

The Conclusions of the Convener of the Symposium
on "The Biology of Early Stages and Recruitment
Mechanisms of Herring"



1. While percentage fertilisation and survival rates during the egg stage appear to be high in Clupea harengus, there is still considerable uncertainty regarding mortality during and immediately after hatching. Further studies on egg masses of differing thickness and age structure are needed both under natural conditions and in laboratory experiments.
2. Little is known of the environmental factors determining selection of spawning sites. Bottom sampling and under-water observations in the vicinity of spawning sites are highly desirable.
3. A list of abundant fish which feed on herring spawn should be established, giving the size range over which these fish prey on herring spawn. Experimental and field observations of daily ration, food selection, and on abundance of these fish on the spawning grounds, could lead to estimates of predation rates.
4. Further study is needed of the effects of fishing on recruitment by destruction of spawn, or by interference with spawning behaviour.
5. Man made effects, other than fishing e.g. pollution, exploitation of sea-weed, altering the characteristics of spawning sites are becoming important for coastal spawning areas and should be carefully monitored. The importance of this topic should be drawn to the attention of the Fisheries Improvement Committee.
6. Much effort has been put in studies of the interrelations between the state of the adult stock and subsequent larval production. The effects of age, size and condition of the mother on fecundity have not yet been sufficiently analysed. Experimental studies on herring and other fish, on the relation between parental characteristics and fecundity should be encouraged.

Laboratories engaged on fecundity studies should be invited to analyse their data with respect to these factors and to table their data, and report their results to the 1969 meeting of the Pelagic Fish (Northern) Committee. This analysis should take account of possible variations in fecundity from year to year unrelated to age and size of the parent.
7. The relation between the condition and growth-rate of the female, and the dry weight of eggs, should be compared in the various spring and autumn spawning stocks of C. harengus. A report by AtlantNIRO on its relevant biochemical studies should be invited for the 1969 Annual Meeting.
8. The importance of temperature on the spawning grounds for subsequent recruitment has been demonstrated for the herring stocks of the Central and Southern North Sea. Studies should be made of the part played by temperature in determining recruitment in other areas. This information should be complemented by experimental studies of optimum incubation temperatures in herring of the various stocks.
9. Because of evidence presented of changes in the distribution and abundance of herring larvae in the various North Sea stocks the Pelagic Fish (Northern) Committee should recommend the continuation and intensification of the International Herring Larvae Surveys in this area. These should be supplemented by simultaneous studies of food organisms for and predators of herring larvae.
10. In view of increasing interest in estimation of larval abundance as a measure of spawning stock size it is important that further studies should be made of the merits of the various modifications of the Gulf III sampler used by different countries. Because of the importance of standardising the sampling

by countries engaged in the International Herring Larval Surveys in the North Sea countries should continue to use the standard Gulf III sampler in 1969 but tests should be made of the unencased sampler and reported to the Pelagic Fish (Northern) Committee in 1969.

11. Evidence was produced that in recent years the Faroe area has been of considerable importance as a spawning area for the Atlanto-Scandian stock. Further studies of larval production and spawning stock characteristics, including fecundity and egg size, in this area are badly needed.

12. The importance of the spawning area to the west of Scotland, and in the region between Butt of Lewis and Orkney was shown in various contributions. More detailed and more extensive sampling in this area is required to monitor possible larval exchange between this area and the North Sea.

13. Studies of the vertical distribution and its diurnal changes, in different size groups of herring larvae should be carried out in areas of differing depth and degree of hydrographical stratification.

14. In view of the restricted searching capacity of herring larvae, contagious distributions of larvae and food organisms might play an important role in determining survival. The attention of the Plankton Committee should be drawn to the need for the simultaneous sampling of herring larvae and food organisms in small volumes of water.

15. Length independent measures of condition (e.g. water content, biochemical composition) of herring larvae as well as more information on growth in weight, and length, and of allometric changes, under various conditions of food supply and temperatures, are urgently required.

16. One of the major deficiencies in the data presented to the Symposium was the lack of contributions on the commercial fisheries on adolescent herring. Countries with fisheries on young herring should be urged to make available data and conclusions on the stock composition and the recruitment mechanism of the exploited young fish populations.

17. There is now evidence that recruitment to the Atlanto-Scandian stock is determined prior to the 0-group stage. Studies should be made of 0-group abundance in other areas, and related to year-class strength, to see whether recruitment is, in all areas, determined in the egg or larval stages.

18. A short review of "The Results of the International Young Herring Surveys in 1960-61" should be prepared for the published volume of the Symposium contributions. The review should include an outline of the techniques applied, particularly of the discriminant function analysis, and its use in similar studies of stock reparation.

19. Thirty-seven contributions were presented to the Symposium and two others were read by title. In view of the value of these contributions they should be published in a special volume of *Rapports et Procès-Verbaux*. In the light of financial limitations it may be necessary to restrict publication to papers most relevant to the topics of the Symposium. Papers which will be published elsewhere in full should appear in the volume as extended summaries only.

The editor should circulate papers to the authors by mid-December with his editorial changes for approval. If no reply is received before 1st February the editor will assume his editorial changes have been approved.