

correlations are transformed by principal component analysis and the resulting vectors compared by ranking methods with hydrographic features, some of which, however, are of rather subjective meaning (Craig's "oceanic influence" and "spring anomaly"). More than half the variation in plankton from year to year would appear to be connected in some way with hydrographic events occurring in the spring, and only 10 per cent with possible oceanic influence.

Messrs. Glover, Cooper and Forsyth discuss the average abundance of the organisms arranged subjectively in the order neritic-oceanic in comparison with the grouping found by Williamson. Although there is some agreement considerable differences exist, particularly the status of species of group Z, which they class as intermediato, not oceanic. The so-called oceanic forms are discussed in comparison with their distribution in the north-east Atlantic and North Sea, as shown by continuous recorder sampling. It emerges that many 'oceanic' species vary in the extent to which they occur in the ocean from year to year, and hence many of the changes taking place

in the North Sea, although obviously related to changes outside, can no longer be regarded as due to variations in the strength of inflow of oceanic water. However, the authors do not take their discussion further than this, and continue to stress the importance of oceanic water to fisheries.

One criticism must be made: in both contributions biogeography is considered only from the point of view of oceanic-neritic differences, and north/south or other temperature differences are not mentioned. Hence, for example, an attribution oceanic to a species could cover any category from arctic to tropical according to the depth (and temperature range) at which it was abundant. This difficulty is increased by the need to combine certain species. The grouped euphausiids, for example, include arctic/boreal forms such as *Thysanoessa* and *Meganyctiphanes* as well as the sub-tropical/temperate *Nyctiphanes*. This aspect should surely be taken into account in attempts to unravel the complexities of plankton distribution in relation to the pelagic fisheries.

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RESEARCH IN INDUSTRY

INDUSTRIAL Research in Manufacturing Industry, 1959-60*, has been prepared by the Federation of British Industries in conjunction with the National Institute of Economic and Social Research. It is the first investigation to attempt a qualitative as well as a quantitative analysis of research and development in British manufacturing industry. C. Freeman and R. W. Evely, of the National Institute of Economic and Social Research, worked for a year in analysing questionnaires and samples which would provide information on the research pattern in different industries, the breakdown of research expenditure into basic and applied research, the growth of research departments in different industries, the effect of Government expenditure on research in industry and the relationship of research to growth. On the basis of this information two commentaries were written, one by Prof. Bruce Williams on behalf of the National Institute of Economic and Social Research and one by G. A. Dummett, the chairman

of the Industrial Research Committee of the Federation of British Industries.

The survey shows that as much expenditure is being devoted to basic research and new products as to improvements in existing products and processes. Despite the fact that the science-based industries and large firms account for most of the recent expansion in research, there has been a greater relative increase in industries with lower research ratios and among the medium and small-sized firms. One example in the attempt to correlate research expenditure and the growth of the firm shows that, in chemicals, five firms out of the twenty-two selected which grew fastest in terms of total net assets had a level of internal expenditure on research and development 2½ times as large as the five firms which grew least.

Nearly one in ten of all, and one in four of large, respondent firms have direct Government research contracts. On the deficiencies which the survey shows up, the most important limitation on expansion of research activity is the lack of qualified manpower—there is a standing vacancy of about 13 per cent overall in industry's research and development departments.

* Federation of British Industries. *Industrial Research in Manufacturing Industry 1959-60*: Results of a Survey including Commentaries and a Statistical Report. Pp. 129. (London: Federation of British Industries, 1961.) 40s.

SCINTILLATIONS OF RADIO STARS AND SATELLITES DURING INTENSE MAGNETIC DISTURBANCES

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AN unusual relationship between the received frequencies and the amplitude scintillations of signals from the discrete sources Cygnus A and Cassiopeia A was noted when results were recorded simultaneously at 62, 109 and 226 Mc/s. during several

periods of intense magnetic disturbance (local magnetic index¹ ≥ 6). These investigations were made with the 84-ft. parabolic antenna of the Air Force Cambridge Research Laboratories' Sagamore Hill Radio Observatory at a geographical latitude of