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**Guidelines for assessing marine
aggregate extraction**

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1. LICENSING

Exploitation or use of the seabed requires approval and consent from the Crown Estates Commissioners acting as landlords. Granting of licences by the Crown Estates Commissioners for the exploitation of offshore aggregate deposits has, since 1970, been controlled through the non-statutory 'Government View' Procedure. As part of this process, MAFF undertakes a comprehensive assessment of the potential effect of new aggregate extraction areas on the marine environment, on commercial fisheries and fishing operations. Production licences are not given a 'positive Government View' unless MAFF is satisfied that the issues under its responsibility are protected and that the conditions for extraction are such that any impacts are minimised.

Within the Ministry's Directorate of Fisheries Research (DFR), a wide range of scientific expertise is available and is consulted when each application is submitted. The Sea Fisheries Inspectorate (SFI) will advise whether they are aware of any problems that are likely to be caused for commercial fishing operations. As the Ministry's 'eyes and ears' on fisheries matters around the coast, they will advise if fishermen have reported any changes in normal fish movements or fishing patterns in the area.

In June 1985, the EC Directive 'The Assessment of the Effects of Certain Public and Private Projects on the Environment (85/337/EEC)' (European Communities, 1985) was adopted and came into force in July 1988. The Directive identifies exploitation of mineral resources as an activity which might, under certain circumstances, require a supporting Environmental Assessment (Department of the Environment/Welsh Office, 1989).

The requirements of the Directive were incorporated into the Government View Procedure in 1989. The companies in the marine sand and gravel extraction business have generally accepted that adequate assessment is needed for the purposes of MAFF's evaluation of the impact on fishing and the marine environment, and these guidelines set out a more detailed explanation of what is required.



Figure 1. Undisturbed gravel substrate off north Norfolk (0.75 m²)

2. FISHING AND MARINE ENVIRONMENTAL INTERESTS

In the early years of the modern marine aggregate extraction industry, there was limited competition from fishermen for the occupancy of parts of the coastal waters because the main fishing fleets were operating in distant deep waters. However, the contraction of the offshore fleet increased the pressure in coastal waters and, as a consequence, increased the friction between the two industries. The publication in 1981 of a Code of Practice (MAFF, 1981) for avoiding conflict between the fishing and marine aggregate industries when new reserves are proposed for exploitation was an important step in recognising and seeking to reconcile the operating difficulties that were being experienced on a routine basis.

In order to formulate its response under the Government View Procedure, MAFF undertakes a comprehensive evaluation of the marine environmental implications of aggregate extraction and the aggregate extraction industry will, therefore, need clear guidance on the factors that have to be considered in providing data for such an evaluation. The Guidance notes annexed have been drawn up having regard to work done on aggregate extraction in a Working Group of the International Council for the Exploration of the Seas (e.g. ICES, 1992) and also take account of technical guidelines for the management of dredged material disposal. The Guidelines are in two parts, the first dealing with pre-licensing assessment and the second with monitoring the impact of the extraction operation. As presented here they represent a framework which will in due course be supplemented by more detailed guidance on particular aspects.



Figure 2. Dredged gravel substrate off north Norfolk (0.75 m²)

ACKNOWLEDGEMENT

Illustrations kindly supplied by my colleague, Andrew Kenny.

3. REFERENCES

EUROPEAN COMMUNITIES, 1985. The Assessment of the Effects of Certain Public and Private Projects on the Environment (85/337/EEC). Off. J. Eur. Commun., *175*: 40-48.

DEPARTMENT OF THE ENVIRONMENT/WELSH OFFICE, 1989. 'Environmental Assessment: a guide to the procedures'. Her Majesty's Stationery Office, 64 pp.

ICES, 1992. Effects of Extraction of Marine Sediments on Fisheries. Co-operative Research Report, No. *182*: 78 pp.

MAFF, 1981. A Code of Practice for the Extraction of Marine Aggregates. MAFF, London, 11 pp.



APPENDIX. INFORMATION REQUIRED BY MAFF FOR THE PURPOSES OF EVALUATING THE IMPACT OF SEABED AGGREGATE EXTRACTION ON THE MARINE ENVIRONMENT

Background

1. The EC Directive on 'The assessment of the effects of certain public and private projects on the environment' (85/337/EEC) was adopted on the 27 June 1985 and came into effect in July 1988. The effect of the Directive is to require an Environmental Assessment (EA) to be carried out, before development consent is granted, for certain types of major project which are judged likely to have significant environmental effects. Exploitation of mineral resources is identified in the Directive as an activity which might, under certain circumstances, require a supporting EA.
2. An explanatory booklet, 'Environmental Assessment: a guide to the procedures', has been prepared by the Department of the Environment in conjunction with the Welsh Office (Department of the Environment/Welsh Office, 1989). The booklet describes the legislation and the criteria which trigger the requirement to provide an EA. It also provides guidance for the content of an EA.
3. The guidelines which follow set out MAFF's requirements relevant to those elements of the environmental assessment of a proposed extraction area for which the Ministry is responsible.

Introduction

4. The effects of marine aggregate extraction on the marine environment will be physical, due to possible changes in sediment topography and type through removal of material and resettlement of fine particles. There will also be secondary biological effects as a consequence of seabed alteration and disturbance resulting in modification of benthic infaunal and epifaunal assemblages with consequent effects upon food supply for higher organisms including commercial fish and shellfish species.
5. The International Council for the Exploration of the Sea (ICES) Working Group on the Effects of Marine Aggregate Extraction upon 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.
6. The considerations relevant to the deposit of dredged material at sea, including disposal site assessment, contain many common features with those for aggregate extraction. In the UK, dredged material disposal is regulated by a licensing system which reflects undertakings within the International waste disposal Conventions (the Oslo and London Conventions). The technical groups within those Conventions have developed specific guidance for dredged material disposal. This guidance forms the basis of the subsequent technical considerations for marine aggregate extraction.

Nature of the deposit

7. The resource should be identified by its geographical location and described in terms of:

- the bathymetry of the area;
- the distance from 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 deposits, sediment particle size as well as the geological stability of the deposit;
- the natural mobility of the sediments.

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

Physical impact

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;
- bedload sediment including occurrence of sand waves;
- natural suspended sediment loads;
- storm or wave-induced bottom turbidity;
- transport and settlement of fine sediment suspended by the dredging activity;
- dispersion of an outwash plume resulting from hopper overflow or on-board processing and its impact on normal and maximum suspended sediment load;
- nature and type of nearby coastline and implications for coastal erosion;
- implications for local water circulation resulting from removal or creation of (at least temporarily) topographical features on the seabed;

Biological impact

10. The principal biological impact of marine aggregate extraction is the disturbance and removal of benthic infauna and epifauna and alteration of the substrate upon which colonisation depends. This will in turn affect its suitability as a fish or shellfish food resource or habitat. Where the remnant substrate is identical to the undisturbed surficial sediments (and this is normally required by licence condition), disturbance is unlikely to be permanent and the extraction area will be recolonised, although the timescale will vary depending on nature and location of the deposit. To assess the biological impact of aggregate extraction, the following information should be provided;

- an assessment of the benthic community structure(s) (species type and abundance) within the proposed extraction area including temporal (e.g. quarterly) and spatial variations;

- information on the fishery and shellfishery resources, including spawning areas, with particular regard to benthic spawning fish (e.g. herring and sand eels), nursery areas, overwintering grounds for ovigerous crustaceans and known routes of migration;
- predator/prey relationships between the benthos and demersal fish species (e.g. by stomach content investigations);
- the estimated recolonisation time for the denuded sediments;
- areas of natural beauty or significant cultural or historical importance in or adjacent to the proposed extraction area;
- areas of special scientific or biological interest in or adjacent to the proposed extraction area, such as adjacent Sites of Special Scientific Interest (SSSI), Marine Nature Reserves (MNR) and Marine Consultation Areas (MCA), Marine Special Protection Areas (SPA), sites designated under the Ramsar Convention, the World Heritage Convention or the UNEP 'Man and the Biosphere' programme.

Interference with other legitimate uses of the sea

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

- the method of dredging, including the effect of different suction equipment upon the seabed and the need for on-board processing;
- seasonal (quarterly) commercial fishing patterns, including type of gear used, distribution, value and number of fishermen involved;
- shipping lanes;
- military exclusion zones;
- engineering uses of the seabed (e.g. adjacent extraction activities, undersea cables and pipelines);
- adjacent areas of the sea designated as sites for the disposal of dredged material and sewage sludge;
- adjacent current or proposed extraction areas;
- location of wrecks and war-graves in the area and general vicinity.

Evaluation of impact

12. 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 as well as setting out why the proposal is not thought likely to affect other interests of acknowledged importance in the area.

13. These consequences can be summarised as an impact hypothesis which will draw on the results of earlier studies of environmental characteristics and their variability.

14. 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;
- zoning the area to be licensed or scheduling extraction campaigns to protect sensitive fisheries or to respect access to traditional fisheries.

15. 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.

Monitoring

Definition

16. In the context of assessing and controlling the environmental effects of marine aggregate extraction, monitoring is the repeated measurement of an effect whether direct or indirect on the marine environment.

17. Monitoring of the marine environment is generally undertaken for the following reasons:

- to establish whether licence conditions are being observed;
- to establish whether licensing conditions are preventing extraction activities having adverse effects on the marine environment;
- to provide the necessary evidence to demonstrate that the control measures applied were sufficient to ensure that any lasting environmental damage did not result from exploitation of marine resources;
- to improve the basis on which future licence applications are assessed by improving knowledge of field effects which are not readily estimated by laboratory or literature assessment.

18. Monitoring operations are expensive for they require considerable resources both at sea and in subsequent sample and data processing. In order to approach a monitoring programme in a resource-effective manner, it is essential that the programme should have clearly defined objectives derived from the impact hypothesis. Only then can it be assumed that measurements will meet those objectives. The results should be reviewed at regular intervals in relation to those objectives and the monitoring scheme should then be continued, revised or even terminated.

19. In preparing a monitoring programme and before any measurements are made, the following questions should be addressed:

- what is the purpose of monitoring a particular variable or biological effect?
- what measurements are necessary to meet specified objectives?
- in what environmental compartment or at what locations can the measurements be made most effectively?
- how many measurements are necessary to meet the objective?
- for how long should the measurements continue to be made to meet the objective?
- what should be the spatial and temporal scale of measurements made to test the hypothesis?

20. The extraction of marine aggregate has its primary impact at the seabed. Thus, although a consideration of water column effects cannot be discounted in the early stages of monitoring planning, it is often possible to restrict subsequent monitoring to the seabed.

21. Where it is considered that the effects will be largely physical, monitoring may be based on remote methods such as sidescan sonar to identify changes in the character of the seabed. These measurements will require a certain amount of sediment sampling to establish ground truth.

22. Biological sampling to assess changes in the benthic community structure may also be appropriate, provided there is a scientific basis for the interpretation of the resulting data.

23. In order to assess the impact, it will be necessary to take account of natural biological variability. This can best be achieved by comparing the physical or biological status of the affected areas with reference sites located away from the extraction site. Such reference sites should be identified during the preparation of the Impact Hypothesis.

24. The spatial extent of sampling will need to take into account the size of the area designated for extraction, any possibility of operating outside the licensed area and the mobility of fine material raised into suspension by the dredging activity.

25. Since the effects of marine aggregate extraction will have some similarities in different sites, it will probably not be necessary to conduct the same level of biological monitoring at all sites. It is also appropriate to consider 'far-field' effects of extraction such as the relationship between spawning grounds and areas of recruitment. Information on the interaction of extraction with seasonal fishing patterns should be obtained at each site.

26. Concise statements of monitoring activities should be prepared. Reports should detail the measurements made, results obtained, their interpretation and how these data relate to the monitoring objectives. The frequency of monitoring will depend upon the scale of extraction activities and the anticipated period of consequential environmental changes which may extend beyond the cessation of extraction activities.

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