

these external galaxies. Objections relating to the high rate of increase of mass given by the formula, the difficulties regarding the time-scale, the lack of any observable distinction separating stars of small velocity from those of slightly higher velocity, etc., are considered by the authors who, if they have not established their theory, have indicated certain lines along which investigations should be conducted. Reliable observations which supply information of the density distribution and velocities of the stars relative to the cloud will confirm, modify or disprove the theory.

<sup>1</sup> See *Proc. Camb. Phil. Soc.*, **35**, 405, 592 (1939); **36**, 325, 424 (1940) and also *NATURE*, **146**, 97 (1940) with earlier references.

<sup>2</sup> *Proc. Camb. Phil. Soc.*, **36**, 313 (1940); *Mon. Not. Roy. Astro. Soc.* **100**, 500 (1940).

## FISH OILS

PRIOR to the War, the fish oil industry was successfully applying to problems of production the results of recent research, particularly with respect to vitamins A and D. The liver oils from some species possess extraordinary potency, thus the blue-fin tuna or horse mackerel yields oil containing up to 400,000 I.U./gm. of vitamin A and 60,000 I.U./gm. of vitamin D as compared with 800 I.U./gm. (A) and 100 I.U./gm. (D) for average cod liver oil. The soupfin shark liver contains 40-70 per cent of oil the vitamin A potency of which is frequently more than 100,000 I.U./gm., but on the other hand it is very poor in vitamin D, the potency being only about 20 I.U./gm. This oil is produced on a large scale in California at relatively small cost, and is probably the cheapest source of vitamin A in a highly competitive market.

The discovery in 1937<sup>1</sup> that oils extremely rich in vitamin A can be obtained by extracting the intestines of fish like halibut, has been followed up commercially on the Pacific Coast, but the nature of the raw material demanded modifications in technique. These have been kept secret. According to Brocklesby<sup>2</sup> 126,000 dollars worth of halibut livers and 37,000 dollars worth of intestines were landed at Prince Rupert, B.C., in 1938. In 1939, 3,853 cwt. of halibut livers yielding 650 gal. oil compared with 688 gal. visceral oil were produced in British Columbia. Fishing for halibut in the Pacific is regulated by an international agreement between Canada and the United States, and the annual quota is about 46 million lb. of which about a quarter is landed in Canada. The viscera account for about 2 per cent of the weight of the fish and the oil content (1-5 per cent) is low. The vitamin A potency is, however, usually two or three times greater than that obtained from the liver. The characteristics of commercial halibut visceral oil are given in detail by Brocklesby and his colleagues.

The viscera from various species of salmon yield a few per cent of oil containing usually more than 5,000 I.U./gm. and 100 I.U./gm. of vitamins A and D respectively. Very large quantities of oil are extracted from salmon cannery waste and the commercial salmon oil is of considerable value for poultry feeding, as well as having other important uses.

<sup>1</sup> Lovern, Edisbury and Morton, *NATURE*, **111**, 234, 276.

<sup>2</sup> "The Chemistry and Technology of Marine Animal Oils with particular reference to those of Canada", *Bull.* 59, Fisheries Research Board of Canada, 1941.

## PLANKTON STUDIES

IN two important papers, Gordon A. Riley continues his investigations on the interaction of the plankton with its environment ("Plankton Studies. 3. Long Island Sound", *Bull. Bingham Oceanograph. Coll.*, Peabody Museum of Natural History, Yale University, **3**, Jan., 1941. "Plankton Studies. 4. Georges Bank", *ibid.*, June, 1941). The preceding work ("Plankton Studies" 1 and 2, in the same periodical, 1938 and 1939) dealt with the Tortugas region and the western North Atlantic. Light and dark bottles filled with natural sea water and suspended near the surface were used to determine oxygen production and consumption, the utilization and regeneration of nutrients and the production and consumption of chlorophyll. Analyses were made of oxygen, chlorophyll and phosphates in the Long Island surface waters for a period of about a year. Counts were made of zooplankton and, during the last half of the investigation, nitrate determinations were made.

The quantity of chlorophyll in the phytoplankton was much higher than in the oceanic waters outside the sound. The nutrients, particularly phosphate, were also high; the ratio of nitrate to phosphate low. The amount of photosynthesis was influenced directly by the quantity of chlorophyll and by temperature and light. The similarities between experimental results and the events in the free water were considered sufficiently marked to permit the use of the former in making rough estimates of productivity.

In the latest paper an analysis was made of the methods of measuring phytoplankton, and it was found that the determination of plant pigments (after the method of Harvey, 1934) has the highest mean correlation with other types of measurement and is therefore the most nearly representative determination of phytoplankton. This portion of the work is a study of the quantitative aspects of the phytoplankton of Georges Bank in relation to the environmental factors which influence its growth and distribution. It is part of a general survey of Georges Bank by several investigators, the purpose of which is to obtain needed information about the spawning and larval development of the haddock.

## APPOINTMENTS VACANT

APPLICATIONS are invited for the following appointments on or before the dates mentioned:

PSYCHIATRIC SOCIAL WORKER, and a SPEECH THERAPIST—The Education Officer, The Guildhall, Cambridge (September 13).

PROFESSOR OF MATHEMATICS—The Registrar, University College of Swansea, Singleton Park, Swansea (September 13).

POWER STATION SUPERINTENDENT—The Borough Electrical Engineer and Manager, 19-23 Northgate, Halifax (endorsed 'Power Station Superintendent') (September 15).

PSYCHIATRIC SOCIAL WORKER—The Chief Education Officer, Education Office, Warrior Square, Southend-on-Sea (September 17).

ASSISTANT DEPUTY CHIEF ENGINEER—The Town Clerk, Town Hall, Manchester 2 (endorsed 'Assistant Deputy Chief Engineer') (September 22).

BOROUGH ENGINEER AND SURVEYOR—The Town Clerk, Town Hall, St. Marylebone, London, W.1 (endorsed 'Borough Engineer and Surveyor') (September 27).

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