R1/6 In confidence: Not to be quoted without reference to the Laboratory 14CR76

Cruise Report

FRS 'Clupea'

30 November - 21 December 1976

Survey of Pelagic Fish in Southern Moray Firth

The western part of the survey proved to have few fish, and an additional area, extending from Cullen to Troup Head, had to be grafted on to cover an area of commercial fishing for sprat. Apart from this change, the survey was carried out as planned, two days being lost on account of gales. The results of the acoustic work are laid out on the attached summary figure. Normal calibrations were carried out using a table-tennis ball, and the assumed target level was -34dB per kilogram.

During the first survey, two wires in the towing cable were found to be broken, thus reducing the sensitivity of the equipment. It should have been possible to allow for this by use of the appropriate calibration, but the results show that adjustment by a simple factor leads to rather poor concordance with later surveys. What this indicates is a non-linearity in the relation between fish density and integrator readings, which could be accounted for by overload occurring during normal operation. If this were so, it would imply that the tabulated figures are an under-estimate of the pelagic fish population.

In the tabulation, a non-linear correction has been applied to survey 1, so as to harmonize the maximum observed densities, which, for a $\frac{1}{4}$ hour run were around 800 tons per square nautical mile. Only the excess over 10 tons per square nautical mile is recorded as pelagic fish. That is to say any $\frac{1}{4}$ hour run showing less than 10 tons per square mile is treated as zero, while a run showing eg 75 tons per square mile is treated as 65.

The biological sampling suggested that the pelagic fish present were sprat and herring in the ratio 3:1 by weight, thus the final estimate for the area of survey is: Sprat 30,000 tons Herring 10,000 tons

Biological Sampling

To identify the source of acoustic targets seven hauls were made with an '0'-group Gadoid Trawl provided with $\frac{1}{2}$" knotless codend in areas where concentrations were recorded on the echosounder. Catches ranged from a few fish to a maximum of 3 baskets. The smaller catches were of fish small enough to escape easily through the codend mesh, and so were not a true reflection of abundance.

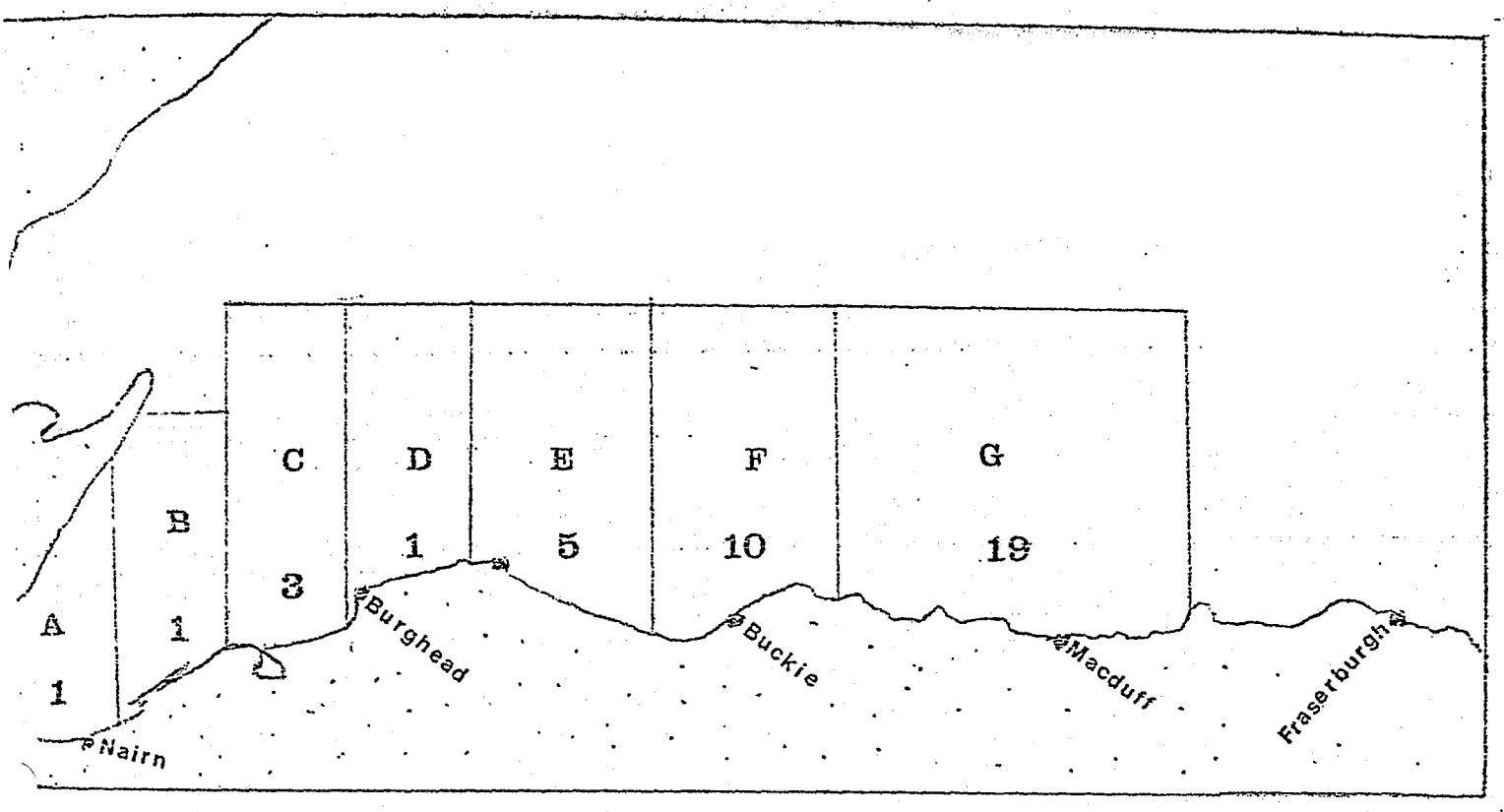
The main species were sprat and herring, but a small proportion of whiting and Norway pout were found in some of the catches. Herring were taken in significant numbers in 5 out of 7 hauls and represented an estimated 25% of the total weight of fish taken in all hauls combined. The length range of sprats caught was 3-15 cm with a wide variation in modal size between hauls. The herring were in the range 9.5-17 cm, with a clear modal length of 14.5 cm.

Hauls were made in water depths from 25-47 fathoms both near the surface and just off the bottom, but there was no obvious difference between the relative numbers of sprat and herring taken in these two situations.

Otoliths were taken from sprat and herring and returned to the Laboratory for age determination. Samples of larvae and very small fish were preserved for later analysis and quantities of juvenile herring were also frozen for meristic and parasitological examination.

R E Craig
1 February 1977

Seen in draft: G Geddes



gure 1. Showing the areas surveyed and the mean weight of pelagic fish in each area in thousands of tons.

Table I showing dates and results of each survey

Survey	Date	A	B	C	D	E	F	G	Totals
1	1/12	0	4	8	2	16	13		43
2	2-3/12					3	9		12
3	6-7/12	1	1	3	1	6	19		31
4	8-9-10/12	1	0	2	3	1	13	23	43
5	13-14/12		0	1	1	5	8	14	29
6	15-16/12		1	1	0	1	3	11	17
7	20-21/12			2	0	0	3	28	33
Areas	n.m.^{2}	50	50	82	66	110	154	217	