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PRELIMINARY REPORT ON A STUDY OF TOXICITY IN MUSSELS AS RELATED TO DINOFLAGELLATE POPULATIONS IN NORWEGIAN COASTAL WATERS

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Accumulation of mytilotoxin in sufficient concentration as to make shellfish dangerous for human consumption does only take place when dinoflagellates become numerous. In the European localities where shellfish poisoning due to mytilotoxin has been reported, pollution by sewage in general appears to provide the necessary supply of nutrients for the dinoflagellates.

In the inner part of the Oslofjord the fertilizing effect of sewage from the city of Oslo was first observed by Gran in 1917 and in later years more extensive surveys have supplied more detailed information on the pollution effect upon the phytoplankton. From late April through the summer, when the Norwegian coastal waters otherwise are relatively poor in phytoplankton, the inner Oslofjord waters contain an extremely abundant phytoplankton population with dinoflagellates as a major component. The composition of the dinoflagellate society has been found to vary extensively from one year to another, different species showing predominance in the various years. Among the regularly occurring species are also some which in other areas have been made responsible for serious cases of paralytic shellfish poisoning. Repeatedly it has been pointed out that, on this background, it might be expected that concentrations of poison-producing species might occur which would lead to high toxicity in mussels. Since no observations on the actual toxin content of the mussels were available and cases of mussel poisoning in the inner Oslofjord had been reported only from 1901 and 1939, the health authorities did not find the situation serious, in spite of the fact that registration of such cases obviously was incidental.

On the initiative of Dr. K.F. Wiborg a study of the toxicity in mussels of the inner Oslofjord was started in 1963 and has continued during 1964. The Department of Food Hygiene, Veterinary College of Norway, was in charge of the toxin analyses, while the Institute of Marine Biology, University of Oslo, arranged the collecting of mussels and of samples for quantitative studies of the phytoplankton.

In 1963 none of the mussel samples showed any appreciable

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content of toxin, while, in 1964, from late April through May and June the toxin content was found to exceed the limit set by American health institutions, namely 400 mouse units per 100 g. The toxin content in the mussels varied from one locality in the inner fjord to another and changed with time. The maximal values for the toxin content amounted to many times that regarded as the upper safety limit and a warning against consuming mussels from the inner Oslofjord seemed well justified. Through broadcasts and articles in the newspapers the public was made aware of the situation and the authorities stopped the sale of mussels within the city of Oslo. Fortunately no case of serious poisoning has been reported during the period of investigation. In July the toxin concentrations decreased and in late summer no appreciable toxin content was recorded. The observations will be continued till the end of November as very large dinoflagellate populations usually are found during the autumn months.

Phytoplankton samples which were examined by Miss Ingrid Nygaard demonstrated that, in 1964, the population of the well-known toxin-producer Goniaulax tamarensis was considerable within the inner fjord all through the period when toxicity values were high. The species occurs regularly in the Oslofjord but the populations recorded e.g. in June 1963 when toxicity values were low, were much smaller than those recorded during the corresponding period of 1964. The actual concentrations recorded in 1964 varied very much, from one locality to another as well as from one sampling date to another. The highest concentration recorded was 400 000 per litre, while most of the figures were 1/10 or less of this maximum value. Together with Goniaulax tamarensis occurred large populations of other brown dinoflagellates, e.g. ceratia, Peridinium triquetrum and P. trochoideum. There is, however, every reason to assume that G. tamarensis is responsible for the main part of the high toxicity of the mussels observed in 1964.

The general picture of the occurrence of mytilotoxin in mussels of the inner Oslofjord accords with that obtained from other records from European waters in as much as it is closely related to the pollution of the fjord waters by sewage.

In addition to the observations in the inner Oslofjord, a great number of toxicity analyses were made on mussel samples from the outer Oslofjord and from other coastal areas. None of the samples from the outer Oslofjord showed any appreciable toxin content and the same was the case with many samples from other parts of the coast. In the Trondheimsfjord, however, a rather high toxin content was observed in several samples and it was a surprise to find that high values were observed in a sample from the outer part of the fjord where no pollution effect should be expected. A couple of phytoplankton samples which have been examined gave no indication of large dinoflagellate populations in this fjord. It is, however, too early to discuss the situation in the Trondheimsfjord in any detail, since the hydrographical data and the phytoplankton samples from a rather extensive all-year survey undertaken in 1963 and 1964 have not yet been worked up. It may only be pointed out that shellfish may retain a high toxicity for a long period after a Goniaulax bloom has gone down. One cannot, therefore, expect any close correlation between the toxin content and the amount of Goniaulax tamarensis at each sampling date. Unusual

hydrographic conditions are known to give occasion to blooms of phytoplankton in the outer coastal waters of the Norwegian coast. It is possible that such a situation may be the background for the high toxicity records in the outer part of the Trondheimsfjord. Further information on this problem may be obtained when the hydrographic studies and the enumeration of the phytoplankton populations for the years 1963 and 1964 have been completed.