ICES Journal of Marine Science, 53: 1051–1053. 1996

Short communication

The physical impact of marine aggregate extraction in the North Sea

S. J. de Groot

Groot, S. J. de 1996. The physical impact of marine aggregate extraction in the North Sea. – ICES Journal of Marine Science, 53: 1051–1053.

The marine aggregate extraction industry in the North Sea is well established and growing. The article reviews the potential physical impact of sand and gravel extraction. The impact is site-specific and depends on numerous factors, including extraction method, sediment type and mobility, bottom topography, and bottom current strength.

Key words: dredging, marine aggregates, North Sea, physical impact.

S. J. de Groot: Netherlands Institute for Fisheries Research (RIVO-DLO), PO Box 68, 1970 AB IJmuiden, The Netherlands.

Introduction

The marine aggregate extraction industry is well established in several countries around the North Sea, contributing up to 15% of some nations' demands for sand and gravel. The methods most commonly practised in the area include anchor and trailer suction hopper dredging. The latter is the technique most widely used. Whereas Dutch suction hoppers generally work without an overflow system, gravel dredgers operating in UK waters do. As the hopper fills, displaced water flows back into the sea, forming a turbid plume of suspended sand and silt. Sometimes the aggregate is screened to maintain a specific sand-to-pebble ratio and excess sand or pebbles may be returned to the sea floor. The most serious physical impacts thus relate to substratum removal and alteration of the bottom topography, the formation of temporary plumes in the water column, and re-deposition of material.

The information presented represents a summary of the data collated by the ICES Working Group on the

Table 1. Physical disturbance of the seabed in the North Sea in 1986 data. (Data supplied by the Institute of Offshore Engineering – IOE, Heriot-Watt University, Edinburgh; OSCOM 13: Report of the Thirteenth Meeting of the Oslo Commission, 1987.)

% Area	Source	Area	No. or amount	Reference/source
54.	Fishing	309 204 km^2*		IOE calculation
0.03	Aggregate extraction	180 km^2*	30×10^6 t	IOE calculation
0.01	Dredging disposal	72 km^2*	72×10^6 t	Calculated from OSCOM 13
0.001	Waste disposal	5.5 km^2*	5.5×10^6 t	Calculated from OSCOM 13
0.001	Sludge disposal	5.5 km^2*	5.5×10^6 t	Calculated from OSCOM 13
0.05	Platforms	313 km^2	399	IOE calculation
0.05	Well heads	300 km^2	382	IOE calculation
1.5	Pipelines	8374 km^2	8374 km	IOE calculation
1.27	Cables	7322 km^2	7322 km	IOE estimate
0.05	Wrecks	284 km^2	7100	IOE calculation
0.0001	Cuttings disposal	0.5 km^2*	593 741 km	IOE calculation
56.95	Total	327 000 km^2		

*Annual figures.

1054–3139/96/061051+03 $18.00/0

Effects of Extraction of Marine Sediments on the Marine Ecosystem between 1975 and 1994. A bibliography may be found in those reports (e.g. ICES, 1975, 1992, 1994). A limited amount of additional information has also been included.

Quantitative data

Figure 1a shows the known amounts of sand and gravel extracted from the North Sea bottom over the period 1974–1994 by country. These figures are split into the amount extracted for land use (Fig. 1b) and a combined figure for capital and maintenance dredging (Fig. 1c). The difference, however, is not always clear cut. For instance, all dredging in the 40 miles long entrance to the Rotterdam harbour from Noordhinder lighthouse to the Hook of Holland is classified under the category maintenance dredging, but sand dredged in shipping channels is often used for beach nourishment, underwater constructions, or land use. Also, the data supplied may differ from other published figures, because factors used to convert sand and gravel from tonnes to cubic metres may vary.

There is a tendency in these mining activities to shift gradually from land-based resources to the marine environment. Hence, future extractions are expected to be at the same level or slightly higher than during recent years. Marine sand requirements for The Netherlands have been estimated at 32×10^6 t yr^{-1} and for the United Kingdom between 21 and 35×10^6 t yr^{-1} (ICES, 1994).

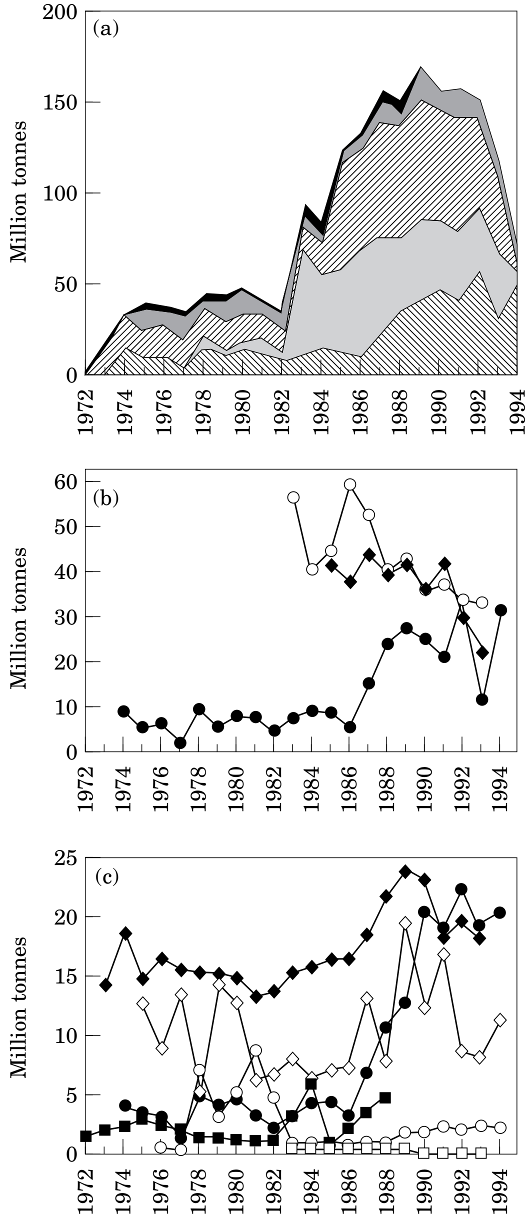

Figure 1. Quantities (million tonnes) of extracted marine aggregates per year by country, 1974–1994. (Conversion factor from m^3→tonnes: 1.5; source: ICES, 974, 1992, 1994; additional material supplied for The Netherlands by RWS–North Sea Directorate) N – Norway, G – Germany, D – Denmark, UK – United Kingdom, B – Belgium, NL – Netherlands. (a) Cumulative totals (□ – N, ■ – G, ▩ – D, ▨ – UK, ⊡ – B, ▧ – NL). (b) Marine extraction for land use. (c) Capital and maintenance dredging. (For (b) and (c): ● – NL, ○ – B, ◆ – UK, ◇ – D, ■ – G, □ – N.)

Effects on living resources and fisheries

Substratum removal and alteration of the bottom topography due to dredging result in the destruction of infaunal and epifaunal biota. Separating sand from gravel during the dredging process may significantly alter the substratum and change a stable gravel bank into an area of mobile sand. Trailer suction dredging may cause an uneven bottom profile. This can lead to reduced current strength and may result in the deposition of finer sediment. Pits and furrows are generally filled up very slowly, except in areas of mobile sand.

Fisheries interests may be seriously threatened when dredging activities coincide with herring spawning grounds. Also re-deposition of fines from the plumes, which may extend beyong the actual dredging area, may smother eggs laid on the bottom (De Groot, 1980).

Estimates of the surface areas of seabed (% and absolute values) disturbed annually by various human activities are given in Table 1. Bottom trawling appears to have a much greater impact than all other activities together. Marine aggregate extraction disturbs only 0.03% of the total seabed in the North Sea on an annual basis. However, dredging is concentrated in coastal waters, which represent specific habitats, and local effects may be significant.

Acknowledgements

The members of the ICES Working Group on the Effects of Extraction of Marine Sediments on the Marine Ecosystem deserve full credit for the contents of this contribution. Special thanks are extended to the rapporteurs: Richard Millner, Steve Rowlatt, George Lees, John Side, Peter Bide, and Frank Hallie.

References

Groot, S. J. de 1980. The consequences of marine gravel extraction on the spawning of herring, *Clupea harengus* L. Journal of Fish Biology, 16: 605–611.

ICES. 1975. Report of the Working Group on Effects on Fisheries of Marine Sand and Gravel Extraction. Lowestoft, 2–3 April 1974. Cooperative Research Report 46. 57 pp.

ICES. 1992. Report of the ICES Working Group on the Effects of Extraction of Marine Sediments on Fisheries. Cooperative Research Report 182. 78 pp.

ICES. 1994. Report of the Working Group on the Effects of Extraction of Marine Sediments on Fisheries. Keyworth, Nottingham, England, 3–6 May 1994. ICES CM 1994/E: 4.