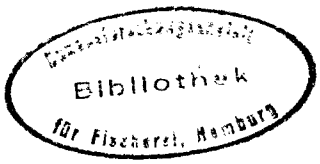
Note: This paper not to be cited without prior reference to the author.



65th Statutory meeting I.C.E.S.,

Reykjavik, Iceland. 1977

"Navigation and position recording to avoid oil/gas seabed obstructions"

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Industrial Development Unit

NAVIGATION AND POSITION RECORDING TO AVOID OIL/GAS SEABED OBSTRUCTIONS

INTRODUCTION

This paper deals with a problem peculiar to the fishing industry, the avoidance of seabed obstructions. These are not regarded as navigational hazards by shipping interests though these interests are of course concerned with the proper reporting and marking of surface obstructions. The Scottish fishing industry has encountered a particular and related problem in this respect, the existence of free floating marker buoys which have broken adrift from their moorings. These surface hazards however are capable of being marked, illuminated and fitted with radar reflectors and therefore the normal good practices of seamen should take care of this problem. Seabed obstructions on the other hand are of course not visible and difficult to mark with buoys in deep water. A vessel towing fishing gear on the seabed must utilise the most up to date navigational equipment available in order to constantly monitor his position relative to the reported position of obstructions. In addition an adequate and frequently updated reporting system must be offered by the oil/gas industry.

This paper can of course only deal with the avoidance of established obstructions such as production wellheads or suspended wellheads and pipelines. The problem of uncharted oil related debris is quite a separate one and only capable of being solved through better housekeeping by oil industry operators and an adequate compensation scheme for the fisherman.

FISHING METHODS AND PARTICULAR PROBLEMS

Bottom trawling and Danish seining are the two fishing methods most directly affected by this problem. In one case a bag of netting is dragged across the seabed at speeds of up to 4 knots. Typically the catchment spread of this gear would be up to a maximum of about 70 metres between the otter boards or spreading devices. This gear is of course in close contact with the seabed. The Danish seine on the other hand consists of encircling ropes laid on the seabed and encompassing an area up to one mile in diameter, these are attached to the vessel at one end and to a netting bag at the other. The ropes are dragged across the seabed until the circle is closed and the fish shepherded into the net. The latter is then dragged towards the vessel. Clearly both these fishing gears are very vulnerable to seabed obstructions. Some wellhead structures are reportedly 5 metres in height. Fishermen have traditionally contended with natural obstacles in the form of boulders or rocky ground by navigating around these usually well documented obstructions, in the past by the use of the echo sounder and direction finder and more recently by the use of hyperbolic navigation systems.

The nearest corollary to the problem of suspended wellheads and pipelines are the numerous wrecks, mainly the debris of two wars strewn around the coastal sea areas of Western Europe. The positions of these are however well documented and their numbers are not significant in the offshore areas. Again, these are established hazards long familiar to the fisherman and accepted as inevitable. However the oil/gas industry seabed fixtures have proliferated rapidly over a very short space of time and in addition the situation changes almost day by day. As previously mentioned serious problems have arisen when attempts have been made to maintain buoys over wellheads in the exposed Northern banks of the North Sea, not the least of which is the previously mentioned hazard of free drifting buoys.

Reporting Systems

In 1975 the apparently conflicting oil/gas and fishing industry interests in the U.K. were brought together in the form of the Fisheries and Offshore Consultative Group. This forum was established by the Department of Agriculture and Fisheries for Scotland. Discussions ranged across the conflicting interests and general agreement was reached on the main topics of supply of information on obstructions and of compensation to fishermen and/or oil companies for damage caused. It was clear that neither side had really appreciated the problems of the other. For the sake of this paper the main conclusion reached was that the Department of Agriculture and Fisheries in Scotland and the Ministry in London should arrange to provide the fishing industry with an obstruction position service. The Department chose to publish a weekly bulletin and to distribute it directly to fishing companies, fish salesmen and harbour authorities, undoubtedly the most direct route. The Ministry on the other hand followed the more traditional process of supplying the information to the Admiralty who include it in their weekly Notices to Mariners. This however must, of necessity, reach only a small section of this wide ranging fishing industry.

The hydrocarbons industry provides this information in the form of latitudes and longitudes and of course fishermen in the North Sea now almost exclusively refer to positions by Decca coordinates and, as in the great metric versus imperial changeover process, will inevitably alter the information to the familiar form. Thus there can be no doubt that initially much of the information was either ignored or wrongly plotted. In the case of permanent obstructions such as surface structures, these are noted in Notices to Mariners and in the normal way plotted on Admiralty and special fishing charts. However quite a different requirement is the need to provide fishermen with immediate information on known subsurface obstructions. The only quick and effective method is to provide this information in the form of lists of Decca coordinates and to update these as frequently as they are altered. At the same time charts produced specifically for fishermen must be updated.

The White Fish Authority Service

The Authority, represented on the discussion groups as a producer of fishing charts, was in a position technically to offer a service which would convert the information received quickly into a form immediately understandable by fishermen. For the past few years the Authority has operated the Kingfisher Automated Cartography System (KACS) for the production of its series of Kingfisher charts. These charts have in fact been in existence for over a decade now but prior to 1972 were produced by manual cartography methods. Since then new master charts have been produced from information fed into a computer data bank and electronically plotted, thus greatly expediting production. The range covers all the sea areas around the British Isles and Iceland, the Norwegian Coast and Barents Sea and also large parts of Eastern Canadian sea areas. These charts are produced at a scale much greater than equivalent Hydrographic Office charts of offshore areas, typically 1:100.000. They include information on seabed obstructions as well as augmenting existing information on sea bottom composition by the inclusion of fishermens' observations on rough ground etc. Apart from information on wrecks which is supplied by the Hydrographic Office, the positions of 'fasteners' as they are known to trawlermen have been provided by Captains of fishing vessels.

Nearly all the areas charted are within the Decca Navigator system coverage. A few are within Loran C coverage and several use as their obstruction references radar bearings and distances of headlands, islands, and so on. Of course the latter may be used in conjunction with direction finders where conveniently placed beacons are available. The sea areas presently being utilised for oil or gas exploration are however all well covered by Decca. Nevertheless future areas may require Loran references or even bearings and distances. Regardless of the presentation, the Authority's KAC System can, within hours, produce information in the desired format for the Department to circulate as printed lists of coordinates and at the same time provide this information for the immediate correction of the bank of master charts held in Hull. In addition every two weeks the Fishing News journal publishes lists of newly reported underwater obstructions provided by the WFA charts service. Included in these lists are the positions of suspended wellheads and other oil/gas industry obstructions.

Many fishing vessels are equipped with track plotters to be used in conjunction with either the Decca or Loran C systems. The design of these plotters dictates that the two lanes or lines of position used to establish the vessel's location are shown on the plotter chart at right angles to each other. This of course means that, as the lanes may really intersect at an acute angle, the plotter chart is in many cases grossly distorted and the vessel's track and features on the chart are presented in a false manner, not true geographically. Nevertheless this system facilitates the easy repeating of tows even in areas strewn with obstructions. Two years ago the Authority decided to offer an additional service which could be conveniently provided by its computerised cartography facility.

Information taken directly from rolls of track plotter paper was produced in the form of track plotter books, each page displaying on plotter paper the accumulated information on trawling tracks and obstructions in a given area. Each sheet is detachable and designed to be placed in the plotter to replace the blank roll normally used.

Information displayed on fishing charts is presented in the form most easily used by busy fishing skippers. Fishermen report obstructions which they have found to WFA, in uncorrected Decca coordinates. They do not have the time and indeed, do not really require to correct the readings to establish a geographically correct position. All their plotting is relative to similar uncorrected references over relatively small individual sea areas. Therefore when the Kingfisher service converts latitude and longitude information into Decca coordinates the fixed errors for that area are applied so that the operator receives readings as close as possible to those which would appear on his decometers with the ship positioned over a given obstruction.

Similarly the positions of all seabed obstructions with the exception of pipelines are plotted on latticed Kingfisher charts in this manner. Therefore their true geographic positions will differ slightly from those indicated by the chart margins. In the case of pipelines it is necessary to plot these in a geographically correct manner because these normally cross many miles of sea bottom and eventually locate with a fixed point on the coast. Therefore distortions would otherwise arise due to the variation in the fixed errors across charts.

In places where pipelines emerge from the sea bottom and in the case of suspended wellheads, these may be observed by the use of sonar. Indeed, the use of the Decca or Loran system to locate the obstruction and the subsequent use of sonar to navigate accurately in close proximity is practised increasingly by fishing vessels. The lower priced short range sonars are normally purchased for this use as opposed to the longer range sets used for fishing pelagic shoals of fish. Fishermen have recently asked the oil/gas industry to consider making the wellhead structures more sonically reflective. This procedure must be regarded as the only effective way of fishing within the safety margin dictated by the accuracy of the navigation system used. Five hundred metres is generally regarded as a safe daylight margin for North Sea navigation with Decca although during the hours of darkness this can be unreliable when even lane slip can occur.

H. McDiarmid.

N.B. There are about half a dozen overhead projector transparencies suitable for this paper.

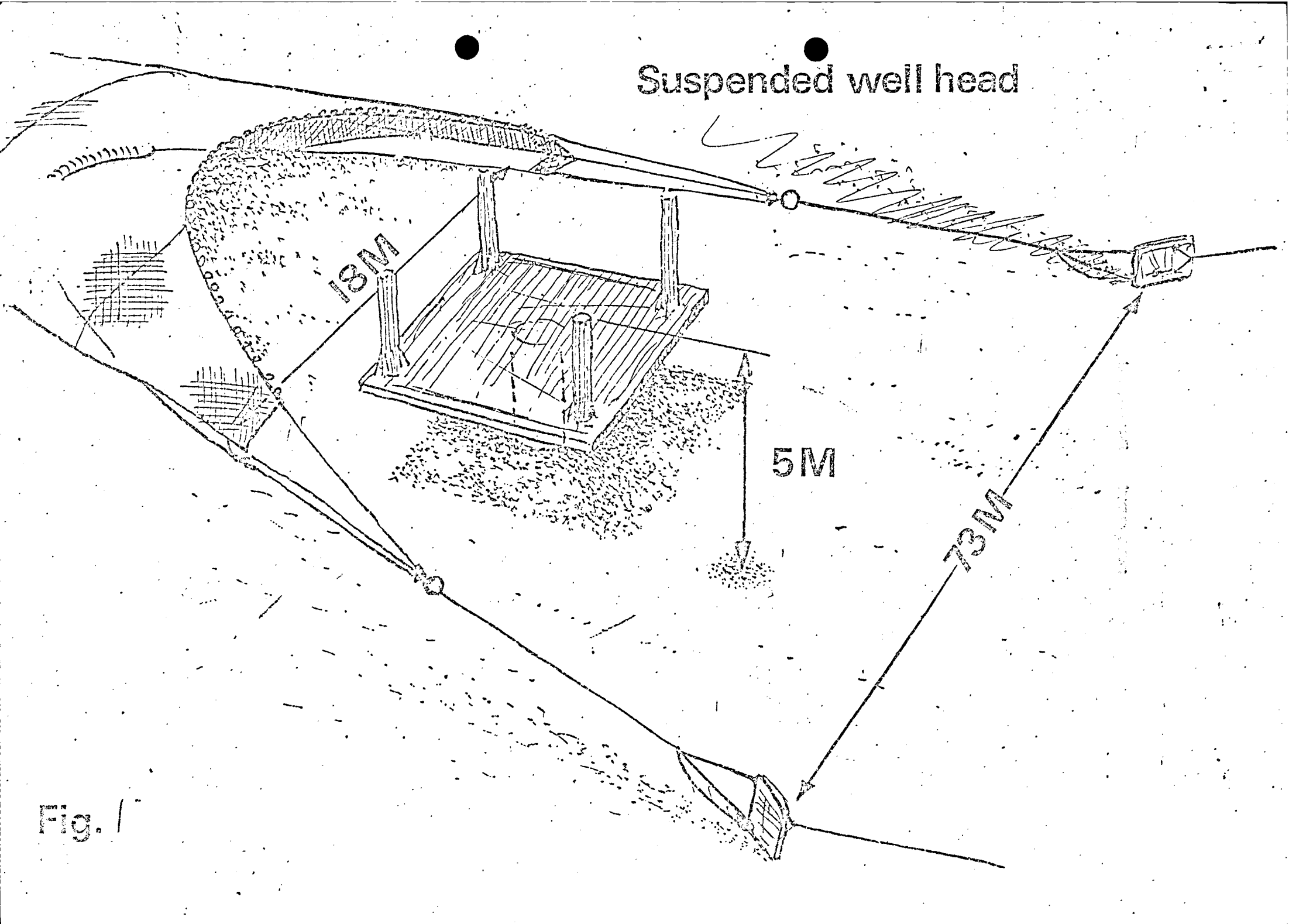


Fig. 1

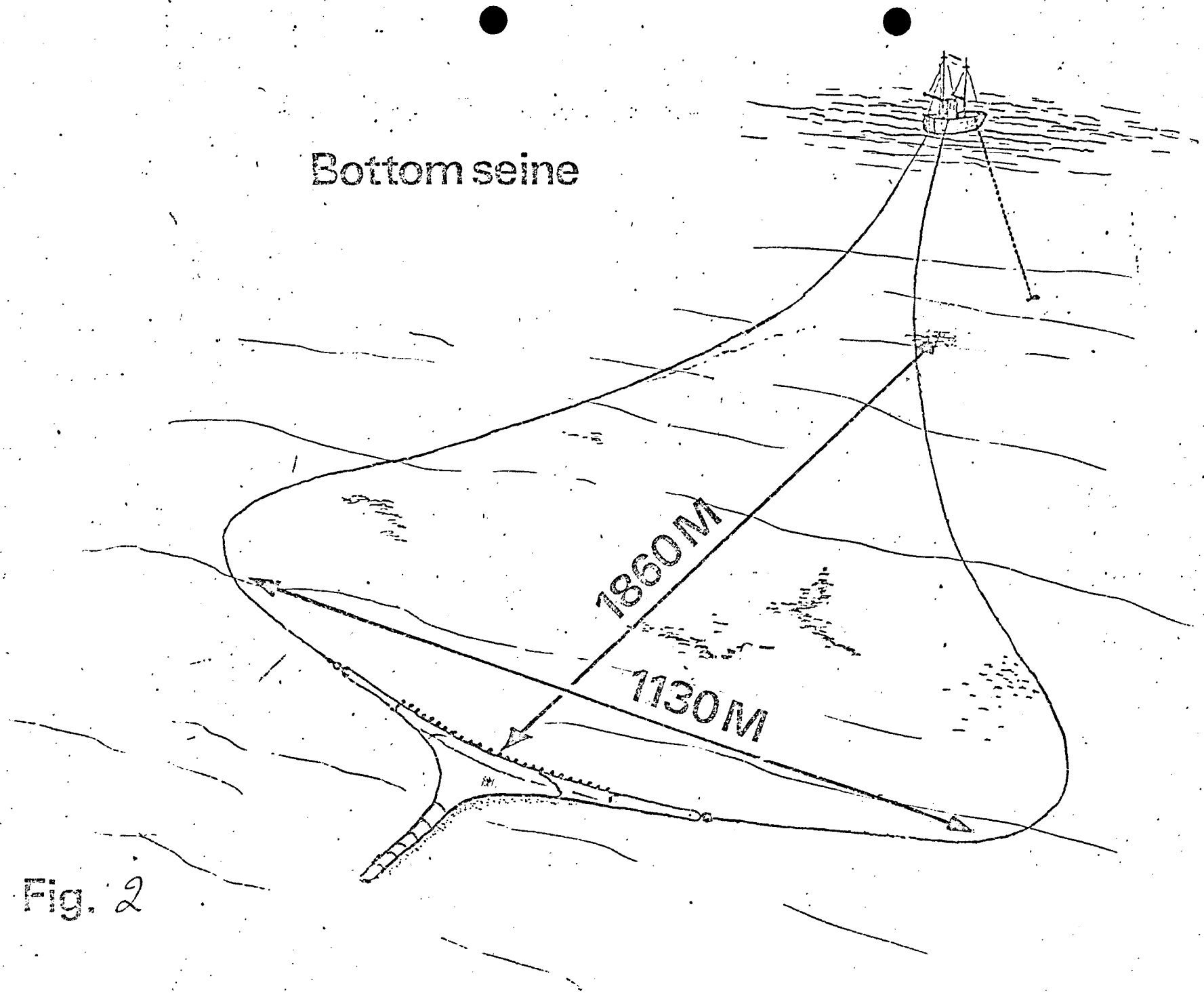


Fig. 2

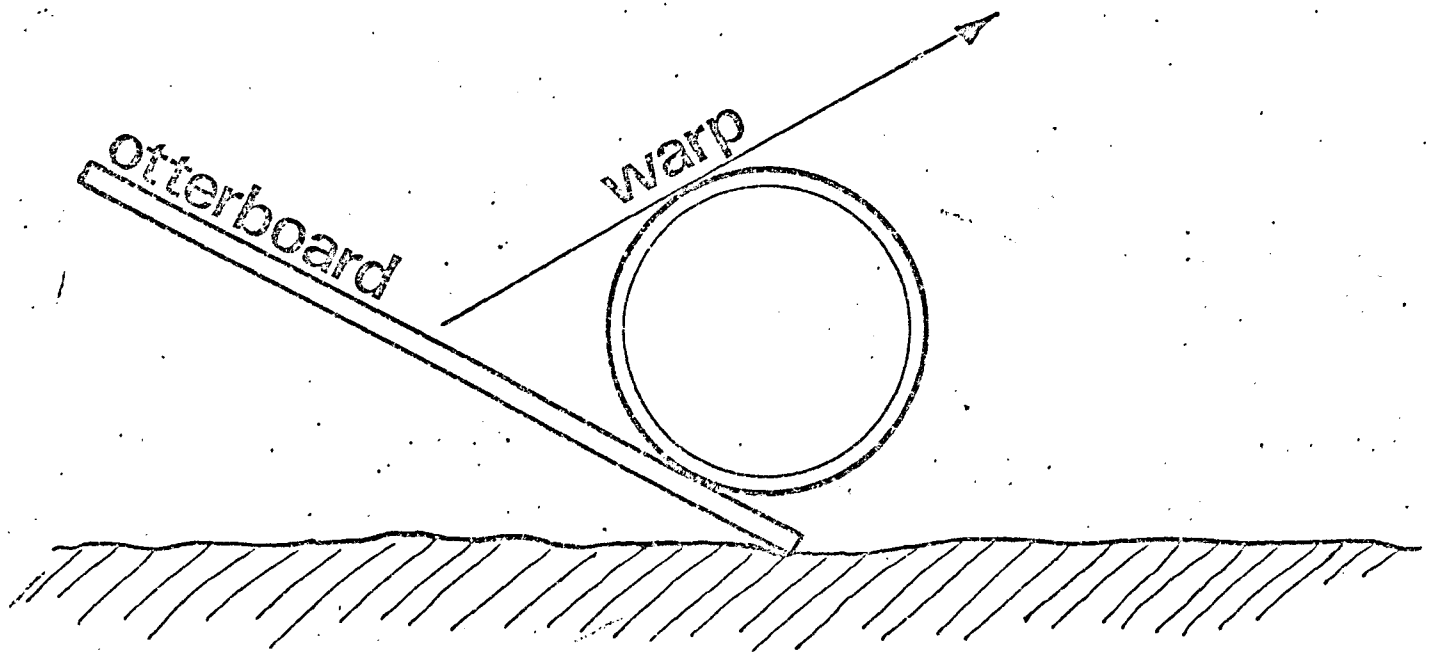


Fig. 3

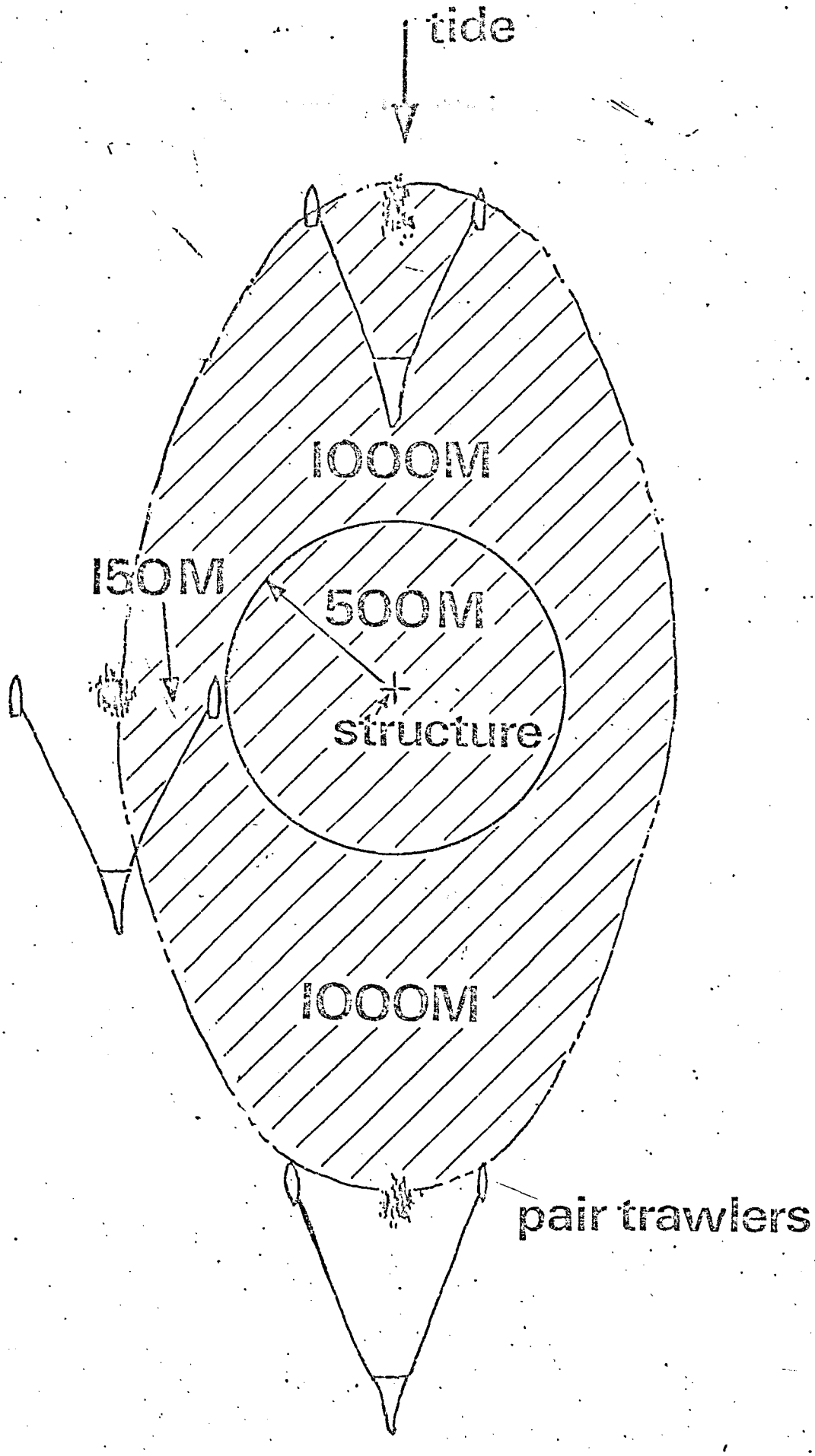
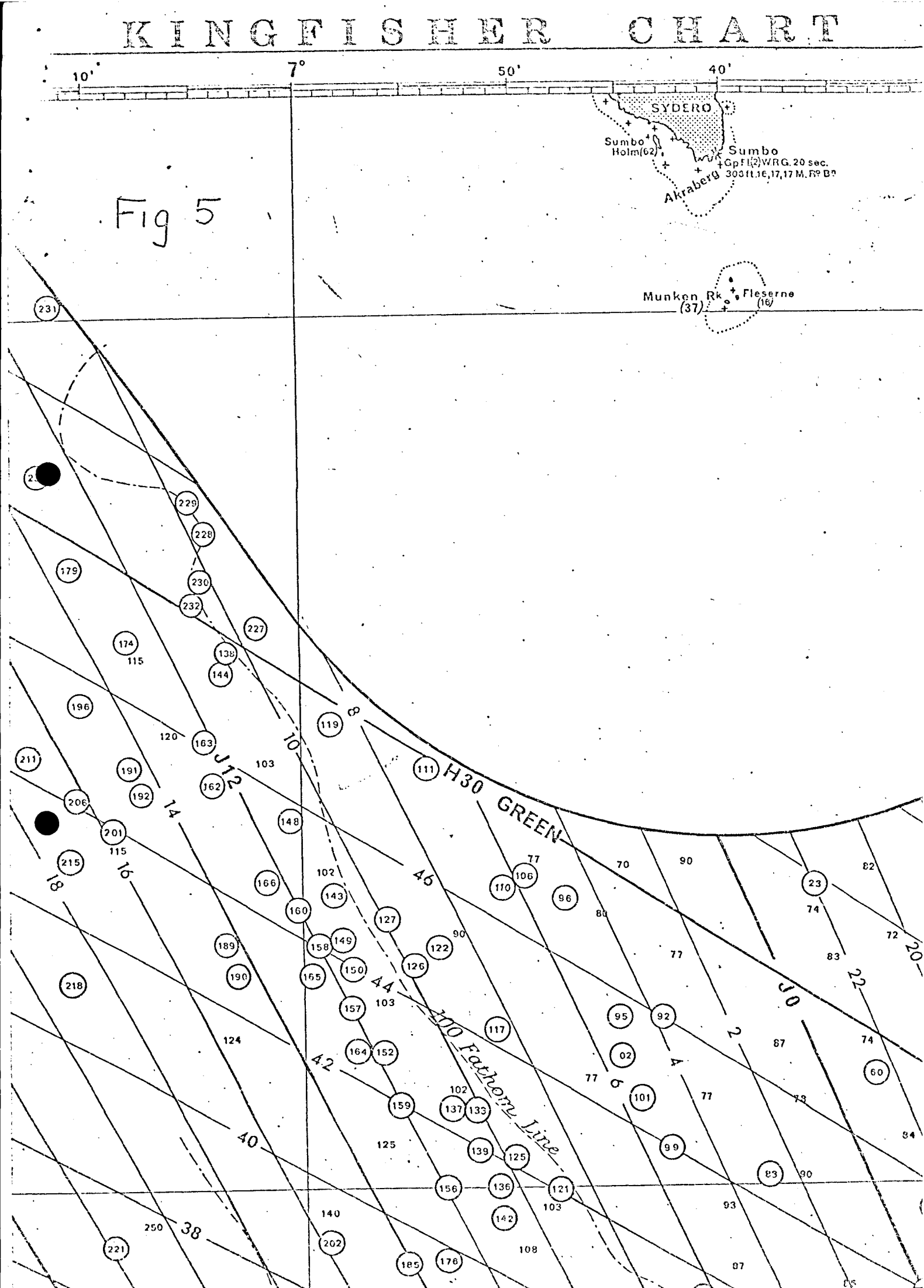
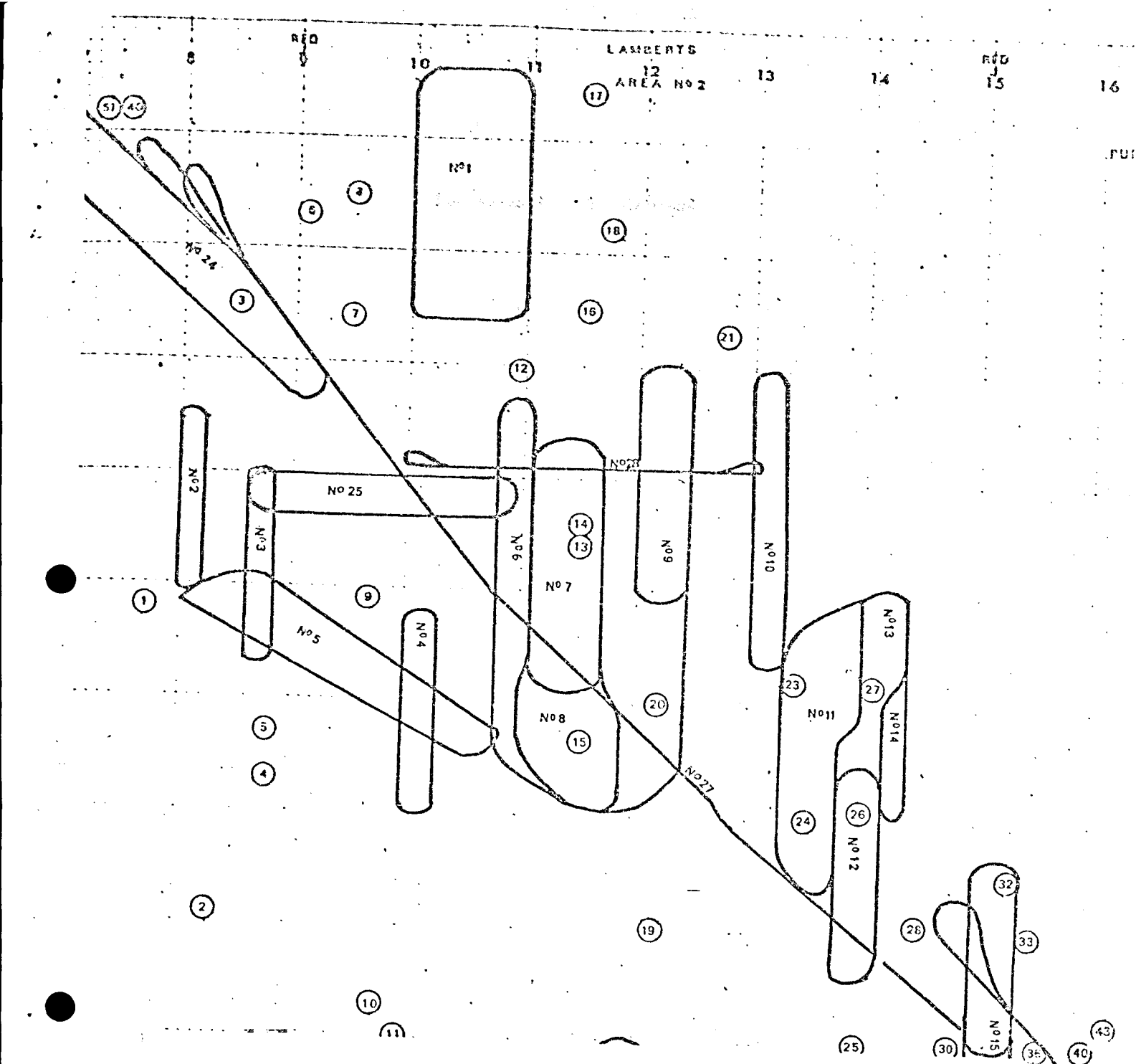


Fig. 4


KINGFISHER CHART
10'
7°
50'
40'
SYDERO
Sumbo
Holm(62)
Sumbo
Gp Fl(2)WRG.20 sec.
Akraberg 308ft.16,17,17 M. R° B°
Fig 5
Munken Rk
(37)
Fleserne
(16)
H30 GREEN
J12
J10
100 Fathom Line



INNER HOLE

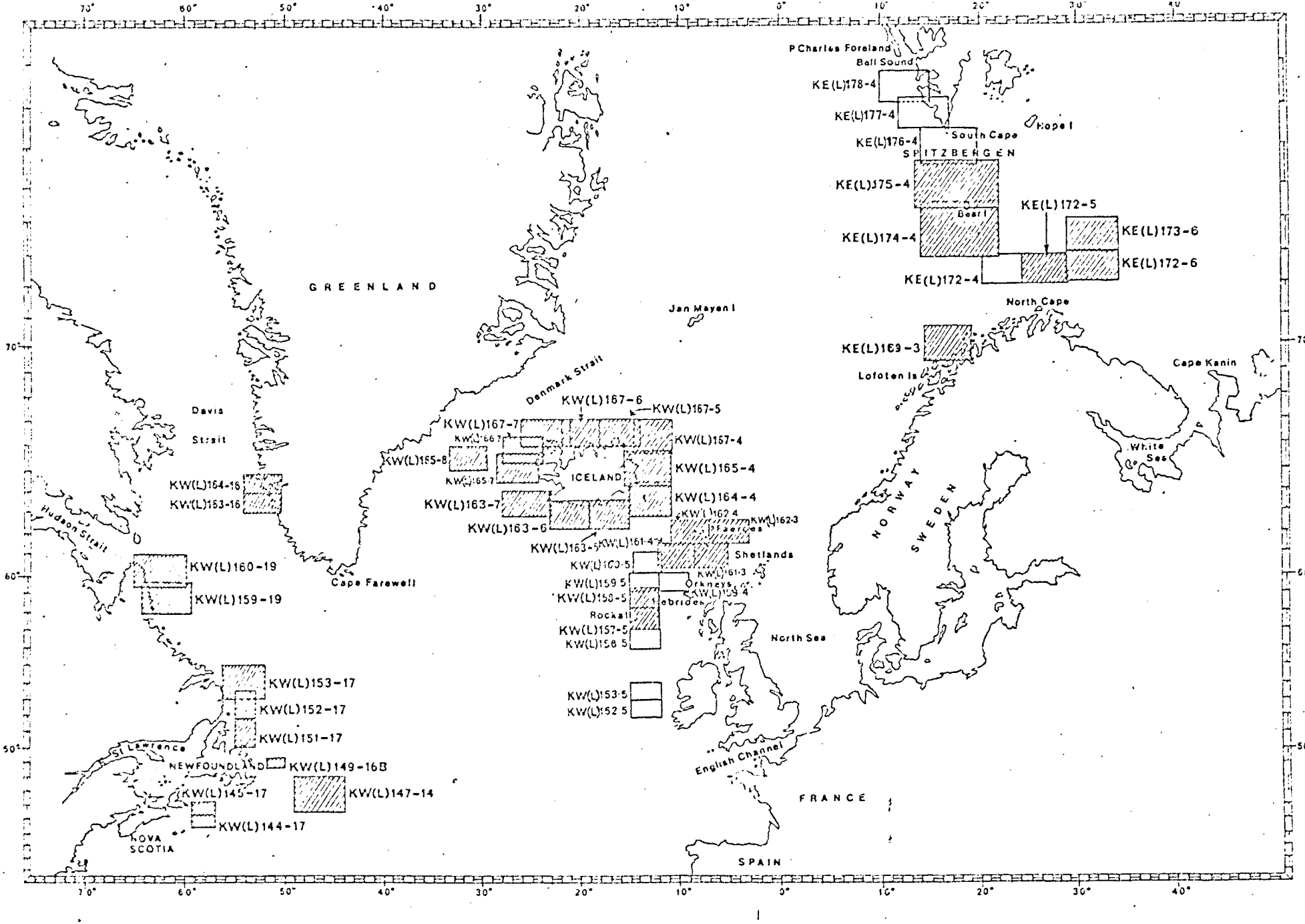
FISHING TOWS CLEAR OF OBSTRUCTIONS FOR AREA No. 3

No. 1

From J 17.90 D 64.00 tow Northerly along J 17.90 until D 65.10, alter course, tow Easterly along D 65.10 until J 18.75, alter course South Westerly until J 18.75, alter course Westerly, tow along D 64.00 to start.

Obstructions No. 8 - 132 - 135 - 141 - 11 - 10

Fig 6 DECCA TRACK PLOT

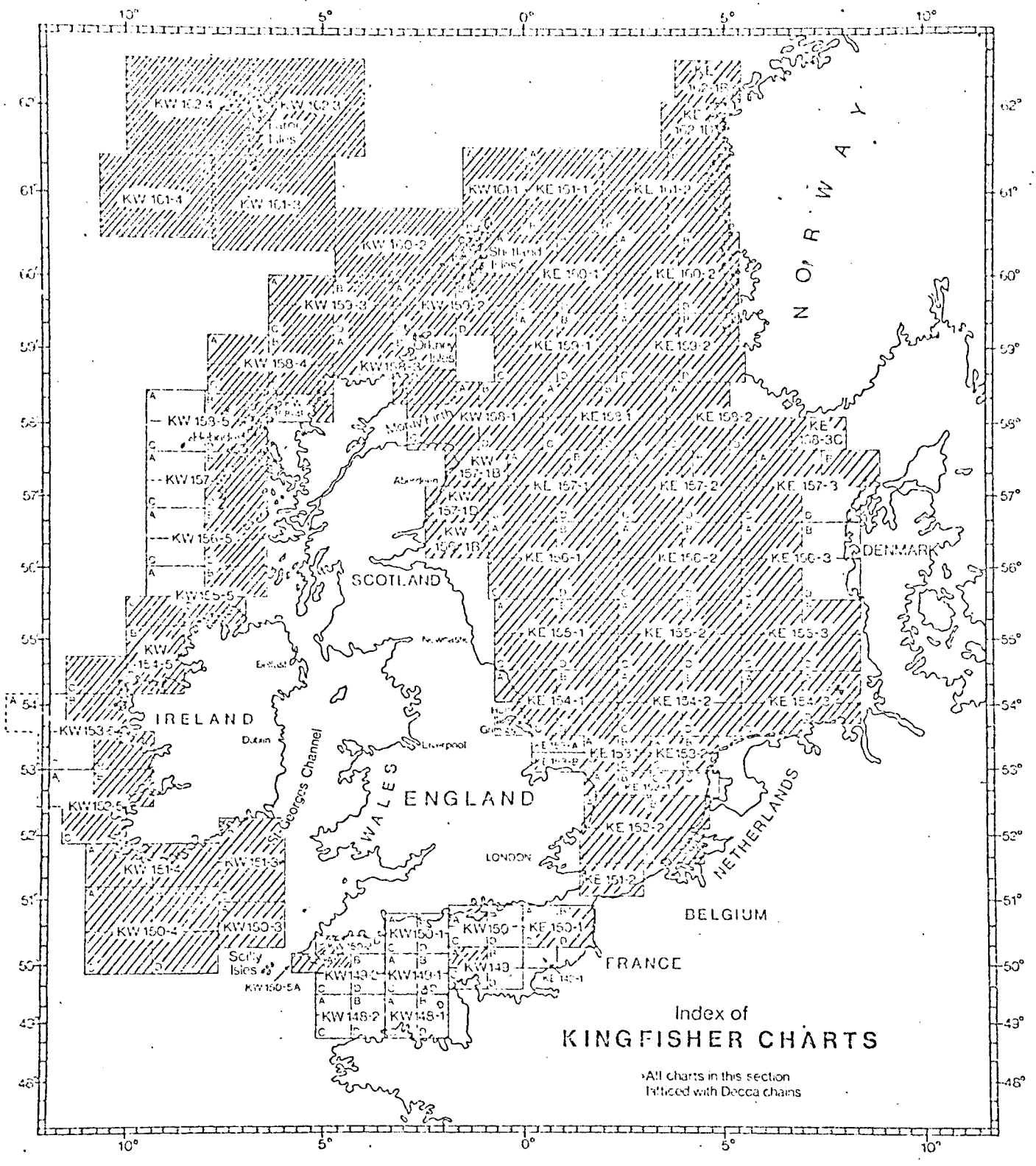


kingfisher charts

DISTANT WATER: LORAN (C)

Areas unshaded denote ● in preparation ●

Fig 7



kingfisher charts

HOME WATERS

All charts in this section latticed with Decca chains
Shaded areas show charts on sale

Fig 8

Fig 9

CONVERSION SHEET 05/04/77

LAT.	LONG.	LANES OR DELAYS GC R	GC G	GC P
61.4836	1.4239	A18.80	G30.73	F50.74
61.4489	1.5153	A17.65	G30.76	F54.07
61.4103	1.7144	A15.85	G30.64	F60.09
61.4072	1.7475	A15.62	G30.61	F60.96
61.4036	1.5425	A16.75	G30.73	F56.33
61.3906	1.7347	A15.43	G30.59	F61.29
61.3617	1.5283	A16.16	G30.69	F57.53
61.3614	1.5844	A15.83	G30.65	F58.87
61.3483	1.5814	A15.64	G30.63	F59.28
61.2775	1.1314	A17.24	G30.76	F50.91
61.2742	1.5919	A14.41	G30.43	E62.37
61.1783	1.7750	A12.03	F47.70	E70.64
61.1086	1.2856	A13.48	G30.26	F61.37
61.1669	1.0389	A14.91	G30.60	F55.00
61.0983	1.6914	A11.26	F47.37	F72.02
61.0908	1.2592	A13.34	G30.23	F61.42
61.0308	1.7425	A10.07	F46.70	F76.26
61.0272	1.3833	A11.69	F47.61	E67.34
61.4739	1.5567	A17.80	G30.76	F54.15
61.3908	1.5433	A16.54	G30.72	F56.81
0.0000	0.0000	A22.15	C38.10	H63.03
0.0000	0.0000	A22.15	C38.10	H63.03
61.3089	1.2450	A17.03	G30.75	F52.60
0.0000	0.0000	A22.15	C38.10	H63.03
61.1081	1.3378	A13.19	G30.17	E62.74
61.0861	1.3689	A12.67	G30.00	F64.45
61.0647	1.7369	A10.57	F47.00	F74.61
61.6669	1.3783	A22.21	G30.35	D73.76
61.5872	1.2800	A21.55	G30.43	D74.00
61.6058	1.2950	A21.76	G30.40	D73.76
59.7256	1.5578	A 0.03	D44.33	H64.10
59.7489	1.5750	A 0.01	D45.56	H62.58
59.5253	1.3939	A 0.57	D32.70	H77.69
59.5497	1.5319	A 0.51	D34.71	H78.97
59.5286	1.5344	A 0.61	D33.54	I50.97
59.5167	1.4175	A 0.62	D32.31	H79.11
59.5028	1.5431	A 0.75	D32.12	I53.58
59.5750	1.5436	A 0.41	D34.17	H76.96
59.6217	1.5025	A 0.23	D38.62	H71.71
59.4858	1.5364	A 0.84	D31.13	I55.00
59.4331	0.7069	A 0.73	C39.81	H66.81
59.1233	1.5067	A 4.31	D45.86	J60.51
60.9256	1.2458	A10.82	F47.19	E68.20
60.8614	1.4603	A 8.89	F45.85	F76.93
60.8964	1.4294	A 9.52	F46.34	E74.45
60.9244	1.4203	A 9.97	F46.66	F72.90
60.8614	1.5153	A 8.66	F45.66	E78.37
60.9500	1.4128	A10.38	F46.92	F71.54