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Fecundity of Bank and Downs Herring

by

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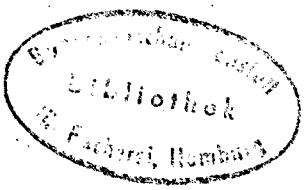

INTRODUCTION

At the 1969 Annual Meeting we reported on the fecundity/weight regressions of the Bank and Downs herring in relation to the data of Baxter (1959) on the Buchan stock. If sufficient differences occurred in these regressions it was thought that they could be used to separate the Bank and Downs stocks in the mixed fisheries at North Shields and Haisborough. It was found that though such a separation was possible in the large fish, in the smaller fish (the abundant age group) the overlap of the 95 per cent confidence limits was too great to allow a useful separation. It also appeared that the Bank fecundity/weight relationship was somewhat different from that of the Buchan. Again, however, this difference was not well marked.

The major consistent difference observed between Bank, Downs and Buchan stocks has been in length, whether l_1 or total length. Weight, which also shows a consistent difference, is less sensitive as a stock character due to the large secular changes caused by gonad development.

This paper re-examines the fecundity/length relationships of these two stocks, and a fecundity index is derived which clearly separates the stocks.

THE FECUNDITY/LENGTH RELATIONSHIP

The form of the relationship between fecundity and length has been well established previously (Baxter 1959, Bridger 1961). It is curvilinear and in this form is even more difficult to adapt for discrimination than the regression in weight. In the following analysis the Bank and Downs material has been raised by the third power. By this transformation linearity is achieved but in addition the transformed lengths may be considered as weight functions from which the effects of seasonal variations in gonad growth have been eliminated.

Fig. 1 shows the regression of fecundity on length cubed for Bank and Downs herring in maturity stage 4/5 and over. While the variance about the regression remains quite high in each stock it can be seen that there is rather a sharp demarcation between the fecundities of the two stocks at low lengths.

The utilization of length as the second discriminant character removes the necessity for the fecundity comparisons between stocks to be made at comparable maturity stages in order to minimize differences due to gonad weight changes. Fecundities may be compared as long as the eggs are countable.

Discrimination by regression of two variables is less convenient than using a single variable. A fecundity index has therefore been calculated:

$$\text{Fecundity Index} = \frac{\text{Fecundity}}{\text{Length}^3}$$

For known Bank and Downs herring the distributions of these fecundity indices for three- and four-year-old fish are shown in Figs 2 and 3. It is seen that in both cases there is almost no overlap in the distributions. In both cases however the Bank herring have variances about four times those for the Downs.

In the North Shields fishery in 1970 all gonads in which it was possible to separate the eggs were counted for fecundity (stage 3 and above). Fecundity indices were calculated for all fish and the distributions are also shown in Figs 2 and 3. Obviously fecundity indices cannot be calculated for fish in maturity stages 2 and 8. These fish would be Downs herring and the numbers of low fecundity index fish in the North Shields histograms in Figs 2 and 3 must underestimate the proportions of Downs herring in the fishery.

Table 1 shows the proportion of Downs herring by two week periods in the 1970 North Shields July and August fishery. The forecast method used here was based on fish in and below maturity stage 3/4. In the recruiting herring this appears to overestimate the Downs stock. Some overestimate occurs in the four-year-olds but there is a close similarity between the two methods. The relative year-class strength of the Downs and Bank herring are clearly demonstrated.

Table 1 Percentage of driftnet caught Downs herring at North Shields, 1970

	Age 3		Age 4	
	Fecundity index method	Forecasting method	Fecundity index method	Forecasting method
1st half July	27	72	79	85
2nd half July	36	67	73	77
1st half August	20	34	53	53
2nd half August	20	25	71	71

Within an age class it would appear that the fecundity index is independent of length, Figs 4 and 5. Increase in fecundity index is clearly a function of age.

In the mixed fisheries the fecundity index would appear to be a useful character for discrimination between Bank and Downs stocks.

REFERENCES

BAXTER, I. G., 1959. Fecundities of winter-spring and summer-autumn herring spawners. J. Cons. perm. int. Explor. Mer, 25: 73-80.

BRIDGER, J. P., 1961. On Fecundity and Larval Abundance of Downs Herring. Fishery Invest., Lond., Ser. 2, Vol. 23, No. 3.

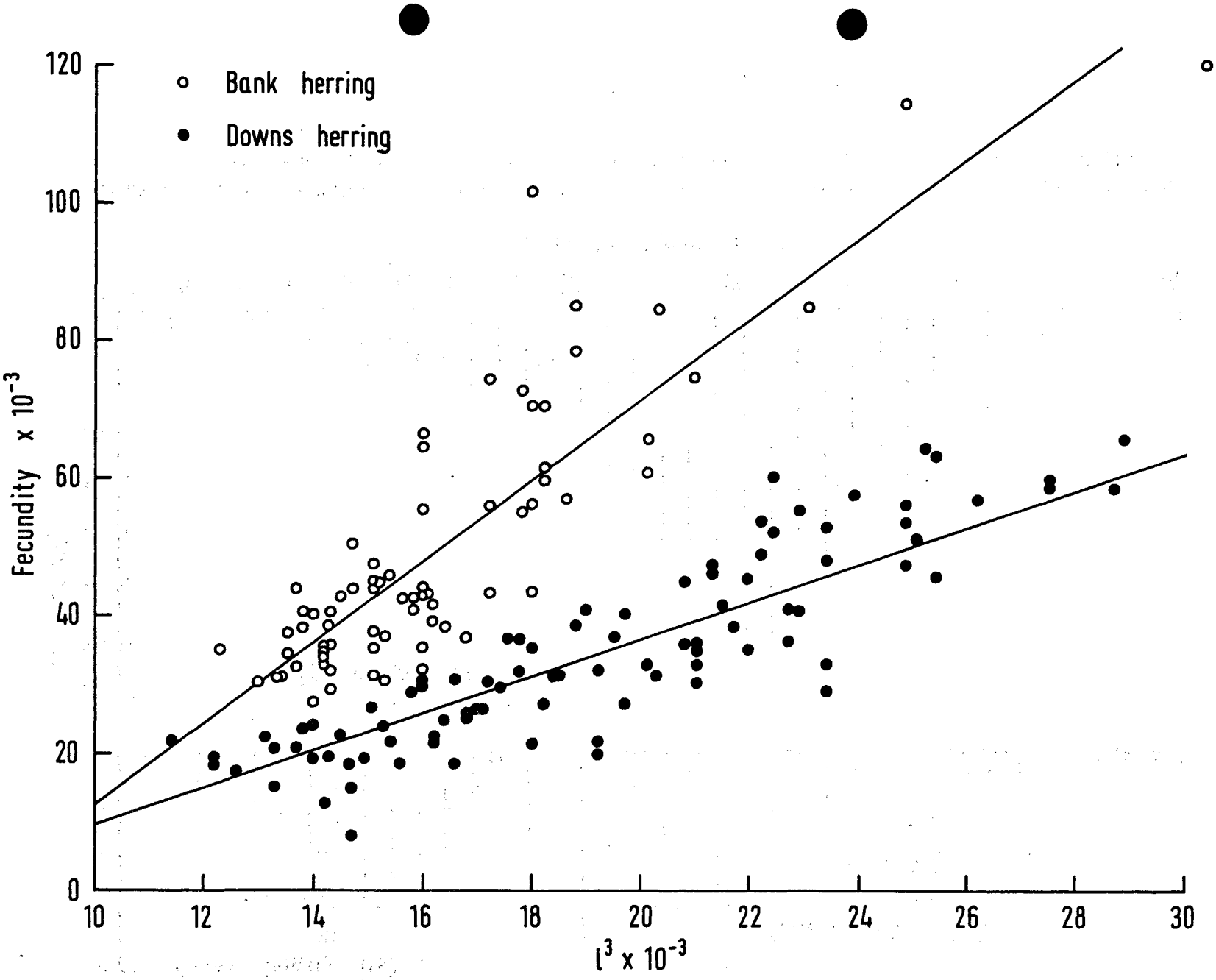

Figure 1 The fecundity/length cubed relationship for known Bank and Downs fish.

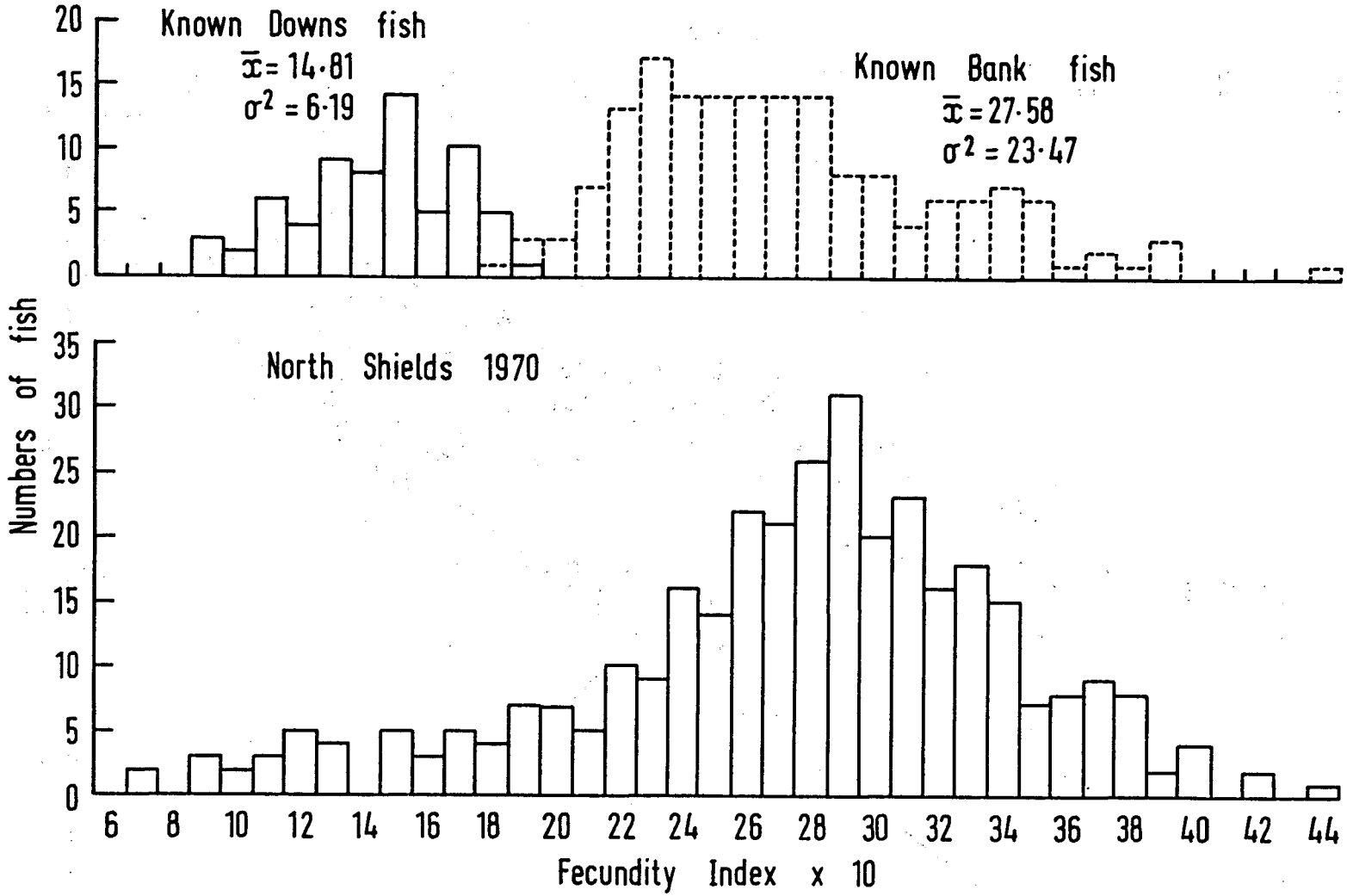

Figure 2 The distribution of the fecundity indices of 3-year-old known Bank and Downs fish with means and variances, and the distribution of the fecundity indices of the 3 year old North Shields fish, 1970.

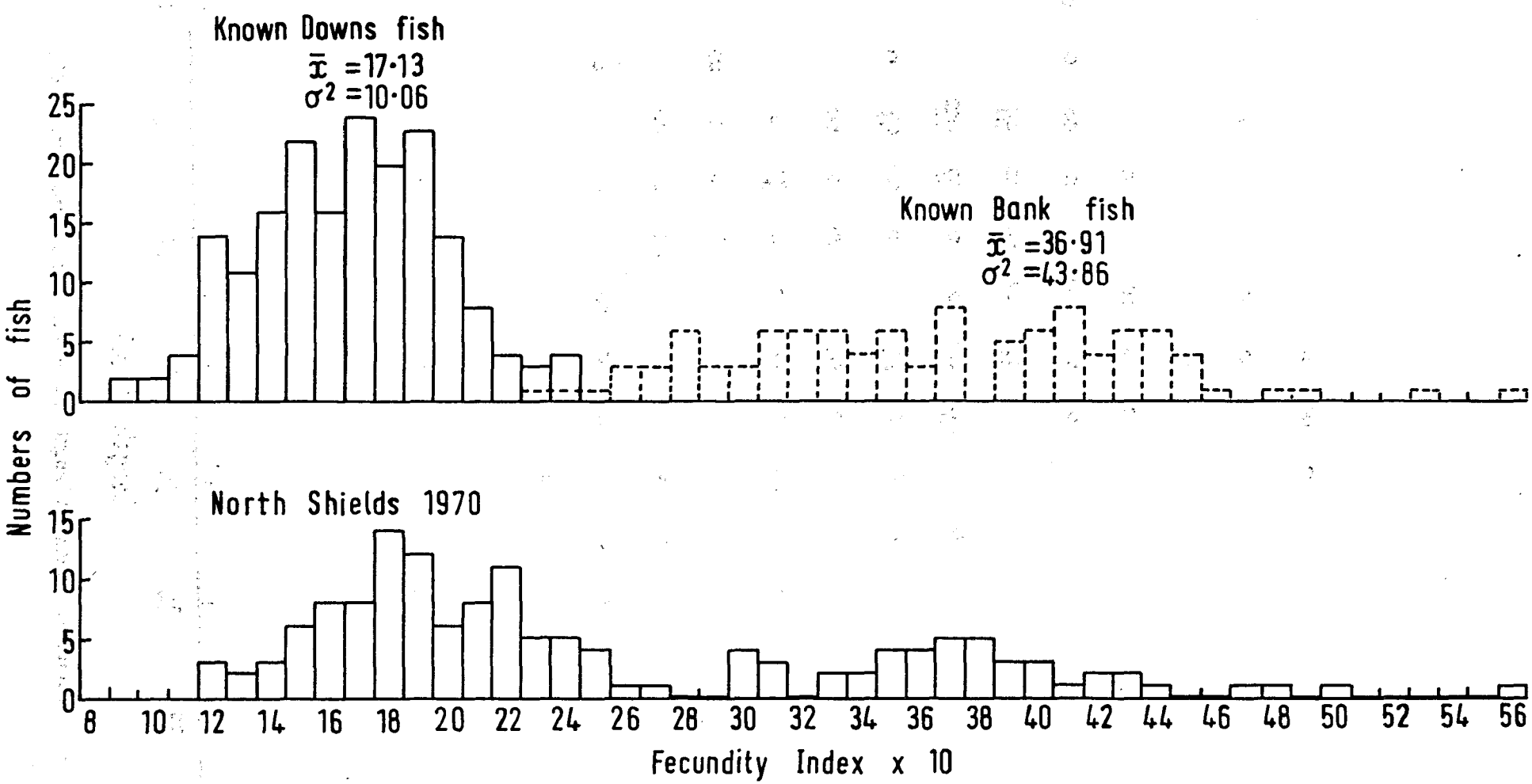

Figure 3 The distribution of the fecundity indices of 4-year-old known Bank and Downs fish with means and variances, and the distribution of the fecundity indices of the 4 year old North Shields fish, 1970.

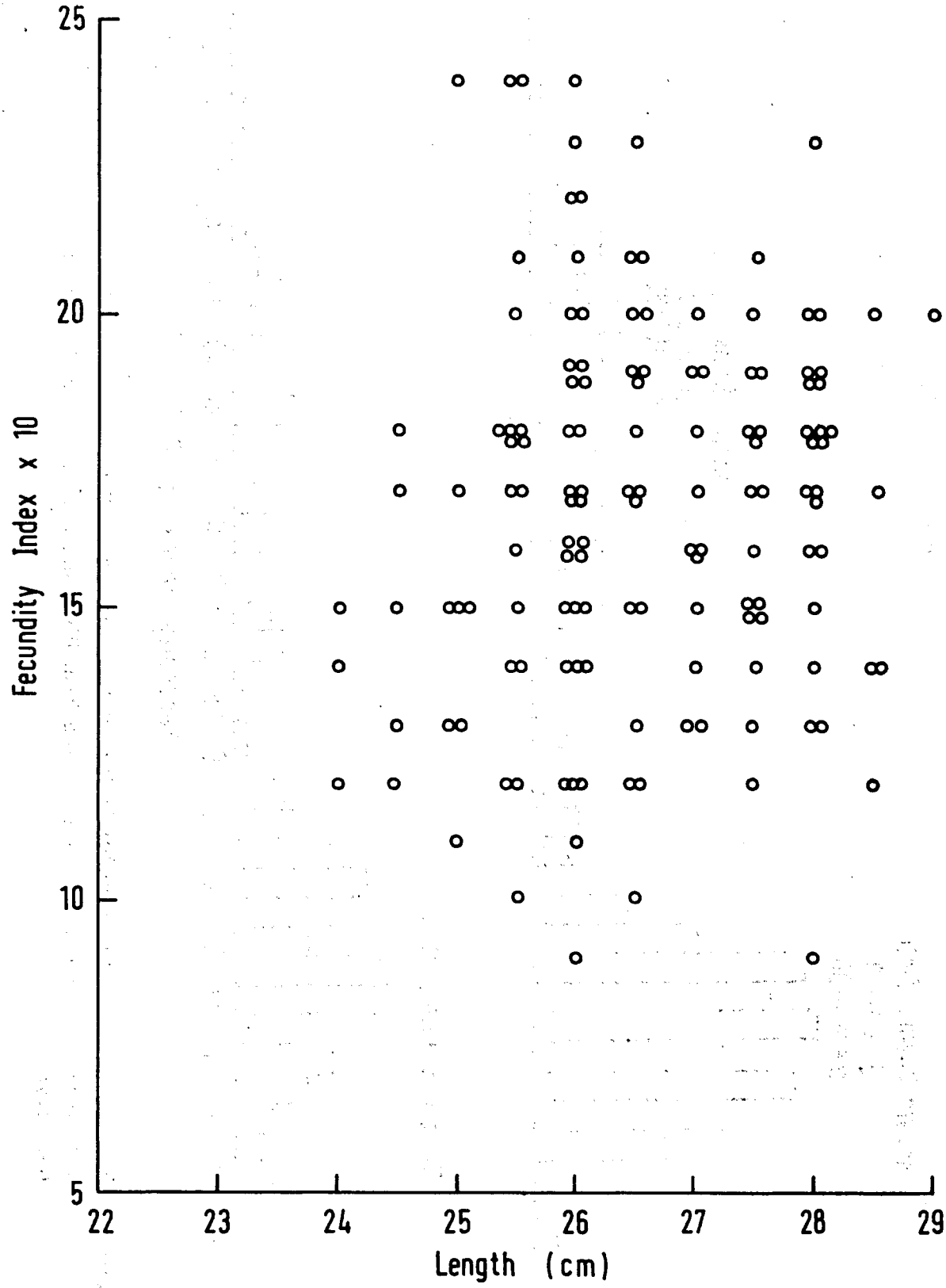

Figure 4 Fecundity index on length for 4-year-old Downs fish, 1962.

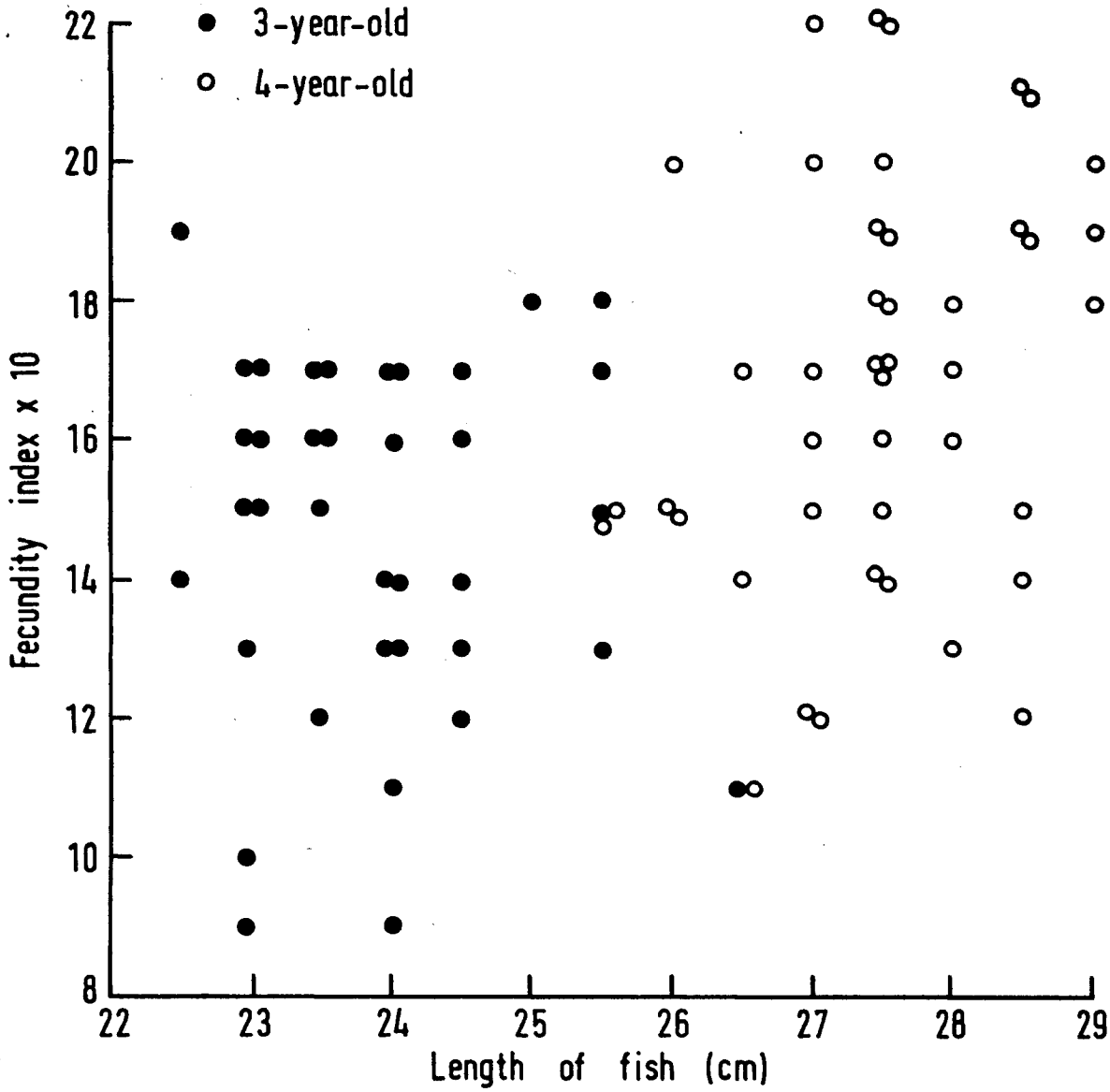

Figure 5 Fecundity index on length for 3- and 4-year-old Downs fish, 1965.