Dr. Wood

CONFIDENTIAL: Not to be quoted without reference to the laboratory. 7
S.16 6 S.R.58

CRUISE REPORT

F.R.S. "SCOTIA"

July 4-18, 1958.

GENERAL

The cruise was worked in two parts, July 4-13 was devoted to a pre-arranged survey of a grid expected to cover the whole of the Shetland herring grounds, and as detailed in the cruise programme. This grid covered the area between 59°30'N and 61°01'N and between 2°15'W and 1°00'E. The two Perkins lines were also included. At each of the stations the Edinburgh 'Plankton Indicator' was towed. Between stations the MS24F echosounder was used.

During the second part, July 14-18, the "Scotia" made more detailed investigations in areas indicated by the results of the first part and it was also hoped to include shark lining, but the recall of "Scotia" on 18th July precluded this possibility.

Part 1

Leaving on July 4 "Scotia" completed the first of the Perkins lines and then started systematically to work the pre-arranged grid of stations. Weather was not all it might have been and twice "Scotia" had to abandon work for about twelve hours. Nevertheless all stations but two were completed in detail (one of these two was worked later). The second of the Perkins lines was then completed and "Scotia" returned to Aberdeen on Sunday, July 13. The Edinburgh Plankton Indicator was used at all stations and the samples retained for analysis by the Edinburgh laboratory. Mr. Colebrook, a visitor on board from the Edinburgh laboratory, left the ship at Aberdeen having completed the work in which he was particularly interested. Dr. Johnston was replaced by Mr. Burns.

Echo traces were of two types: a ribbon of diffuse trace, usually at about 20 metres depth, and individual plumes, presumably from herring either in surface layers or near the bottom. Sometimes both types occurred together. The diffuse traces could probably be associated with young fish and not with the normal zooplankton animals. Plankton nets and the high speed sampler were used in and below the traces; they showed the densest Calanus and Limacina (which was at times extremely abundant) to be distinctly below the level of the diffuse trace, e.g. the diffuse trace at 20m and the Limacina at 100m, and they gave no indication of their presence on the echo-sounder. This diffuse trace occurred both by day and by night. /C.f. cruise report "Scotia" June/July 1955 which showed that the young fish in the upper layers were probably responsible for ribbon traces and were not subject to diurnal vertical migration/. These diffuse traces in July 1958 were not marked on the Perkins lines but were very marked east of Fair Isle and Shetland. They were present but less marked to the north-east of Shetland on the 61°01'N line but were again well marked north-west of Shetland and between Foula and Fair Isle.

The herring traces (plumes) were very scarce indeed in the southern area - i.e. on the Perkins lines and N.E. from Buchan - but there were a few very close to the coast near Rattray Head. On the Shetland grid the main traces were east of Fair Isle and in the Roost, 20 miles E of Sumburgh, 30-50 miles E of Yell, 10 miles N.W. of Flugga and between Foula and Shetland. Bottom traces were most evident in D19d and E19c, C18c (East of Fair Isle) and between Foula and Shetland.

These herring traces were nowhere particularly dense and large plumes were indeed few and far between. This is quite consistent with the spotty distribution of the shoals as found by the commercial vessels in the Shetland area and the real lack of herring in the Peterhead area.

The pattern of the Plankton was fairly well marked and consisted of four main types:

1. Dominant and abundant Calanus, only in the Fair Isle area from 2°15'W to 0°15'E.

2. Mixed Calanus, Euphausid furcillia and other zooplankton with fairly abundant small jellies (Cosmetira and Laodicea in the area south of Fair Isle and in the Moray Firth area, Pleurobrachia east of Shetland).

3. Calanus with abundant Limacina - at times extremely abundant - in the area north of Flugga and west of Shetland within 25-30 miles of the coast and with a tendency to leak through into the area north of Fair Isle.

4. Outside the Limacina area dense quantities of Salpa fusiformis, at times almost pure but sometimes mixed with moderate numbers of Calanus.

There were only occasional individual salps found east of Flugga on the 61°01'N line and to the east of Shetland.

Although bottom temperatures ranged from below 6°C, temperatures on the whole were rather higher this year than in the past two years and the distribution was similar to that of July 1955. In contrast to 1955 the increase has been delayed this year but has been much steeper.

Surface temperatures on the east coast of Shetland were mainly below 11°C but increased to above 13°C in the south-east area of the grid and most of the stations on the South Perkins Line exceeded 14°C.

Bottom temperatures ranged from below 6°C in the south-east area of the grid and eastern area of the Perkins Lines to above 10°C to the north-west of Fair Isle.

Although much more marked in the south and east a thermocline was present at 20-30 metres or 30-40 metres almost throughout but was absent in the neighbourhood of Fair Isle where the herring fishery appeared to be most profitable.

Twenty drift indicators were liberated at 60°01'N 0°30'W. One of these with a 40fm line was recovered by a fishing vessel five days later at a position seven miles S.W. of release point.

From this survey it may be understood that the early dense concentrations of Calanus found in March had not been maintained except in the Fair Isle area, but had in the north-western North Sea generally been replaced by a rather poorer mixed plankton community with the jellies, Cosmetira to the west and in the Orkney area and with Pleurobrachia east of Shetland. The Atlantic inflow off the edge of the shelf contained abundant salps, but although these have been present in the area to the N.W. of Flugga since June (see "Scotia" cruise report 5 S.R.58) they had still not penetrated, except an odd one or two, south of 61° to the east of Shetland. Where the Atlantic and local waters mixed there was a great development of plankton, but although Calanus was present in fair numbers in this area as usual it was dominated by Limacina in 1958 to a much greater extent than normal.

Samples from 36 stations, taken from the surface, were enriched, in pairs, one with phosphate, nitrate and silica and the other with phosphate, nitrate, silica and trace metals. These samples were cultured on board under fluorescent light and then brought to the laboratory for continued treatment. Preliminary results show that all cultures are growing but those with trace metals show most growth.

Part 2

With this background of environmental conditions "Scotia" returned to the Shetland area, sailing on Monday, July 14. On the way north a sudden rich echotrace was found at 58°08'N 2°05'W, but no further traces of importance were found until reaching the Fair Isle area. Here marked traces were found especially S.E. and S. of Fair Isle, much denser than in

part 1 of the cruise, and commercial vessels were making good catches here for the Lerwick market.

It was therefore decided to re-investigate the environmental conditions in a quick survey to find out if any change had occurred that could be responsible for this marked increase, and to find out if the traces in other areas had increased or decreased.

Salps had still not penetrated east of Shetland though their numbers N.W. of Shetland were extremely great. The mixed water with dense Limacina had penetrated and was now dominant off the east coast of Shetland as far south as 60°. The Calanus/jellyfish community had been pushed rather further east and still existed to the east and south of the Calanus/herring area at Fair Isle. Herring traces were, however, still present in other areas as before, but not nearly so heavily marked as in the Fair Isle area. They were most noticeable in the Roost, east of Sumburgh, in the area 30 miles east of Shetland in the environs of 0° long. and also some 20 miles N.W. of Shetland. Traces were at times in these areas in the form of very large distinct plumes with some 5 or 10 miles between each so that catches there could have been extremely sporadic. Some Russian vessels were working there. At the north entrance to Bluemull Sound traces were very heavy indeed but seem likely to have been caused by young stages, too small for commercial catches.

On the steam south from Lerwick the drifters were concentrated again in the Fair Isle area but mainly just to the north of 59°30' whereas the traces on "Scotia's" echosounder were much more concentrated just to the south of 59°30' where only a few ships were working. On the southward steam some traces were again seen just to the north of 58°.

It would seem that herring in Shetland waters were fairly widely distributed but the shoals were in very local concentrations that would have been difficult to fish commercially except in the Fair Isle area. This concentration in the Fair Isle area coincided with the only area of abundant Calanus that was also free of small jellyfish and this also was the only area of more or less homogeneous temperatures. Where Calanus was abundant or moderately abundant but mixed with small jellies or with Limacina herring were sporadically distributed north of 59°30' but almost absent south of 59°30'.

Opportunity was taken on the cruise to fit up for test purposes the continuous turbidity meter. This promises to be a success when voltage stabilisation has been properly achieved. The T.V. camera and equipment was taken for the second part of the trip and it was found convenient to work it from the midships hydro winch with the screen and ancillary equipment in the starboard side of the main laboratory. "Scotia's" A.C. output is inadequate to deal with the consumption of the equipment and the 1000 watt A.C. underwater lamp so that experiments were tried using the 100 volt D.C. and smaller A.C. lamps for illumination but none of the bulbs available would withstand the pressure. No results were obtained from the 30 metre level but near the surface where there was adequate daylight the equipment worked well.

"Scotia" was recalled to Aberdeen on Friday 18th without having had opportunity to do shark lining or trawling for cod.

J. H. FRASER

29th July 1958