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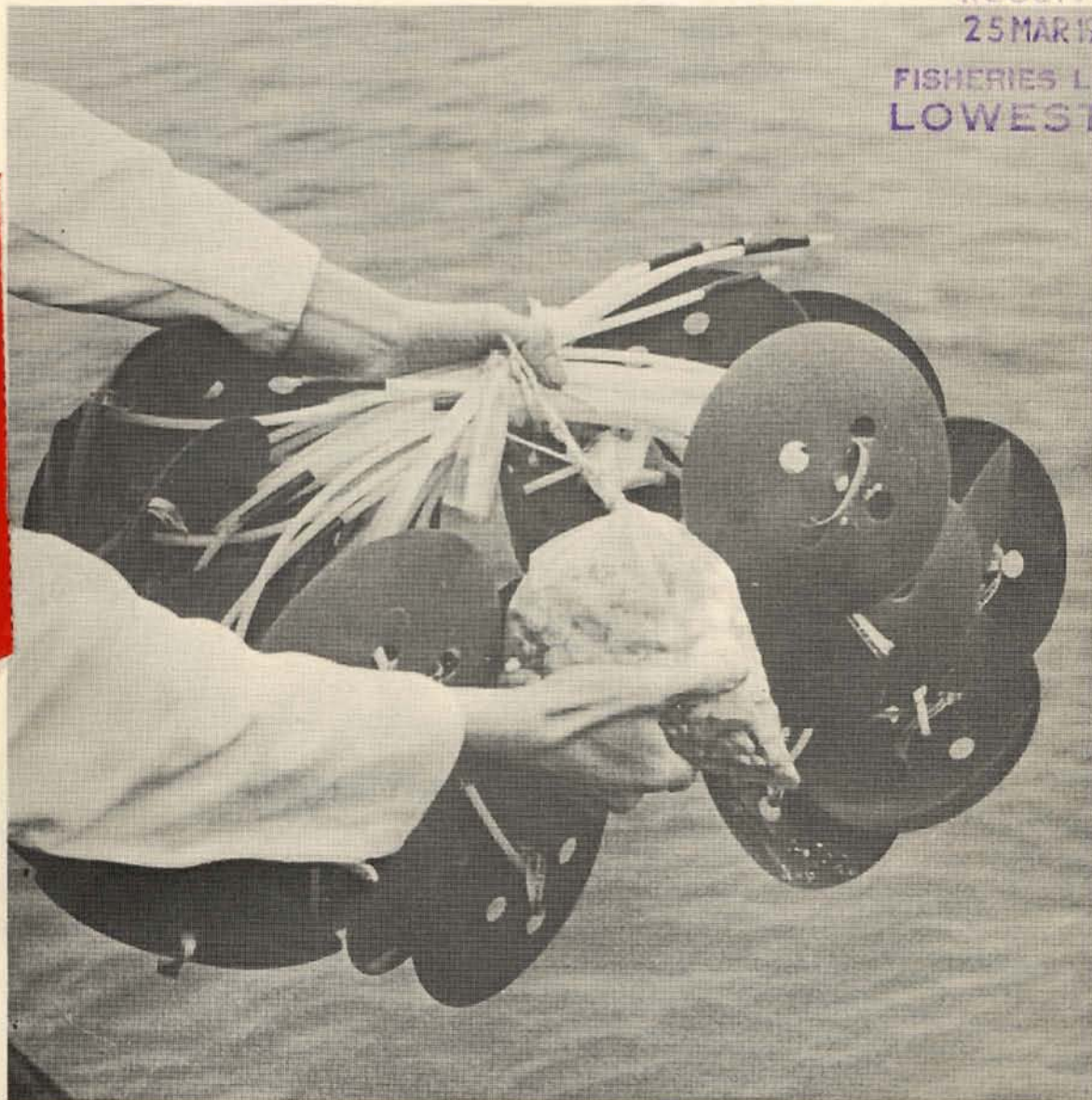
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STUDIES WITH THE WOODHEAD SEA-BED DRIFTER IN
THE SOUTHERN NORTH SEA

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Studies with the Woodhead Sea-Bed Drifter in the Southern North Sea

Introduction

During the period 1904-39 large numbers of specially designed and weighted glass bottles which drifted over the sea-bed were released in the southern North Sea in order to discover the speed and direction of the currents there. They were released in batches at certain points in the sea and later recaptured in trawls or washed on to beaches and found by members of the public. On the postcard which the bottles contained the finders were asked to give details of position and date of recapture, and by building up a store of this information fishery research workers were able to work out a generalised picture of the currents near the sea-bed. In recent years plastic sea-bed drifters have replaced the old glass bottles, and since 1960 nearly 15,000 of them have been released in the southern North Sea.

Mr. R. E. Craig, of the Marine Laboratory, Aberdeen, first had the idea of such a drifter, but the particular drifter used not only in the southern North Sea but also off the coasts of the United States, Canada, South Africa and India was developed by Mr. P. M. J. Woodhead, of the Fisheries Laboratory, Lowestoft.

The Woodhead sea-bed drifter

The cover photograph shows a bundle of sea-bed drifters about to be released. A length of soluble film has been wound round the stems of the mushroom-like drifters, and the bag of gravel tied to this acts as a weight. Mr. B. H. Holford, a diver on the staff of the Fisheries Laboratory, Lowestoft, has observed, timed and filmed the descent of bundles of drifters tied together in this way and he finds that the soluble "string" dissolves in about twenty minutes, leaving the drifters free to stand upright and move off in the bottom current. Figure 1 is a photograph taken by Mr. Holford of some Woodhead sea-bed drifters moving over part of the sea-bed near the Isle of Man.

Both the red saucer ($7\frac{1}{4}$ inches in diameter) and the white stalk (21 inches long) are made of polyethylene; the weight crimped on to the sharpened end of the stalk is of copper. This copper weight makes the drifter just, but only just, negatively buoyant so that it can still move up the gentle slopes of submarine hills and be carried over rocky obstacles by eddies. A numbered yellow polyvinyl chloride tag is tied on to the saucer, as shown in the cover



photograph, and this carries the message "5/- Reward for drifter, tag and full details". On the saucer has been embossed English, French, Norwegian and German versions of the message "Reward: Return sea-bed drifter and tag with date and position found to your Fishery Officer or Fisheries Laboratory, Lowestoft". If the position of recapture can be given in Decca Navigator System co-ordinates this is particularly welcomed.

The release of the drifters by Ministry research vessels is publicised by means of posters displayed on fish markets and elsewhere. An on-the-spot repayment is made if a drifter is handed to a Fishery Officer or a member of his staff, and these officers are usually able to give the finder details of the position and date of liberation of the drifter which he has returned. If a drifter is returned direct by post to the Fisheries Laboratory, Lowestoft, then the reward is paid by postal order and the cost of postage is refunded; in this case, also, the finder is notified of the release details.

Liberations in the North Sea

As an example of the high rate at which the Woodhead sea-bed drifters are returned through the active co-operation and goodwill of fishermen and the general public, we can consider the 2,000 drifters liberated in the spring of 1960 in the area south of the Dogger Bank. Within one year of the release 48% of the markers had been returned, and 11% of these returns came from beaches. All subsequent releases in the southern North Sea show the same pattern of returns: within 365 days 42-50% of the drifters have been recaptured, and of these about 10% come back from beaches. Most of the drifters recovered from trawls have been assigned Decca fixes by their finders, and though it is realised that recapture may have occurred at any point over the ten miles or so of an average trawl haul, the position given by the finder has been accepted without alteration in plotting out points of recapture. In rare instances returns have been made that were obviously errors in reporting; where possible these have been corrected, and at other times the reports have been discarded. About one quarter of the drifters returned from trawlers have been sent in by foreign fishermen.

Because of the intensive fishing of the southern North Sea throughout the year continuous returns of Woodhead drifters have been made from all releases. This has meant that it has been possible to compare distances travelled over successive periods of 28 days starting from 20 April 1960 (see Table 1) and, for the most part, to have some drifters in each 28-day period that have been in the sea for not more than 9 or 10 weeks. All returns made in each

Table 1. Dates of the four-week recapture periods Nos. 1-13

Period No.	Dates (1960)	Period No.	Dates (1960)	Period No.	Dates (1960-1961)
1	20 April-17 May	5	10 Aug. - 6 Sept.	9	30 Nov.-27 Dec.
2	18 May -14 June	6	7 Sept.- 4 Oct.	10	28 Dec.-24 Jan.
3	15 June -12 July	7	5 Oct. - 1 Nov.	11	25 Jan.-21 Feb.
4	13 July - 9 Aug.	8	2 Nov. -29 Nov.	12	22 Feb.-21 Mar.
				13	22 Mar.-18 Apr.

28-day period have been collected together, and in the first instance their recapture positions have been plotted, together with the points of release. The points of recapture of individual markers from each drop at each release point have then been joined up by straight lines so that an "envelope" is formed, drawing attention to the area from which drifters were culled in that particular 28-day period (see Figure 2). After trends during one period have been noted, these can be directly compared with those shown by the pattern of returns in the next, and so on. In due course, as new releases are made, the direction of movement away from the release point in these cases can be compared with the trends that have developed over previous weeks from the earlier releases. Figure 2 shows how this method of presentation develops with time, and the movement of the drifters from release points A, B and C over periods 5 to 13 can readily be observed.

The sea-water circulation as found from the study of sea-bed drifter recaptures

From a comparison of these patterns of recapture it seems that the residual bottom currents in the southern North Sea during 1960-1 were seasonal in type. During the winter (October-March) eastward-moving bottom currents swept over the whole area from Flamborough to the Wash at about 1 mile per day (Figure 3). At the same time a north-east-going current of similar strength flowed in the Southern Bight, and these two streams merged in a great inverted funnel stretching up from the Norfolk Banks and Texel into the German Bight. Drifters released off Flamborough Head moved eastwards either into the deeper water of the Outer Silver Pit or over the Well Bank Flat to the Botney Ground, from which they then moved off north-eastwards

in the combined stream. Only two markers have been returned from the Danish coast, although groups of 4 or 5 have been trawled up in the German Bight after a year or eighteen months in the sea. This suggests that there is to be found in the German Bight a self-contained bottom circulation that does not allow free passage of bottom water northwards.

The returns of the sea-bed drifters during the spring and summer months (April-September) of 1960 and 1961 suggest a more complex pattern of bottom currents for the southern North Sea. The north-easterly thrust through the Straits of Dover was still in evidence throughout the period, but the early summer recaptures showed a westward-moving current sweeping the South-West Patch and Spit and then a flow northwards following the western boundary of the Dogger Bank. Markers released in the area off Flamborough Head showed some eastward movement at first, but then moved off northwards and were lost for a time. From one release point in this area drifters were carried straight to Spurn but this seems to be a local complication, since there was a very definite movement northwards from all other points. Recaptures from stations south of the Outer Silver Pit suggest the existence of an anti-clockwise swirl in the region bounded by the Norfolk Banks and the southern limit of the deeper water.

These currents were replaced during the late summer (July-September) of 1960 by an arm of water that swept southwards past Flamborough and either brought drifters, in sequence, to the beaches of Flamborough Head, Spurn and the Lincolnshire coast or pushed them south-eastwards towards the Botney Ground. At this season very confused conditions existed both in the deeper water of the Silver Pit itself and over the relatively shallow, well-fished area immediately to the north; this confusion was brought to an end by the onset of the winter east-going currents. All these developments are summarised in Figure 3.

Future studies

Further large-scale releases of drifters are being made in the southern North Sea in 1965, to check the findings made from previous liberations. Releases of this sort are likely to continue over the next few years. They will also be made in increasing numbers in the Irish Sea and occasionally off the north-west coast of Norway and in the Barents Sea. The success of these investigations will depend very largely on the fishermen and members of the public who find the drifters, as the greater the number returned with accurate details of the positions and dates of their recapture, the more accurate will be the information available from which to deduce the current systems.

THE CO-OPERATION OF FISHERMEN AND THE GENERAL PUBLIC IN THE PAST IS GRATEFULLY ACKNOWLEDGED AND THEIR CONTINUED SUPPORT IN THE FUTURE IS EARNESTLY REQUESTED.



Figure 1

Woodhead sea-bed drifters about 20 minutes after release

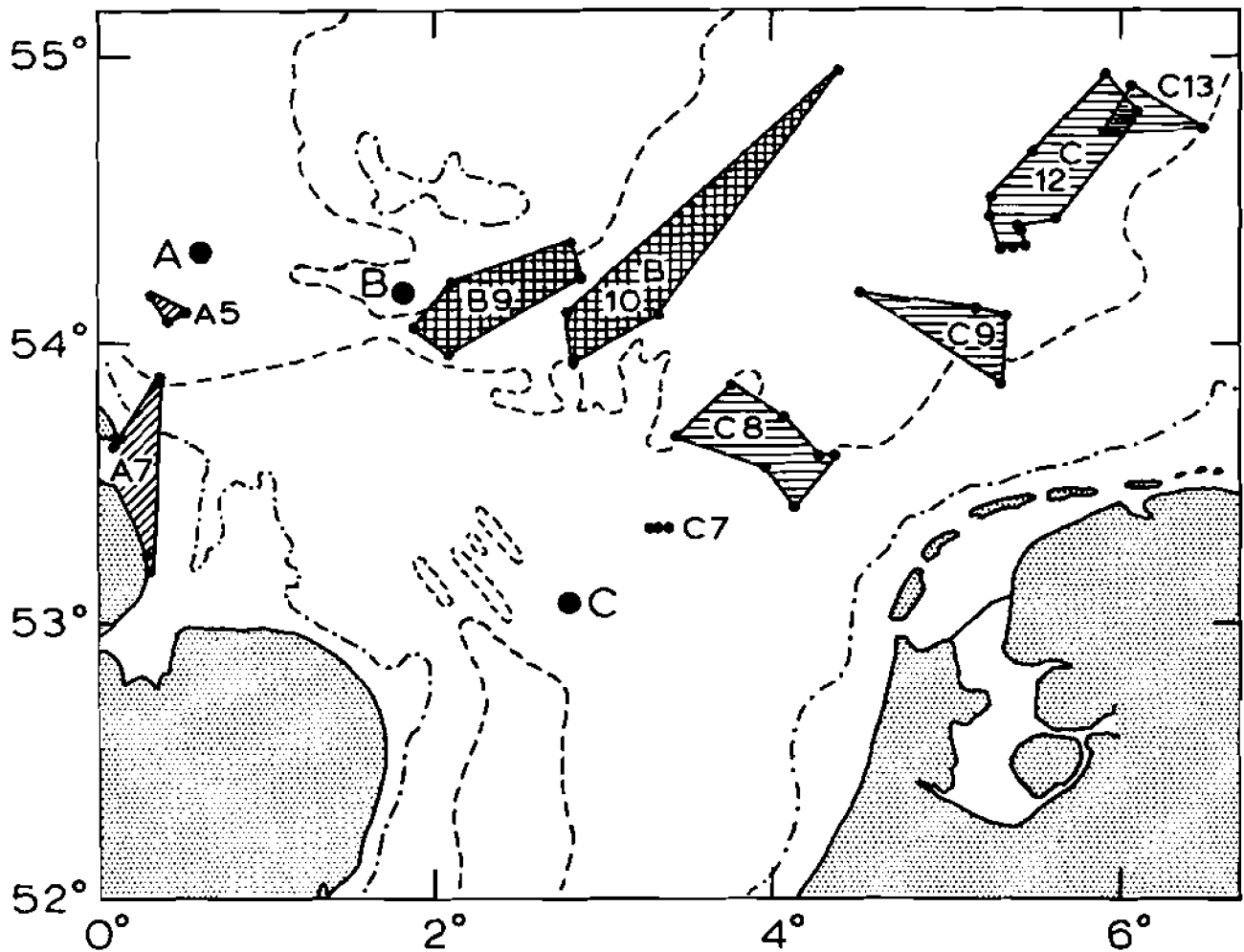


Figure 2

Directions of residual flow, as indicated by the returns of drifters from releases 4 and 5, 1960.

The three large circles indicate the release points: A, 23 July; B, 14 July; C, 6 October; the small circles indicate recapture positions, and the numbers the recapture periods (see Table 1); hence the envelope A7, for example, denotes recaptures in period 7 from release A.

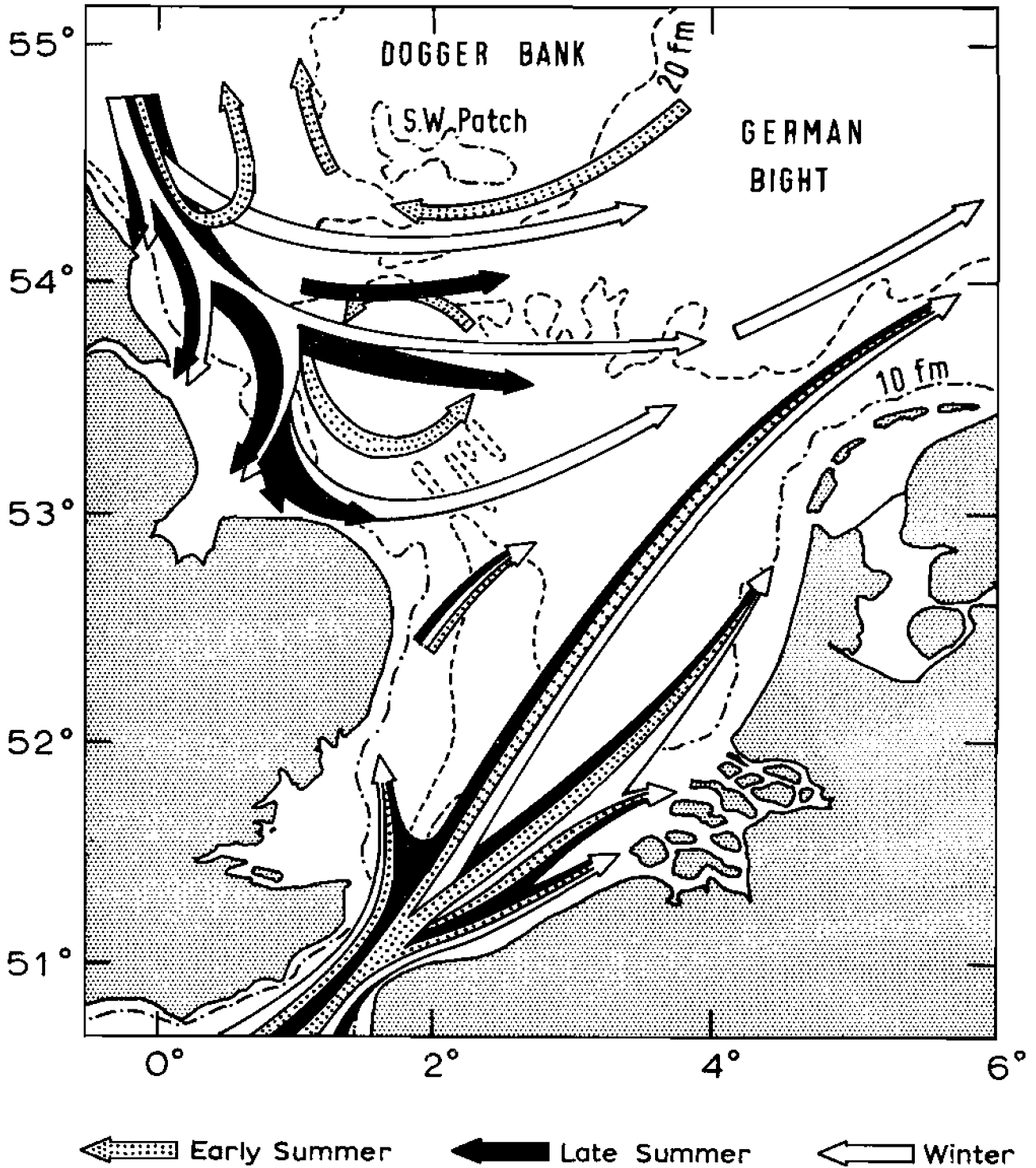


Figure 3 Bottom currents in the southern North Sea during 1960-61, as found from the returns of Woodhead sea-bed drifters.