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C R U I S E R E P O R T.

F. R. S. "S C O T I A". - November 13th - 22nd, 1951.

The work carried out on this cruise was as follows :-

(1). November 13th - 17th. Trials with the pelagic trawl.

(2). November 19th - 22nd. Hydro-biological survey of Fladen Ground.

(1). Pelagic Trawl Trials.

Adverse weather conditions caused a delay in sailing from Aberdeen until mid-day on Tuesday, November 13th, and with strong wind forecasts, it was decided to operate in the coastal area between Aberdeen and the Firth of Forth.

The objects of the experiments were :-

(1). To determine the depth of fishing and stability of the trawl when towed at different towing speeds and warp lengths.

(2). To fish in daylight and darkness in areas where fish-like echo-traces were obtained, in order to determine the catchability of the gear.

Altogether 15 hauls were carried out, and warp lengths and towing speeds of between 50 - 100 fms. and 60 - 110 revs respectively were used. On most hauls, two depth recorders were fitted on the trawl, one each on the centre of the headline and bosom, and during all hauls, a number of measurements of the angle of the warp from the vertical were made. **The relationship between depth of fishing and length of warp for different towing speeds is shown in Figure I.**

The rig of the net was essentially unchanged throughout the duration of the trials, and had the specification shown in the appendix to this report.

Observations on trawl behaviour.

Shooting.

The technique used in shooting the trawl was that used in normal ground trawling. In all hauls, it was shot with 50 fathoms of warp aft, and when the ship had been straightened on to the towing course, the warp was let out to the required length.

No difficulties in shooting were observed during the course of the experiments, and only in haul 2, when the towing speed was increased too rapidly and the trawl surfaced were any difficulties experienced.

Behaviour of trawl in action.

The trawl was towed on a straight course on each occasion, the engine revs and warp lengths being adjusted as desired during the course of each tow.

It was evident from the inspection of the warps at the towing block, and their angles from the vertical, and also from the depth recorder records, that the trawl was stable throughout the duration of each tow, and that a good spread from board to board was maintained. No direct measurements of this spread were attempted but rough measures of the angle between the warps at the towing block, gave an estimated spread between the boards of approximately 60 ft. with 60 fathoms of warp from the towing block and with 75 engine revs. This represents 83% of the total length of the headline and "legs".

The catches of fish and pelagic invertebrates in each haul are given in Table I. A total of 45 fish were caught in the 15 hauls. Although no substantial catches

/were

were obtained in any single haul, the results were sufficiently consistent to show that the trawl was fishing satisfactorily, and when operated in large concentrations of fish would probably provide a useful sampling device. It is interesting to note that the hauls carried out in darkness produced, on average, significantly more fish than the daylight hauls, and interesting captures in darkness were specimens of Lemon Sole, Angler and Dabs at some 6-10 fms. from the ground.

Wherever possible, the trawl was shot on grounds where the presence of "fish" was indicated on the echo chart, but in no instance were large dense shoals encountered, but scattered "comet" traces were located during most daylight hauls. In view of the scattered nature of these traces, which probably consisted of small shoals of sprats, young herring and whiting, the trawling results are considered to be fairly satisfactory.

In the "night" hauls, large numbers of unscaled larval herring were found attached to the meshes of the trawl, and it is interesting to record that the echo-traces obtained at these times were of the "diffuse-layer type" and were located in the 0 - 12 fathom depth range.

Table I. Details of Pelagic Trawl Hauls.

Haul No.	Depth of Water.	Depth of Fishing.	Duration of Haul.	CATCH.
1	20 fms.	12 fms.	13.10 - 14.10 (daylight).	2 Herring, 6 Whiting.
2	25 "	foul	haul.	
3	18-22 "	13-17 fms.	10.30 - 11.30 "	3 Herring. 1 Portunus 1 Sepiola Atlantica.
4	21-25 "	17-21 "	13.10 - 14.25 "	1 Herring, 1 Sprat, 1 Lon[illegible] Dab.
5	22 "	10-12	16-15 - 18.00 (Darkness)	1 Herring, 1 Sprat, 4 [illegible] 2 Long Rough Dab. Large No. of unscaled herrin[illegible] attached to meshes of net.
6	19 "	12 fm.	19.05 - 20.05 "	1 Angler, 1 Herring. Large No. of unscaled herring[illegible] meshes.
7	22 "	11-20 "	17.35 - 12.35 (Daylight)	Nil.
8	22 "	12-15 "	13.10 - 14.10 "	"
9	21 "	10-15 "	14.55 - 15.55 "	"
10	21 "	8-15 "	17.55 - 18.55 (Darkness)	1 Whiting, 1 Large Rough Dab. Numerous unscaled herring.
11	22 "	10-15 "	11.00 - 12.30 (Daylight)	Nil.
12	19 "	12-13 "	13.35 - 14.35 "	Nil.
13	29 "	8-12 "	15.55 - 16.30 (Daylight-Dusk)	8 Herring.
14	14 "	8-10 "	17.30 - 18.30 (Darkness)	2 Herring, 3 Sprats, 2 Whi[illegible] 1 Lemon Sole, 1 Long Rough Da 3 Portunus, 1 Crangon, 1 Sepiola. Numerous unscaled herring.
15	20 "	8-12 "	19.20 - 20.10 "	1 Herring, 1 Whiting. Numerous unscaled herring.

(2). Fladen survey.

The object of this part of the cruise was to carry out the Fladen Herring Survey ecial survey No. 6).

Narrative/

Narrative.

As the start of the trip was delayed by bad weather and the ship had to be back in Aberdeen for contractor's visits, it was considered unlikely that the survey could be completed. The order of the stations was therefore altered to give the greatest coverage of the area within the time available. This alteration allowed twenty-one stations to be carried out as shown in the attached sketch.

A heavy swell was encountered throughout most of the trip.

Only a few trawlers were seen working at Fladen.

Hydrography.

Surface Temperatures.

Surface temperatures ranged from 10.0°C to 10.2°C as the highest values were found on the most southerly line. The lowest values ranged from 9°C at 58°35'N 0°40'E to 9.5°C and 9.6°C on the 58°05'N line. This shows the presence of a tongue of colder water extending below 30 metres and running from N.N.E. to S.S.W. in the north central and the central areas of the grid.

South and south-east of a line joining 58°35'N 1°00'E and 57°55'N 00°00', the surface to 30 metres layer was homogeneous to within 0.02°C. To the north and north-west of that line, surface to 10 metres was uniform to within 0.05°C and surface to 30 metres within 0.4°C with the exception of the two most westerly stations of the 58°35'N line which were within 1.0°C.

Bottom Temperatures.

Bottom temperatures ranged from 6.3°C to 6.8°C at all stations deeper than 125 metres.

Phosphate.

Fixations for these and oxygens were carried out at eighteen of the twenty-one stations sampled.

A range of about 0.4 u gm-atoms PO_4 - P/litre at surface to 1.0 u gm-atoms PO_4 - P/litre or slightly less at bottom was encountered. The values are normal for this time of year.

Plankton.

Plankton hauls were carried out as shown on the attached chart. Calanus and Sagitta were the chief organisms taken in the Hensen hauls. Calanus, Sagitta, Limacina, Pleurobrachia and Euphausids were the chief organisms taken in the 1 m. silk net when towed obliquely. On a preliminary scrutiny, no fish larvae were seen in any of the collections.

Trawling.

Eleven hauls were carried out at the stations specified in the chart. The trawl gear used was the 30'Otter trawl. A total of sixty herring were taken during the trip/ a few at each station and these were preserved for racial analysis. Among the other species taken by the trawl, only whiting and Gadus esmarkii were plentiful at each station. Hauls of about fifty haddock were taken at E16 c and d.

Echo-sounding.

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Echo-sounding.

The echo-sounder was run continuously throughout the trip at ½ - 2/3rds. of its maximum sensitivity. Only a few traces, probably of fish, were detected. The records were kept for more detailed examination.

B. B. PARRISH.

ROBERT ELLIS.

6th December, 1951.

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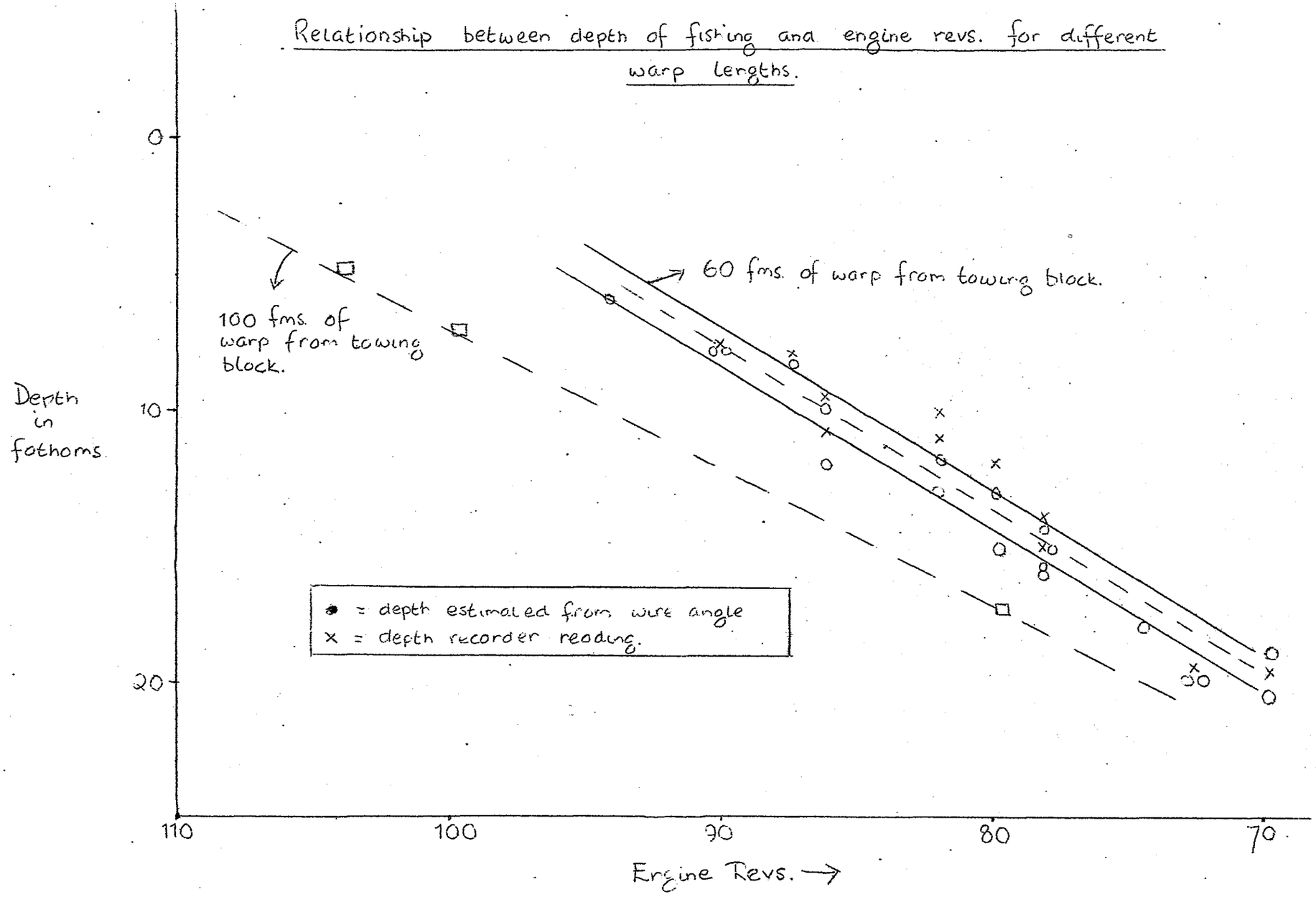
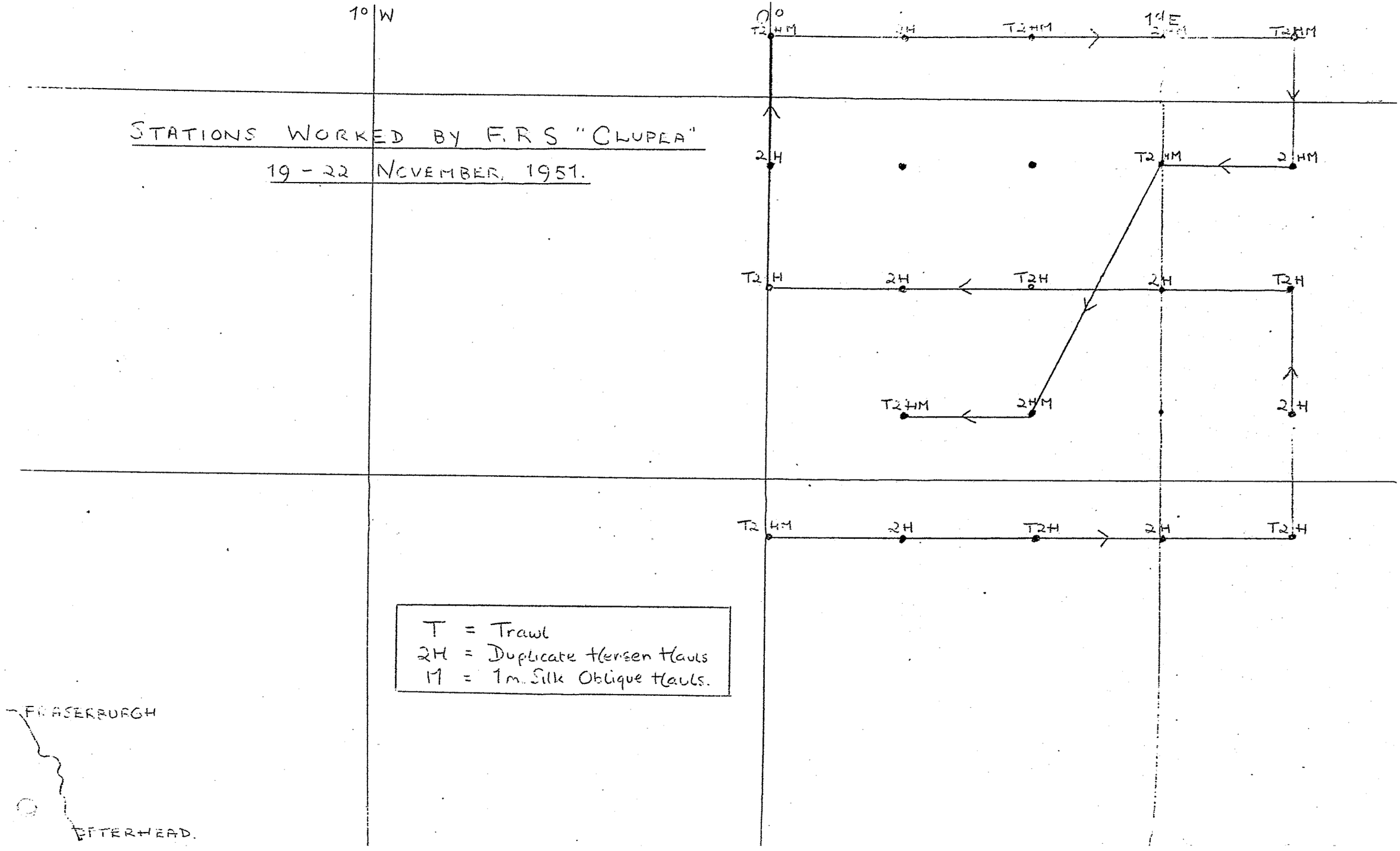
Fig. I.


Relationship between depth of fishing and engine revs. for different warp lengths.
0
10
20
Depth in fathoms
100 fms. of warp from towing block.
60 fms. of warp from towing block.
● = depth estimated from wire angle
× = depth recorder reading.
110
100
90
80
70
Engine Revs. →

STATIONS WORKED BY F.R.S. "CLUPEA"

19 - 22 NOVEMBER, 1951.



T = Trawl
2H = Duplicate Hensen Hauls
M = 1m. Silk Oblique Hauls.

Appendix.

Notes on one-ship pelagic trawls.

The trawl used in the trials described in this report was made along the lines of a standard commercial ground trawl, its departures from the standard pattern being in the size of the twine, the size of the mesh (2" except the codend which was $1\frac{1}{2}$") and the overall length of the net, approximately 40 ft.

The complete specification was as follows :-

(1). Length of Headline	=	32 ft.	(2" 4 stranded manilla).	
(2). Length of Groundrope.	=	20 ft.	($1\frac{3}{4}$" 6/12 steel wire rounded with rope $2\frac{1}{2}$" diameter.	
(3). Length of Bosum.	=	10 ft.	(soft).	
(4). Square.	=	10 ft.	2" mesh.	240/160/10ft.
(5). Top-wings.	=	13 ft.	2" "	80/10/13ft.
(6). Lower Wings.	=	28 ft.	2" "	160/20/28 ft.
(7). Belly.	=	10 ft.	2" "	160/80/10 ft.
(8). Baitings.	=	10 ft.	2" "	160/80/10 ft.
(9). Codend.	=	8 ft.	$1\frac{1}{2}$" "	Double twine.

The trawl was fitted to standard wooden trawl-boards 7 ft. 6" by 3 ft. 6" by means of 20 ft. wire headline and footrope legs.

Although the results of the above trials were completely satisfactory as far as the performance of the trawl whilst fishing is concerned, it is evident that the make up of this trawl is not absolutely satisfactory for pelagic fishing.

The aim in the construction of a net for this purpose is obtaining the maximum possible gape area for the lengths of headline and groundrope, and with this object in mind, and to provide a net of sufficient dimensions to bring the net reasonably in line with other well-known pelagic trawls, the following dimensions and construction is suggested. (see attached sketch).

The main features of this trawl are :-

(1). A net with rectangular mouth opening 100 ft. x 20 ft.
(2). Vertical supports between net mouth and wing sections to maintain the vertical gape and promote stability.

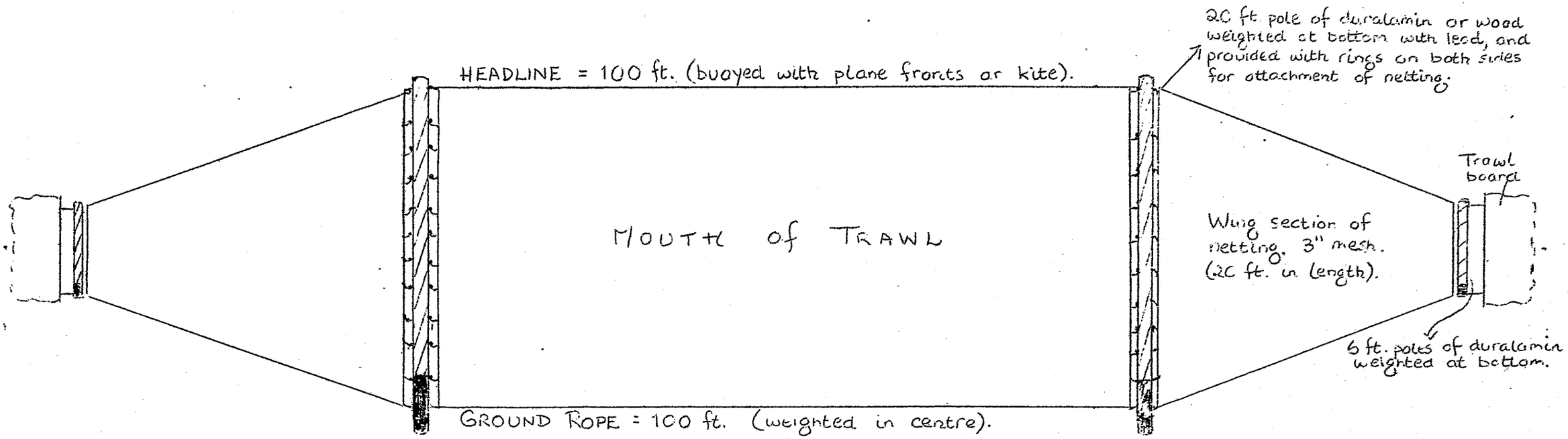
(3). Trawlboards of the "wing" type used on the Larrson trawl, which, being in aerofoil section, are likely to be more efficient than the customary wooden boards, and are likely to produce less "noise".

It is difficult to judge at this stage to what extent factors other than trawl design play a part in determining the efficiency of a pelagic trawl as a catching device. Factors which must be considered are :-

(1). Vibration and noise of warps and doors.
(2). Noise from ship's engines.
(3). Backwash from trawl.
(4). Presence of warps in mouth area.

It is recommended that as soon as possible, we should endeavour to determine the noise involved during the passage of the pelagic trawl through the water by means of hydrophones, and should also consider the fitting of flow metres along the length of the trawl between its mouth and the entrance to the cod-end. It is likely that the importance of ideal filtration in a pelagic net is more critical than in the bottom trawl. Attempts should also be made to observe the pelagic trawl in action using frogmen, and under-water observations should be made in the filtration behaviour of the net.

PLAN OF PROPOSED PELAGIC TRAWL.



Netting of trawl to be constructed in consultation with Mr. Craig.

Trawl boards to be of the "Wing" type used on the Larsson trawl.