BIOLOGY

An Automatic Fish Egg Counter

THE fecundity of fish has hitherto been generally determined by making direct counts of weight or volume sub-samples of the total gonad contents. These counts are then raised by the ratio of the total weight or volume of the gonad contents to the sample weight or volume.

This process is very time-consuming, and, in consequence, routine studies of the fecundity of large numbers of fish have not been practicable. While typical fecundity estimates have been obtained for a large number of fish species, using material classified by size and age, and collected in one or two seasons, no detailed long-term investigations have been conducted. Such investigations could be of considerable value in studies of the biology and population dynamics of fish populations where it is desired to know the changes in fecundity from year to year, the factors determining these changes, and the dependence of recruitment and strength of year-class on these changes.

To meet this need for routine measurement of fecundity (in the first instance of herring) an apparatus has been devised here. This makes rapid counts of all the eggs in a gonad, thus eliminating the tedious work of hand-counting, and also eliminating the errors of sub-sampling.

The apparatus is shown diagrammatically in Fig. 1. This shows that the eggs are drawn in a stream of water through a constricted tube, interrupting a beam of light which is directed through it. The light beam falls on the cathode of a photomultiplier tube, and the interruptions of the beam are recorded on an electronic counter.

The constricted tube, or counting chamber, has a minimum internal diameter of 1.53 mm., and it has been found that this is just large enough to pass the largest herring eggs without causing frequent stoppages.

The photomultiplier tube used is an 'R.C.A. type 931A' with nine dynodes, and the light source is a 2.2-V. 0.25-amp. lens-end flash-light bulb. The counter is a 'Panax type D554' which conveniently supplies the E.H.T. for the photomultiplier (roughly 200 μ amp. at 1,000 volts) and an a.c. supply for the light source.

As will be seen from Fig. 1, a flow of bubble-free water is maintained from a constant-head tank through the counting chamber. Eggs to be counted are first cleared of all connective tissue and placed in water in the large glass funnel, and the stirrer speed is adjusted to bring them into suspension. The tap at the base of the funnel is then opened, and the

Fig. 1

eggs sink slowly downward and are swept through the counting chamber. The rate of sinking, and so the counting-rate, can be adjusted by varying the speed of the stirrer. In practice, a counting-rate of about 100 per sec. is found to be best. Attempts to increase this rate generally result in blockage of the system.

A considerable number of trials have been made to gauge the accuracy and consistency of the counts. Typical sets of results are shown in Table 1, which gives small successive counts of samples of known size, and in Table 2, which shows successive counts of large samples.

Table 1

Sample	Actual number of eggs	No. recorded by counter in successive trials			
		1	2	3	4
1	521	521	519	525	523
2	778	775	777	771	770
3	507	505	505	505	503
4	808	805	803	801	800

Table 2

Sample	No. of eggs recorded by counter		
	1	2	3
1	19,088	19,128	19,101
2	25,093	25,135	25,274
3	39,494	39,513	39,596
4	43,106	43,150	43,279

These results show that the maximum discrepancy between counts and the maximum error on known samples does not exceed 1 per cent. It is thus felt that reliance can be placed on the method, and a programme of routine investigations of herring fecundity is being developed accordingly.

B. B. PARRISH
I. G. BAXTER
M. J. D. MOWAT

Marine Laboratory,
Aberdeen.

A Pale Hag-fish

DE GRAAF¹ and more recently Ewer² have described specimens of *Xenopus laevis* lacking haemoglobin. In the course of an investigation on the physiology of the heart of the cyclostome *Myxine glutinosa*, I found on August 20 an animal about 25 cm. long which was remarkably pale, except in the caudal and dorsal regions, which were grey. Its blood appeared to have no pigmentation due to haemoglobin except near the gills, where there were some small localized red areas. All the blood vessels were cream in colour as well as the heart, although the ventricle might have been pink (? myoglobin, cytochromes). The liver was dark green and after fixation in 8 per cent formal the principal dorsal vessels showed a light greenish coloration due perhaps to the destruction of haemin compounds. As for the gall bladder, it did not appear greener than normal.

When first observed, the animal was in the dark in circulating sea water at 15° C. among a mixture of hag-fish, and showing as much vitality apparently as the other animals; it is particularly interesting to emphasize that this specimen had been caught at the same time as the others, two days before, in the Gullmars Fjord, Sweden, using G. Gustafson's technique, that is, by means of a large bottle contain-