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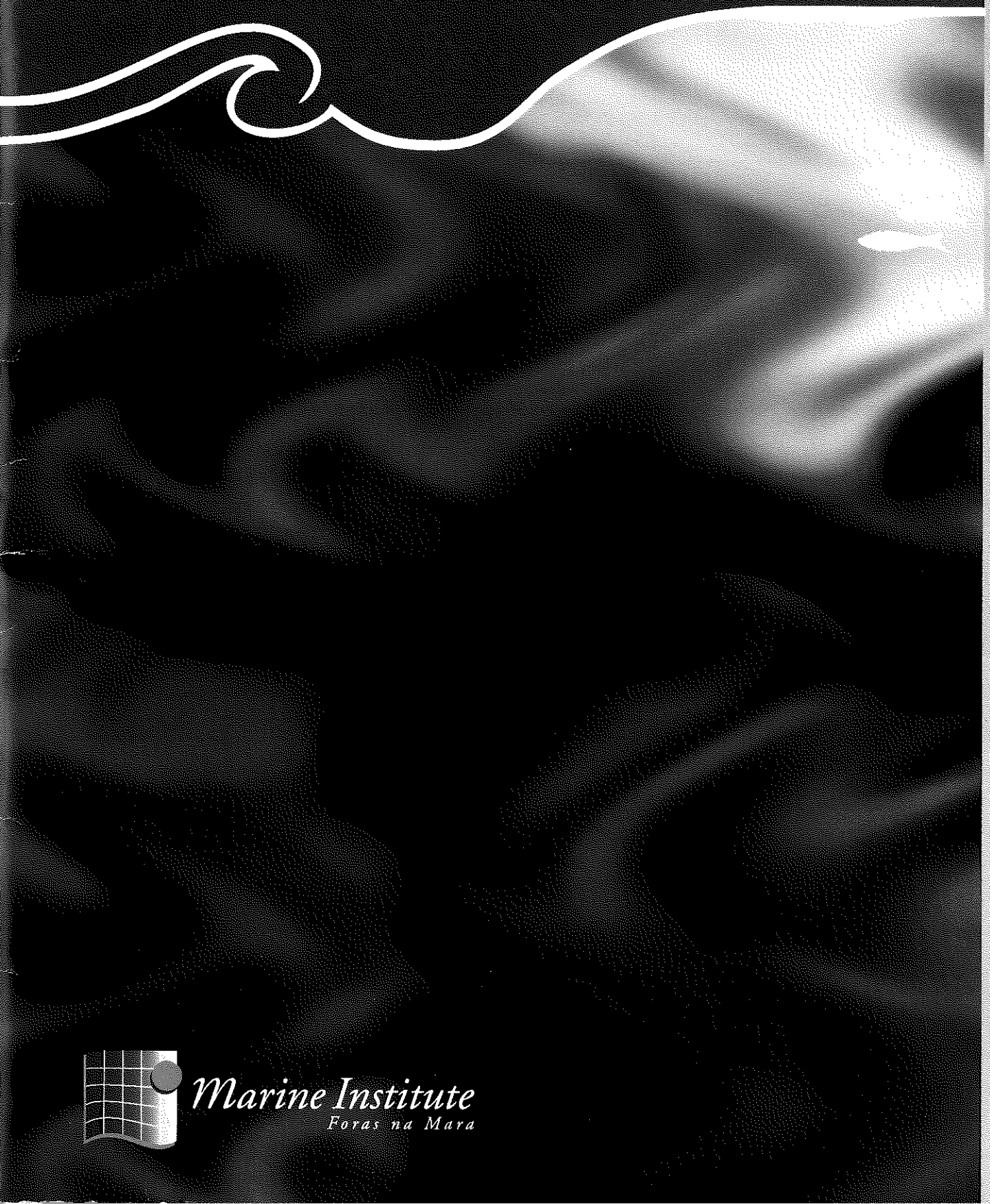

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Appraisal of the whelk (*Buccinum undatum*) fishery on a part of the Codling Bank following aggregate extraction for beach restoration at Bray, Co Wicklow

by

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TABLE OF CONTENTS

SUMMARY

The Codling Bank is an important contributor to the south west Irish Sea whelk fishery; a large proportion of the whelk population there are juveniles. Traditionally, whelks have been harvested ungraded from this area. Fishing trials were undertaken on the Codling Bank in May 2001 to ascertain the consequences for the whelk fishery of aggregate removal by suction dredging during the previous winter months. The results suggested some localised diminution in cpue in the vicinity of dredging operations four months after the event. However, it is not feasible to conclusively attribute the reduction to dredging operations.

1. Introduction

During the winter months of 2000/2001 some 235,000 m³ of seabed gravels were suction-dredged from the Codling Bank, off the coast of Arklow, Co Wicklow, to replenish the beach at Bray which had suffered appreciable erosion in recent years. Concern had been expressed about the consequences of substrate removal for the whelk (*Buccinum undatum*) fishery, particularly by fishermen working out of Wicklow and Arklow. Dredging operations were completed on 20 January 2001 and a follow-up fishing survey was undertaken using conventional whelk gear on 9 and 10 May 2001 to ascertain whether any diminution in performance of the fishery might be attributed to the work.

1.1 Background

Offshore sand and gravel banks run parallel to the coast of south east Ireland; most of these banks consist of mobile sand but the Codling Bank is a stable formation composed of glacial outwash sand and gravel deposited during the last ice age (Warren and Keary, 1989). The Bank is defined by the 20m isobath and it covers an area of approximately 200 km².

The principal fishery interest in the Codling Bank nowadays is whelk (*Buccinum undatum*). The Environmental Impact Statement (E.I.S.) which examined the proposal to extract gravel from the bank (Anon, 1996), recorded the numbers of vessels involved in the fishery in 1995 as 20, together taking whelk to the value of €1.65m. Landings from the whelk fishery declined after reaching a peak in 1996 and the number of vessels participating in the fishery also fell. However, landings into the ports of Wicklow and Arklow have accounted for an increasing proportion of landings from the south west Irish Sea fishery since (Fig 1). A large percentage of these whelks come from the Codling Bank.

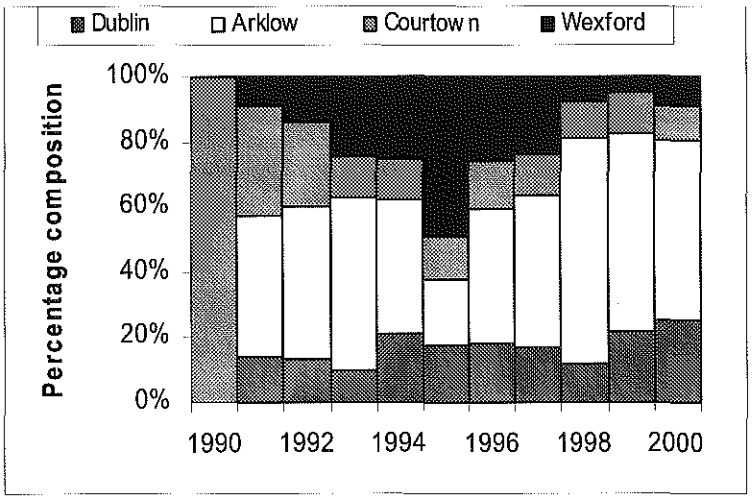

Fig 1. Relative contribution of four sectors of the whelk fishery in the south west Irish Sea to the total landings. The Arklow sector is largely dependent on the Codling Bank.

The whelk fishery in the south west Irish Sea extends from Howth in the north to Carne in the south. The fishery is regarded as being made up of an indeterminate number of stocklets rather than of a single stock. For assessment purposes the fishery is divided into four sectors, the two centremost of which contain higher proportions of juvenile whelk. These centre sectors include the Codling Bank; their substratum would appear to be particularly productive nursery and possibly spawning ground for whelk (Fahy *et al*, 2000).

The proposed extraction site was to be contained within a designated 5 km* 3km rectangle (referred to here as the exploration box) whose co-ordinates were:

Point	Latitude			Longitude		
NW	53	08	36	5	50	30
NE	53	08	36	5	47	48
SE	53	06	00	5	47	48
SW	53	06	00	5	50	30

The location of the exploration box on the Codling Bank is shown in Fig 2.The suction dredger made extensive trials within the exploration box but concentrated on the NW corner and virtually all of the dredge material was taken from some 10% of the available area. The suction dredge head measured 3 m in width and it worked to a depth of 0.5 m. In the course of eight trial dredge runs 10,000 m^3 of aggregate were removed (Fig 3), a further 225,000 m^3 of aggregate being extracted during 92 production runs (Fig 4).

2. The post-dredge survey - Methods

Post-dredge fishing trials were carried out on 9-10 May 2001. Ten trains of 45 pots each were set within the limits of the neap tide envelope in which sand and silt were predicted to settle after dredging operations (see Fig 4.1, Anon, 1996), six of these were within the exploration box, four outside it, two north and two south of its boundaries. Commercial fishing gear was used in the survey and the method of its use conformed with commercial practice. Each pot was baited with standard rations of brown crab (*Cancer pagurus*) and dogfish (*Scyliorhinus* spp) (Fahy, 1999). The soak time was 24 hours and the pots were lifted in the order in which they had been set.

A second group of eight pots fished by the same vessel, which had been in the water for 8 days, were lifted in the course of the work and their contents were also noted.

In accordance with operating procedures in this fishery, pots were hauled on board and their contents were spilled into 45 kg plastic fish boxes. The volume of a box occupied by the combined catches of all 45 pots in a train was estimated by eye. Subsamples of the catches were removed to the laboratory to be measured (total length, mm) and weighed (g).

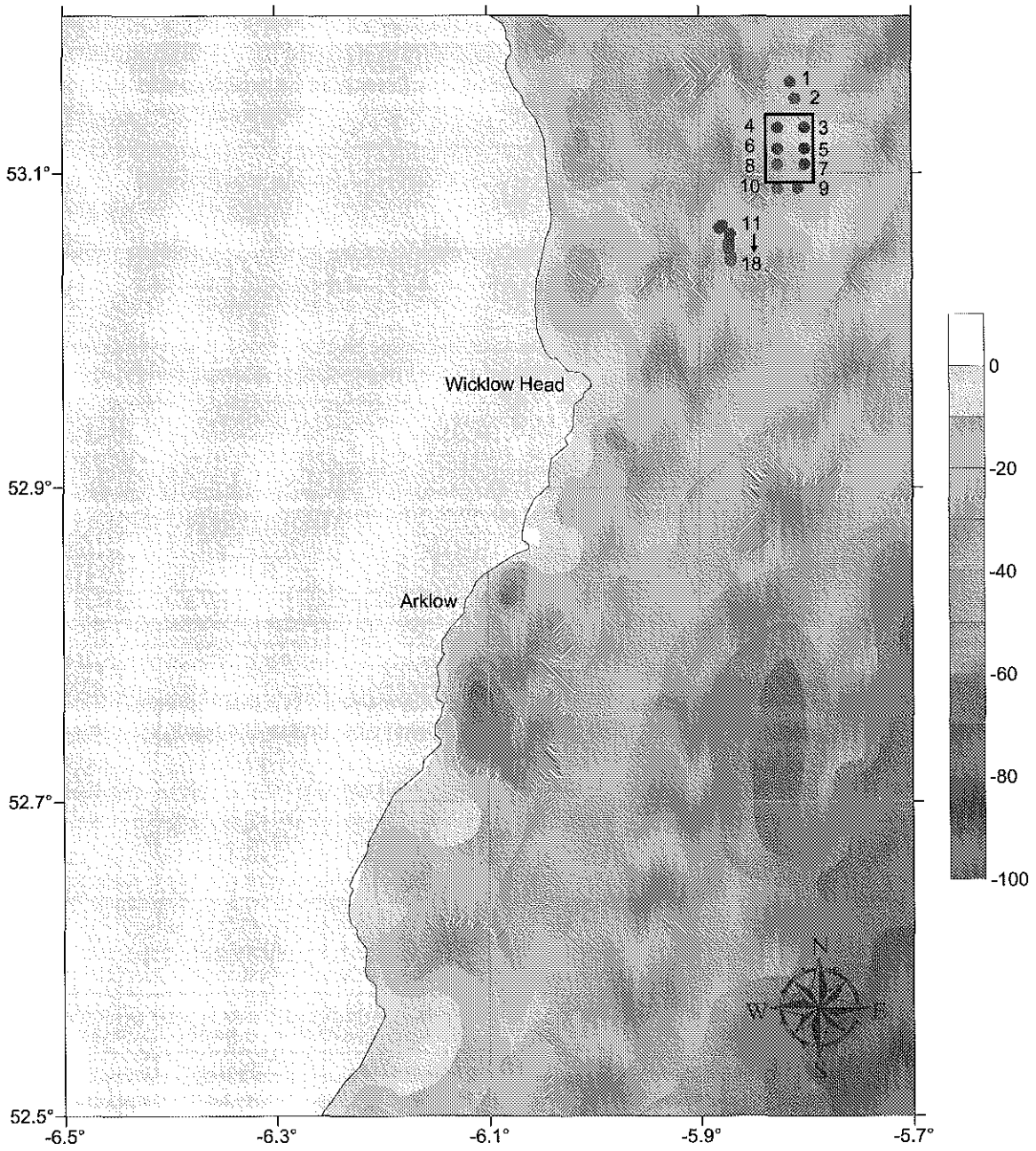

Fig 2. Bathymetry of the Codling Bank and its vicinity on which have been superimposed the exploration box and the positions of trains of whelk pots in May 2001 (numbered). The vertical scale shows the depth in m.

3. Results

The yield from the whelk pots in May 2001 is set out in Table 1. Pots fishing for eight days had marginally heavier catches than those set for the purpose of the survey.

The length frequencies of whelk taken by the survey pots varied but the animals were predominantly small (Table 2). Whelk potted on the Codling Bank are invariably small (Fahy *et al*, 2000) and in Fig 5 the length frequency of those taken in the course of the experimental fishery (bulked) is compared with the length frequency distribution of

samples from the landings into Arklow and Wicklow in 2000. In Fig 5 the vertical arrow approximately marks the size limit (in fact, this is defined as the maximum width of the animal in the conservation regulation but the length is approximately twice this measurement). The two length frequencies do not differ significantly (Chi-square = 13.4 with 8 degrees of freedom P>0.05). It is noteworthy that the weights reported in Table 1 are of catches so the landings in 2000 were, effectively, unsorted, and that has been the rule for as long as this fishery has been monitored: small whelk are harvested without discarding and contrary to conservation regulations. In both length frequencies in Fig 5 more than 50% of the animals are less than 50 mm long and hence, less than the size at which capture is legally permitted.

Table 1. Whelk fishing trail results following dredging of the Codling Bank.

Station number	Depth (m)	Latitude			Longitude			Yield (boxes)/train	Yield (kg)/pot
a. Yield from pots fishing for 24 hours									
1	21.5	53	09	50	5	48	08	0.1	0.0
2	15.5	53	08	85	5	48	55	0.8	0.7
3	14.5	53	07	75	5	48	00	1.8	1.6
4	15.5	53	07	75	5	49	53	2.4	2.1
5	17.5	53	06	95	5	48	00	0.9	0.8
6	16.5	53	06	95	5	49	53	4.9	4.4
7	15.8	53	06	35	5	48	00	2.5	2.2
8	18.5	53	06	35	5	49	53	3.1	2.8
9	18.2	53	05	45	5	48	04	2.0	1.8
10	16.5	53	05	43	5	49	55	2.0	1.8
								Average	***1.8***
b. Yield from pots fishing for eight days									
11	38.5	53	03	40	5	52	30	2.5	2.2
12	34.9	53	03	69	5	52	25	2.2	2.0
13	38.5	53	04	0	5	52	70	2.4	2.1
14	38.5	53	03	90	5	52	86	3.5	3.1
15	38.5	53	03	25	5	52	30	1.4	1.2
16	38.5	53	03	10	5	52	30	1.8	1.6
17	37.5	53	02	80	5	52	20	3.1	2.8
18	37.5	53	02	65	5	52	24	1.8	1.6
								Average	***2.1***

Variation in cpue with latitude (effectively from the north-north-east to south-south-west) is shown in Fig 6, the two groups of whelk pots being distinguished. Among the experimental group, there was an improving trend in yield which rapidly reached those of catches from the more southern group of pots with longer soak time.

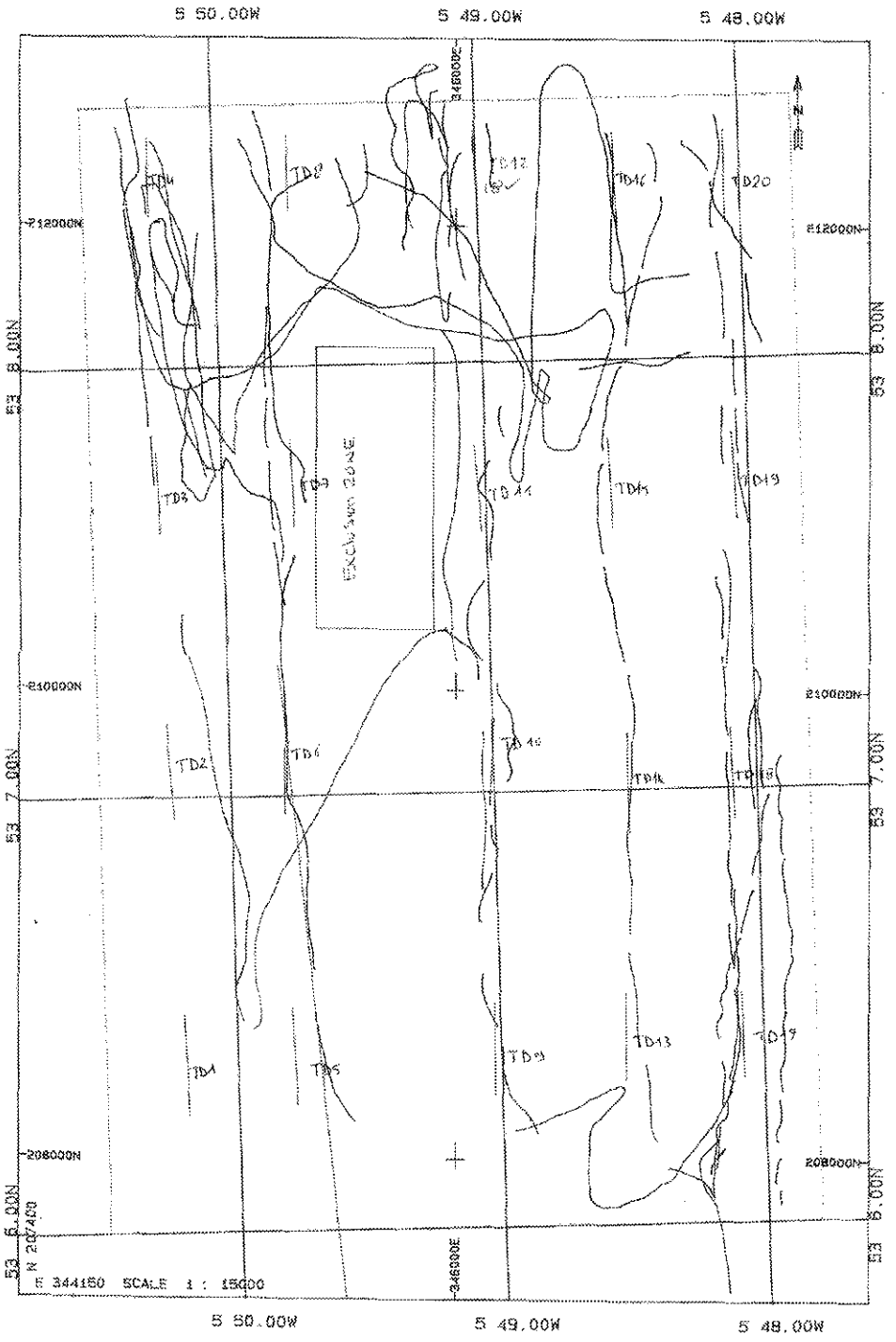

Fig 3. Tracks of eight trial exploration runs within the exploration box in the course of which 10,000 m^3 of aggregate were extracted.

4. Discussion

The E.I.S. envisaged the physical elimination of the benthic community by the removal of the upper sediment in the dredged area. However, the widespread nature of the benthos, the limited size of the dredge site ($1/800^{th}$ of the Codling Bank) and the short period of disturbance would, it was anticipated, all favour a rapid recolonisation of the

area of disturbance. The period of actual recovery would vary with the species involved. Resettlement by planktonic larvae would be a quick mechanism.

Whelk do not have a planktonic stage, for which reason local populations acquire distinctive characteristics so that, in theory at least, recolonisation by whelk would be a relatively slow process.

Table 2. Percentage length frequency distributions of *Buccinum undatum* from experimental fishing sites on the Codling Bank.

Length frequency (cm)	Train 1	Train 2	Train 3	Train 4	Train 5	Train 6	Train 7	Train 8	Train 9	Train 10	Overall
0.0	0	0	0	0	0	0	0	0	0	0	0
0.5	0	0	0	0	0	0	0	0	0	0	0
1.0	0	0	0	0	0	0	0	0	0	0	0
1.5	0	0	0	0	0	0	0	0	0	0	0
2.0	0	0	0	0	0	0	0	0	0	0	0
2.5	0	6	0	5	0	0	0	0	0	0	1
3.0	2	15	0	6	0	0	3	0	1	0	3
3.5	8	15	0	6	0	2	4	0	2	1	4
4.0	17	18	0	8	6	5	9	0	8	3	8
4.5	19	10	12	14	8	21	17	0	17	17	14
5.0	12	8	19	11	25	10	19	6	23	24	16
5.5	4	6	7	10	23	14	11	13	24	15	14
6.0	4	2	17	11	17	10	19	23	7	15	12
6.5	2	5	7	13	11	12	10	23	6	13	10
7.0	8	8	10	5	5	9	3	6	8	10	7
7.5	12	2	14	10	2	2	4	6	1	1	5
8.0	8	2	5	0	2	7	1	12	0	0	3
8.5	4	3	2	2	0	0	0	2	1	0	1
9.0	2	2	5	0	2	5	0	4	0	0	2
9.5	0	0	2	0	0	2	0	6	0	1	1
10.0	0	0	0	0	0	2	0	0	0	0	0
10.5	0	0	0	0	0	0	0	0	0	0	0
11.0	0	0	0	0	0	0	0	0	0	0	0
11.5	0	0	0	0	0	0	0	0	0	0	0
12.0	0	0	0	0	0	0	0	0	0	0	0
12.5	0	0	0	0	0	0	0	0	0	0	0
Total	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**

The E.I.S. stated that none of the important commercial fishery species have known spawning grounds on the Codling Bank but, in fact, it is likely that whelk spawn there. The Codling and Rusk Banks are known for large proportions of small, young whelks which are harvested by the commercial fishery. Preliminary results of a grading analysis of core and grab samples from the Codling in March/April 1996 indicated that the seabed material suitable for extraction consisted of 80% gravel, 20% sand and <1% silt. The E.I.S. estimated that only 1% of the finest grades would escape with the overflowing waters from the dredger but that some sand size grade would also escape.

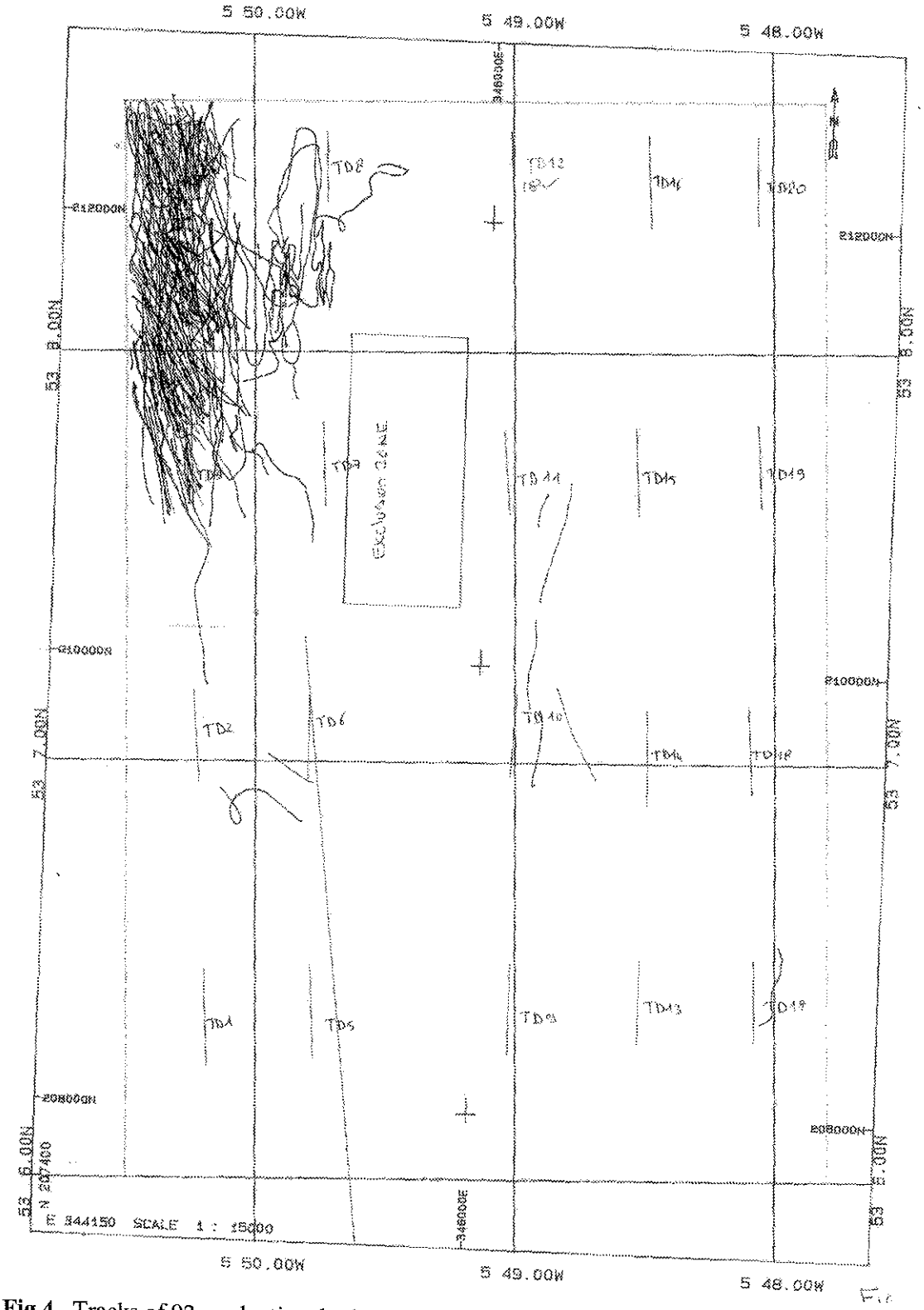

Fig 4. Tracks of 92 production dredge runs in the course of which 225,000 m³ of aggregate were extracted.

Estimates of the paths of plumes and sediment deposition models were made with the aid of numerical models; the overflow material size distribution was taken to be composed of medium sand (40%), fine sand (40%) and silt (20%), assuming that the dredging operation was randomly distributed over a spring and neap tidal cycle.

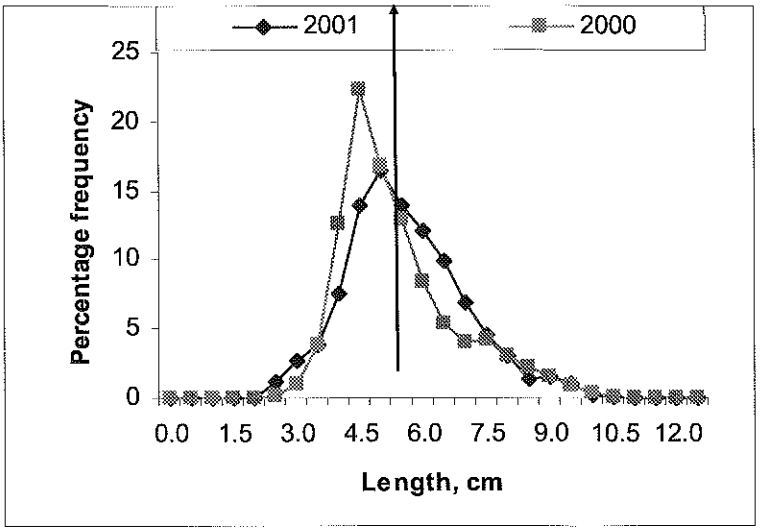

Fig 5. Length frequency of whelk catches taken by the 10 experimental trains of pots set in May 2001 compared with the length frequency of whelk from Arklow and Wicklow sampled during 2000. The vertical arrow approximately marks the size limit.

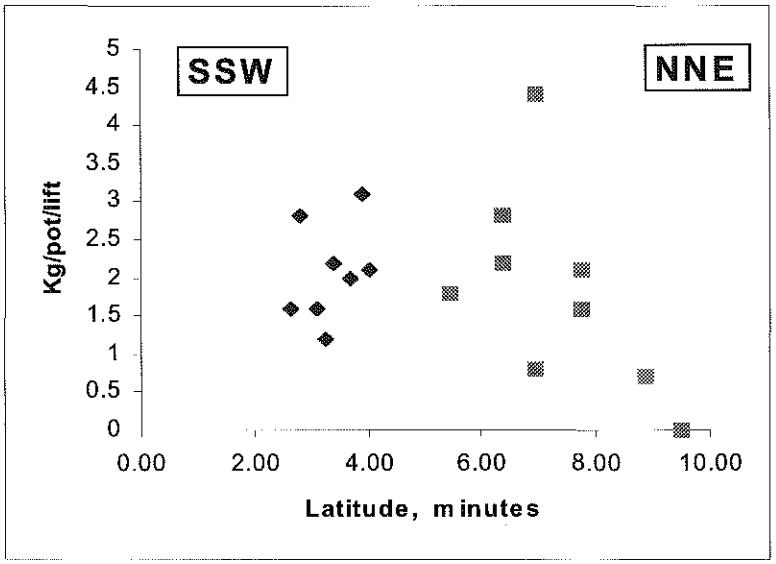

Fig 6. Trend in cpue among two groups of whelk pots fishing the Codling Bank in May 2001; solid symbols indicate the pots with an 8 day soak time; the hatched squares are the pots which were trial fished for 24 hours.

The model predicted that a typical spring tidal plume would travel 3.5 km to the north-north-east on the flood and to the south-south-west on the ebb and that 98% of all material discharged would settle back on the seabed within this area. If dredging were restricted to a smaller area, then the envelope of impact would be reduced. In fact, the model used did not take into account the possibility of re-suspension of material which would be redistributed to deeper areas of slower current speeds.

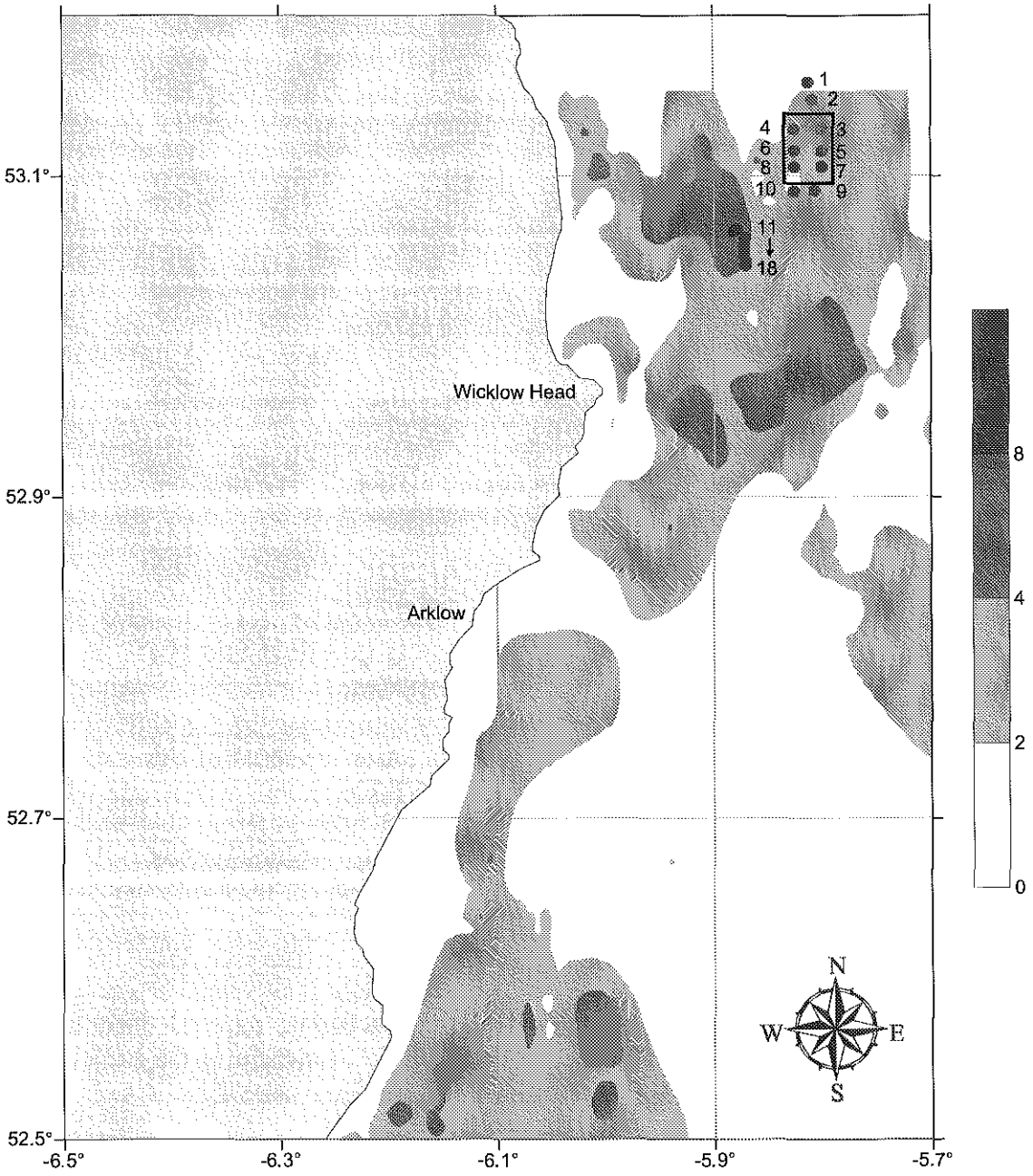

Fig 7. Variation in cpue over much of the whelk fishery in the South West Irish Sea. The exploration box and whelk pots are shown as in Fig 2. The vertical scale shows reported catch in Kg per pot per lift, from logbook data.

One of the risks associated with dredging is the mobility of disturbed sediments which settle out in the vicinity of dredging, smothering sessile filter feeders in the process. Such sediments are not supposed to directly damage whelk (Anon, 1996).

The E.I.S. concluded that any whelk patches affected by extraction would be limited to the actual dredged area.

The interpretation of fishing surveys which are used to indicate species abundance is not straightforward; the ground might already have been fished shortly before sampling took place, for example. Obtaining such data using baited pots may be additionally complicated by the fact that the feeding stimulus, on which catches depend, is temporarily modified by environmental conditions.

There are several fishery-independent methods of assessing whelk numbers but they are problematical and impractical, particularly in the strong tidal currents of the Codling Bank. Furthermore, any historic data on whelk in this area have been obtained from logs of the performance of the pot fishery. Hence, this is the basis on which comparison with earlier surveys is made.

The survey results in May 2001 came from two sets of whelk pots: one had a 24 hour soak time, which is the desired norm in this fishery (although it is frequently extended by bad weather), the other set had been in the water for 8 days. The attraction of a whelk pot declines as the bait deteriorates and is dispersed; its capacity to retain whelks depends on the conditions in which fishing takes place. Longer periods at sea in the strong tidal currents of the Codling Bank result in pots being rolled over and their contents spilled out so that cpue tends to fall with the passage of time (Fahy *et al*, 2000).

Historic regional variation in performance of the south west Irish Sea whelk fishery was ascertained from fishermen's logs and is graphically summarised in Fig 7. Over much of the fishery 2-4 kg/pot/lift is widespread and the lower threshold of this range was achieved by the pots with the 8 day soak time (Fig 6, Table 1). Pots with a soak time of 24 hours had an overall average performance of 1.8 kg/pot/lift but this is largely explained by the low yields of pots set to the north of the exploration box and to one train which was set within its boundaries. The trains of whelk pots with the 24 hour soak time tended to improve their yield moving SSW.

The survey in May 2001 did not fish the area from which most aggregate was removed. It may be assumed, as predicted by the E.I.S., that substrate removal there would effectively eliminate the whelk population for a period. Elsewhere in the exploration box it is difficult, four months after dredging operations ceased, to conclusively demonstrate any diminution in the performance of the fishery.

ACKNOWLEDGEMENTS

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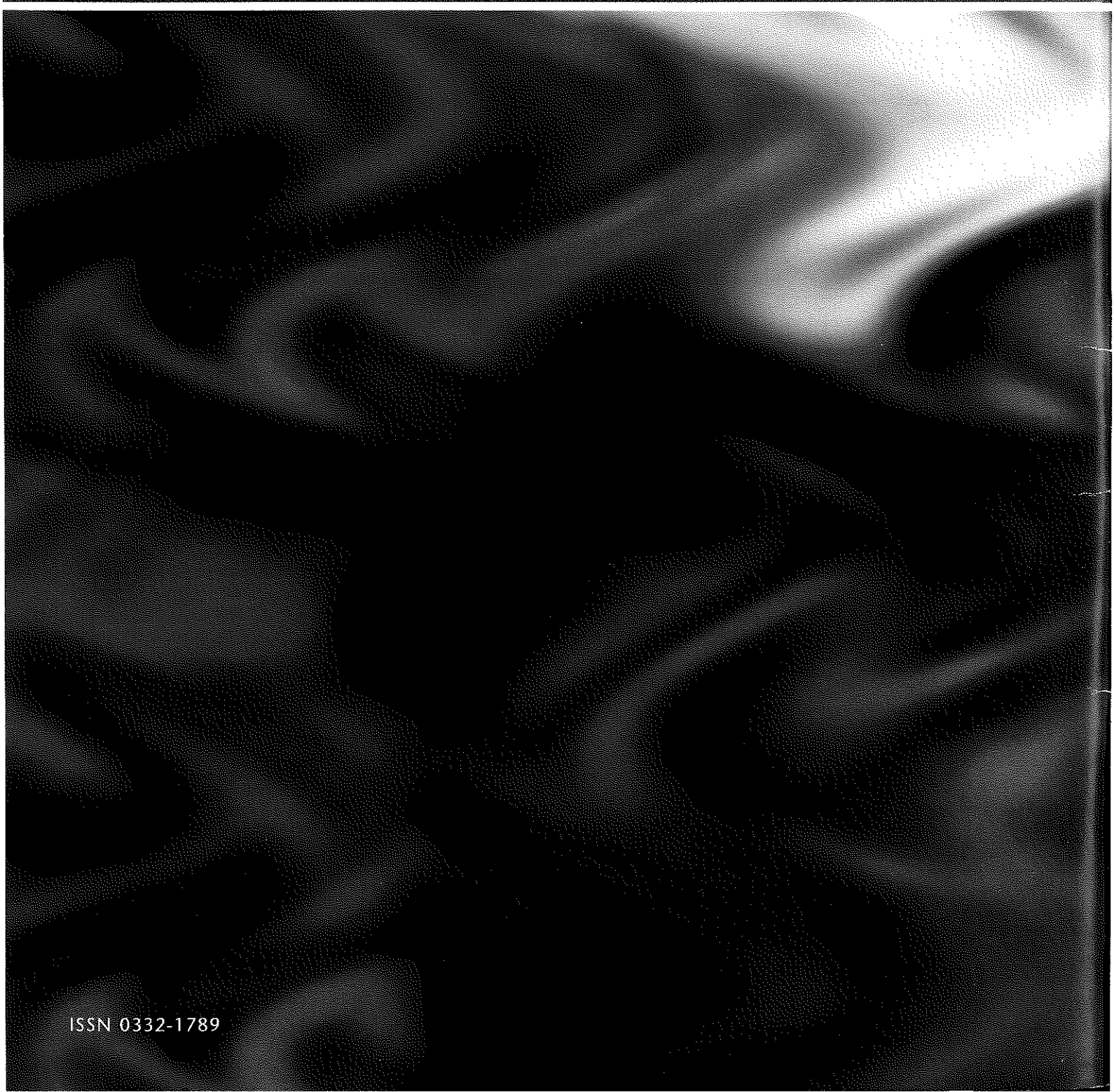

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