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A Short-cut Method for Estimating Zooplankton Composition while at Sea.

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In most cases plankton work at sea merely consists of sampling and preserving the samples collected. Thus, when the plankton material has been brought to the laboratory its composition is usually unknown. Working up the material often takes a long time, possibly many years. However, an intelligent sampling and practical choice of plankton stations is difficult, and a plausible working hypothesis may be hard to establish until some preliminary results have been obtained. Moreover, in the example of a research vessel where one of the main functions is to assist the fishing fleet, information on the main features of the plankton quantity and its composition is needed as quickly as possible.

With these facts in mind Dr. HERMANN EINARSSON attempted to find a short-cut method to be used at sea for estimating the composition and the percentage frequencies of some components of zooplankton which he collected on board the Icelandic research vessel Ægir during the summer of 1955. He has described the method and given a preliminary account of his results (EINARSSON, 1956).

By this method 100 animals are counted from each sample and percentage frequencies of the various components are noted. Simultaneously diagrams are prepared showing zooplankton volume, percentage frequencies of zooplankton components according to this short-cut method, the colour of copepods, frequency of diatoms found in the samples and the penetration of light by the Secchi method. All this work takes relatively short time and can therefore be done with ease without delaying the cruises.

In most cases these 100 animals counted in every sample represent only a very small portion of the animals in the sample. But when the distance between stations is 10 to 15 nautical miles, i. e. almost one sample is taken every hour, there is practically no time left for a more thorough plankton study on board with the usual staff of research workers.

During the cruises with Ægir in the summers of 1956 and 1957, the author has continued to use this method. To test its reliability the author has made a comparison between the plankton components as found by the short-cut method and those found by the conventional method. The purpose of this short paper is to describe the results of this preliminary investigation.

The main components of the zooplankton which are identified by this short-cut method are as follows:

1. Neretic plankton,
2. *Calanus finmarchicus* plankton, and
3. *Calanus hyperboreus* plankton.

The percentage frequencies of the following components in the portion counted are also determined. These are:

1. *Calanus finmarchicus,* each stage counted separately and grouped in the following manner: a) juvenile, i.e. copepodite stages I—III, b) adolescent, i.e. copepodite stages IV—V and adult stage VI.
2. *Calanus hyperboreus.*
3. Neretic plankton, i.e. *Temora, Acartia, Evadne, Podon* and larvae of Decapoda and of various benthonic animals.
4. Varia, i.e. *Pseudocalanus, Metridia, Oithona* and scarce components as juvenile stages of Euphausiids and Amphipods, Limacina, Chæthognaths and fish eggs.

As soon as these analyses are completed, a diagram of the percentage frequencies is made as illustrated in Figs. 1 and 2. The two examples chosen for this illustration are a part of the Kögur section off the NW-coast of Iceland (Fig. 1), and stations from a surveyed area 80—100 nautical miles north off Langanes (Fig. 2). The samples from the Kögur section (Fig. 1) were collected on May 31 and June 1 1956. The first 3 stations of this section are on a line extending to the NW, but the rest of them on a line to the NE, following the limit of the drift ice. The uppermost part of the figure indicates the bottom configuration and the isotherms in a vertical section 0—140 meters. The middle part of the figure shows the percentage frequencies of the zooplankton components according to this short-cut method. The lowest part of the figure illustrates the percentage frequencies of the same samples after they had been fractioned in LEA's improved plankton divider and one of the fractions counted.

In Fig. 2 the diagram showing the bottom configuration and isotherms in a vertical section is omitted. The top half shows the percentage frequencies of the zooplankton components after the samples had been divided in LEA's improved plankton divider and one of the fractions counted. The bottom half illustrates these frequencies according to the short-cut method. These samples were collected on June 7 and 8 1956.

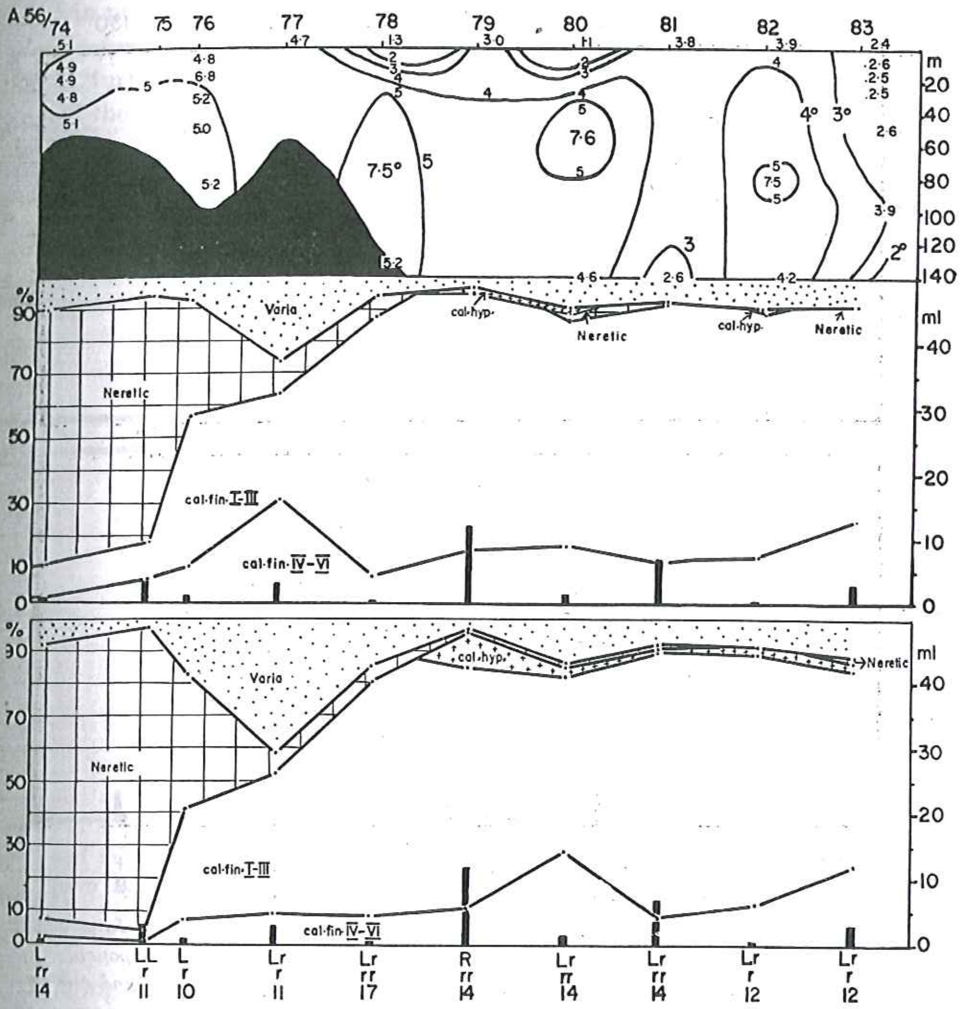

FIG. 1. Kögur section. Stations A 56/74–83 taken on May 31 and June 1 1956. Uppermost part: Bottom configuration and isotherms from 0–140 m. Middle part: The percentage frequencies of zooplankton components according to the short-cut method. Lowest part: The percentage frequencies of the same samples after they had been fractioned in Lea's improved plankton divider and one of the fractions counted. For further explanations see text.

As for both figures, the black columns indicate the volume of each sample in milliliters, and below the colour of copepods, frequency of diatoms and light penetration by the Secchi method is indicated.

Fig. 1 clearly shows how neretic plankton dominated in the shallow waters, but off the edge and along the drift ice *Calanus finmarchicus* juvenile was the dominating component. On some few stations along the ice limit *Calanus hyperboreus* was observed and also some neretic plankton was indicated.

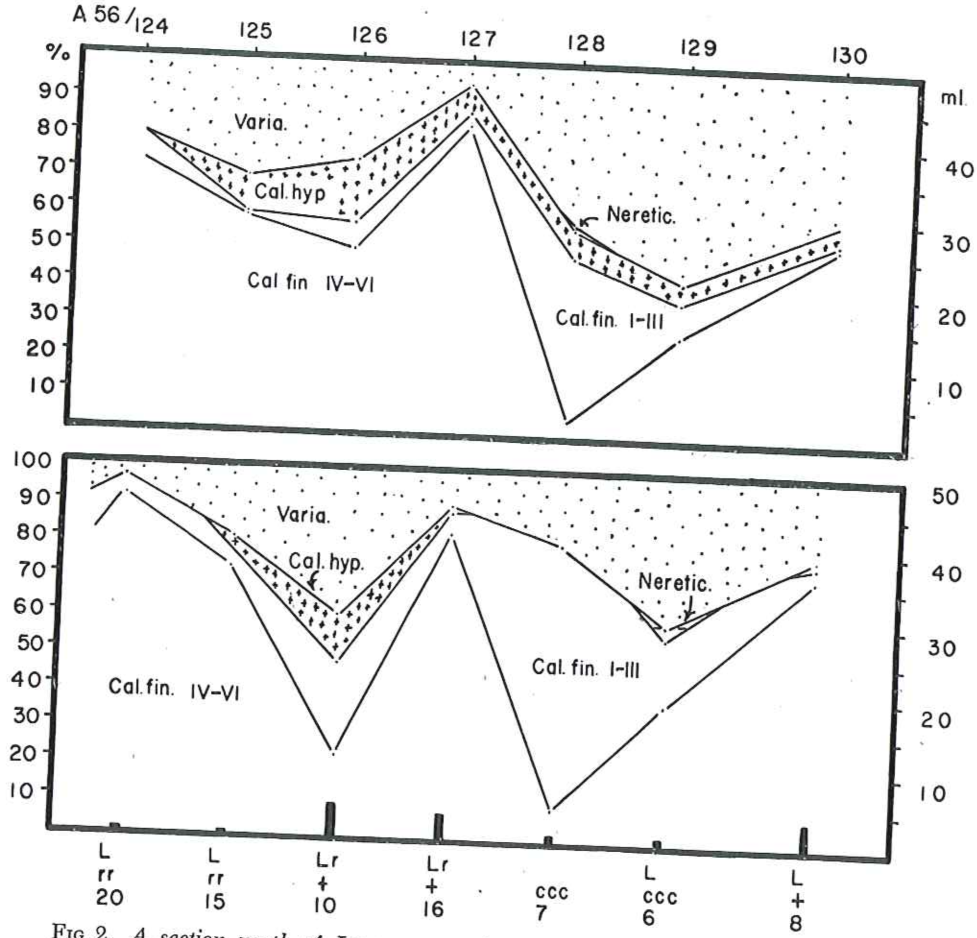

FIG. 2. *A section north of Langanes, station A 56/124—130 taken on June 7 and 8 1956. Top half: The percentage frequencies of zooplankton components after the samples had been divided in Lea's improved plankton divider and one of the fractions counted. Bott half: The percentage frequencies of the same samples according to the short-cut method.*

Indeed, it is striking how little differences there are between the two plankton diagrams in each figure. These two examples show that the short-cut method illustrates fairly well the general features in the plankton composition.

In order to illustrate the agreement between the two methods a scatter diagram (Fig. 3) was prepared. This includes the *Calanus finmarchicus* counts for all stations in Fig. 1 and 2. The regression line of the short-cut method on the conventional method was calculated and plotted on the diagram.

The standard deviation of the difference between the percentage of the total counts of *Calanus finmarchicus* as obtained by the two methods, was found to be 14,2%. The mean difference was 10,0%, the short-cut method giving in practically all cases higher values. This indicates a consistantly higher *Calanus finmarchicus* counts due to the technique used in the short-cut method. A further experimentation on the technique is intended. Possibly, a way to avoid the selectivity of the short-cut method as regards *Calanus finmarchicus* might then be found or a reliable correction factor established.

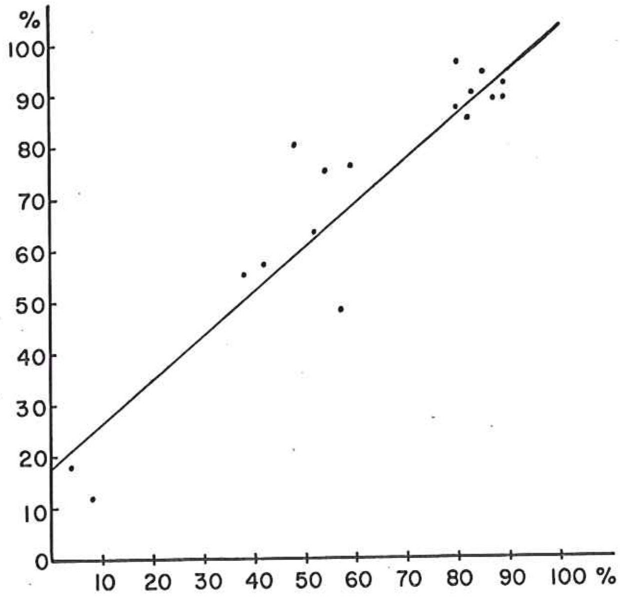

Fig. 3. *A comparison between the results obtained by the conventional (abscissa) and the short-cut method (ordinate) for the total Calanus finmarchicus counts from all stations in Figs. 1 and 2. The straight line is the calculated regression line.*

Judging from these data it seems reasonable to presume that the short-cut method can advantageously be used to trace the main components of the zooplankton and roughly show their percentage frequencies. On the other hand, as a result of the relatively few animals counted one can not expect a high degree of accuracy for single species which only occur in small numbers and at few stations.

It is clear that if the general distribution of certain zooplankton organisms is important for the location of certain foodfishes such as herring, it is of no less importance to be able to estimate the possible future development of these organisms. The method has in fact been applied succesfully to help locating herring (Einarsson 1956, Jakobsson 1957) on board the Ægir where it has been used to a greater or a lesser extent during the last three years.

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