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NEKA OBILJEŽJA RASPODJELE MORSKIH ALGA NA OBALAMA NORVEŠKE

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The notable differences in regional and local distribution of the benthic algae along the Norwegian coast is obviously due to an exceptionally wide range in environmental factors such as temperature, salinity, submarine light supply, exposure and, to a lesser extent, pollution.

Temperature conditions are subjected to variations due partly to the fact that the coast stretches from 57°57' N to 71°11' N, extending far into the Arctic region, and partly to a marked positive temperature anomaly in sheltered localities, conditioned by special topographical and hydrographical features of the inner coastal areas.

Salinty exhibits a great variation in its annual amplitude: the outer localities have rather uniform salinity conditions all through the year, while at the head of the fjords a concentrated summer discharge of rivers fed by water from melting snow and glaciers produces brackish conditions during May-July.

Submarine light supply varies with latitude according to the marked difference between daylight supply in the summer and winter season, most accentuated in the arctic zone where periods of midnight sun and winter darkness represent the extremes. In addition, local differences in turbidity, most strikingly demonstrated in the regions influenced by turbid glacier rivers, lead to a reduction in the submarine light supply from the outer coastal areas to the head of the fjords.

Within every part of the coast the exposure factor exibits an extremely wide range, not only due to the sheltering effect of a profusion of islands in the outer part and the indentation of fjords penetrating far into the mainland, but also because in all parts of the coastal area there occur semiclosed bays which may exhibit very sheltered localities even close to the open sea.

Pollution induces local effects upon algal distribution in a number of localities, but only in a few, above all in the Oslofjord, is pollution a major feature in the ecological spectrum.

In the following, a few examples are given of algal distribution along the Norwegian coast. They are mainly based upon the following publications: Alstadsaeter 1954, Breivik 1957, Grenager 1957, Lund 1949, Printz 1926, 1952, Faegri and Moss 1952, Stokke 1957 and Sundene 1953. In addition unpublished results by O. Sundene on the distribution of bluegreen algae in the Oslofjord, by I. Jorde and N. Klavestad or results from a survey of the Hardangerfjord and by P. Svendsen on the vegetation of the Spitzbergen coast have made available.

Among larger benthic algae which presumably have a temperature-conditioned distribution may be mentioned:

a) Northern species having a southern limit of distribution on the Norwegian coast: *Halosaccion ramentaceum, Petrocelis polygyna, Turnerella septentrionalis, Saccorhiza dermatodea.*

b) Species having their northern limit on the Norwegian coast: *Codium tomentosum, Asperococcus bullosus, Desmotrichum undulatum, Leathesia difformis, Saccorhiza schizodes, Chylocladia kaliformis, Gelidium crinale, Gracilaria verrucosa, Laurencia pinnatifida, Nemalion multifidum, Rhodophyllis bifida,* to mention a few of the many species of this group.

Some of these species have shown a more or less pronounced expansion towards the north during the last decades. This is the case with *Codium tomentosum (C. dichotomum* and *C. fragile)* which has been recorded from the west coast of Norway for about 100 years, but has become far more widespread during the last 20 years and has penetrated even into Arctic region. Similarly *Gracilaria verrucosa,* a species not recorded in Norway until 1941, has been found to be of common occurrence along the coast up to about 63° N. *Colpomenia sinuosa* var. *peregrina* also seems to have been introduced fairly recently and is known from a number of localities up to the same latitude; a similar situation is met with in a number of other less conspicuous species.

Recent surveys of the local distribution of the littoral algae in fjords of southern Norway demonstrate the effect of the salinity factor upon algal distribution. Examples of species which are lacking in the inner parts of the fjords, presumably on account of the large amplitudes in salinity, are: *Fucus spiralis* and *Pelvetia canaliculata,* while *Ascophyllum*

nodosum and *Fucus vesiculosus* as well as representatives of *Chlorophyceae* thrive well even at the head of the fjords.

The distribution of species like *Alaria esculenta* and *Himanthalia* elongata, which locally may be determined by exposure, is in a broader sense influenced by the salinity factor. In their distribution along the south-eastern coast these species seem to be hindered in penetrating to the eastern parts on account of the lower salinity of the waters prevailing there.

The surveys of the Oslofjord, the fjords near Stavanger and the Handangerfjord have demonstated the pre-eminent importance of the exposure factor for the local distribution, so well known from upper sublittoral zone. The societies of exposed shores may be found also at some distance from the outermost coast provided that local exposure is sufficiently strong; however, there is a gradation in the requirements of the various species.

Also in the sublittoral vegetation the effect of the water movement is noticeable in the distribution of a number of species, as for instance in *Laminaria hyperborea* which becomes scarcer and smaller as one departs from the outer region of active circulation of the water and which does not penetrate far into the fjords.

The ligth factor is yet most unsatisfactorly studied, especially in its importance for the general distribution from south to north. Locally its effect is obvious in the depth distribution of the sublittoral vegetation in the fjords. The depth of the sublittoral zone is reduced towards the head of the fjords where more turbid waters occur ,at least during certain seasons. This has been demonstrated as well in fjords receiving glacial river water, for instance the Hardangerfjord, as in other fjords, like the Trondheimsfjord and the Oslofjord, a pronounced effect of terrigenous particles upon light transmission being a general feature of inner coastal waters.

Detailed studies of the littoral and upper sublittoral vegetation of the inner Oslofjord have clearly demonstrated that among the bluegreen algae oligo-, meso- and polysaprobic species occur, while the green algae seem to have representatives of the two first groups only. Among the brown an red algae there are species with a considerable resistence towards pollution, while none seem to be favoured by or dependent upon definitely polluted waters. A favourable response by some of the species of these groups upon a very slight degree of pollution is probable, but not always easy to ascertain.

In addition to the environmental factors which commonly determine the local distribution of marine algae on the Norwegian coast H_2S may also be mentioned. In the many land-locked bays where H_2S occurs in the deeper layers, the society which may be found at levels where H_2S-water prevails for longer periods of time consists of species which exhibit a high resistance against this poison, for example *Gracilaria verrucosa*.

The Spitzbergen coasts represent an area where arctic environmental conditions are even more extreme than in Northern Norway. Some Arctic species as *Dilsea integra* and *Laminaria solidungula* occur in Spitzbergen but not on the Norwegian coast, while many other species are common to the two coasts. A great number of the species which occur along the Norwegian coast are missing in the Spitzbergen area, so the general character of the vegetation is definitely different.

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Kratak sadržaj

Prikazuju se, u krupnim crtama, utjecaji nekih ekoloških faktora, naročito temperature, slanoće, svijetla i organskih primjesa na raspodjelu bentoske vegetacije alga na obalama Norveške.

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