channel: 1,061,642 m$^3$
- IJ-Channel: 2,838,501 m$^3$
- Dutch Continental Shelf: 8,986,306 m$^3$

Total: 12,886,449 m$^3$

In the navigation channels a combination is made between maintenance dredging and a type of capital dredging. This capital dredging is the so called "over-dimensioning", e.g. broadening and deepening of navigation channels. It is also a sort of forward maintenance.
The main use of the sea sand is in the beach nourishment programme. About 8.8 million m\(^3\) was used in 1993. The rest, 4 million m\(^3\), is used for land fill, burial of oil\gas pipelines and construction (concrete).

Gravel

In 1993 no extraction took place in the Dutch part of the North Sea.

Shells

In 1993 no extraction took place in the Dutch part of the North Sea.

3.8. Norway

Traditionally, sources of aggregate for the construction industry have been based on land based gravel pits and hard rock quarries. In Norway marine extraction of sand and gravel has been in modest quantities. The total amount of marine aggregates has never exceeded 1% of the volume of aggregates produced.

The annual demand for aggregates in Norway is about 52 million tonnes. This corresponds to c. 13.4 tonnes/inhabitant, of which 5.9 tonnes is sand/gravel and the remaining is hard rock aggregate. Approximately 46% of the consumption goes to road construction, 20% to concrete and the remainder to other uses. The export of aggregates in 1992 was c. 7 million tonnes within Europe.

The Norwegian Geological Survey (NGU) has mapped all sand and gravel resources in Norway. About 9,000 sand and gravel deposits are registered, with a total volume of about 12 billion m\(^3\). Although there is an abundance of aggregates in Norway, in many areas there is a shortage of building materials, especially in the coastal areas. However there is no tradition of extracting building material from the sea.

In 1983 the first national standard for building materials was established. After that, the use of marine aggregates declined, for many reasons, but especially due to salt problems.

Carbonate sand is used for different purposes, but the main use is as a fertilizer, and about 40% of the total amount is extracted from the sea. Between 100,000 and 150,000 tons are extracted each year, and it is an important industry in parts of Norway, especially in the south-west.

There are conflicts associated with marine resource extraction, but very little research has been done on the topic in Norway. The extraction is done by anchor dredging with different types of grabs, so that only small areas are affected. The license management was delegated by the Department of Industry to the different counties about one year ago. This means that NGU may be given the job of mapping the carbonate sand resources. Local authorities have contacted biologists to examine the effects on the natural environment in the extraction areas.

3.9. Sweden

Extraction of marine aggregate in Sweden has ceased as a consequence of including the in 1992 ongoing extraction seabed area at Västia Haken within
a newly created marine nature reserve on the southern Falsterbo peninsula. No other extraction areas were licensed during 1993 and no new applications of marine sand extraction has been made to the Swedish Government.

Large dredging operations are planned in 1994-98 from both the Danish and Swedish sides in the Sound to compensate the influence of the planned link between Denmark and Sweden on the water exchange between the Baltic Sea and the Kattegatt Sea. The Swedish Government has stated that a "zero-solution" of the water exchange has to be fulfilled by the company building the bridge-tunnel connection. During the last months the planned dredging operations has mainly been focused on the spill of sediments during the operation and its influence on the bottom fauna and flora. Of a total 6.8 m.m$^3$ which is to be dredged 5.4 m.m$^3$ will be dredged on the Danish side and 1.7 m.m$^3$ on the Swedish side. The total spill is accounted to 0.31 m.m$^3$, which corresponds to an average 5% of the total dredged volume. The spill is estimated to vary between 1% and 17%.

3.10. United Kingdom

Maximum extraction 23.7 million tonnes in 1989, production has fallen consistently since then 19.3 million tonnes in 1992 and 17.9 million tonnes in 1993.

10 - 11 million tonnes was used by the construction industry mainly for concrete. 1-2 million tonnes was used for Beach Recharge/Land Reclamation and about 6 million tonnes went for export primarily to the Netherlands and Belgium with similar quantities to France and Germany.

Marine Aggregate supplies about 7% of the total aggregate requirement in Great Britain but the main areas of use are concentrated in the South East principally London and the Thames Estuary and the southwest. Marine sand mixed with crushed rock accounts for about 80% of the South Wales concreting market.

There was no calcareous seaweed and a very limited quantity of waste coal extracted in 1993. Very small quantities of marine sand and gravel from non Crown land.

All extraction licences are checked for their impact on adjacent coastlines. Aspects covered include beach drawdown, interruption of littoral drift and wave energy reaching the coast. A licence will only be issued if the studies show zero impact.

In addition to the individual licence investigations regional studies looking at the effects on the coastline of blocks of dredging licences have also been undertaken off the South East of England.

The recovery of an experimental dredging plot off the North Norfolk coast has been studied for the past three years. The physical recovery of the seabed and animal communities has been closely monitored since the site was dredged in April 1992. A more detailed description of the study is given in Annex VI.

The Crown Estate and the local coast protection authorities jointly funded a study into the sediment mobility on the South Coast of England to the east of the Isle of Wight. The study looked at the sediment types from the
shoreline out to the 50 metre depth contour. Wave and current data was also collected from the same area using field studies and historical records. By combining the sediment and current data maps were produced showing the number of hours sediment would be mobile each year and the direction of movement.

MAFF have undertaken a number of surveys of individual dredging areas principally to study changes in the bathymetry and side scan sonar surveys of dredging tracks and towed fishing gear.

Research is being undertaken by the Construction Industry Research and Information Association (CIRIA) (see 4.11 and Annex VII) funded by a wide variety of organisations into the future requirement for beach nourishment material and potential sources of such material in the inshore zone (out to 50 metres water depths).

The Department of the Environment is proposing to commission a number of regional studies looking at the Environmental Impact of marine aggregate extraction. A study in the Bristol Channel is planned to start in 1994 and other regional studies will follow as time and funds permit.

3.11. United States of America

In the northern Atlantic waters of the U.S., marine sands and gravel are being extracted for three purposes. These are:
(a) construction aggregate, (b) beach nourishment, and (c) for use in capping (or covering) contaminated dredge sediments disposed in open water.

As in past years, only one commercial company is engaged in marine extraction of construction aggregate. This company operates in New York metropolitan area. They have been allowed to remove sand from an authorized navigation channel in New York Harbour (the Ambrose Channel) and to over-deepen the channel to a depth of 67 feet. In 1993, they removed about 1.9 million cubic yards of sand for construction aggregate from the channel although some of this material had to be mixed with crushed rock from quarries to provide a suitable product. This operation continues to be viable because of the combination of a large regional market, a source of accessible marine aggregate and a nearby shore processing facility.

Associated with this operation, the company has been monitoring levels of dissolved oxygen at the site once a week while dredging continues. Monitoring was undertaken principally to address the concern that deepening of the channel, perhaps irregularly, may enhance the isolation of bottom water and depress levels of dissolved oxygen.

If levels of dissolved oxygen were to fall below 5 mg/litre, daily observations would be made and, if it fell below 3 mg/litre, the operation may be interrupted. Levels of dissolved oxygen have remained about 5 mg/litre and no anomalously low values were detected.

Sand mined from the navigation channel was also used to cap, or cover, contaminated dredged sediment at an open-water disposal site on the Atlantic shelf outside of New York Harbour. In 1993, about 500,000 cubic yards of dredged silt and clay containing dioxin were dredged from the Port of New York and New Jersey and placed at an ocean disposal site. This was covered by about 2.2 million cubic yards of sand to provide a blanket of sand 3-feet thick over the entire deposit.
Winter storms of 1992–93 caused severe beach erosion along the U.S. Atlantic coast and several large beach nourishment projects have been undertaken. Preliminary estimates to date place the volume of marine sand involved with these projects in excess of 2 million cubic yards.
4. OVERVIEW OF NATIONAL SEABED SEDIMENT MAPPING PROGRAMMES

4.1. Belgium
No new information is available.

4.2. Canada
Marine mapping remains the responsibility of the Geological Survey of Canada and the projects are continuing on both the Atlantic and Pacific coasts. Surveys are conducted on the nearshore and on the continental shelf and slope. With the Province of Nova Scotia the Atlantic Geoscience Centre has begun an assessment of the aggregate potential of the Scotian Shelf and the adjacent areas.

Vast quantities of aggregate are suspected to occur on the shallow offshore banks and other areas of the inner, central and outer Scotian Shelf, but little subsurface information exists on the characteristics of the deposits. Additionally, their suitability for varied industrial uses is largely unknown. This study will survey, map, describe and identify areas with potential for aggregate mining and will determine the processes that have developed the deposits. It will include an assessment of the marine habitat and possible effects of marine mining.

A new development in studies of the seabed off Canada is the collection of shallow water swath bathymetric data and its presentation in shadowgramme format with the Canadian Hydrographic Service. Using both sweep and swath mapping systems, these new maps have provided an enhanced insight into shallow water seabed sediments and structures. Resolution in the vertical is in decimeters and the horizontal in metres. Reflectance data is also collected and maps of calibrated seabed hardness ( lithology) are being produced. It is hoped that the collection of this information will be expanded across the southern continental shelf.

For the marine geologist who has traditionally collected and interpreted seismic reflection data, sidescan sonar and sample data, the swath bathymetry is a major development in the interpretation of seabed geology and processes. However, there still remains the need for the collection of the traditional data sets in order to properly interpret the swath images.

4.3. Denmark
A map of the surface sediments in the Danish part of the Sound at a scale of 1:100,000 was published in 1990.


A detailed map of the Flensborg Fjord area will be published during 1994 by the Geological Survey of Denmark.

Some of the most important stone reefs in Danish waters have been mapped.

The systematic reconnaissance resource mapping continues and is concentrated in The North Sea and The Baltic. Since 1991 mapping programs have been carried out on Jutland Bank and Horns Reef in The North Sea and in Fehmarn Belt, Adler Ground, Rønne Bank and Kriegers Flak in The Baltic. Maps at a scale of 1:100,000 of surface sediments, Quaternary geology and sand and gravel resources have been prepared. At present, between 80% and 90% of potential resource areas in the Inner Danish Waters have been mapped.

Detailed resource mapping programmes have been carried out in some regional extraction areas with materials of high quality and in areas licensed for bridge and tunnel projects.

4.4. Finland

No new information since 1991.

4.5. France

The implementation of side scan sonar within the framework of the environmental monitoring of the Penly nuclear power plant and that of IFREMER programs, has enabled superficial underwater units along the coastal strip 5 to 6 km wide between Dieppe and Le Tréport to be mapped.

This five colour map with a scale of 1:20 000 shows both detailed sea floor morphology as isobath curves 1 meter apart, and the type and distribution of different sedimentary units. Extensions of coastal chalk are identified, as well as pebbles, gravels, predominating medium sand and fine silted sands along the coastline.

Transport shapes (sand ribbons) predominate in the bedforms observed, with few accumulation shapes (sand waves).

The many man-made underwater structures and traces left by machines indicate the region's maritime activities.

4.6. Germany

No information available

4.7. Ireland

1) Irish Sea and South Coast as far West as 8° meridian has been completed and published in cooperation with B.G.S on a scale of 1:250 000.

2) South Coast area between 8° and 10° W is in progress and 60% complete.
3) Galway Bay area chart is compiled on a scale of 1:250,000 and due to be published this year. (It will probably be of little significance as resource mapping as there is no shortage of aggregate in the area.)

4) An area in the Waterford estuary on the South-East coast was mapped intensively using Boomer, Sidescan Sonar, and RoxAnn. This area is being considered as a licensed dredging area.

4.8. Netherlands

Geological Survey of the Netherlands Regional mapping programme:

Three mapping programmes are carried out in the Dutch sector of the North Sea:

1) 1:1,000,000

As a 'spin off' from the regional mapping programmes several maps of the entire Dutch sector of the North Sea are made and digitally (Arc Info) available:

A) The seabed sediment map of the entire Dutch sector in three sheets:
   -- The grainsize distribution of the sand fraction (63-125 micron; 125-250 micron; 250-500 micron and 500-2000 micron).
   -- The mud content (<10%; 10-50%; 50-90% and 90-100%).
   -- The superficial formations.

B) The lithostratigraphy of the top of the Pleistocene formations.

C) A contour map of the depth of the top Pleistocene.

2) 1:250,000

All seabed sediment maps between 51° - 56° N and 2° - 4° E, which are made in close cooperation with BGS, are available. The seabed sediment map of the Oyster Ground sheet (54° - 55°N/4° - 6°E) is digitally (Arc Info) available, but not yet printed. On this map a small scale map will be presented to show the concentration of heavy metals in the seabed sediments. The sampling for the Terschellingbank sheet (53° - 54°N/4° - 6°E) has been finished and the samples are being analyzed.

3) 1:100,000

Detailed geological maps of the coastal area are produced at a scale of 1:100,000. The maps are printed on both sides. One side shows the lithology of the first and second metres of the sea bed: grainsize, mud content, gravel content, intercalations of clay and silt and calcium carbonate content. The other side shows the geological formations in a fence diagram and the related maps with subcrops of the top of the Pleistocene and older formations.

The first map which is available is sheet Rabsbank (51° 20' - 51° 40'N and
Applied geological research in 1993/94

For the nourishment of several beaches which are exposed to severe erosion several offshore areas were investigated in order to determine the quantity and quality of the sediments. Extraction is allowed to take place seaward of the 20 m isobath or at least 20 kilometres from the coast. At some locations near shore studies were made for the construction of dump pits for dredged mud from the harbour of Rotterdam. The sand from the pits will be used for beach nourishment.

Besides investigations for sand for beach nourishment a study has been made along the entire Dutch coast from about the 5 m line to 50 km offshore in order to determine sand resources for the concrete industry in this area. Two maps have been compiled of this area. Both maps are digitally available (Arc Info) in colour and at scales of 1:750,000 and smaller.

Reports:


Research has been carried out in the framework of studies of the presence of exploitable amounts of shells in the upper two metres of the sea bed along the 20 metres isobath.

Reports:

4.9. Norway

During the last four years, a mapping program of bedrock and quaternary sediments in Skagerrak has taken place. NGU has collected 20,000 km of shallow seismic profiles, not specifically for sea bed resource mapping, but the data gives a good overview for further resource mapping (sand and gravel). The program will finish by the end of 1995.

**Sand and gravel mapping**

No systematic or detailed mapping of marine sand and gravel resources has been done along the coast of Norway.

**Carbonate sand mapping**

Carbonate sand extraction is an important industry in parts of coastal Norway, and is confined to a narrow zone along the western coast of Norway. About 90% goes direct to agricultural purposes, but there are also three carbonate sand "refineries", where the sand is dried, sieved and packed. Carbonate sand mapping is carried out in several counties where extraction is taking place. Mapping is being carried out by NGU in these counties where NGU has financial support. Up to now mapping has been done in one county by the University of Bergen, three counties by NGU, and during 1994/95 the most important "carbonate sand county" will be mapped (Hordaland). By then, five of the seven important carbonate sand counties will have been mapped.

4.10. Sweden

The ongoing seabed mapping programme of the Swedish Continental Shelf Area at a scale of 1:100,000 finished the work in the Kattegatt area in 1992. Two of three planned maps of this area have been published up to 1994. From 1993 the mapping continued with the Swedish area of the south-western part of the Baltic proper between the southern part of the Sound and Bonshalm island. This work will be ended in 1994. From 1995 the mapping will continue over the next five year period along the Swedish east coast from the southern Stockholm area and southwards to Öland island. The mapping programme is based on a digital system covering data collection, processing, interpretation, presentation and final making of originals for printing. The maps show the distribution of the topmost sediments of the seabed as well as the stratigraphy down to the bedrock. The data is based on hydroacoustic profiling, coring and surface sampling. In addition to the mapping programme an environmental programme dealing with the contaminants of the recent sediments is also in progress. About 40 chemical elements are analysed as well as organic contaminants such as PAH, pesticides, PCBs and extractable organic chlorides and bromides.

4.11. United Kingdom

The systematic reconnaissance geological survey of the UK Continental Shelf...
by the British Geological Survey (BGS) which began in 1969 was completed in 1992. The 1:250,000 scale maps form a series totalling 342 sheets. Summary maps at the 1:1,000,000 scale are also available.

A series of offshore regional geological reports accompanying the map series and currently six reports covering the Moray Firth, Southern North Sea, Western English Channel, English Channel, Hebrides – West Shetland Shelf and Malin – Hebrides are published. The series, which will comprise 10 reports, is to be completed shortly.

The current status, with publication dates, of the Marine Aggregate Resources programme (mainly funded by the Department of the Environment and the Crown Estate) is outlined below:

<table>
<thead>
<tr>
<th>Desk Studies (available from the Crown Estate)</th>
<th>Resource Surveys (available from BGS)</th>
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<tbody>
<tr>
<td>Southern North Sea 1986</td>
<td>Great Yarmouth – Southwold 1988</td>
</tr>
<tr>
<td>South Coast 1988</td>
<td>Isle of Wight – Beachy Head 1989</td>
</tr>
<tr>
<td>East Coast 1990</td>
<td>Humber 1992</td>
</tr>
<tr>
<td>Irish Sea 1992</td>
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</table>

BGS (in partnership with HR Walingford and Posford Duvivier) are currently undertaking a desk study for the Construction Industries Research and Information Association (CIRIA) into the resources of, and the demand for, materials suitable for beach recharge in England and Wales. Further details are given in Annex VII.

4.12. United States of America

It does not appear that any new maps of interest to this working group have been published. The U.S. Minerals Management Service has published a series of maps showing the distribution of sand and gravel resources on land in the New England states, but these do not include offshore areas. The U.S. Geological Survey has been conducting an extensive mapping project in Boston Harbour and Massachusetts Bay; these are being conducted principally in connection with studies of environmental quality and rely on acoustic (side-scan and sub-bottom) surveys. The U.S. Geological Survey is also involved with acoustic surveys on Georges Bank.
5. REVIEW OF DEVELOPMENTS IN LEGAL AND ADMINISTRATIVE FRAMEWORKS

5.1. Belgium

One of the conclusions of the report mentioned under (3) above is the request of the Ministry of the Environment (Management Unit of the North Sea Mathematical Models = MUMM) to install a black-box on board of all extraction vessels. The installation of a black-box has two objectives: (1) a control of the licence requirements; and (2) obtaining the exact coordinates of the extraction site and time/duration of dredging.

The new permits which were granted by Ministerial Decree mention that a black-box should be installed. The renewals of the existing permits - which were granted in 1993 for most of the private firms for another 10 years - have the same condition. The specification for the black-box will be described in a Royal decree which is in preparation. This law is expected to come into force at the beginning of 1995.

5.2. Denmark

A new Raw Materials Act has been adopted in 1991. Dredging in EC bird protection areas will be forbidden from June 1994 except in a few areas where dredging will be terminated in 2 - 10 years. Existing dredging locations landwards of the 6 m isobath will be evaluated in 1995 and in the remaining areas in deeper waters during 1995 - 1996. An environmental assessment will be carried out in all areas.

All dredging locations are subjected to a Government View procedure which includes public and private involvement. Dredging projects exceeding 250,000 m³ are subjected to special procedures.

The National Forest and Nature Agency is responsible for the mapping of sand and gravel in Danish waters. Since 1990 the Geological Survey of Denmark has carried out the mapping projects.

5.3. Finland

No new information since 1991.

5.4. France

Because of the exhaustion of authorized continental granulate reserves planned for 2000 in upper Normandy, the important marine shelf reserves should soon be authorized for extraction. Two single sites (Dieppe and Le Havre) are presently exploited, but account for only 3.4% of the total production. Several licences are waiting this authorization in the Baie de Seine, generating concern amongst fishermen.

An interregional commission of dialogue for the management of the Baie de Seine has recently been established with two main objectives:

- simplify the present legislation,
- control the environmental impact of this new activity.

This commission created two working groups, one on marine environment
quality, the other on marine resources. The main objectives of the marine resources W.G. are:

- to consider conditions of compatibility between marine aggregates dredging and fishing activity,
- to make technical and regulation proposals in order to allow this compatibility in the best conditions.

The working scheme was adopted with reference to the developing ICES guidelines for the environmental impact assessment of marine aggregates dredging activity:

1. Information requirements

1.1. Nature of the deposits (BRGM)

1.2. Biological environment
   - benthic fauna (GEMEL)
   - fish and shellfish resources (IFREMER)

1.3. Interference with other legitimate uses of the sea
   - fishing activities (IFREMER, Affaires Maritimes, fishermen)
   - navigation (Le Havre and Rouen harbours)
   - military zones

2. Environmental Impact Assessment

2.1. Dredging techniques and monitoring (IFREMER, GEMEL, dredging companies)

2.2. Impact of dredging activities
   - on benthos (GEMEL)
   - on fisheries (IFREMER, GEMEL)

2.3. Compensation measures (IFREMER, GEMEL)

3. Use scheme for aggregates resources

3.1. Location of authorized extraction areas: GIS (BRGM)

3.2. Experimental extraction site with monitoring of dredging activities and environmental impact (IFREMER, GEMEL)

3.3. Proposals for an extraction and monitoring programme, including compensation measures.

5.5. Netherlands

Introduction:
In the Netherlands, the Ministry of Finance are owners of the seabed of the Dutch continental shelf.
Rijkswaterstaat, North Sea Directorate is responsible for issuing licences to extract sand, gravel and shells. Beside licences for dredging of sand for beach nourishment, Rijkswaterstaat, North Sea Directorate, also gives production licences.

Due to the fundamental conditions of the policy for extraction, as written down in the (RON/EIA), each licence relates to standard conditions and to the total amount of material which can be extracted in a certain area of the seabed.

Because of a lot of complaints about dredging vessels working out of their permitted area, Rijkswaterstaat, North Sea Directorate, has identified the need to introduce an appropriate form of Ship Registration System.

By means of such a system, Rijkswaterstaat can properly monitor and control the conditions of the licence.

**General Requirements:**

* Data logging (continuous record of the position at any time)
  - Name of ship
  - Number of the licence
  - Extraction area/boundaries
  - Extraction quantity

* Dredging condition by means of status information of:
  - Engine on/off
  - Pump on/off
  - Pipe in front of hole y/n
  - Depth of the suction head
  - Etc.

* The system must be tamper proof:
  - No errors during logging processes
  - No simulated tracks
  - No tampering with wires etc.

* Internal power-supply (by dead-vessel condition)

* Memory capacity of 60 days (200Kb)
  - By intervals every 5 min.

**Technical requirements of the system:**

* Time
* Positioning by internal GPS receiver
* Adjustment of registration-intervals
* 8 Status signals
* Moment of current failure
* Alarm condition: which cable and when short circuited
* Water protection
* Salt water - resistant
* Easily changeable unit
* Only accessible by controller/technician with a special key
* Data storage to be transferred onshore within about 1 month
* Option for telemetric communication

**Procedure for implementation:**

Because of the Dutch Policy to promote sea sand extraction above land extraction, Rijkswaterstaat, North Sea Directorate, intends to install 5 black-boxes on operational dredgers in May 1994.

In the future (by the year 2000) every applicant for a licence will have to install such a system at their own expense.

**Equipment compatibility and standardization:**

Arrangements have to be made in cases where vessels are working on Continental Shelves of other countries where different administrative arrangements apply. Discussion about this should be initiated as soon as possible.

5.6. United Kingdom

Licences for marine sand and gravel extraction are issued by the Crown Estate Commissioners following receipt of a positive Government View from the Department of the Environment (ICES COOP RES REP 182). The British Government has been conducting a comprehensive review of the present arrangements for the licensing of marine minerals dredging. A public consultation paper on the review of the licensing arrangements was issued in April 1994. This consultation seeks views on a number of options for licensing marine minerals dredging. The Executive Summary from the consultation paper is at Annex VIII.

The Department of the Environment issues guidance to planning authorities on the provision of aggregate materials for construction requirements in England. New guidelines for the period to 2006 were issued in April 1994 (Minerals Planning Guidance Note 6 (MPG 6): Aggregates Provision in England). These guidelines provide advice on the level of provision of all aggregate materials including marine dredged sand and gravel required at a regional and national level to meet anticipated construction demands.

5.8. United States of America

There would seem to have been no new development in legal or administrative frameworks of interest to this working group. The State of New York is continuing to develop a leasing program for the mining of marine sands and gravels. The State has applied for the necessary environmental permits, but the final protocols are still under discussion. The potential for shore erosion is a principal concern.
The regulatory process has begun to consider expanding the mining of aggregate in New York and New Jersey waters to include other navigation channels. As mentioned earlier, this is a viable industry and projections of future needs for capping material (to isolate and contain contaminated dredged sediment) are favourable for its expansion. The principal concerns being discussed are the impacts of altering the channels on the regional fisheries, especially recreational fisheries.
6. REVIEW OF RESULTS OF ENVIRONMENTAL IMPACT ASSESSMENTS RELATED TO MARINE AGGREGATE EXTRACTION OPERATIONS

6.1. Belgium

A summary of the impact studies which are mentioned in the report referred to in (3.1) above and Annex V is given here.

1. Morphological and sedimentological impact

   (i) The bank volume:

   The average yearly trend of the bank top volume shows that there is an influence on the top volume and on the morphological stability of the zone. The total bank volume however is more or less stable.

   (ii) The natural sand supply:

   Residual sand supply for the channels arrives through the bank flanks towards the top of the bank. This mechanism is responsible for the recovery and the existence of the bank. But this mechanism also calls into question where the sand comes from and the possible morphological evolution of the source site(s). This may have implications for the problem of the cause of the intense erosion of the Belgian beach which has been taking place for some time. But at present there is no evidence to link the two phenomena. The issue is under study.

   (iii) Changes in surface sediments:

   In general sediment is becoming slightly coarser.

2. Impact on fisheries

   A general conclusion is that a distinction should be made between direct consequences and long term influences. The yearly reports of the State Fisheries Station did not mention direct negative effects.

   For demersal fish, no clear differences from reference zones were observed.

   Epibenthos data is available from 1985. There is an indication of decreasing numbers of species, abundance and biomass for zone 2 compared to reference zones.

3. Ecological impact

   - Ecological modelling

   The normal evolution of dissolved organic nitrogen, phytoplankton and zooplankton is not being significantly changed by sand extraction. Some amplitude distortions have been observed caused by higher turbidity.
Modelling of the erosion energy

Simulations by means of a hydrodynamical model of the Belgian coastal area have proved that there is a tendency towards erosion of the banks. Work is currently taking place on a sediment transport model for the whole Belgian continental shelf. The results are promising and prove the importance of the influence of waves.

6.2. Denmark

In Denmark the National Forest and Nature Agency is responsible for administration and licensing of marine aggregate dredging. All new licensed areas are subjected to a Government View Procedure including public and private involvement. The Agency prepares an environmental statement and determines if possible effects require a detailed Environmental Impact Assessment.

The results of a study of the effects on sea bed, benthic fauna and hydrography following a dredging of 3 m. m$^3$ sand was published in 1992. Both trailing suction dredgers and stationary suction dredgers were used. In the trailing suction area up to 2 m of the sea bottom have been removed while in the stationary suction area up to 10 m deep holes were formed. The paper describes the situation 17 months after the dredging was finished. In the trailing suction area annual benthic faunal species had largely recovered, whereas the larger perennial ones were still low in biomass.

A desk top study reviewing the latest results of environmental impact studies of dredging was published in 1993 in cooperation with the National Environmental Research Institute.

During the Great Belt bridge and tunnel project the company (A/S Storebaltsforbindelsen) prepared a number of very comprehensive environmental impact assessments of the dredging of sand fill and glacial till. The assessments include hydrography, sediment spreading, nutrients, shading of flora, benthic fauna, settling of mussels and behaviour of birds, especially Eider Ducks. The reports have not been published but information is given on application.

In 1993 the Forest and Nature Agency prepared a study on sediment spreading from dredging project in the Great Belt. The study compares sediment spreading from different types of resources and dredging methods.

In the Sound between Denmark and Sweden impact assessments are being carried out prior to the initiation of the tunnel and bridge project. The consequences of dredging in chalk have been closely studied. A detailed resource assessment and an environmental impact assessment of dredging of sandfill has been carried out on Kriegers Flak in the Baltic by the Øresund Consortium.

In 1994 The Forest and Nature Agency initiated a 3 year research project on the consequences of marine dredging in cooperation with the Geological Survey of Denmark and the National Environmental Research Institute. The project includes studies of fines in potential resources, computer models for studies of sediment spreading, development of ecological models and field tests. One of the aims of the project is to establish a decision framework (computer aided Expert System) to evaluate the environmental
consequences of existing and future dredging projects based on content of 
fines in the resource, hydrography, spreading of fines and ecological 
models.

6.3. Finland

No new information since 1991.

6.4. France

A report entitled "Impact de l'extraction de granulets marins sur le milieu 
marin" was published in april 1994.

It is a synthesis, in french language, of the ICES Cooperative Research 
Report No 182 and of the 1991 - 92 and 93 annual meeting reports of the 
working group on the "Effects of extraction of marine sediments on 
fisheries".

This report is an important contribution for the Interregional Commission 
of concentration for management of the Baie de Seine (see (3) above).

6.5. Germany

There are no projects presently in progress that relate directly to marine 
aggregate extraction. Studies that relate to environmental effects of 
physical disturbance of the sea floor include the following:

An investigation on environmental effects of disposal of dredged material 
with a special focus on benthic communities and nutrient release is 
presently being conducted in the Western Baltic Sea to supplement the 
dredged material disposal concept of the ministry of environment of the 
state of Schleswig-Holstein.

A survey of environmental effects caused by beam trawl fishery in the North 
Sea by imaging methods, such as underwater Video and sediment profile 
imaging (REMTS) techniques is being undertaken by the Institute for marine 
research in Kiel in the framework of IMPACT II (EC AIR Programme).

Studies on sediment transport due to storm induced current events in the 
Baltic Sea have been carried out by the University of Kiel.

6.6. Netherlands

Environmental Research

The Regional Extraction plan for the Dutch part of the North Sea contains 
an action programme for items which are not well understood. Every year 
more information on the composition of the seabed becomes available. A 
study of the possible uses for marine sands and gravel is in progress 
(CUR).

Research is being carried out for a new type of dredger, the "Punaise" 
(drawing in). Near Bloemendaal and Zandvoort a beach nourishment of 
500,000 m³ is been carried out now. The "Punaise" digs into the sea bed and 
makes a large pit, approximately 18 m deep. The sand is pumped ashore for 
beach nourishment. Refill sand is supplied from the IJ-channel by a hopper
dredge. The advantage of this dredger is its ability to work independently. However there are problems getting the dredger into position and with the connection with the pipeline.

Because it is a new kind of dredging in a sensitive area a monitoring programme was set up. Before the work started the following items were monitored:

- sea bed morphology;
- geological composition of the sea bed;
- biological composition of the sea bed;

During the work the turbidity is checked by aerial photography. In the event of severe turbidity a research vessel will take water samples for laboratory research.

One year after the work has ended the monitoring programme will be repeated.

Following this a decision will be made on whether this new type of dredger is suitable for operating in accordance with the extraction plan.

Within the Ministry a study is being carried out into the possibility of reserving areas suitable for sand mining locations, particularly in those regions where there are problems with sand quality and quantity.

6.7. Norway

In Norway, the mode of dredging is exclusively by anchor dredging with grab. Normally the boats are small (maximum loading capacity up to 500-1000 tonnes). Anchor dredging means that the impact upon the sea floor is severe, but localized. The creation of turbidity plumes associated with anchor dredging is not thought to be significant. Carbonate sands are deposited in high energy areas, that means that the fines are washed out several times, and thus, re-deposition of fines is also a minor problem. There have been many conflicts associated with carbonate sand dredging, especially from fishery interests and environmental movements. The fishery interests are worried that the spawning areas are being destroyed, and also that deep holes depleted of oxygen result from the dredging.

There has been one study on the effects of carbonate sand dredging in Norway, by the Norwegian Institute of Water Research (Oug & Golmen 1992). The authors conclude that, generally, the effects of carbonate sand extraction are moderate, and that the effects are located in and near the pit areas.

6.8. United Kingdom

The revised Government View arrangements issued in 1989 made clear provision for the consideration of the need for an EA in accordance with the Council Directive 85/337/EEC (EC Directive on the Assessment of the Effects of Certain Public and Private Projects on the Environment (85/337/EEC)) and indicated the type of case for which an EA may be required. As a guide in assessing the need for an EA and giving an indication of the types of case for which an EA may be required the following indicative criteria were published in 1989:
- if the dredging area is within 1 km of a Marine Nature Reserve;
- if the dredging area includes an important fish (including shell fish) spawning area or nursery ground;
- if the dredging area is within an area which supports a known commercial fishery;
- if dredging area is to take place in water depths of less than 18 meters;
- if dredging is proposed within 500 meters of an historic wreck designated under the Protection of Wrecks Act 1973.

More recently the Government has taken the view that in all cases before the GV can be issued an appropriate appraisal of the environmental impact will be needed. The applicants may therefore find it helpful to produce a formal Environmental Statement to support most applications for a production licence.

The MAFF has recently issued guidance on the content of environmental assessments for marine dredging (Guidelines for Assessing Marine Aggregate Extraction, Laboratory Leaflet No. 73, MAFF, 1993).

The review of marine mineral licensing arrangements is considering the role of environmental assessment in the licensing process in the light of experience from recent license applications.

6.9. United States of America

In 1993, dissolved oxygen levels were monitored at the site of sand and gravel extraction in the principal navigation channel of New York Harbour. This was a special situation where the main concern was that over-deepening the channel, perhaps lowering the channel floor irregularly, would enhance the isolation of bottom waters and lead to depressed levels of dissolved oxygen. Anomalously low levels of dissolved oxygen were not found and no patterns of dissolved oxygen distribution, adverse or otherwise, were detected associated with the dredging.

The U.S. Army Corps of Engineers has fairly extensive monitoring plans associated with their largest beach nourishment projects which begin in 1994.
7. RECOMMENDATIONS REGARDING THE CONTENT OF ENVIRONMENTAL IMPACT ASSESSMENTS

Background

The Subgroup considered the draft guidance produced by WGEXT in 1993 (CM 1993/E:7 MEQC) in the light of UK guidance produced in 1993 (Annex IV, Reference 5). The guidelines were clarified and adapted to be applicable to all ICES member countries. The following guidelines were produced and are recommended to ICES.

GUIDELINES FOR THE PREPARATION OF AN ENVIRONMENTAL IMPACT ASSESSMENT EVALUATING THE EFFECTS OF SEABED AGGREGATE EXTRACTION ON THE MARINE ENVIRONMENT

Introduction

1. This guidance describes the requirements of an Environmental Impact Assessment (EIA) such as required by the "Code of practice for the commercial extraction of marine sediments (including minerals and aggregates)". It forms the basis of the subsequent technical considerations for marine aggregate extraction.

2. The effects of marine aggregate extraction will be both physical and biological. The ICES working group on the Effects of Marine Aggregate Extraction on Fisheries has conducted a comprehensive literature review on the impacts on fisheries and the marine environment in general of sand and gravel extraction (ICES 1992). However, the significance to the wider marine environment of such dredging-induced changes will clearly depend upon the size and location of the licensed areas.

3. An EIA should normally be prepared, but in cases where multiple extraction operations in the same area are proposed, a single impact assessment may be adequate.

4. A framework for the content of the EIA should be established by early consultation with interested parties, including the licensing authority, on all concerns, both regionally and within the proposed area of extraction.

Environmental Impact Assessment

Nature of the deposit and proposed method of extraction

5. The resource should be identified by geographical location and local and regional setting and described in terms of

- the bathymetry of the area;

- the distance from, and natural processes affecting, the nearest coastline;

- the geological history, including the source of the material, type
of material, mean thickness of deposit, evenness of the deposit over the proposed extraction area, the nature of underlying deposit, sediment particle size as well as the geological stability of the deposit;

- the natural mobility of the sediments.

6. The total quantity of material in the resource should be estimated along with proposed extraction rates and the expected life of the deposit.

7. The method of dredging, including the effect of different suction equipment upon the seabed and the need for on-board processing.

Physical impact

8. The main physical impacts of marine aggregate extraction include possible changes in sediment topography and type through removal of material and suspension and resettlement of fine particles.

9. To assess the physical impact of aggregate extraction activities, information should be provided on:

- local hydrography including tidal and residual water movements;
- wind and wave characteristics;
- average number of storm days per year;
- estimates of bedload transport;
- the occurrence of sand waves and topographic features;
- contamination of sediments and possible release of contaminants by dredging.

- natural suspended sediment loads under both tidal currents and wave action;
- transport and settlement of fine sediment suspended by the dredging activity and its impact on normal and maximum suspended sediment load;
- dispersion of an outwash plume resulting from hopper overflow or on-board processing and its impact on normal and maximum suspended load;
- implications of extraction for coastal processes;
- implications for local water circulation resulting from removal or creation of (at least temporarily) topographical features on the seabed.

- regional, as well as local, effects of the above processes should be considered.
10. When no data can be obtained, estimates may be acceptable.

Biological impact

11. The principal biological impacts of marine aggregate extraction may include the disturbance and removal of benthos and alteration of the substrate.

12. To assess the biological impact of aggregate extraction the following information should be provided:

- a description of the benthic communities (e.g. species and abundance) within the proposed extraction area including temporal and spatial variations;

- information on the fishery and shellfishery resources including spawning areas with particular regard to benthic spawning fish, nursery areas, overwintering grounds for ovigerous crustaceans and known routes of migration;

- predator/prey relationships between the benthos and demersal fish species;

- the recolonization time for the denuded sediments;

- areas of special scientific or biological interest in or adjacent to the proposed extraction area, such as adjacent sites designated under local or international regulations (e.g. sites designated under the Ramsar convention, the World Heritage convention or the UNEP 'Man and the Biosphere' programme).

13. When no data can be obtained estimates may be acceptable.

Interference with other legitimate uses of the sea

14. The assessment should consider the following in relation to the proposed programme for exploitation of the resource;

- areas of natural beauty or significant cultural or historical importance in or adjacent to the proposed extraction area;

- commercial fisheries in the area including seasonal fishing patterns, species caught, type of gear used, value of fish and location and number of boats and fishermen involved;

- shipping lanes;

- military exclusion zones;

- engineering uses of the seabed (e.g. undersea cables and pipelines);

- adjacent areas of the sea designated in the present or past as sites for the disposal of dredged or other materials;
- adjacent current or proposed extraction areas;
- location of wrecks and war-graves in the area and general vicinity.

**Evaluation of impact**

15. In evaluating the overall impact, it will be necessary to identify and quantify the marine and coastal environmental consequences of the proposed activity and the basis of a monitoring plan. The EIA should evaluate the extent to which the proposed aggregate extraction operation is likely to affect other interests of acknowledged importance in the area.

16. The environmental consequences of the aggregate extraction operation should be summarized as an impact hypothesis.

17. The impact hypothesis should include consideration of the steps that might be taken to mitigate the effects of extraction activities. These may include:

- the selection of dredging equipment and timing of dredging operations to limit impact upon benthic communities and spawning cycles;
- modification of dredging depth to limit changes to hydrodynamics and sediment transport and to allow future safe use of fishing gear;
- zoning the area to be licensed or scheduling extraction campaigns to protect sensitive fisheries or to respect access to traditional fisheries.

18. It is also necessary to demonstrate the need to exploit the resource in question through careful, comparative consideration of local, regional and national need for the material in relation to the identified impacts of the proposal and the relative environmental and social costs of provision from other sources both marine and terrestrial.
8. **A consideration of standards for marine geological surveying and sampling**

**National Reconnaissance Surveys**

Maps may be prepared using traditional cartographic methods or the developing GIS and digital systems.

**Scale**

Map scale outputs vary considerably between countries eg. Within the UK scales vary between 1:1,000,000, 1:250,000, France from 1:1,000,000 to 1:250,000, Canada 1:250,000, Netherlands, Belgium as in UK, Sweden 1:100,000

**Techniques**

For these map outputs appropriate techniques are (possibly with digital output) considered to be:

**Bathymetry**

Side Scan Sonar - 100 to 500 kHz frequency

High resolution seismic profiling

Low frequency seismic profiling

Line spacing should generally be between 5-10 km on a rectangular grid. Provided budgets are available, surveyors should be aware of new developments in multiswath bathymetry and other high resolution seismic equipment for the top few cm.

**Positioning** of survey equipment can be to within cm using short base line GPS equipment on external sources.

**Positioning for all surveys** should be by at least Differential GPS.

Most ICES member countries would prefer maps to be in UTM, but modern GIS systems can convert into other projections.

**Sampling**

Grab with average penetration 10-30 cm and typical volume of 25 litres depending upon sediment type. Underwater photography may be advisable, and can be used with Image Analysis techniques for determination of particle size, shape etc.

**Coring** - using gravity corer with 7-10 cm barrel for softer sediments. Piston corers may also be used (boxcoring).

Vibrocoring for coarse sediments including tills, electric air-hammer or hydraulic.
Dredged samples may also be taken.

At these scales sample sites should be chosen in order that "ground-truth" calibration of the geophysics is ensured. Full interpretation of the geophysics should be carried out by experienced professionals. Field logging of samples (with photographs) should cover:

- Sub-sampling
- Grain size distribution
- Stratigraphy
- Colour
- Shape
- Lithology
- Biogenic components

**Geotechnical properties**

- Torvane
- Pocket penetrometer
- Water content/porosity tests
- Plasticity index

Further guidance on all these matters could be gained from the Geological Surveys of the member countries.

**Subsequent laboratory work**

- Particle size distribution (including details of method).
- Carbonate content of sand and gravel.
- Petrology
- Aggregate testing

Geotechnical properties such as for clays, porosity, plasticity, strength could be derived.

**Resource mapping** — generally undertaken by government, but also by industry

**Scale** 1:100,000 (UK, the Netherlands, France etc.) is appropriate but depends on budgets and overall aims of projects. 1:50,000 may also be appropriate scale.

**Techniques** — same as reconnaissance level studies although some more detailed techniques and procedures may be applied e.g. side scan sonar mosaic.

**Geophysical line spacing** — generally 2 km or 1 km rectangular grid with some lines at 0.5 km spacing over areas of special interest.

**Sample density** — may use a grid sampling approach but calibration of seismic data is prime objective.

**Type of sample** — longer cores may be necessary at this level of appraisal.

**Analysis of samples** — depends on potential end use of sediment (e.g. beach nourishment, constructional, fill aggregate (coarse and fine),
industrial sand, carbonate sand).
- e.g. grain size, shape, organic and inorganic contaminants, lithology, aggregate testing, concrete testing, ASR, heavy minerals, geotechnics.

Bed form analysis - sediment transport, processes and dynamics.
Sea bed/subsurface features - Quaternary features.

Reserve appraisal - generally undertaken by industry, sometimes by public bodies.

Scale - 1:10,000 - 1:30,000 is typical range

The survey area is likely to be highly defined.

Techniques

Bulk sampling (pilot mining) using a dredger becomes of increasing importance, incorporating subsampling and real-time monitoring of quality.
Biological sampling - 'Day' Grab, Hamon grab, ROV work.
Cone penetrometer
Hydrodynamic measurements
Geo-electrical surveying
Hazard mapping involving magnetometer to establish cables and wrecks.

Line spacing - generally 500 m

Sample density - Grid sampling and infill sampling to prove seismic interpretation and to equate quality with seismic profiles.

Type of sample - Grab, core and dredged sample.

Analysis of samples

Particle size analysis appropriate to the market requirements for the material
Contaminants - including fines percentages of sand
- within different end use size fractions
- lithology
- aggregate suitability - alkali-silica reaction (ASR), shell content to market standards
- heavy minerals
- geotechnics
- shape

Reserve assessment

An estimation of reserves can be made from the above data.

With the advances in PC software programmes for Digital Ground Modelling (DGM), fairly accurate measurements of reserves can be made provided base data is of sufficient quality.

For commercial purposes, criteria have to be applied to reserve assessments, such as:
Accessibility to reserve by current machinery and technology, e.g. Where a deposit lies within a "bowl", indicated from the seismics, not all the reserve can be recovered due to slopes.

Contamination of basal reserves from underlying bedrock or substrate. e.g. Where reserves are underlain by clays or muds, the reserves cannot be sold if any of the substrate is extracted with the basal layers.

For these reasons, confidence factors are applied to the assessment. These factors can be expressed by including three figures for reserves:

Proven  Depth of reserve recovered by sampling.
Probable Depth of reserve penetrated by sampling and assumed to be economic.
Possible Depth of reserve indicated by seismics but not fully calibrated by sampling.

Minimum and maximum figures for these reserve classifications are usually given.

All figures can be given as "all-in" (i.e. sand and gravel) or as "gravel-only" and a multiplication factor for the market ratio of sand and gravel required applied to this figure.

It is important that reserves are assessed at regular intervals and new criteria and factors applied to the assessment for pertinent developments in markets and technologies.
9. SCOPE FOR COORDINATION OF AND CORRELATION BETWEEN GEOLOGICAL AND BIOLOGICAL MAPPING

It is known that a relationship exists between bottom fauna and sediment type. This relationship can be used to increase the efficiency of sampling design, e.g. to decrease the number of benthic samples and/or to improve the distribution of sampling sites.

To achieve a better understanding and to clarify (and to simplify) the above relationships between the benthic fauna and the different sediment types mapped by the geologist, the following proposals are made:

1. In order to point out a simplified and useful relationship between the biological and geological distribution maps the Benthos WG and WGEXT should collaborate.

2. To correlate the biological and geological data, the following multidisciplinary information is needed:
   - benthic community structure (species diversity, abundance and biomass) including temporal and spatial variations;
   - fishery and shell fishery resources, including spawning areas of particular benthic spawning fishes (herring and sand-eel), nursery areas and overwintering grounds for crustaceans;
   - sediment characteristics (e.g. granulometric composition, carbonate content, organic carbon, anthropogenic contaminants).
   - hydrographic parameters (e.g. salinity, temperature, bottom water oxygen content, bottom water dynamics).

3. The W.G. proposes to collect relevant existing biological and geological information from various sources (e.g. ICES Benthos W.G., international and national programmes) and to point out typical reference areas and/or potential conflict areas representing each sediment type. This should be used to work out biological indexes based on standardised biological and geological information collected at similar times but always at the same sampling station.

4. The W.G. recommend that member countries build up a national GIS data-base on biological and geological site-specific information to be used in this WGEXT exercise.
10. Marine extraction and dredging statistics for the period 1983–1993

The WG has been charged by ICES to prepare an overview of the amounts of material dredged for marine aggregates and for navigational purposes over the period 1983–1993 from member countries.

Members have provided data on marine aggregate extraction to ICES (MEQC) for many years. This data was requested from ICES to form the basis of the overviews. WGEXT were informed by the Environmental Officer ICES that these forms had been destroyed because the information was available in the MEQC Committee E:1 papers. The ICES General Secretary has been asked by the Chairman WGEXT to investigate the matter further and, if the original forms have been destroyed, to assist with restoration of the missing data. This information was not made available in time for the Working Group meeting in Nottingham and serious doubts have been expressed about the completeness of the record in the E:1 papers. The WG were of the view that the data sheets on extracted material should not have been destroyed as they represented a unique record which will be difficult to replace.

The WG nevertheless attempted to produce the overview requested from the information provided by delegates and information available from previous reports of sand and gravel WG. The information is attached at Appendix IX.

Some information was available from 14 countries. Complete data on extraction and navigational dredging was available from two countries only, the UK and Belgium. Marine Aggregate extraction figures were available from virtually all the countries but in most cases the records were not complete.

The information on navigational dredging was much more sparse, 8 countries provided no data at all and only 1 country distinguished between capital and maintenance dredging. The information provided was generally not complete.

There was considerable disparity in the units, the conversion factors and the description of the material. The information in Appendix IX was standardised to tonnes and a uniform conversion factor applied according to its description. The conversion factors used are noted on the individual forms.
11. Recommendations for future work

The Working Group proposes the recommendations listed below.

The Working Group on the Effects of Extraction of Marine Sediments on Fisheries (Chairman, Dr S J de Groot) will meet from 2-5 May, 1995 at GSI, Dublin, Ireland (The WGEXT noted that 1995 is the 150th birthday of the Geological Survey of Ireland and that the GSI had kindly offered to host the next WGEXT meeting in Dublin) to carry out the following tasks:

a. the WGEXT prepare a report on the requirements for monitoring the environmental effects of marine aggregate extraction operations;

b. to review and report the status of marine aggregate extraction activities in ICES member countries and related environmental research;

c. to review and report the development of seabed resource mapping in ICES member countries;

d. review and report the results of Environmental Impact Assessments related to marine aggregate extraction operations;

e. to review and report developments in legal and administrative frameworks and procedures in accordance with ICES Coop Res Rep 182;

f. review and report the systems of sediment grainsize classification operating in member countries;

h. recommend minimum standards for geological surveying;

i. member countries compare geological and biological data and submit it to the 1995 meeting of the WGEXT where an overall assessment will be made for use in future recommendations;

The Working Group recommends the following actions to ICES:

j. ICES publish the guidelines on the content of environmental impact assessments prepared in accordance with C. Res 2:22-a;

k. ICES to retrieve the historical statistical data on marine aggregates extraction from member countries;

l. ICES to reconsider the need for the WGEXT to undertake work on navigational dredging in the light of the work being carried out by the other WGs, particularly the WGMS, and the information held on public record by the OSPARCOM and the London Convention.

In addition the exchange of information, including working Group Reports, with the Benthic Ecology Working Group is recommended in order to provide coordination in overlapping fields of interest. To facilitate this exchange the attendance of the Chairman or a representative of the Benthic
Ecology Working Group at meetings of the Working Group of the Effects of Extraction of Marine Sediments on Fisheries is recommended to continue.
12. Close of meeting

The report of the Working Group was agreed by participants.

The Chairman thanked participants for their contributions and thanked the rapporteur.

The meeting was formally closed by the Chairman.
13. Acknowledgements

The Working Group gratefully acknowledges the assistance of the British Geological Survey, without who's help the meeting would not have been possible.
ANNEX I

Agenda - ICES Working Group on the effects of extraction of marine sediments on fisheries, 2-6 May 1994

1. Welcome by BGS.
2. Welcome by Chairman.
3. Appointment of rapporteur.
4. Terms of Reference, adoption of Agenda.
5. Terms of national marine aggregate extraction activities and related environmental research (C.Res. 2:22 - e).
6. Review of the development of sea bed resource mapping in ICES Member Countries (C.Res. 2:22 - g).
7. Review developments in legal and administrative frameworks and procedures in accordance with ICES COOP.RES.183 (C.Res. 2:22 - d).
8. Review the results of the environmental impact assessments related to marine aggregate extraction operations (C.Res. 2:22 - b).
9. Consider further the content of the environmental impact assessments which, according to the "Code of Practice for the Commercial Exploitation of Marine Minerals", may have to be carried out prior to the extraction of such deposits, with a view to producing guidelines for consideration at the 1994 ACME meeting (C.Res. 2:22 - h). This topic will be dealt with in subgroups.
10. Consider standards for marine geological surveying and sampling (C.Res. 2:22 - c) - Sub-group activity - reporting to full WG under point 13.
11. Examine the scope for coordination of and correlation between geological and biological mapping (C.Res. 2:22 - h) - Sub-group activity - reporting to full WG under point 13.
12. Compile and present marine extraction and dredging statistics for the period 1983 - 1993 including comparison with published statistics for capital and maintenance dredging (C.Res. 2:22 - f) - Sub-group activity- reporting to full WG under point 13.
13. Full WG to discuss the results obtained in the sub_groups under 9, 10, 11 and 12.
15. Date and place of next meeting.
16. Close of meeting
ANNEX II

Terms of Reference

The Terms of Reference of the Working Group on the Effects of Extraction of Marine Sediments on Fisheries as stated in ICES Cooperative Research Report 182 are:

a) to update the present status of marine extraction operations and their impact on the marine environment;

b) to examine the recent results of national research programmes on the effects of marine extraction operations on the marine environment, particularly the influence on fisheries;

c) to compare the national codes of practice for the control of dredging activities and to evaluate the changes since 1979;

d) to provide information on activities in the near future and their possible impact on the marine environment and effects on fisheries;

e) to advise on major issues where an ICES policy is needed;

f) to make recommendations on management and research, as necessary.
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Annex IV

References


effets sur l'environnement marin des extractions de sable et de gravier sur le plateau continental belge
EFFETS SUR L'ENVIRONNEMENT MARIN DES EXTRACTIONS DE SABLE ET DE GRAVIER SUR LE PLATEAU CONTINENTAL BELGE

Rapport de Synthèse

Mars 1993
Les premières exploitations de sables et graviers marins sur le plateau continental de la Belgique débutèrent en 1976.

Les autorités nationales habilitées à l'octroi des concessions d'exploitation ont, dès le début des premières exploitations, assujetti celles-ci à l'obligation d'effectuer des études d'impact permanentes sur le milieu marin.


Le présent rapport élaboré par la Commission d'experts d'exploitation de sable et gravier, créée par le Ministère des Affaires Économiques, et composée de :

- l'Administration des Mines, le Service Géologique de Belgique,
  Ministère des Affaires Économiques,

- l'Unité de Gestion du Modèle Mathématique de la Mer du Nord
  et de l'Estuaire de l'Escaut,
  Ministère de la Santé Publique et de l'Environnement,

- la Station Nationale de Pêche Maritime,
  Ministère de l'Agriculture,

- le Service des Ports Côtiers,
  Ministère de la Région Flamande,

et avec la collaboration du Prof. Dr. G. De Moor, Université de Gand, Laboratoire de Géographie Physique, constitue la synthèse de ces études.

Ce rapport a également servi de document de référence aux autorités nationales lors de l'instruction des dernières demandes de concession d'exploitation du plateau continental.

LE DIRECTEUR GENERAL DES MINES H.,

Ir L. RZONZEF
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Introduction

En Belgique, l’exploration et l’exploitation des ressources du plateau continental sont réglementées par les lois et arrêtés royaux ci-dessous.


L’arrêté royal du 7 octobre 1974, modifié par l’arrêté royal du 22 avril 1983, relatif à l’octroi de concessions de recherche et d’exploitation des ressources minérales et autres ressources non vivantes sur le plateau continental détermine la procédure pour l’autorisation particulière de concession qui prévoit la publication d’arrêtés royaux et ministériellement réglementant la méthode à suivre. La modification du 22 avril porte sur les explorations et les exploitations concernant du sable destiné à des travaux portuaires ou côtiers exécutés par l’État ou pour le compte de celui-ci : la demande de concession est remplacée par une déclaration, introduite par le Ministre des Travaux Publics. Les travaux d’exploration et d’exploitation ne peuvent être entrepris qu’après que le Ministre des Affaires Économiques ait donné acte de la déclaration.

L’arrêté royal du 16 mai 1977 portant des mesures de protection de la navigation, de la pêche maritime, de l’environnement et d’autres intérêts essentiels lors de l’exploration et de l’exploitation des ressources minérales et autres ressources non vivantes du lit de la mer et du sous-sol dans la mer territoriale et sur le plateau continental précise que les concessions et autorisations d’exploration et d’exploitation ne peuvent être accordées que pour deux zones bien délimitées.

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L’expression "plateau continental" est utilisée pour désigner :
(i) le lit de la mer et le sous-sol des régions sous-marines adjacentes aux côtes mais situées en dehors de la mer territoriale jusqu’à une profondeur de 200 m ou, au-delà, jusqu’à la profondeur des eaux supérieures permettant encore l’exploitation des ressources naturelles de ces régions ;
(ii) le lit de la mer et le sous-sol des régions sous-marines semblables adjacentes aux côtes des îles.

L’État côtier exerce sur le plateau continental des droits souverains pour l’exploration et l’exploitation des ressources naturelles du plateau. Les ressources naturelles comprennent les ressources minérales et autres ressources non vivantes du lit de la mer et du sous-sol, ainsi que les organismes vivants qui appartiennent aux espèces sedentaires.

La définition précise des limites du plateau continental belge avec, d’une part, le Royaume-Uni de Grande-Bretagne et d’Irlande du Nord et, d’autre part, la France, fait l’objet d’accords bilatéraux qui sont soumis actuellement à la ratification parlementaire. Les négociations en la matière avec les Pays-Bas ne sont pas encore terminées.
définies (figure 1). Ces activités sont formellement interdites en dehors de ces zones. Les limites de ces zones ne peuvent être modifiées que sur base d'un étude scientifique préalable et par les Ministres qui sont responsables de l'application du présent arrêté. L'arrêté fixe également les différentes conditions et modalités concernant ces activités, leur contrôle et les sanctions en cas d'infraction.

La législation précitée prévoit des mesures pour le contrôle et l'étude des conséquences possibles de ces extractions de sable. Une commission d'experts a été créée pour coordonner ces tâches; elle est présidée par le Directeur Général des Mines de l'Administration des Mines du Ministère des Affaires Économiques et est composée de représentants des départements Affaires Économiques (Service Géologique de Belgique), Santé Publique et Environnement (Unité de Gestion du Modèle Mathématique de la mer du Nord), Agriculture (Station d'État de l'Écologie Marine) et Communauté flamande (Service des Ports côtiers). Cette commission d'experts adresse des avis à l'Administration des Mines qui impose éventuellement des mesures aux concessionnaires.

**Localisation des bancs**

L'exploitation de sable et de gravier se fait surtout sur certains bancs de sable du plateau continental belge (fig. 1).

Le banc Thornton et le banc Goote qui font partie des crêtes dorsales du West Zeeland se trouvent dans la zone de concession 1. Le Kwintebank, le Oost Dyck et le Buiten Ratel se trouvent dans la zone de concession 2 et font partie du complexe des Bancs des Flandres.

Les crêtes dorsales du West Zeeland se situent en majorité sur un axe de direction O-E. Elles sont adjacentes au plateau continental des Pays-Bas où on ne trouve plus de bancs de sable mais uniquement encore quelques vagues de sable. Les crêtes du West Zeeland sont formées des dépôts d'érosion des périodes glaciaires qui proviennent de la ligne côtière et qui ont été transportées par les forts courants de marée vers la mer pour y former des bancs de sable (Houbolt, 1968).

Les Bancs des Flandres se situent dans un axe SO-NE. Ils forment un complexe de bancs parallèles qui s'élèvent jusqu'à 25 m au-dessus du sous-sol marin environnant. Leur longueur varie de 15 à 25 km et leur largeur de 3 à 6 km. Les bancs de sable sont séparés l'un de l'autre par des chenaux de 4 à 6 km de large. Le chenal Ratel se trouve entre le Oost Dyck et le Buiten Ratel, le Kwintegul entre le Oost Dyck et le Kwintebank et le Negenvaam se trouve à l'est du Kwintebank.

La plupart de ces bancs ont un sommet qui présente en certains endroits des structures sédimentaires superficielles prononcées (notamment des mégagrades et des vagues de sable) Les trois bancs situés dans la zone de concession 2 sont asymétriques et présentent un flanc plus escarpé, celui situé au N-0.

Dans la zone des Bancs de Flandres on rencontre une couverture quaternaire constituée en majeure partie de sables holocènes marins du large de la côte, qui composent les bancs et recouvrent le fond des chenaux. Ils reposent sur une surface d'érosion. Cette surface recoupe un substrat tertiaire d'argile ipérienne (céocène) et est localement incisée de chenaux résiduels plus profonds et de dépressions probablement for-
mées par l'érosion antérieure des rivières au cours du niveau bas de la mer pendant la dernière période glaciaire, et par les marées. Ces chenaux résiduels sont remplis de dépôts quaternaires qui peuvent probablement être mis en corrélation avec les dépôts des rivières d'une période glaciaire.

La présence de gravier dans les couches quaternaires du fond des chenaux est limitée à quelques zones dans les chenaux. Le gravier est probablement un gravier résiduaire composé principalement d'un gravier de silex plus ou moins altéré qui contient généralement beaucoup de coquillages entiers ou brisés. Il est rare que le pourcentage de gravier représente en effet plus de quelques dizaines de kg/m³. Dans les chenaux, la couche supérieure contenant du gravier au-dessus du substrat argilequaternaire n'est pas épaisse (parfois inférieure à 2 m) de sorte que la possibilité d'exploitation à grande échelle du gravier de surface dans la zone de concession 2 est loin d'être prometteuse.
V. Conclusions générales des études

Conclusion de la recherche morphologique et sédimentologique:

La tendance annuelle moyenne du volume du sommet du banc montre que l'exploitation plus intensive de sable dans la partie nord du Kwintelbank a bien une conséquence sur le volume du sommet et sur la stabilité morphologique dans cette zone. Lorsque le volume total du banc est pris en compte, la réduction n'est pas très prononcée (sur base du volume d’exploitation actuel).


Conclusion de la recherche sur la pêche:

En ce qui concerne les études sur les conséquences possibles pour la pêche de l’extraction de sable, il y a lieu de faire une distinction entre les conséquences directes et les influences à long terme.

On n’a pas encore observé de conséquences négatives directes jusqu’à présent. Ceci a été mentionné dans le rapport annuel d’activités de la Station d’Etat de Pêche maritime pour l’information de tous les milieux concernés.

Une période plus longue (10 à 15 ans) est nécessaire pour l’étude de toutes les conséquences indirectes possibles. Toutes les données sont stockées à cet effet dans une banque de données. Leur interprétation au moyen de modèles informatiques adéquats constituerait un point d’action dans un proche avenir. On accordera également une attention à l’accroissement de la granulométrie du sédiment. L’intensification des exploitations de sable peut provoquer une modification des communautés du benthos et exercer une influence négative sur la chaîne alimentaire des poissons commerciaux. Il ne faut pas perdre de vue que la partie sud de la zone 2 d’extraction de sable est une nursery pour la sole, la plie et la firande de moins d’un an.

Conclusion de la recherche écologique:

Les simulations qui ont été effectuées à l’aide du modèle hydrodynamique de la zone côtière de la mer du Nord ont montré qu’il existe une certaine tendance à l’érosion des bancs, ce qui est confirmé par les relevés sur le terrain.

L’évolution normale de l’azote organique dissous, du phytoplancton et du zooplancton n’est pas modifiée de façon significative par les extractions de sable. On observe toutefois quelques écarts d’amplitude à la suite surtout d’une turbidité accrue et en moindre mesure de la perturbation de la régénération de l’azote anorganique par le sédiment du sous-sol.

Des études du benthos ont montré que parmi le matériel animal aspiré, une partie du nombre total d’individus est perdue (mortellement endommagés par le rejet dans la mer ou restant dans le sédiment dans la cale). Les organismes du benthos constituent une source alimentaire importante pour les poissons démersaux. La destruction du benthos peut donc avoir des conséquences directes pour les stocks de poissons même si les études de la Station d’Etat de Pêche Maritime ne peuvent encore le démontrer (voir plus haut le commentaire sur les conséquences indirectes à long terme).
VI. Conclusion générale et recommandations de la commission d'experts

Les extractions de sable peuvent être poursuivies à condition de prendre en considération les dispositions suivantes:

1. Vu les "signaux" déjà mentionnés dans le présent rapport, ces extractions doivent être assorties d'une stricte procédure de contrôle, de monitoring et d'étude des conséquences, dont les coûts doivent rester à charge des titulaires de concession.

2. La réglementation imposée doit être respectée strictement. En particulier, toutes les données factuelles relatives à l'exploitation doivent être connues avec précision. Dans cette optique, les navires d'exploitation doivent être équipés d'un système d'enregistrement automatique, boîte noire ("black-box"), dont la mise au point et la gestion repose sur l'expérience de l'Unité de Gestion du Modèle Mathématique de la mer du Nord et de l'estuaire de l'Escaut (UGMM).

3. Les pouvoirs publics doivent conserver la possibilité de réagir immédiatement lorsque des influences néfastes sont observées (comme c'était le cas en 1990 pour la partie nord du Kwintebank).

4. La Belgique doit poursuivre son rôle actif dans les accords internationaux qui traitent ce sujet: Code of Practice for the Commercial Extraction of Marine Minerals du Conseil International pour l'Exploration de la Mer, définition de la meilleure pratique pour l'environnement (Best Environmental Practice, BEP), collaboration ultérieure prévue dans le cadre de la nouvelle Convention de Paris, etc.
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13 JUIN 1969.
Loi sur le plateau continental de la Belgique (Mon. 8-10-1969).

Baudoin, Roi des Belges,

A tous, présents et à venir, Salut.

Les Chambres ont adopté et Nous sanctionnons ce qui suit:

Article 1er.
Le Royaume de Belgique exerce des droits souverains sur le plateau continental tel qu'il est délimité à l'article 2 de la présente loi aux fins de l'exploitation de celui-ci et de l'exploitation de ses ressources naturelles.

Au sens de la présente loi :

a) l'expression "plateau continental" désigne le lit de la mer et le sous-sol des régions sous-marines adjacentes aux côtes mais situées en dehors de la mer territoriale;

b) les "ressources naturelles" comprennent les ressources minérales et autres ressources non vivantes du lit de la mer et du sous-sol, ainsi que les organismes vivants qui appartiennent aux espèces sedentaires, c'est-à-dire les organismes qui, au stade où ils peuvent être pêchés, sont soit immobiles sur le lit de la mer ou au-dessous de ce lit, soit incapables de se déplacer si ce n'est en restant constamment en contact physique avec le lit de la mer ou le sous-sol.

Art. 2.
La délimitation du plateau continental belge vis-à-vis du plateau continental du Royaume-Uni de Grande-Bretagne et d'Irlande du Nord est constituée par la ligne médiane dont tous les points sont équidistants des points les plus proches des lignes de base à partir desquelles est mesurée la largeur de la mer territoriale de chacune des puissances intéressées.

Cette délimitation peut être amenagée par un accord particulier.

La délimitation du plateau continental vis-à-vis des pays dont les côtes sont adjacentes aux côtes belge, c'est-à-dire la France et les Pays-Bas, est déterminée par application du principe de l'équidistance des points les plus proches des lignes de base à partir desquelles est mesurée la largeur de la mer territoriale de chacune des puissances intéressées.

Cette délimitation peut être amenagée par un accord particulier avec la puissance intéressée.

Art. 3.
La recherche et l'exploitation des ressources minérales et autres ressources non vivantes du lit de la mer et du sous-sol sont subordonnées à l'octroi de concessions accordées aux conditions et selon les modalités déterminées par le Roi.

Art. 4.
Sauf exceptions collectives ou individuelles qui peuvent être accordées par le Roi, sont réservées aux ressortissants belges l'exploration et l'exploitation des organismes vivants qui, selon la définition de l'article 1er, alinea 2. b, appartiennent aux especes sedentaires.

Art. 5.
Les installations et autres dispositifs établis en haute mer, nécessaires à l'exploration ou l'exploitation des ressources naturelles du plateau continental, ainsi que les zones de sécurité visées à l'article 6 ne pourront générer d'une manière injustifiable la navigation, la pêche ou la conservation des ressources biologiques de la mer, ni l'utilisation des routes maritimes régulièrement d'un intérêt essentiel pour la navigation internationale, ni les recherches océanographiques fondamentales ou les autres recherches scientifiques effectuées avec l'intention d'en publier les résultats.

A cet effet, le Roi fixe les mesures à prendre ainsi que leurs modalités d'exécution.

Il détermine de même toute obligation qu'il juge utile à cette fin, notamment en ce qui concerne la signalisation et les moyens d'éviter la pollution des eaux de la mer ainsi que la détérioration des câbles sous-marins et de pipe-lines.

Il arrête la procédure à suivre pour l'application du retrait partiel ou total de l'autorisation ou de la concession.

Art. 6.
Une zone de sécurité pourra être établie selon les modalités déterminées par le Roi pour chaque installation ou dispositif situé sur le plateau continental.
Elle peut s’étendre à une distance de cinq cents mètres mesurés à partir de chaque point du bord extérieur de ces installations ou dispositifs.

**Art. 7.**
Les installations ou autres dispositifs situés en haute mer, fixés à demeure sur le plateau continental et visés par la présente loi, ainsi que les personnes et les biens qui se trouvent sur ces installations ou dispositifs sont soumis au droit belge.

**Art. 8.**
Toute personne qui aura commis une infraction reprimée par le droit belge sur une installation ou un autre dispositif visé à l’article précédent pourra être poursuivie en Belgique.

A défaut d’autres règles attributives de compétence, les juridictions qui siégent à Bruxelles sont compétentes.

**Art. 9.**
Les actes ou faits ayant des effets juridiques autres que pénaux qui se produiront sur ou à l’égard d’une installation ou d’un autre dispositif visé à l’article 7 seront réputés s’être produits en Belgique.

A défaut d’autres règles attributives de compétence, ces actes ou faits seront réputés s’être produits sur le territoire du deuxième canton de justice de paix de l’arrondissement judiciaire de Bruxelles.

**7 OCTOBRE 1974.**
**Arrêté royal relatif à l’octroi de concessions de recherche et d’exploitation des ressources minérales et autres ressources non-vivantes sur le plateau continental (Mon. 1.1.1975).**

Baudoin, Roi des Belges,

A tous, présents et à venir, Salut.

Vu la loi du 13 juin 1969 sur le plateau continental de la Belgique et notamment l’article 3;

Vu l’avis du Conseil d’État; Sur la proposition de Notre Ministre des Affaires économiques et de Notre Secrétaire d’État, adjoint au Ministre des Affaires économiques,

Nous avons arrêté et arrêtons:

**Article 1er.**
Les demandes de concession de recherche et d’exploitation des ressources minérales et autres ressources non-vivantes sur le plateau continental sont adressées au Ministre avant les mines dans ses attributions, dénomme ci-après «le Ministre».

La demande est introduite par une requête en sept exemplaires. Elle mentionne la nature de la substance qui fera l’objet des recherches et de l’exploitation, et comprend:

- les nom, prénoms, profession et domicile du demandeur et sa nationalité. Si le demandeur n’a pas de domicile en Belgique, il est tenu d’y écrire domicile;

- s’il s’agit d’une société, ses statuts, ainsi que des documents attestant les pouvoirs des signataires de la requête;

- un plan à l’échelle de 1/100 000 indiquant les limites du périmètre de la zone de recherche et d’exploitation, ainsi que les limites des zones voisines pour lesquelles une concession a déjà été accordée;

- des éléments permettant d’apprécier les capacités techniques et financières du demandeur;

- une note contenant la description de l’établissement et indiquant l’objet de l’exploration ou de l’exploitation avec indication exacte de la substance recherchée et de la profondeur d’exploitation ou d’exploitation, les appareils et procédés à mettre en œuvre, le nombre d’ouvriers, la nature et la puissance de chaque moteur ainsi que les quantités approximatives des matières extraites, fabriquées ou emmagasinées;

- une note exposant les moyens qui seront mis en œuvre pour combattre la pollution;

- une note exposant les moyens qui seront mis en œuvre en vue d’assurer la préservation des réserves de poissons et d’empêcher la destruction du filet, du filet et de l’environnement naturel des poissons.

**Art. 2.**
§ 1er. La demande est inscrite, le jour de son dépôt, à la diligence du directeur général des mines, dans un registre ad hoc. L’inscription mentionne les éléments de la requête et renvoie
au dossier, à la constitution duquel la demande a donné lieu. Le requérant reçoit notification de l'inscription. Tout intéressé peut prendre connaissance de l'inscription, de la demande et des annexes.

§ 2. Aucune inscription n'est opérée aussi long-temps que la demande n'est pas complète conformément à la disposition de l'article 1er.

Le directeur général des mines peut fixer un délai dans lequel la demande devra être complétée à peine de forclusion.

Art. 3.
Un exemplaire de la demande et des annexes est transmis, le jour de l'inscription dans le registre, à la diligence du directeur général des mines pour avis aux Ministres qui ont respectivement les Affaires étrangères, les Communications, les Travaux publics, l'Agriculture, la Santé publique et la Défense nationale dans leurs attributions. Ces Ministres donnent leur avis dans les soixante jours qui suivent la réception de la demande d'avis, à défaut de quoi il est passé outre.

Art. 4.
La demande est publiée au Moniteur belge au moins deux fois et à trente jours d'intervalle. La publication est faite à la diligence du directeur général des mines dans les trente jours qui suivent l'inscription visée à l'article 2.

La publication comprend les éléments dans la requête et mentionne le lieu où la demande de concession et ses annexes peuvent être consultées. Les frais de publication sont à charge du demandeur.

Art. 5.
Tout intéressé peut adresser une demande en concurrence ou faire opposition à une requête introduite en application de l'article 1er.

Les demandes en concurrence doivent être introduites et les oppositions formées dans les trente jours qui suivent la deuxième publication au Moniteur belge. Elles sont notifiées au Ministre par lettre recommandée à la poste et inscrites dans le registre des demandes de concessions, conformément aux dispositions de l'article 2, à la diligence du directeur général des mines. À la requête de leurs auteurs, elles sont notifiées par l'exploit d'huissier de justice aux personnes intéressées.

Les demandes en concurrence comprennent les mêmes éléments que ceux qui sont prescrits à l'article 1er pour les demandes de concession. Les oppositions doivent être motivées.

Les demandes en concurrence et les oppositions sont notifiées le jour de leur inscription, à la diligence du directeur général des mines, aux Ministres visés à l'article 3.

Art. 6.
Dans les soixante jours qui suivent l'expiration du délai fixé pour former les demandes en concurrence et les oppositions, le directeur général des mines fait rapport au Ministre. Ce rapport est établi après avis des Ministres visés à l'article 3; il mentionne notamment tous éléments permettant d'apprécier les facultés techniques et financières du demandeur et éventuellement du demandeur en concurrence.

Art. 7.
Le Ministre transmet le dossier et le rapport du directeur général des mines au Comité ministériel de Coordination économique et sociale; le Comité se prononce dans les trente jours et renvoie le dossier au Ministre.

Art. 8.
La concession est accordée ou refusée par arrêté motivé du Ministre, sur avis conforme du Comité ministériel de Coordination économique et sociale.

Art. 9.
La concession n'est accordée que pour une durée déterminée, limitée à trente ans au maximum, à condition que le prolongeur, admis et le périmètre à l'intérieur duquel les travaux d'exploration ou d'exploitation devront être exécutés soient déterminés avec précision.

Art. 10.
Les conditions d'exploration ou d'exploitation de chaque concession seront déterminées par arrêté royal.

Cet arrêté déterminera également l'activité minimum annuelle requise, ainsi que les cas éventuels de retrait ou de renonciation à la concession.
Section 4
Surveillance

Art. 9.
Les fonctionnaires désignés par les Ministres, chargés de l'exécution du présent arrêté, sont habilités à vérifier le respect des dispositions du présent arrêté et des mesures prises en application de celui-ci et à constater les infractions.

Art. 10.
Les infractions aux dispositions du présent arrêté et des arrêtés pris en exécution de celui-ci seront punies conformément aux dispositions de l'article 1er de la loi du 6 mars 1818, concernant les peines à infliger pour des contraventions aux mesures générales d'administration interieure, ainsi que les peines qui pourront être statuées par les règlements des autorités provinciales ou communales, modifiée par la loi du 5 juin 1934.

Art. 11.
Notre Ministre des Affaires économiques, Notre Ministre de l'Agriculture, Notre Ministre des Communications et Notre Ministre, adjoint aux Affaires économiques sont chargés, chacun en ce qui le concerne, de l'exécution du présent arrêté.
ANNEX VI

A Paper presented to the WGEXT by Ian Napier, MAFF Fisheries Laboratories, Burnham on Crouch, England

THE EFFECTS OF MARINE GRAVEL EXTRACTION ON THE MACROBENTHOS:
EARLY POST-DREDGING RECOLONISATION.

A J Kenny & H L Rees

Marine Pollution Bulletin - In press

This presentation is based on the above paper, to be published shortly, and presents some of the results from a study being conducted by Mr Kenny with sponsorship from the Ministry of Agriculture, Fisheries and Food and the Crown Estate Commissioners. The study aims to assess the initial impacts of marine aggregate extraction on the benthic macrofauna and the subsequent processes of recolonisation following dredging.

Following a wide-scale survey of gravel communities in English coastal waters a site was chosen off North Norfolk for experimental dredging. The gravel deposits in this area (approximate composition - gravel: 41%, sand 51%, mud: 4%, shell: 3%) were of commercial quality and supported a relatively rich and stable epifauna.

Treatment and reference sites, each of about 135,000 m², were defined 1 mile apart, and in a five day period in April 1992 a total of 52,000 tonnes of mixed aggregate were dredged from the experimental site by a commercial trailer-suction dredger (courtesy of South Coast Shipping). The benthos of the treatment and reference sites were sampled using a Hamon grab in March, before dredging, and in May, August and December, after dredging. Additional information was provided by divers, underwater T.V. and side-scan sonar surveys.

It was found that the dredging of the treatment site had created well defined furrows, 1-2 m wide and 30 to 50 cm deep covering about 70% of the sea bed. On average, the sea bed had been lowered by about 30 cm, although this increased to almost 2 m in some areas where several dredge tracks had crossed. The dredge tracks were all found to contain a few cm of mobile sand.

Non-metric multi-dimensional scaling (MDS) ordination of the species abundance data grouped reference and pre-dredging treatment site samples fairly closely, indicating that they were biologically similar. While the reference site samples remained closely grouped throughout the sampling period, the immediately post-dredging samples were clearly separated from them. Although the treatment site samples shifted towards the pre-dredging state later in the year, the MDS ordination indicates that recovery was incomplete after 7 months.

Numbers of species, numbers of individuals and biomass were all found to be significantly lower in the treatment site following dredging. Although these all increased thereafter, as recolonisation occurred, they were still significantly lower in the dredged area in December. The biomass abundance ratios for two of the most abundant species, the barnacle Balanus crenatus and the sea-squirt Dendrodoa grossularia were markedly lower at the
treatment site than at the reference site in the post-dredging period. This shows that there was a higher proportion of smaller individuals at the treatment site and indicates that recolonisation of the area was occurring through recruitment of juveniles.

The study also found that the recruitment success of Balanus crenatus and Dendrodoa grossularia differed markedly between the treatment and reference sites in the period following dredging. Two possible reasons for this are suggested: 1. The accumulation of mobile sand in the dredge tracks may have reduced the area of stable coarse substrate suitable for settlement of these species' larvae. 2. The loss of adult sessile populations from the dredged area may have reduced the potential for larval settlement. In some Balanus species, for example, the presence of adult populations is known to stimulate larval settlement, while larval Dendrodoa are no planktonic and settle within only a few metres of the parents.

Sampling of these sites continued in 1993, and although analysis of the results is not yet complete, preliminary indications are that the benthos at the treatment site suffered a higher rate of mortality over the winter period than that at the reference site, with reductions in the abundance and biomass. There are two possible reasons for this: 1. The fauna at the treatment site had a higher proportion of juveniles which may suffer a higher rate of mortality than adults over the winter. 2. The sediments in the treatment site may have been subject to a higher degree of physical disturbance by winter storms than those in the reference site less as a consequence of having been dredged.

Full details of these and other results from this ongoing study will be reported at a later date.

ANALYSIS OF SIDE-SCAN SONAR RECORDS

Side-scan sonar surveys of the Hastings Shingle Bank, in the English Channel, a major aggregate extraction area, were carried out by MAFF in May and December 1993 and in February 1994. From the records obtained we are confident that we are able to distinguish the marks left in the sea bed by trailer suction dredging from those left by towed fishing gear. Although it is unlikely that we will be able to precisely age dredge tracks from side-scan sonar records, we are able to identify 'new' and 'old' tracks. Comparison of side-scan records of the same area has shown that dredge tracks present in May 1993 were still clearly visible in December of the same year. However, all the dredge tracks present in December had been obliterated by the following February. This indicates that, at this site at least, dredge tracks do not survive through the winter. The tracks are presumably eradicated by reworking of the sediments by wave action during winter gales.
ANNEX VII The CIRIA research project

As well as supplying the needs of the construction industry both in the UK and in Continental Europe, the resources of the UK shelf are likely to be increasingly sought after to satisfy the demands of beach recharge schemes. It is the Government's intention to promote coastal defence solutions that are environmentally acceptable. The concept of managed retreat is being appraised, while the use of soft engineering in coastal defence by the artificial recharge of beaches instead of the installation of rigid structures is now commonplace.

The growing use of marine-dredged sand and gravel for recharge from resources that are available to the aggregate industry has raised concern that these resources may be insufficient to meet the needs of coastal defence engineers and the industry over the long-term. This concern is being addressed by CIRIA (the Construction Industry Research and Information Association) who have implemented a research project aimed at establishing a clearer picture of the demand for beach recharge materials in relation to the resources of marine materials; also to explore the procedural framework whereby materials that are presently unavailable to the dredging industry might be made accessible for the purposes of beach recharge.

In late 1993, BGS (the British Geological Survey), in partnership with HR Wallingford and Posford Duvivier, were contracted by CIRIA to undertake the demand and resource parts of the project which are due to be completed in mid-1995.

The specific objectives of the project are:

* to indicate the distribution and quality of existing information on marine materials that may be suitable for beach recharge;
* to assess the demand for beach recharge materials over the next 20 years;
* to provide information on the distribution and quality of marine materials suitable for beach recharge schemes;
* to consider the use of alternative materials for beach recharge schemes.

The extensive information on marine sand and gravel resources held by BGS will be supplemented by data from the dredging industry which is held by Posford Duvivier on behalf of the Crown Estate. The combined dataset will be used to define the general distribution off England and Wales of gravels and medium to coarse sands (these being the lithologies used for beach recharge), from the high water mark to the 60 m isobath. The principal resource areas identified will be examined in greater detail to provide information on water depths, sediment thickness, sediment type and gradings, facies and contaminants such as chalk and clay. Resource map output will be generated from the computerised database and the project report will include descriptions of the geological background to the deposits, the relationship between economic significance and depositional history and the renewability of the deposits. The report will also provide volumetric estimates of aggregate and non-aggregate materials on a regional basis. Non-aggregate is material that is unsuitable for, or unavailable to, the construction industry; both aggregate and non-aggregate may be suitable for beach recharge purposes.
The project will investigate alternatives to marine-dredged materials for recharge. These will include crushed rock and secondary aggregates and materials dredged from navigation channels. The investigation covers constraints including geographical location, transportation, lithologies, available volumes and environmental issues.

In assessing the demand for recharge materials over the next 20 years, the project will consider existing surveys carried out by MAFF, DOE and the NRA, as well as information supplied by maritime district councils. A standard approach will be applied to the estimation of specific demand at a number of sites around the coasts of England and Wales using modelling techniques, taking into account a range of climatic and sea-level scenarios. The results will be extrapolated to determine the total volume requirements for gravels and sands for English and Welsh beaches. The study will conclude with a regional evaluation of the potential of sea bed resources to meet the estimated demand.
ANNEX VIII

CONSULTATION PAPER: REVIEW OF LICENSING ARRANGEMENTS FOR MINERALS DREDGING IN ENGLAND AND WALES

Summary

1. The Environment Select Committee in their report on Coastal Zone Protection and Planning identified a number of concerns about the current licensing arrangements for minerals dredging, in particular the operation of the Government View procedure (GV).

2. These concerns included: the possible conflict between the role of the Crown Estate Commissioners acting both as landowner and the quasi planning authority in respect of minerals dredged (an issue which the Crown Estate Commissioners have indicated is also of concern to them -see para 8 below); that insufficient attention is paid to environmental effects of dredging; that the procedure is not sufficiently public; the lack of a right of appeal/challenge against the decision whether to grant a licence or not; and that the GV takes an unreasonable length of time to determine.

3. The most extensive minerals dredging which takes place below the low water mark is for sand and gravel. This is a particularly important source material for South East England and South Wales. In 1991 some 19 million tonnes (mt) were extracted from 6 regions around the coast of England and Wales for construction, fill and beach nourishment purposes. Other minerals which are currently dredged are calcified seaweed and waste coal, but the volumes are small.

4. Minerals dredged in territorial waters and on the Continental Shelf can only be carried out with the consent of the owner of the mineral rights. The Crown Estate owns about 55% of the foreshore - the area between low and high water marks - and virtually all the sea bed within territorial limits and the Continental Shelf. Much of the remainder of the foreshore is owned by the Duchies of Lancaster and Cornwall, local authorities, private owners or public bodies. Most minerals dredging takes place in waters where The Crown Estate is the owner of the sea bed. Some dredging does take place on seabed in private ownership although the amount extracted is small.

5. Government policy supports minerals dredging where it is possible without unacceptable damage to the coast, sea fisheries and the marine environment. Dredging may cause disturbance to fisheries, damage the marine environment and may obstruct navigation, particularly where there is a concentration of licences.

6. At present most minerals dredging off England and Wales is controlled by GV procedure which is coordinated by the Department of the Environment and the Welsh Office. The GV procedure entails an extensive two stage consultation process and provides a comprehensive analysis of the environmental implications of the proposed dredging. Production licences for the extraction of marine minerals are only given by The Crown Estate when there has been a positive GV. Any conditions given in the GV are incorporated into the licence given by The Crown Estate. Monitoring and enforcement of the licence conditions are the responsibility of the landowner.
7. A small amount of dredging is controlled under section 18 of the 1949 Coast Protection Act and by mineral planning authorities under the Town and Country Planning Act 1990. The GV procedure takes on board various statutory controls, for example s.34 consents for the Department of Transport.

8. A number of positive aspects of the current GV arrangements have been identified, but there are weaknesses in the arrangements and the Government has concluded that the environmental and commercial issues generated by mineral dredging proposals are not as visible as is now taken to be desirable. It also accepts that the procedures take too long. The Crown Estate Commissioners have indicated that they do not wish to be involved in the consultation and control procedures and wish to concentrate on their landowner role. Furthermore areas of the seabed owned by The Crown Estate are subject to different controls.

9. In the recently published report "Development Below the Low Water Mark" the Government has said that it does not believe there is a general case for extending the present seaward boundaries of the planning system. Against this background this paper examines three possible options:

- whether to adapt the GV by using the Town and Country Planning Act procedures on a non statutory basis; in this case DOE/WO would act as the regulatory authority with The Crown Estate acting as a landlord only:

- a statutory system again adapting the Town and Country Planning Act procedures and run by DOE/WO; and

- a statutory system administered by the Ministry of Agriculture Fisheries and Food (MAFF) by extending the controls of the Food and Environment Protection Act 1985.

10. The Government is not proposing that either the second or third options should displace other statutory controls currently taken on board in the GV procedure.

11. The Government has concluded that a statutory system offers advantages in terms of due process, transparency and certainty for the industry and interested parties. Any new statutory system, however, requires the introduction of primary legislation which will take sometime.

12. Before coming to a view about any changes the Government will wish to consider the views of consultees on the regulatory impact and in particular whether:

- the adaption of the GV Procedure on a non-statutory basis using Town and Country Planning procedures would provide a satisfactory long term control;

- the GV should be replaced by a statutory system either along the lines of the Town and Country Planning Act 1990 or the Food and Environment Protection Act 1985.
## ANNEX IX  MARINE EXTRACTION AND DREDGING STATISTICS 1983 – 1993
INCLUDING CAPITAL AND MAINTENANCE DREDGING

### Belgium

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<th>Maintenance Dredging</th>
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**Conversion factor 1.5 of tonnes Capitalandmaint.(together) Sand**
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### INCLUDING CAPITAL AND MAINTENANCE DREDGING

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### Note
- Marine Extraction: million tonnes
- Capital and Maintenance Dredging: tonnes
- Calcareous material: tonnes
- Sand and gravel: 1.66 million tonnes
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**Convers factor:** 1.36 Sand 1.5

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**INCLUDING CAPITAL AND MAINTENANCE DREDGING**

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#### Sweden

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MARINE EXTRACTION AND DREDGING STATISTICS 1983 - 1993
INCLUDING CAPITAL AND MAINTENANCE DREDGING

U.K (England and Wales) million tonnes

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UK (Scotland) tonnes

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ANNEX X  Recommendations to Council

The Working Group on the Effects of Extraction of Marine Sediments on Fisheries (Chairman, Dr S J de Groot) will meet from 2-5 May, 1995 at GSI, Dublin, Ireland to carry out the following tasks:

a. the WGEXT prepare a report on the requirements for monitoring the environmental effects of marine aggregate extraction operations;
b. to review and report the status of marine aggregate extraction activities in ICES member countries and related environmental research;
c. to review and report the development of seabed resource mapping in ICES member countries;
d. review and report the results of Environmental Impact Assessments related to marine aggregate extraction operations;
e. to review and report developments in legal and administrative frameworks and procedures in accordance with ICES Coop Res Rep 182;
f. review and report the systems of sediment grainsize classification operating in member countries;
g. review existing classifications of bedform analysis and recommend a preferred system;
h. recommend minimum standards for geological surveying;
i. member countries compare geological and biological data and submit it to the 1995 meeting of the WGEXT where an overall assessment will be made for use in future recommendations;

The Working Group recommends the following actions to ICES:

j. ICES publish the guidelines on the content of environmental impact assessments prepared in accordance with C. Res 2:22-a;
k. ICES to retrieve the historical statistical data on marine aggregates extraction from member countries;
l. ICES to reconsider the need for the WGEXT to undertake work on navigational dredging in the light of the work being carried out by the other WGs, particularly the WGMS, and the information held on public record by the OSPARCOM and the London Convention.

In addition the exchange of information, including working Group Reports, with the Benthic Ecology Working Group is recommended in order to provide coordination in overlapping fields of interest. To facilitate this exchange the attendance of the Chairman or a representative of the Benthic Ecology Working Group at meetings of the Working Group of the Effects of Extraction of Marine Sediments on Fisheries is recommended to continue.