

DISTRIBUTION
OF THE RHODOPHYCEÆ IN THE
DANISH WATERS

BY

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WITH 4 FIGURES

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In the paper Marine Algæ of Denmark I—IV (1909—1931) (K. Danske Vidensk. Selsk. Skrifter 7. Række, Vol. 7) I have published the finding places of the Danish Rhodophyceæ as far as known at the moment of publication. As several years have elapsed before the finishing of the paper, many new localities have later been ascertained for most of the species contained in the three first parts of the paper. In the following pages I give first a list of all the new localities for the Danish Rhodophyceæ met with after the publication of my work, chiefly through my own collections, but also from dredgings by other scientists, viz. HJ. DITLEVSEN, m. sc., dr. C. A. JØRGENSEN, dr. P. L. KRAMP, SØREN LUND, m. sc., prof. C. H. OSTENFELD, BOYE PETERSEN, lector, and dr. HENNING PETERSEN.

The same succession of the species as in M. A. D. and the same nomenclature are used in the following list, with a few exceptions (*Chantransia*, *Rhodochorton*).

New localities for Marine Algæ in the Danish waters.

Bangia fusco-purpurea (Dillw.) Lyngb. K. R. 1909, p. 56.

Was found very abundantly in the harbour of Frederikshavn in July 1927 after a cool spring and early summer, often with cloudy weather and moist air. In other years much more scanty.

Localities. **Ns**: Vorupør, mole (S. Lund). — **Sk**: Lønstrup, groin (S. Lund). — **Kn**: The buoy of Skagens Reef (2 brooms) (Ostenfeld); Kölpén; Østerby harbour, Læsø. — **Lb**: Baaring, mole. — **Sb**: Kerteminde, mole; Avernakhage by Nyborg, June 1933 (S. Lund), female filaments with attached spermatia. — **Su**: Helsingør, outer side of southern mole, June 1934 (S. Lund), small and thin specimens, 1 to 1.5 cm high and in November 1934 in the new harbour (K. Gram), similar specimens. Copenhagen, breakwater at Kroneløbet, the northern entrance to the harbour, June 1934, (S. Lund), small specimens, 1.5 cm high. The specimens from the Sound might perhaps be referred to *Bangia pumila* Aresch. but as I am not able to distinguish with certainty this species from *B. fusco-purpurea*, they are here referred to the latter species.

Porphyra umbilicalis (L.) J. Ag. K. R. 1909, p. 60.

KNIEP (Die Sexualität der niederen Pflanzen, 1928, p. 208) thinks that the possibility that the monoecious specimens of this species, where the two sexes are separated by a longitudinal line, were the produce of a concretion of two individuals (sectorial chimæras) is not quite precluded. I consider that very improbable. The

monoecious specimens are quite predominant in number; if such concretions were to take place so frequently, it would be strange if more than two plants did not sometimes coalesce, but more than one separating line was never observed. The separating line has the same character as those separating the antheridial spots from the carpogonial portions of the frond in *Porphyra atropurpurea*.

Localities. **Ns:** Havneby, Rømø, large specimens up to 60 cm long; Vorupør, mole (S. L.). — **Kn:** Tyvholm, Hirsholm harbour, dioecious and monoecious; Deget; east end of Hjellen; stony reef at Understed. — **Ks:** Nyrup Strand, small specimen. — **Lb:** Rosenvold harbour and Tirsbæk mole in Vejle-fjord (S. Lund); Snoghøj; Kongebro, on stones, low water. — **Sb:** North side of Asnæs, at Sortensten, stony beach; Vresen, at low-water. — **Su:** Aalsgaard (K. Gram).

Porphyra atropurpurea (Olivi) De-Toni.

P. leucosticta Thur., K. R. 1909, p. 65.

Localities. **Kn:** Østerby harbour, Læsø. In July 1919 numerous specimens of a reddish colour were found growing on *Fucus vesiculosus*, but all sterile. They were 2—8.5 cm long and much resembled

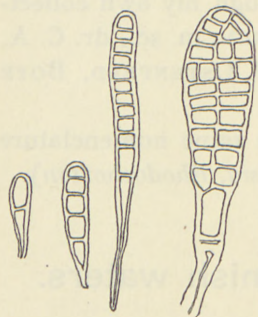


Fig. 1.

Porphyra atropurpurea.
Germlings, on *Fucus* and stones. Læsø. July 1928. 390:1.

P. atropurpurea from Skagen and must probably be referred to that species. In July 1928 numerous similar specimens were met with in the same locality. The same day similar small specimens were met with in Vesterø harbour in the same island, growing in great numbers on *Fucus spiralis* and *F. vesiculosus* and on stones. It had not been observed here before, and the following year one 5 mm long specimen only was met with, though the species was searched for with much zeal. The specimens found in 1928 were all sterile; there were numerous quite young plants, a proof that a great invasion of spores had taken place; they were broad, orbicular, often about 1 cm in diameter. It deserves to be noted, that *P. umbilicalis* had hitherto not been observed on the isle of Læsø. — Frederikshavn harbour, northern transverse mole, June 1933, with distinct antheridial spots, on *Fucus vesiculosus*. Had hitherto not been observed at Frederikshavn. — **Su:** Mr. S. Lund on May 9th 1934 made the surprising find of *Porphyra atropurpurea* at Copenhagen, at the northern end of the harbour, at the entrance to Skudehavnen and at the breakwater. The specimens were well developed, up to 9 cm long and had

very distinct typical antheridial spots in the upper part of the frond. This finding is very interesting, as the species has otherwise not been met with south of the isle of Læsø in the northern Kattegat; but it recalls the discovery of the species in the Kieler Förde by NIENBURG and CURT HOFFMANN in 1926. The salinity of the surface water in the Kieler Förde is about 14.5 ‰, while it is about 29 ‰ at Skagen. But the appearance of the species at Copenhagen is still more peculiar as the salinity here is only about 10.7 ‰ (12.6—9.1 ‰). At the west coast of Sweden the species has not been met with south of Fiskebäckskil (Båhus).

If the *Porphyra atropurpurea* had been introduced by sea-currents, it would without doubt have come from the North, and it would then probably also have been brought to Helsingør, where there exist localities which seem convenient for its occurrence. To investigate that possibility, Mr. S. LUND, at my request, examined the moles and the stony slopes of the harbour of Helsingør in May 1934. He found numerous specimens of *Porphyra umbilicalis* but no specimens of *P. atropurpurea*. I think therefore that the species has been introduced into Copenhagen by means of a vessel on which it has been growing. But it still remains inexplicable

that it can thrive in the water of low salinity (about 10 ‰) at Copenhagen, while it otherwise only occurs in the North Sea and Skagerak and in the northernmost Kattegat in water with a salinity of about 30 ‰, and then newly at Kiel. On June 8th Mr. LUND visited Gilleleje harbour on the North side of Sealand; he found no *Porphyra* at all on the moles in spite of careful investigation.

Erythrotrichia carnea (Dillw.) J. Ag. K. R. 1909, p. 67.

Localities. **Ns**: Thyborøn beacon in SE $\frac{1}{2}$ E 14 $\frac{1}{2}$ miles, 31 m; Vorupør, on *Porphyra umbil.* (S. L.). — **Lf**: Nykøbing. — **Kn**: gK, NW of Læsø, 9.5—11 m. — **Km**: 6 miles SSW $\frac{1}{2}$ W of Læsø Rendes lightship, 8 m (C. A. Jørgensen). — **Lb**: Kongebro. — **Sb**: Between Knudshoved and Slipshavn, 5—6 m, November; XS, Kløverhage. — **Bw**: bY, south of Als, 11 m.

Porphyropsis coccinea (J. Ag.) K. Rosenv., 1909, p. 69.

Localities. **Kn**: NE Reef at Hirsholmene. (Oct. 1922 C. A. Jørg.), July 1928!; Tyskerens Reef at Hirsholmene, 5—11 m (Henn. Petersen); between Laurs Reef and Borrebjergs Reef.

Erythrocladia irregularis K. Rosenv., 1909, p. 72.

Localities. **Kn**: Tyskerens Reef at Hirsholmene, 11 m, on *Laomedea* on *Halidrys siliquosa*.

Erythrocladia subintegra K. Rosenv., 1909, p. 73.

Localities. **Ns**: aF, Thyborøn beacon SE $\frac{1}{2}$ E 14 $\frac{1}{2}$ miles, 31 m, on *Flustra foliacea*. — **Kn**: NE Reef and Tyskerens Reef at Hirsholm, on hydroids. — **Ke**: IQ, Fladen, on *Sertularia abietina*.

Goniotrichum elegans (Chauv.) Le Jolis. K. R. 1909, p. 75.

Localities. **Ns**: Esbjerg harbour. — **Kn**: Tønneberg Banke; E. of Hirsholm; E. of Deget (H. E. Pet.); Frederikshavn; Nordre Rønner, $\frac{1}{2}$ mile S. of the broom. — **Km**: XF, Søndre Rønners beacon i ENE 4 miles. — **Lb**: Vejleford, Rosenvold (S. L.).

Asterocytis ramosa (Thwaites) Gobi.

Localities. **Sa**: Sønderby Strand, Asvig (S. L.). — **Lb**: Bridge over Lillebelt (S. L.).

Rhodochorton (Naegeli) emend. Drew.

In the third part of my paper, 1924, p. 388, remarks have been made on the systematical position of the genus *Rhodochorton* and its relation to the genus *Chantransia* (*Acrochaetium*). The question has later been thoroughly worked out by KATHLEEN M. DREW in a paper, A revision of the genera *Rhodochorton*, and *Acrochaetium*, with description of the marine species of *Rhodochorton* (Naeg.) gen. emend. on the pacific coast of North America (University of California Publications in Botany. Volume 14 No. 5 pp. 139—224, plates 37—48. Berkeley 1928). The author arrives at the conclusion that the two (three) genera can not be kept distinct, and they are therefore combined under the name of *Rhodochorton*, which is the first of the new names proposed by NÆGELI in 1861, the name of *Chantransia* being abandoned as a generic name.

As the sexual reproduction is unknown in most of the species of *Chantransia* and in all the species of *Rhodochorton*, a sure conclusion as to their relationship

cannot be obtained. But the presence of pyrenoids in nearly all the species of *Chantransia* goes to prove the connexion of these species and their relation to the *Helminthocladiaceæ*, as the organs named are only known in this family of the *Rhodophyceæ*. Only in the two species referred by me to the subgenus *Grania* (*Ch. efflorescens* and *Ch. pectinata*) are there several ribbon-shaped chromatophores without pyrenoids; but these species belong undoubtedly to the same circle of relation. The three species mentioned by me (1924) under *Rhodochorton* have all cells with several chromatophores without pyrenoids. But in *Rh. floridulum* the cells have, as shown by KUCKUCK (Beitr. z. K. Meeresalg. 2. 1897, p. 21), several stellate chromatophores with a central pyrenoid.

Another character which might be used as distinctive between the two genera is the growing habit, the species of *Chantransia* growing on algæ or on hydroids or bryozoans, whereas the typical *Rhodochorton* grow on rocks, stones and wood, as is the case with *Rh. Rothii* and *Rh. floridulum*. However, *Rh. penicilliforme* and *Rh. membranaceum* grow on the same substrata as the *Chantransia*-species, and these two species fit well in the genus *Chantransia*, in particular *Rh. membranaceum*, the chromatophores of which resemble those of *Chantransia efflorescens*. The presence of pyrenoids in *Rh. floridulum* makes it highly probable that this species must be referred to the genus *Chantransia*. I consider this character more important than the growing habit. It must be emphasized that *Chantransia efflorescens*, which is a typical member of the genus has been met with growing on shells of *Buccinum* and on stones, though it is ordinarily epiphytic. Finally, the most common species, *Rhodochorton Rothii*, which is usually saxicole, but also may grow on the stipes of *Laminaria*, has numerous small chromatophores without pyrenoids. It can be regarded as an incomplete species of the *Ceramiaceæ* but equally of the *Helminthocladiaceæ*; it is impossible to settle its relationship. But as it shows resemblance to *Rh. floridulum*, I think it unsafe to refer it to another genus than this. I therefore follow Miss DREW in referring all the species to the genus *Rhodochorton* as taken in a wider sense, and in placing it with the *Helminthocladiaceæ*, though the risk is run that single species might possibly be removed as a consequence of further investigations.

Rhodochorton gynandrum (K. Rosenv.) Drew. 1928, p. 15.

Chantransia gynandra K. Rosenv. 1909, p. 88.

Always found growing on *Ectocarpus siliculosus* in great quantities, with sporangia and cystocarps; epigynous antheridia usually not observed.

Localities. **Kn:** Holmehavns Reef; Deget; Marens Reef; south of Kølpen (?), all localities near Frederikshavn. — **Lb:** At Fænø Kalv.

Rhodochorton hallandicum (Kylin) Drew. 1928, p. 151.

Chantransia hallandica Kylin, K. R. 1909, p. 93.

Localities. **Kn:** TU, at the double broom E. of Hirsholmene; TH, North of Læsø; gK, NW of Læsø; 9.5—11 m. — **Km:** Søndre Rønners beacon in ENE 4 miles. — **Sa:** E. side of Vejrø; MY, south of Sletterhage. — **Lb:** Aarø mole. — **Su:** Middelgrundsfort.

Rhodochorton moniliforme (K. Rosenv.) Drew. 1928, p. 151.*Chantransia moniliformis* K. Rosenv. 1909, p. 99.Localities. **Ks**: Lysegrund. — **Lb**: Aarø mole, on stipes of *Laminaria*.**Rhodochorton Thuretii** (Bornet) Drew. 1928, p. 152.*Chantransia Thuretii* (Born.) Kylin, K. R. 1909, p. 100.Localities. **Ns**: ZQ, Jydske Reef, 24.5 m. — **Lf**: Ørodde, Nykøbing; off Feggeklit, 4 m. — **Kn**: Nordøstrev and Tyskerens Reef at Hirsholmene; Marens Reef; south of Hjellen (+ ♂ ○); Brune Reef (f. *amphicarpa*) (Boye Petersen); 3 miles SE by E of Nordre Rønner; at Nordre Rønner, 7 m. — **Ks**: EJ, Lysegrund; GE, 1 mile NE by N of Sejro. — **Lb**: Fænø Sound. — **Sb**: Off Stavreshoved.**Rhodochorton Daviesii** (Dillw.) Drew. 1928, p. 151.*Chantransia Daviesii* (Dillw.) Thur., K. R. 1909, p. 104.Localities. **Sk**: Hirtshals mole, on *Chondrus crispus*. — **Kn**: Nordøstrev (C. A. J.), Nordvestrev and Hvidstensrev at Hirsholmene. — **Ks**: Schultz's Grund. — **Lb**: Near Damgaard, 13 m.**Rhodochorton virgatula** (Harv.) Drew. 1928, p. 151.*Chantransia virgatula* (Harv.) Thur., em. K. R. 1909, p. 109.Localities. **Ns**: Vorupør (S. L.). — **Lf**: Thisted harbour (S. L.). — **Kn**: On various algæ on the triple broom at Skagens Rev (C. H. Ostenf.). — **Ks**: 1 mile NE by E of Sejerø lighthouse. — **Sa**: Klepperne and E side of Vejro; Korshavn. — **Lb**: Lille Grund (Reinke). — **Su**: Blokhus Grund at Hellebæk; Middelgrundsfort; Saltholm (S. L.).**Rhodochorton Macula** (K. Rosenv.).*Chantransia Macula* K. Rosenv. 1909, p. 114.Localities. **Ks**: Lysegrund. — **Lb**: Aarø Sund, mole.**Rhodochorton efflorescens** (J. Ag.) Drew. 1928, p. 151.*Chantransia efflorescens* (J. Agardh) Kjellm., K. R. 1909, p. 134.Localities. **Kn**: Tyskerens Rev and Nordvestrev at Hirsholm; south of Hirsholm; within Laurs Rev; north of Nordre Rønner. — **Ke**: EQ, at Anholt Knob, cyst. and monosp. — **Sa**: KM, east of Øreflippen; PF, off Refsnæs, 18—20 m. — **Lb**: off Kongebro Skov; between Strib and Nederballe, 35—49 m; Lille Grund (Reinke) east of Hesteskoen, 15—19 m. — **Sb**: Off Hjortholm Skov, Langeland. — **Su**: Off Ellekilde, 23—28 m (Th. Mortensen). — **Bw**: cE, Middelgrund south of Als; cG, Trindelen at Regnæs. — With cystocarps and sporangia in the months of June to August.**Rhodochorton pectinatum** (Kylin) K. Rosenv.*Chantransia pectinata* Kylin, K. R. 1909, p. 138.Vegetative filaments were found growing, in Lillebelt, within the tubes of *Tubularia*, from which tetrasporangiferous bushes were given off.Localities. **Kn**: Böchers Banke; Tyskerens Rev at Hirsholm and south of Hirsholm. — **Lb**: Near Damgaard, 13 m; off Lyngsodde; near Fænø Kalv, 15—19 m.

Rhodochorton penicilliforme (Kjellm.) K. Rosenv. 1924, p. 388.

Localities. **Kn:** Trestensrev at Frederikshavn. — **Ke:** fH, Fladen, 17 m, on *Laminaria hyperborea*. — **Sa:** KM, east of Øreflippen. — **Sb:** fP, off Spodsbjerg, 19 m; fQ, off Hjortholm Skov, 21 m, on *Chaetomorpha Melagonium*.

Rhodochorton Rothii (Turton) Nægeli. K. R. 1924, p. 390.

Localities. **Kn:** Hulsig Stene; Vesterø harbour, Læsø. — **Su:** W. of Lusekosten at Saltholm (S. L.).

Rhodochorton membranaceum Magn. K. R. 1924, p. 393.

Localities. **Ns:** Vorupør, in *Abietaria abietina* (S. L.). — **Ke:** Vesterlandsgrund at Gilleleje. — **Sa:** MY, south of Sletterhage.

Kylinia rosulata K. Rosenv. 1909, p. 141.

In two localities in the Skagerak and the northern Kattegat I have met with a very small *Acrochaetium*-like alga, which was found growing in great quantities on *Cladophora gracilis* and *Spermothamnion*. It had a single basal cell, 7–8 μ in diameter, giving off up to 5 (6) short unbranched branches, which bore sometimes terminal monosporangia, 6 to 8 μ long. In specimens from the two localities I succeeded in finding androphores like those described l. c. p. 143, fig. 67 F–K, bearing a single spermatium at the end of a cylindrical stalk-cell, but I have not succeeded in finding anything like the supposed cystocarp described l. c. p. 144, fig. 67 Q, and the interpretation can not therefore be confirmed.

Localities. **Sk:** Hirtshals. — **Kn:** Nordvestrev at Hirsholm.

MARJA MARCHEWIANKA has reported this species from the bay of Danzig growing epiphytically on *Delesseria alata*. (*Z flory glonów polskiego Baltykn. Osobne odbicie z T. CVIII i LIX. Spraw kom. fizjogr. Polskiej Akademji Umiej.*, p. 45). And LILIAN LYLE has described another species of the same genus, *Kylinia scapæ* (Marine Algæ of some German Warships in Scapa Flow etc. The Journal of the Linnean Society of London. Botany, Vol. XLVIII, No. 321. 1929, p. 245).

Nemalion multifidum (Web. et Mohr) J. Ag. K. R. 1909, p. 144.

Localities. **Ns:** Vorupør, mole (S. L.). — **Sk:** Hanstholm mole. — **Lf:** Thisted (S. L.). — **Kn:** Skagen harbour; Jegens Rev, Læsø; Østerby harbour; Hirsholm harbour (Boye Petersen) and reef off the harbour; Sæby harbour. — **Ks:** Rørvig. — **Sa:** Aarhus; Endelave, mole (S. L.). — **Lb:** Harbour of Vejle; off Langøre; Sønderborg, small specimens, scarcely 1 cm high in June. — **Sb:** Refsnæs; Lerchenborg Sønderstrand (O. Smith); Vresen; Spodsbjerg mole, 13 cm high, August. — **Su:** Middelgrundsfort, 10 cm high, September. — **Bw:** Bridge for boats at Sønderskov, Sønderborg. — **Bm:** Orehoved harbour

Dumontia incrassata (O. F. Müll.) Lamour. K. R. 1917, p. 155.

Localities. **Ns:** Vorupør, mole (S. L.). — **Lf:** Thisted harbour (S. L.); Knudshoved NW end of Fur. — **Kn:** Skagen harbour; Hjellen; Østerby, Læsø. — **Ke:** Gilleleje (S. L.). — **Sa:** East of Øreflippen; Kalø Rev; Høve Strand; Ballen, harbour; Paludans Flak, 6–10 m; Hov. — **Lb:** W side of Æbelø; Vejleffjord, Rosenvold harbour (S. L.). Skærbæk harbour, Kolding Fjord; Heilsminde; Brandsø; Knudshoved between Heilsminde and Haderslev Fjord; Bastholm; Linderum; Starbæk Rev; Aabenraa harbour. — **Sf:** E side of Nakke Odde; Avernak Ø; Strandby Stenrev, Langeland. — **Sb:** Kalundborg harbour; Musholm; Knudshoved by Ny-

borg; Lundeberg harbour; Rudkøbing. — **Su**: Hornbæk; off Marienlyst; gM, Taarbæk Rev, 8—10 m, 8—12 cm long, June; N. of Saltholm, WNW of Lusekosten 13 m (S. L.). — **Bw**: At the south end of Kobbek Skov; bridge for boats at Sønderskov, Sønderborg; Bagenkop harbour. — **Bb**: Bornholm (Hornemann); at Vang, sparsely (Krok).

Dilsea edulis Stackh. K. R. 1917, p. 160.

Localities. **Ns**: Vorupør, washed ashore in great quantities (S. L.). — **Sk**: 12 miles E by N $\frac{1}{4}$ N of Hanstholm lighthouse, 15 m (C. A. Jørgensen); 21 miles ENE of Hanstholm lighthouse, 13—17 m (C. A. J.); YN², SE of Bragerne, 10 m (a fragment); 21 miles SW $\frac{3}{4}$ W of Rubjerg Knude lighthouse, 9 m (C. A. J.); $2\frac{1}{2}$ miles NNE of Svinkløv (A. C. Johansen). — **Kn**: Hvidstensrev and Tyskerens Rev at Hirschholmene; E. of Deget; fG, 3 miles W of Læsø Trindels lighthouse, 15 m. — **Ke**: fl, $3\frac{1}{2}$ miles W by N of Fladens lighthouse, 30 m; fH, 1 mile W by N of Fladens lighthouse, 17 m; Groves Flak, 19—28 m. — **Sb**: cO, $55^{\circ}23'N$, $10^{\circ}48'E$ (loose); cT, $55^{\circ}37'N$, $10^{\circ}41'E$ (loose).

Platoma Bairdii (Farlow.) Kuck. K. R. 1917, p. 162.

As this species is very rare, I give here a photograph of a small tuft of specimens found in the Little Belt in 1915.

Halarachnion ligulatum (Woodw.) Kütz. K. R. 1917, p. 163.

Localities. **Ke**: Groves Flak, 28 m (Hj. Ditlevsen).

Furcellaria fastigiata (Huds.) Lamx. K. R. 1917, p. 164.

Localities. **Ns**: eD, 22 miles W of Lodbjerg lighthouse, 41 m (a fragment, loose); eC, 23 miles WNW of Lodbjerg lighthouse, 26 m (a fragment, loose). — **Sk**: 21 miles SW $\frac{3}{4}$ W of Rubjerg Knude lighthouse, 9 m (C. A. J.); 13 miles SW by W $\frac{1}{2}$ W of Rubjerg Knude lighthouse, 14 m (C. A. J.). — **Lb**: Outer part of Kolding Fjord, f. *agagropila*.



Fig. 2.
Platoma Bairdii.
From Lyngs
Odde, Little Belt.
Nat. size.

Polyides rotundus (Gmel.) Grev. K. R. 1917, p. 172.

Localities. **Ns**: Vorupør, 2 m (S. L.). — **Kn**: W side of Deget; Vesterø harbour, Læsø. — **Ke**: 1 mile W by N of Fladens lightship, 17 m; Gilleleje, east mole. — **Sa**: Off Ballen, 13 m; Ballen, harbour; Koldby, harbour. — **Lb**: Knudshoved; Allsund near Arnkilsøre, loose f. *agagropila*. — **Su**: Middelgrundsfort, 2.5—4 cm long. — **Bw**: bY, off Sønderskov at Sønderborg; cD, Middelgrund south of Als; dK, Pøls Rev, 9 m; fS, south of Marstal, 10—11 m, 8 cm.

Petrocelis Hennedyi (Harvey) Batters. K. R. 1917, p. 174.

Localities. **Ns**: Vorupør, on *Purpura lapillus* (S. L.). — **Lf**: Off Kobbekød, 2—4 m. — **Kn**: Deget; Frederikshavn, at Kragholm, on *Chondrus crispus*; Busserev; Nordre Rønner, 7 m. — **Ke**: fJ, $3\frac{1}{2}$ miles from Fladens lighthouse, 30 m. — **Km**: TT, W of Dvalegrund, 7.5 m. — **Sa**: KM, east of Øreflip. — **Lb**: Aarø Sund (*Petrocelis cruenta* recorded by REINKE from this locality in a sterile stage, is probably *Petr. Hennedyi*). — **Sb**: gG, off Bovense, 6.5—8 m, with tetrasp. and cystoc.; fY Sprogø lighthouse in NW $\frac{3}{4}$ W, Halskov Rev lighthouse i NE, 9—10 m, on *Mytilus*, with tetrasp. in November; gA¹, Sprogø lighthouse in NE $\frac{1}{2}$ N, Gjellegrund lightbuoy i SE $\frac{1}{4}$ E; fR, East of Kjelsnor lighthouse, abt. $\frac{5}{6}$ mile, with ♂, August. — **Bw**: Off the south end of Kobbek Skov; fT, south of Marstal 10—11 m. — **Bb**: 8 miles S $\frac{1}{2}$ E of Rønne harbour, 11—19 m (C. A. J.).

Cruoria pellita (Lyngb.) Fr. K. R. 1917, p. 180.

Localities. **Sk**: eX, 10 miles ENE $\frac{1}{2}$ E of Hanstholm lighthouse, 16 m. — **Kn**: Hulsig Stene, with sporangia in July; fG, 3 miles W of Læsø Trindels lighthouse, 15 m; Hvidstensrev and Tyskerens

Reef at Hirsholmene, on hapters of Laminariæ; south of Hirsholm; between Hirsholm harbour and Kölpen, with ripe sporangia in July; Trestensrev; east of Deget, 26 m; Marens Reef. — **Ke**: 1 mile W by N of Fladens lightship, 17 m, with tetr. and cyst., Octob.; $3\frac{1}{2}$ miles W by N of Fladens lightship, 30 m, with tetrasp. Octob.; fM, 10 miles WSW $\frac{1}{4}$ W of Fladens lightship, 23 m; $4\frac{1}{2}$ miles SW $\frac{3}{4}$ W of Fladens lightship 30 m (C. A. J.); $14\frac{1}{2}$ miles SSE of Anholt Knob lightship, 10 m (C. A. J.).

Cruoriopsis danica K. Rosenv. 1917, p. 184.

Localities. **Lf**: Nissum Bredning off Hesdal and off Kobberød; Sæbygaard Hage, Fur, Ejerslev Røn. — **Kn**: Stony reef off Hirsholm harbour; east and south side of Deget; Læsø Trindel lightship in SSE $1\frac{1}{2}$ miles, 21 m.

Cruoriella Dubyi (Crouan) Schmitz. K. R. 1917, p. 193.

Localities. **Lf**: Off Mullerne (Boye Peters.). — **Kn**: Kummel Banke, 23.5—30 m; fG, 3 miles W of Læsø Trindels lightship, 15 m; dT, south of the broom at Læsø Trindel, 20 m; dR, Læsø Trindels lightship in SSE $1\frac{1}{2}$ miles, 21 m; east of Deget, 26 m; Trestensrev at Frederikshavn. — **Ke**: fH, 1 mile W by N of Fladens lightship 17 m; fI, $3\frac{1}{2}$ miles W by N of Fladens lightship, 30 m; fM, 10 miles WSW $\frac{1}{4}$ W of Fladens lightship, 23 m; $4\frac{1}{2}$ miles SW $\frac{3}{4}$ W of Fladens lightship, 30 m (C. A. J.). — **Su**: Taarbæk Reef 12.5 m, on *Mytilus* (S. Lund); NW of Saltholm 14.5 m (S. L.).

Rhododermis elegans Crouan. K. R. 1917, p. 197.

Localities. **Ns**: eQ, 8 miles NW by W $\frac{1}{2}$ W of Lodbjerg lighthouse, 27 m; Vorupør, on stones near land, with sporangia in July (S. L.). — **Kn**: $2\frac{3}{4}$ miles NW by N of Nordre Rønner, 15 m; the broom at Nordre Rønner in S $\frac{1}{2}$ E 1 mile, 11 m, on roots of *Zostera*.

Rhododermis Georgii (Batters.) Collins. K. R. 1917, p. 199.

Localities. **Kn**: Vesterø harbour. — **Sa**: Hov. — **Lb**: Linderum. — **Sf**: Svendborg. — **Sb**: Avernak Hage at Nyborg.

Hildenbrandia prototypus Nardo. K. R. 1917, p. 202.

Localities. **Ns**: eK, Lille Fiskerbanke, 46 miles W by N of Bovbjerg lighthouse; 37 m; eR, 9 miles NW $\frac{1}{2}$ N of Lodbjerg lighthouse, 27 m; Vorupør (S. L.). — **Sk**: $5\frac{1}{2}$ miles W $\frac{1}{2}$ S of Højens lighthouse, 25 m. — **Ke**: Store Middelgrund, 10 m (C. A. J.). — **Sa**: common. — **Lb**: Linderum. — **Bw**: Off Kobbek Skov; Pøls Reef. — **Bm**: East of Hellehavns Nakke (C. A. J.); 14 miles SW by S of Smygehuk lighthouse, 27 m. — **Bb**: Several places around Bornholm, e. gr. 1.5 miles NNW $\frac{3}{4}$ W of Christiansø lighthouse, 36 m (C. A. J.); 11 miles N by E of Hammer Odde Fyr, 73 m (C. A. J.), very thin coverings on stones, only few layers of cells thick, sterile in June.

Lithothamnion læve (Aresch.) Foslie. K. R. 1917, p. 215; Foslie, Contrib. to a Monograph of the Lithothamnia. Trondhjem 1919, pl. III.

Localities. **Ns**: Vorupør, on stones north of the mole (S. L.). — **Ke**: $4\frac{1}{2}$ miles SW $\frac{3}{4}$ W of Fladens lightship, 30 m (C. A. J.).

Lithothamnion Lenormandi (Aresch.) Foslie. K. R. 1917, p. 216; Foslie, Contr. Monogr. Pl. III, figs. 14—20.

Localities. **Kn**: Off Aalbæk, 22 m, with numerous concept., on coal; Kölpen, at low-water mark. (Stamm). — **Sa**: fN, off Ballen (?), 13 m. — **Lb**: South side of Sønderballe Hoved, c. 2 m. — **Sb**: gF, off Teglværkskoven, 8—10 m.

Lithothamnion Sonderi Hauck. K. R. 1917, p. 219; Foslie, Contr. Monogr. Pl. IV, figs. 4—8.

Localities. **Ns**: dZ, 17 miles W $\frac{3}{4}$ N of Lodbjerg lighthouse, 36 m. — **Kn**: Kummel Banke; Tønneberg Banke 15 m. 14 Favne Revet, far east of Kølpen, 26.5 m. — **Ke**: $4\frac{1}{2}$ miles SW $\frac{3}{4}$ W of Fladens lightship, 30 m (C. A. J.). — **Sa**: KM, east of Øreflippen; fN, off Ballen, Samsø. — **Sb**: fR, off Hjortholm Skov(?).

Lithothamnion colliculosum Foslie 1905.

Foslie Remarks on northern Lithothamnia. D. k. norske Vidensk. Selsk. Skrifter 1905 No. 3, p. 34. Contrib. to a Monograph of the Lithothamnia 1929, Pl. XXI, figs. 1—3, 6—7.

L. glaciale Kjellm. var. *colliculosa* (Fosl.) K. R. 1917, p. 222.

In Remarks on northern Lithoth. FOSLIE declares that it is almost impossible to draw any line between *L. Granii* and *L. glaciale*. But still he thinks the former ought to be considered as an independent species. And the same is the case with *L. colliculosum*. In M. A. D. 1917 I have determined *L. Granii* and *L. colliculosum* as forms of *L. glaciale*, owing to the existence of transitional forms. I prefer now to follow FOSLIE in his view of 1905 in considering these two as independent species. FOSLIE has himself determined most of the Danish *Lithothamnia*, thus also the specimens from two localities in the western Limfjord referred to *L. colliculosum*, mentioned in M. A. D. p. 222. They have coarse papillæ, 2—3.5 mm in transverse section, and are up to 4 mm high.

Lithothamnion Granii Foslie.

Foslie, Remarks 1905, p. 59; Contribut. to a Monograph, pl. XVIII, figs. 10—22.

L. glaciale var. *Granii* (Fosl.) K. R. 1917, p. 222.

The species is rather wide spread from Skagerak to the Great Belt. The Danish specimens seem always to be distinct from *L. glaciale*. Crustaceous specimens with low papillæ are often met with, particularly in the inner waters, as e. g. in the Great Belt, near the boundary of the species, where the crusts may be up to 6 cm in diameter, often growing on *Mytilus Modiola* (fig. 3).

Localities. **Sk**: $5\frac{1}{2}$ miles W $\frac{1}{2}$ S of Højens lighthouse, 25 m (C. A. J.); large crusts, 4—5 cm in diam., with few low papillæ, and on pieces of coal with numerous papils up to 2 mm high. — **Kn**: Kummel Banke; fG, W of Læsø Trindels lightship, 15 m; W side of Tønneberg Banke, 19 m; fD, off Aalbæk, 8 miles S $\frac{3}{4}$ W of Skagen lighthouse, 22 m. — **Ke**: fI, $3\frac{1}{2}$ miles W by N of Fladens lightship, 30 m (comp. Foslie Contrib. 1929, pl. 18, figs. 10—11); fH, 1 mile W by N of Fladens lightship, 17 m; fM, 10 miles WSW $\frac{1}{4}$ W of Fladens lightship, 23 m; Groves Flak, 24 m (Hj. Ditlevsen). — **Sa**: Off Ballen, 11 and 22.5 m. — **Lb**: Off Stenderup Skov, 13—15 m, thin expanded sterile crust on *Mytilus*, determination uncertain. — **Sb**: cT, Ryggen, Northern Great Belt, 20 m, crusts up to 6 cm in diam. on *Mytilus Modiola*, with numerous low papils, scarcely 1 mm high (fig. 3); fZ, Sprogø lighthouse in NW $\frac{1}{4}$ W, Halskov Rev lighthouse in NE $\frac{3}{4}$ N, 20 m, large crusts with numerous conceptacles and with papils 1—1.5 mm high.

Lithothamnion norvegicum (Aresch.) Kjellm. K. R. 1917, p. 224; Foslie, Contrib. Monogr. pl. XVI, figs. 30—44.

Localities. **Kn:** Tønneberg Banke, 3 miles W of Trindelens lightship, 15 m, in smaller quantity together with *Lith. calcareum*.

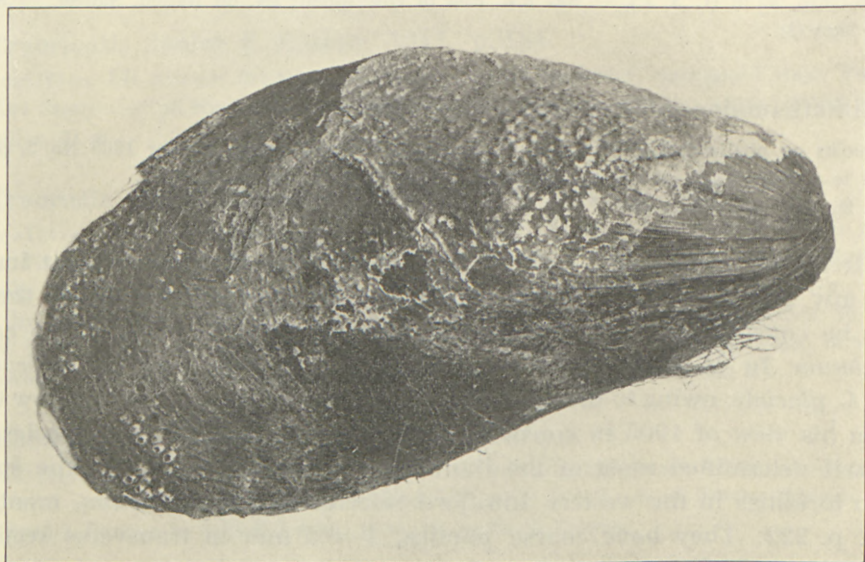


Fig. 3.

Lithothamnion Granii, incrusting form, from Store Belt cT. Nat. size.

Lithothamnion calcareum (Pallas) Aresch. K. R. 1917, p. 226; Foslie, Contrib. Monogr. pl. XVI, figs. 1—28.

Localities. **Kn:** Tønneberg Banke, 12—15 m, various places, partly f. *squarrulosa*. — **Ke:** fH, W by N of Fladens lightship, 17 m, f. *squarrulosa* and f. *subsimplex*; Groves Flak, 24 and 28 m (Hj. Ditlevsen).

Lithothamnion polymorphum (L.) Aresch. K. R. 1917, p. 228; Foslie, Contrib. Monogr. pl. XXXIX, figs. 1—11.

Localities. **Ns:** dZ, 17 miles W $\frac{3}{4}$ N of Lodbjerg lighthouse, 36 m, a crust apparently sterile. — **Kn:** Hulsig Stene; NE Reef, Hvidstensrev and Tyskerens Rev by Hirsholm; 3 miles W of Læsø Trindels lightship, 15 m; at the broom N of Nordre Rønner, 7 m. — **Ke:** Gilleleje E mole. — **Su:** Middelgrundsfort, apparently sterile.

Lithothamnion lævigatum Foslie. K. R. 1917, p. 232; Foslie, Contrib. Monogr. pl. XXXIX, figs. 13—14.

Localities. **Ns:** 17 miles W $\frac{3}{4}$ N of Lodbjerg lighthouse, 36 m. — **Sk:** dZ, 17 miles W $\frac{3}{4}$ S of Lodbjerg lighthouse, 36 m; aX, 10 miles ENE $\frac{1}{2}$ E of Hanstholm lighthouse, 16 m; 13 $\frac{1}{2}$ miles NE $\frac{1}{2}$ E of Hanstholm, 23 m (C. A. J.). — **Kn:** W side of Tønneberg Banke, 19 m; fG, 3 miles W of Læsø Trindels lightship, 15 m; TL, W of Nordre Rønners lighthouse. — **Ke:** fH, 1 mile W by N of Fladens lightship, 17 m; Groves Flak, 24 m (Hj. Ditlevsen).

Epilithon membranaceum (Esper) Heydrich. K. R. 1917, p. 234.

A specimen from the Great Belt, gG, off Bovense, growing on *Mytilus edulis*, seems to be referrible to this species, which has hitherto always been found growing on Algæ.

A frond of *Furcellaria* bearing *Epilithon membranaceum* was placed in a flat glass vessel with sea-water over glass slides on August 1st. Two days later a number of tetraspores were set free and had germinated. In some cases the four spores of a tetrasporangium had kept the position in a row next to each other and had germinated in this position, dividing by walls perpendicular to each other. And some plants were already multicellular discs, thickest in the middle, showing about 50 cells seen from above. These plants were, however, not much larger than the spores, they consisted, therefore, of small cells (fig. 4).

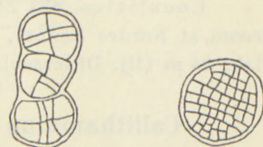


Fig. 4.
Epilithon membranaceum.
Germlings two days old. 95:1.

Localities. **Ke:** fl, 3 $\frac{1}{2}$ miles W by N of Fladens lightship, 30 m. — **Sa:** Off Ballen, 12 m; cU north of Fyn, 7 m. — **Sb:** gG, off Bovense; fP, off Spodsbjerg, 19 m. — **Su:** TF¹, Staffans Flak, 12—13 m, on *Chondrus crispus*. — **Bw:** dK, Pøls Rev, 6—7 m.

Melobesia Lejolisii Rosanoff. K. R. 1917, p. 238.

Localities. **Ns:** At Havneby, Rømø, on dead *Zostera*-leaves. — **Lf:** North of Grønnerup, Saltingsund. — **Lb:** Stony reef in Augustenborg Fjord, on *Potamogeton pectinatus*. — **Sm:** On the beach N of Torrig Skov, on *Potamogeton pectinatus*.

Melobesia limitata (Foslie) K. Rosenv. 1917, p. 245.

Localities. **Lf:** Off Knudshoved, Fur.

Corallina officinalis L. K. R. 1917, p. 269.

Localities. **Ns:** aA, 27 miles W $\frac{3}{4}$ N of Lodbjerg lighthouse, 28 m; eC, 23 miles WNW of Lodbjerg lighthouse, 26 m, Vorupør, mole (S. L.); eT, 15 miles W by N of Hanstholm lighthouse, 34 m. — **Sk:** eX, N of Bragerne, 16 m; 21 miles SW $\frac{3}{4}$ W of Rubjerg Knude lighthouse, 9 m; 13 miles SW by W $\frac{1}{2}$ W of Rubjerg Knude lighthouse, 14 m, everywhere sparsely. — **Lf:** Knudshoved and Sæbygaards Hage, Fur. — **Kn:** Hulsig Stene. — **Ke:** fH, 1 mile W by N of Fladens lightship, 17 m; 4 $\frac{1}{2}$ miles SW $\frac{3}{4}$ W of Fladens lightship, 30 m (C. A. J.), slender form with long thin branches; Groves Flak, 24 and 28 m (Hj. Ditlevsen); 14 $\frac{1}{2}$ miles SSE of Anholt Knob lightship, 10 m (C. A. J.); Gilleleje E mole. — **Km:** 5 $\frac{1}{2}$ miles N by E $\frac{3}{4}$ E of Easter Flaks lightship, 9 m (C. A. J.). — **Sa:** Off Ballen, 13 m; Paludans Flak, 10 m. — **Lb:** W side of Æbelø, c. 2 m; Als (Reinke). **Sb:** Knudshoved mole by Nyborg.

Corallina rubens L. K. R. 1917, p. 274.

Localities. **Kn:** 6 $\frac{1}{2}$ miles SW by W $\frac{1}{2}$ W of Læsø Trindel lightship (C. A. J.); $\frac{1}{2}$ mile S of the broom at Nordre Rønner, 7 m.

Gloiosiphonia capillaris Huds. (Carm.). K. R. 1917, p. 276.

Localities. **Ns:** Vorupør (S. Lund). — **Sk:** Washed ashore at Lønstrup and near Hirtshals (S. L.). — **Kn:** A well developed, 12 cm high specimen was met with in July 1923 by Dr. HENN.

PETERSEN on the head of the northern cross mole in the harbour of Frederikshavn. The species has otherwise only been found in the North Sea, in Skagerak and the Limfjord.

Spermothamnion repens (Dillw.) K. Rosenv. 1924, p. 298.

Localities. **Ns**: Vorupør (S. L.). — **Ke**: Gilleleje, mole. — **Lb**: Vejle fjord, at Stenhøj and Aalegaardshjerg (S. L.). — **Sb**: gF, off Teglværkskov; gE, Stokkebæks Flak; fP, 1/2 mile E of Hov lighthouse.

Trailliella intricata Batters. K. R. 1924, p. 305.

Localities. **Sk**: ZK⁰, Mellemgrund off Lønstrup, 8—9 m. — **Kn**: Jegens Rev; near the double broom at Nordre Rønner, 11—14 m; gK, NW of Læsø; between Hirsholm and Kölpen. — **Ke**: Groves Flak, 24 m (Hj. Ditlevsen).

Callithamnion Hookeri (Dillw.) Aresch. f. **Areschougii** K. Rosenv. 1924, p. 309.

Localities. **Kn**: Læsø Trindel, near the light buoy; Hirsholmene; stony reef south of Hirsholm, 4 m (Boye Petersen); Peder Poulsens Reef; Marens Rev; W side of Nordre Rønner; Vesterø harbour. — **Ke**: Groves Flak, 24 m (Hj. Ditlevsen). — **Sb**: gG, off Bovense; gB, the broom at Vresens Puller E by N 1/2 N, 0.3 miles, 7 m.

Callithamnion Brodiaei Harv. K. R. 1924, p. 313.

Locality. **Kn**: Hvidstensrev at Hirsholmene.

Callithamnion tetragonum (With.) Ag. f. **fruticulosum** J. Ag. K. R. 1924, p. 317.

Locality. **Sb**: fY, Sprogø lighthouse in NW 3/4 W, Halskov lighthouse in NE, 9—10 m, with +, ○ and ♂.

Callithamnion corymbosum (Engl. Bot.) Lyngb. K. R. 1924, p. 325.

Localities. **Kn**: Tyskerens Rev at Hirsholmene, (with ○ and + on the same individual); off Fries' Sten. — **Sa**: Ballen harbour, Kolby harbour. — **Sb**: Knudshoved, mole; fR, E of Kjelsnor lighthouse, about 5/6 mile. — **Su**: Helsingør (S. Lund).

Callithamnion roseum Harvey. K. R. 1924, p. 331.

Locality. **Su**: Langelinie at Copenhagen, well developed specimens about 3 cm high, but sterile, were collected November 1928 by S. LUND.

Callithamnion Furcellariæ J. Agardh. K. R. 1924, p. 336.

Localities. **Sa**: Off Ballen, 13 m. — **Sb**: gF, off Teglværkskoven, with tetrasporangia; Palegrund; fQ, off Hjortholm Skov, Langeland, 21 m.

Callithamnion bipinnatum Crouan.

Crouan Alg. mar. de Finistère 1852, No. 145, Florule de Finistère 1867, p. 136, pl. 11.
Callithamnion sp. K. R. 1924, p. 345.

Professor H. KYLIN has in Botan. Notiser 1933, p. 393 advanced the supposition that the species of *Callithamnion* which I have mentioned in 1924, l. c. without specific name is identical with the above quoted species of CROUAN. After having compared

the Danish specimen with the description and figures of *Crouan* and with his exsiccatum, I think that KYLIN's supposition is right and that the small specimen found by me in the eastern Kattegat really belongs to *Callithamnion bipinnatum* Crouan. The species seems to be very rare, as it has only been found at Brest in Bretagne and at the west coast of Sweden. It differs from *Call. Furcellariæ* by bipinnate ramification but, as shown by KYLIN, like that species it has a lobed cystocarp.

Plumaria elegans (Bonnem.) Schmitz. K. R. 1924, p. 352.

Localities. **Kn**: Deget, near Frederikshavn; N of Nordre Rønner, 3—4 m.

Antithamnion cruciatum (Ag.) Näg. K. R. 1924, p. 359.

Locality. **Kn**: Peder Poulsens Rev, *a genuina*.

Antithamnion Plumula (Ellis) Thuret. K. R. 1924, p. 362.

Localities. **Ke**: NE side of Anholt (Hj. Ditlevsen). — **Km**: E side of Læsø Rende, 18 m; 1 mile E by N of Hals Barre lighthouse, 11—12 m (S. L.). — **Sb**: fQ, off Hjortholm, Langeland, 21 m.

Antithamnion boreale (Gobi) Kjellm. K. R. 1924, p. 368.

Locality. **Sa**: KM, E of Øreflip.

Ceramium (Roth) Lyngb.

Dr. HENNING E. PETERSEN has published a paper: Oversigt over de i det nordvestlige Kattegat forekommende *Ceramium*-Arter (Botan. Tidsskr. 40. Bd. 1929, p. 390, with Plates 1 and 2), in which he takes a survey of the species of *Ceramium* observed in the North-western Kattegat. I refer the reader to Dr. PETERSEN's paper for the descriptions of the species and take the localities from his paper.

Ceramium tenuissimum (Lyngb.) J. Ag. K. R. 1924, p. 376; Henn. Petersen, 1929, p. 394.

Localities. **Kn**: Hulsig Stene; Krageskovs Rev; Marens Rev.

Ceramium diaphanum Harv. et J. Agardh. K. R. 1924, p. 376.

Localities. **Sa**: Kolby harbour. — **Bm**: Strøby.

Ceramium strictum Greville et Harv. K. R. 1924, p. 379; H. P. 1929, p. 394.

Localities. **Kn**: On old *Zostera* in the harbour of Hirsholm (Boye Petersen); Laurs Rev (H. E. P.). — **Bb**: 8 miles S 1/2 E of Rønne, 11—19 m (C. A. J.).

Ceramium fruticosum Kütz. K. R. 1924, p. 385; H. P. 1929, p. 394.

Localities. **Kn**: Numerous places from Skagen to Læsø and Frederikshavn.

Ceramium Areschougii Kylin. K. R. 1924, p. 384; H. P. 1929, p. 396.

Localities. **Kn**: In several localities at 5—15 meters' depth, Krageskovs Rev; Nordre Rønner; Nordvestrev and Tyskerens Rev at Hirsholmene; Peter Poulsens Rev; Døde Anders; Hjellen; Marens Rev; Borrehjergs Rev; Busserev. — **Su**: Taarbæk Rev, 15 m.

Ceramium robustum Henn. Petersen 1929, p. 396.

Localities. **Kn**: Nordre Rønner; Nordvestrev, Tyskerens Rev and Nordøstrev at Hirsholmene; Hjellen; Trestens Rev. — *f. laxa*: Nordvest Rev at Hirsholmene, Deget.

Ceramium septentrionale Henn. Petersen. K. R. 1924, p. 386; H. P. 1929, p. 397.

Localities. **Kn**: Nordre Rønner; Nordvest Rev and Tyskerens Rev; Græsholm; Nordøst Rev at Hirsholmene; Peter Poulsens Rev; Deget; Sælrev; Hjellen; Marens Rev; Laurs Rev; Borrebjergs Rev.

Ceramium rescissum Kylin. H. P. 1929, p. 398.

Localities. **Kn**: Nordre Rønner; Deget; between Trestens Rev and Marens Rev; Marens Rev; København Rev (H. P.); Off Frederikshavn (A. Otterström).

Ceramium vendlicum Henn. Petersen 1929, p. 398, plate 2, fig. 10.

Localities. **Kn**: Krageskovs Rev (K. R.); Nordvest Rev at Hirsholmene; low water at Græsholm, and numerous localities between these places and the coast of Jutland, as far as Borrebjergs Rev (H. P.).

Ceramium abyssale Henn. Petersen. K. R. 1924, p. 384; H. P. 1929, p. 399.

Localities. **Kn**: Tyskerens Rev and Nordøst Rev at Hirsholmene; E of Marens Rev.

Ceramium scandinavicum Henn. Petersen. K. R. 1924, p. 383; H. P. 1929, p. 399, pl. 1, fig. 1.

Localities. **Kn**: On the triple broom at Skagens Rev (C. H. Ostenfeld); Læsø Trindel, 8—12 m; Jegens Odde, Læsø; Nordre Rønner, 4—6 m; Nordvest Rev at Hirsholmene (H. P.).

Ceramium rubrifforme Kylin. H. P. 1929, p. 400, pl. 2, fig. 9.

Localities. **Kn**: Nordøstrev at Hirsholmene; between Marens Rev and Deget; Marens Rev.

Ceramium rubrum (Huds.) Ag. K. R. 1924, p. 386; H. P. 1929, p. 402, pl. 1, figs. 2—3 and pl. 2, figs. 6—8.

Localities. **Lf**: *f. proliferum* Thisted harbour (S. L.) *f. radians* Thisted harbour (S. L.). — **Kn**: The following forms are common in the north-eastern part of this district: *f. prolifera*, *f. secundata*, *f. modificata*, *f. irregularis* (H. P.).

Ceramium furcatum Henn. Petersen 1929, p. 403, pl. 2, fig. 5.

C. rubrum f. furcata H. P. in K. R. 1924, p. 387.

Localities. **Kn**: Nordvest Rev and Tyskerens Rev at Hirsholmene (H. P.).

Bonnemaisonia asparagoides (Woodw.) Ag. K. R. 1924, p. 401.

Localities. NW border of Tønneberg Banke, 19 m.

Laurencia pinnatifida (Gmel.) Lamx. K. R. 1924, p. 403.

Localities. **Kn**: Hirsholm; reef off Hirsholm harbour.

Polysiphonia urceolata (Dillw.) Grev. K. R. 1924, p. 406.

Localities. **Ns**: Vorupør, mole (S. L.). — **Kn**: Hulsig Stene. — **Ke**: Groves Flak, 28 m (Hj. Ditl.). — **Lb**: Vejle fjord, Rosenvold harbour (S. L.). — **Sb**: Off Stavreshoved. — **Su**: Middelgrundsfort, 5 cm high, September.

Polysiphonia elongata (Huds.) Harv. K. R. 1924, p. 415.

Forma *a*, *typica* is common from **Kn** to **Sb**.

I l. c. p. 422 put forward the suggestion that the specimen figured by LAKOWITZ in Algenflora d. Danziger Bucht Taf. II fig. 5 under the name of *P. violacea* f. *tenuissima* might perhaps be identical with *P. elongata* f. *baltica*. In the paper Die Algenflora der gesamten Ostsee 1929 LAKOWITZ has no forms of the species *P. elongata*. He mentions that I have distinguished the two forms β , *Schuebelerii* and γ , *baltica*, and adds: "Sie scharf auseinander zu halten ist zu schwer". I have myself stated that they are connected by transitional forms. But LAKOWITZ has not mentioned the morphological characters by which the species are best distinguished, in particular the position of the branches in relation to the trichoblasts, and it is only by these characters that it is possible to distinguish with certainty the thinner forms of *P. elongata* from the thin forms of *P. violacea*, and it therefore seems highly probable to me that many of the thin forms of *Polysiphonia* referred by LAKOWITZ to *Pol. violacea* must really be regarded as *P. elongata* f. *baltica*. This form is so different from the main form, that it is only by regarding the whole series of forms that its connection with the f. *typica* can be demonstrated.

Localities. **Ns**: Vorupør (S. L.).

Polysiphonia violacea (Roth) Grev. emend. K. R. 1924, p. 422.

Localities. **Ns**: Hvide Sande, basin, common (C. H. Ostenfeld); Vorupør (S. L.). — **Kn**: f. *aculeata*, Osterby harbour. — **Sf**: f. *fibrillosa*, Avernakø. — **Sb**: f. *aculeata*, North side of Asnæs.

Polysiphonia Brodiaei (Dillw.) Grev. K. R. 1924, p. 430.

Localities. **Ns**: Vorupør (S. L.). — **Sk**: Hirtshals, on stones picked up east of the harbour. — **Kn**: On the triple broom at Skagens Rev (C. H. Ostenfeld); Døde Anders, great boulder, reaching almost to the surface of the sea, near Deget at Frederikshavn, the water is here almost always agitated.

Polysiphonia atrorubescens (Dillw.) Grev. K. R. 1924, p. 435.

Localities. **Ns**: Vorupør (S. L.). — **Sk**: Hanstholm, on limestone, 5 m, with antheridia, July 1927; Hirtshals harbour, transverse mole; on stones picked up east of Hirtshals harbour, 4 m. — **Kn**: Skagens Rev, on the triple broom (C. H. Ostenfeld); 2 miles SE of Skagens harbour (Kramp); dT², S of the broom at Læsø Trindel, 26 m; 2³/₄ miles NW by N of Nordre Rønner, 15 miles.

Brongniartella byssoides (Good. et Woodw.) Schmitz. K. R. 1924, p. 445.

Localities. **Kn**: Krageskovs Rev. — **Sa**: Off Ballen, Samsø. — **Sb**: Palegrund; off Spodsbjerg, 19 m; fQ, off Hjortholm Skov, 21 m.

Odonthalia dentata (L.) Lyngb. K. R. 1924, p. 459.

Localities. **Kn:** Nordøst Rev, Hvidstens Rev, Tyskerens Rev and Nordvest Rev at Hirsholmene.
— **Ke:** Groves Flak, 28 m (Hj. Ditlevsen).

Phycodrys rubens (Huds.) Batt. K. R. 1924, p. 467.

Localities. **Sa:** Hov (O. Paulsen). — **Lb:** Vejle Fjord at Stenhøj (S. L.). — **Bw:** Hammermøllen, Flensborg Fjord (Th. Schiøtz).

Delesseria sanguinea (L.) Lamx. K. R. 1924, p. 475.

Localities. **Ns:** Vorupør, mole (S. L.).

Membranoptera alata (L.) Stackh. K. R. 1924, p. 481.

Localities. **Sb:** fR, off Hjortholm, 21 m. — **Su:** Between Nordre Røse and Svalerumpen (S. L.).
— **Bm:** Køge Bugt at Stevns, narrow form.

Harveyella mirabilis (Reinsch) Schmitz et Reinke. K. R. 1931, p. 495.

Localities. **Su:** West of Saltholm, with cyst., April (S. L.).

Chondrus crispus (L.) Stackh. K. R. 1931, p. 499.

Localities. **Ns:** Vorupør, mole (S. L.). — **Bw:** south end of Als (Reinke).

Gigartina mamillosa (Good. et Woodw.) J. Ag. K. R. 1931, p. 509.

In July 1934 this species was discovered at Busserev, near Frederikshavn forming a little vegetation on a boulder at a depth of about one meter below the mean level of the sea. I have previously put forward the suggestion that the species has been introduced into the Danish localities hitherto known by vessels, but this supposition cannot apply to the specimens found at Busserev; it has not yet been observed in the harbour of Frederikshavn. It seems therefore that the species is native in the Danish waters. It is remarkable that the species has not been met with at the west coast of Sweden nor at the east coast of Norway.

The specimens from Busse Rev were well developed, up to 8 cm high.

Phyllophora membranifolia (G. & W.) J. Ag. K. R. 1931, p. 512.

Localities. **Ns:** Vorupør, mole (S. L.).

Phyllophora Brodiaei (Turn.) J. Ag. K. R. 1931, p. 521.

Localities. **Ns:** Vorupør, 30 m north of the mole, with nemathecium, (S. L.).

Ahnfeltia plicata (Huds.) Fries. K. R. 1931, p. 554.

Localities. **Ns:** Vorupør, on stones, near land, crusts (S. L.).

Rhodymenia palmata (L.) Grev. K. R. 1931, p. 569.

Localities. **Kn:** Hulsig Stene. — **Su:** Between Middelgrund and the broom Timeglasset 14.5 m (S. L.); west of Saltholm, 13 m. (S. L.).

Chylocladia kaliformis (Good. et Woodw.) Hook. K. R. 1931, p. 577.

Localities. **Kn**: Hulsig Stene; east of Deget; Marens Rev.

Lomentaria clavellosa (Turn.) Gaill. K. R. 1931, p. 583.

Localities. **Ke**: Groves Flak, 28 m (Hj. Ditlevsen). — **Km**: 1 mile E by N of Hals Barre lighthouse, 11—12 m (S. L.).

Cystoclonium purpureum (Huds.) Batt. K. R. 1931, p. 589.

Locality. **Ns**: Vorupør, mole (S. L.).

Gracilaria confervoides (L.) Grev. K. R. 1931, p. 602.

Locality. **Sk**: Kandestederne, washed ashore. — **Lb**: Sønderborg, loose (Frölich, Reinke).

Conchocelis rosea Batters. K. R. 1931, p. 618.

Localities. **Ns**: eQ, 8 miles NW by W $\frac{1}{2}$ W of Lodbjerg lighthouse, 27 m, in *Pomatocerus triquetrus*. — **Ke**: fH, 1 mile W by N of Fladens lightship, 17 m, in *Pomatocerus*; Dana St. 2922, $4\frac{1}{2}$ miles SW $\frac{3}{4}$ W of Fladens lightship, 30 m, in *Pomatocerus* (C. A. J.); Groves Flak 24 m in *Pomatocerus* (Hj. Ditlevsen).

Distribution of the species in the Danish waters.

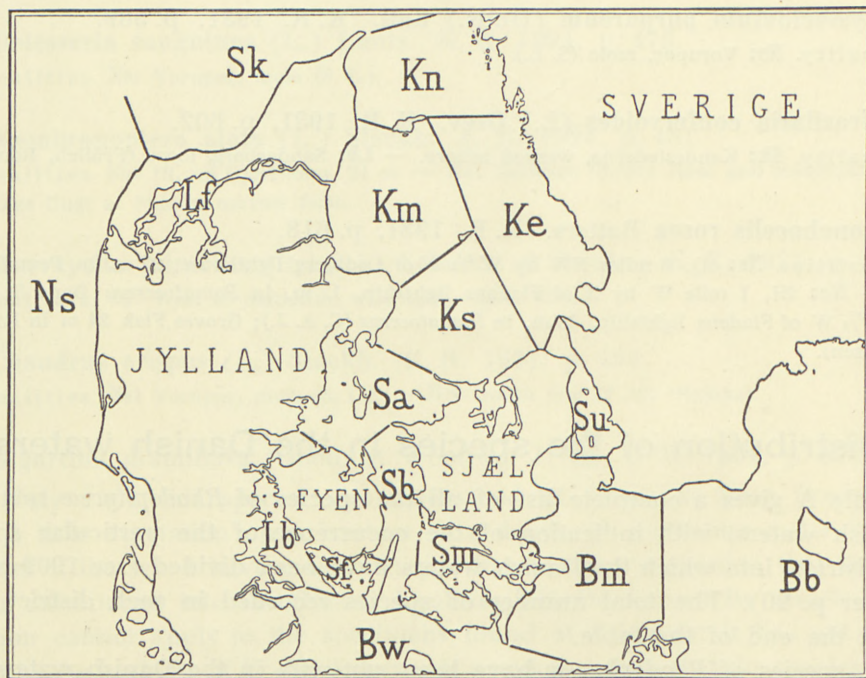
Table A gives a complete list of all the species of *Rhodophyceæ* met with in the Danish waters, with indication of the occurrence of the particular species in the 16 districts into which the Danish waters have been divided (see 1909 p. 19 and this paper p. 20). The total number of species recorded in each district is to be found at the end of the table.

158 species of *Rhodophyceæ* have been met with in the Danish waters. In the following tables it is attempted to show the varying power of the species to immigrate into the Danish waters. In table B all the species are listed which are recorded from the North Sea and the Skagerak but do not go farther into the Danish waters. In table C are shown the species which have invaded the Limfjord but go no farther, and so forth to the last table showing the species which occur in the innermost district (**Bb**). For a discussion of the distribution of the species and the factors determining it, reference may be made to the remarks on the Danish waters, treating principally of the hydrographical conditions, in M. A. D. I 1909 p. 11.

In the last column of list A the distribution outside of the Danish waters of most of the species is given after the list of BØRGESEN and JONSSON (Distrib. of the mar. algae of the arctic sea etc., Appendix to the Botany of the Færøes, 1905), the species being divided into the subarctic (*sa*), the boreal-arctic (*ba*), the cold-boreal (*cb*) and the warm-boreal (*wb*) group. Only very few corrections or additions have been made. A number of species were not included in that list, and have therefore no designation in our list, but as none of these species have been recorded from Greenland, Iceland

and the Færøes, nor from Finmark, they will be counted together with the warm-boreal species. Referring the reader desirous of more details to the paper of BØRGESSEN and JONSSON, I give here a short definition of the three groups:

Subarctic Group, *sa*, common in the Arctic Sea, rather common in the cold-boreal area of the Atlantic Ocean as far south as to the Færøes and Nordland or to England and West-France.



Division of the Danish waters.

- North Sea. **Ns.** Boundary to the south: between Rømø and Sild.
 Skagerak. **Sk.**
 The northern part of the Kattegat. **Kn.**
 The eastern part of the Kattegat. **Ke.**
 The central part of the Kattegat. **Km.**
 The southern part of the Kattegat. **Ks.**
 The Samsø area. **Sa.**
 The Little Belt (Lillebelt). **Lb.** The boundary to the south is the southern end of Allsund and a line from Pøls Huk on Als to Vejsnæs on Ærø.
 The South Fyn waters (Sydfynske Øgaard). **Sf.**
 The Great Belt (Storebelt). **Sb.**
 The Smaaland Sea. **Sm.**
 The Sound. Øresund. **Su.**
 The Western Baltic. **Bw.** The boundary to the south is a line from Krusaa through the middle of Flensborg Fjord.
 The Baltic round Møen. **Bm.**
 The Baltic round Bornholm. **Bb.**

Table A.

	Ns	Sk	Lf	Kn	Ke	Km	Ks	Sa	Lb	Sf	Sb	Sm	Su	Bw	Bm	Bb	
<i>Bangia fuscopurpurea</i>	—	—	—	—	—				—		—		—				ba
<i>Porphyra umbilicalis</i>	—	—	—	—	—			—	—		—		—				ba
— <i>atropurpurea</i>		—	—	—	—								—				wb
<i>Erythrotrichia carnea</i>	—	—	—	—	—			—	—		—		—				cb
— <i>reflexa</i>				—	—												wb
<i>Porphyropsis coccinea</i>				—	—												cb
<i>Erythrocladia irregularis</i>		—	—	—	—												
— <i>subintegra</i>	—	—	—	—	—												
<i>Goniothrichum elegans</i>	—	—	—	—	—			—	—								wb
<i>Asterocytis ramosa</i>								—	—		—	—					wb
<i>Rhodochorton gynandrum</i>				—	—				—								
— <i>rhipidandrum</i>				—	—												
— <i>hallandicum</i>				—	—						—		—	—			
— <i>balticum</i>				—	—											—	—
— <i>moniliforme</i>				—	—			—	—				—	—	—		
— <i>Thuretii</i>	—	—	—	—	—						—						
— <i>Daviesii</i>	—	—	—	—	—						—						cb
— <i>attenuatum</i>			—	—	—												
— <i>strictum</i>					—	—	—	—	—								
— <i>virgatulum</i>	—	—	—	—	—						—	—	—				sa
— <i>Macula</i>					—	—	—	—	—								
— <i>polyblastum</i>				—	—												
— <i>humile</i>											—						
— <i>leptonema</i>		—															
— <i>reductum</i>				—	—												
— <i>cytophagum</i>													—				
— <i>Dumontiæ</i>																	
— <i>Nemalionis</i>			—	—	—												wb
— <i>endozoicum</i>		—			—												
— <i>emergens</i>		—			—												
— <i>immersum</i>				—	—												
— <i>Polyidis</i>				—	—												
— <i>efflorescens</i>	—			—	—	—	—	—	—		—		—	—			sa
— <i>pectinatum</i>	—	—		—	—				—								
— <i>penicilliforme</i>				—	—			—	—		—						sa
— <i>Rothii</i>				—	—			—	—		—						ba
— <i>membranaceum</i>				—	—			—	—		—		—	—			ba
<i>Kylinia rosulata</i>				—	—												
<i>Nemalion multifidum</i>	—	—	—	—	—					—	—	—	—	—			wb
<i>Helminthocladia purpurea</i>		—			—												wb
<i>Helminthora divaricata</i>					—												wb
<i>Scinaia furcellata</i>		—			—												wb
<i>Dumontia incrassata</i>					—												cb
	14	21	11	29	13	10	15	16	19	2	15	4	14	8	5	6	
	22			30		17			19		15						

	Ns	Sk	Lf	Kn	Ke	Km	Ks	Sa	Lb	Sf	Sb	Sm	Su	Bw	Bm	Bb
<i>Dilsea edulis</i>	—	—		—	—								—			<i>cb</i>
<i>Platoma Bairdii</i>									—							<i>wb</i>
<i>Halarachnion ligulatum</i>		—		—	—											<i>wb</i>
<i>Furcellaria fastigiata</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	<i>cb</i>
<i>Polyides rotundus</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	<i>cb</i>
<i>Petrocelis Hennedyi</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	<i>cb</i>
<i>Cruoria pellita</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	<i>wb</i>
<i>Cruoriopsis danica</i>			—	—	—				—							
— <i>gracilis</i>									—							
<i>Cruoriella codana</i>				—	—											
— <i>Dubyi</i>		—	—	—	—	—	—	—					—			<i>cb</i>
<i>Rhododermis elegans</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	<i>cb</i>
— <i>Georgii</i>			—	—	—	—	—	—	—	—	—	—	—	—	—	
<i>Hildenbrandia prototypus</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	<i>ba</i>
— <i>Crouanii</i>									—							<i>wb</i>
<i>Lithothamnion læve</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	<i>sa</i>
— <i>Lenormandi</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	<i>cb</i>
— <i>Sonderi</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	<i>wb</i>
— <i>colliculosum</i>			—	—	—	—	—	—	—	—	—	—	—	—	—	<i>wb</i>
— <i>Granii</i>			—	—	—	—	—	—	—	—	—	—	—	—	—	<i>wb</i>
— <i>norvegicum</i>			—	—	—	—	—	—	—	—	—	—	—	—	—	<i>cb</i>
— <i>calcareum</i>			—	—	—	—	—	—	—	—	—	—	—	—	—	<i>wb</i>
— <i>polymorphum</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	<i>cb</i>
— <i>lævigatum</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	<i>cb</i>
<i>Epilithon membranaceum</i>													—			
<i>Melobesia Lejolisii</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	<i>wb</i>
— <i>subplana</i>								—								
— <i>limitata</i>			—	—	—	—	—	—								
— <i>Fosliei</i>		—	—	—	—	—	—	—								
— <i>minutula</i>				—	—	—	—	—								<i>wb</i>
— <i>trichostoma</i>			—	—	—	—	—	—								
— <i>microspora</i>								—								
<i>Choreonema Thuretii</i>		—	—	—	—	—	—	—	—	—	—	—	—	—	—	
<i>Lithophyllum orbiculatum</i>				—	—	—	—	—	—	—	—	—	—	—	—	<i>wb</i>
— <i>macrocarpum</i>			—	—	—	—	—	—	—	—	—	—	—	—	—	<i>cb</i>
— <i>Corallinæ</i>		—	—	—	—	—	—	—	—	—	—	—	—	—	—	<i>wb</i>
— <i>pustulatum</i>				—	—	—	—	—	—	—	—	—	—	—	—	<i>wb</i>
<i>Corallina officinalis</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	<i>cb</i>
— <i>rubens</i>		—	—	—	—	—	—	—	—	—	—	—	—	—	—	<i>wb</i>
<i>Gloiosiphonia capillaris</i>	—	—	—	— ¹⁾	—	—	—	—	—	—	—	—	—	—	—	<i>wb</i>
<i>Spermothamnion repens</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	<i>cb</i>
<i>Trailliella intricata</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	<i>wb</i>
<i>Callithamnion Hookeri</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	<i>cb</i>
	30	42	33	61	37	24	33	39	39	11	31	11	30	15	11	10
	45		64			44			40		31					

¹⁾ This species is only once recorded from Frederikshavn, it is therefore not reckoned among the species of Kn.

	Ns	Sk	Lf	Kn	Ke	Km	Ks	Sa	Lb	Sf	Sb	Sm	Su	Bw	Bm	Bb		
Callithamnion Brodiaei.....				-													wb	
— tetragonum.....				—	—						—		-				wb	
— corymbosum.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—			wb	
— roseum.....				—									—				cb	
— Furcellariæ.....		—	-	—	—	—	—	—	—	—	—		—	—	—	—	wb	
— bipinnatum.....					—												wb	
Seirospora Griffithsiana.....				—				—									wb	
Plumaria elegans.....				—									-				cb	
Ptilota plumosa.....		—			—		—						-				sa	
Antithamnion cruciatum.....	-		—	—			—										wb	
— Plumula.....	—	—		—	—			—	—		—		—					
— boreale.....				—	—		—	—	—	—	—		—	—			sa	
Ceramium tenuissimum.....		—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	wb	
— diaphanum.....			—	—	—		—	—	—	—	—	—	—	—	—	—	cb	
— strictum.....			—	—	—		—	—	—	—	—	—	—	—	—	—	cb	
— cimbricum.....			—	—														
— Deslongchampsii.....			—	—													cb	
— vertebrale.....																		
— danicum.....								—	—	—	—			—	—			
— rubrifforme.....				—						—							wb	
— arborescens.....	—	—	—	—	-		—	—	—	—	—		—	—	—	—	cb	
— Rosenvingii.....				—			—	—	—	—	—						wb	
— atlanticum.....				—													wb	
— robustum.....				—													wb	
— rescissum.....				—													cb	
— vendlicum.....				—													wb	
— Boergesenii.....			—	—													cb	
— scandinavicum.....				—										—	—		wb	
— abyssale.....	—	—		—	—													
— Areschougii.....				—		—	—	—	—	—	—		—	—			ba	
— fruticulosum.....	—	—		—													wb	
— septentrionale.....				—													sa	
— rubrum.....	—	—	—	—	-	—	—	—	—	—	—	—	—	—	—	—	cb	
— furcatum.....				—														
Bonnemaisonia asparagoides.....				—	—												wb	
Heterosiphonia plumosa.....	—	—	—	—	—												wb	
Laurencia pinnatifida.....		—	—	—				—									wb	
Chondria dasyphylla.....		—															wb	
Polysiphonia urceolata.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	cb	
— orthocarpa.....			—															
— elongata.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	ba	
— violacea.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	cb	
— Brodiaei.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	wb	
— atrorubescens.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	cb	
	43	59	50	97	56	34	48	56	53	25	45	17	46	28	22	18		
	62		103			62		55			45							

	Ns	Sk	Lf	Kn	Ke	Km	Ks	Sa	Lb	Sf	Sb	Sm	Su	Bw	Bm	Bb	
Polysiphonia nigrescens	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	<i>cb</i>
Brongniartella byssoides	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	<i>wb</i>
Rhodomela subfusca	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	<i>sa</i>
Odonthalia dentata	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	<i>sa</i>
Phycodrys rubens	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	<i>sa</i>
Apoglossum ruscifolium	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	<i>wb</i>
Delesseria sanguinea	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	<i>cb</i>
Membranoptera alata	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	<i>cb</i>
Harveyella mirabilis	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	<i>sa</i>
Chondrus crispus	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	<i>wb</i>
Gigartina mamillosa	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	<i>cb</i>
Phyllophora membranifolia	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	<i>cb</i>
— Brodiaei	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	<i>sa</i>
— epiphylla	—	—	—	—	—	—	—	(←)	(←)	(←)	(←)	(←)	(←)	(←)	(←)	(←)	<i>wb</i>
— Traillii	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	<i>wb</i>
Ceratocolax Hartzii	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	<i>sa</i>
Ahnfeltia plicata	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	<i>ba</i>
Cystoclonium purpureum	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	<i>cb</i>
Euthora cristata	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	<i>sa</i>
Rhodophyllis bifida	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	<i>wb</i>
Gracilaria confervoides	—	—	(←)	—	—	—	—	(←)	(←)	(←)	(←)	(←)	(←)	(←)	(←)	(←)	<i>wb</i>
Rhodymenia palmata	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(←)	(←)	<i>sa</i>
Lomentaria clavellosa	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	<i>wb</i>
— rosea	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	<i>cb</i>
Chylocladia kaliformis	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	<i>wb</i>
Plocamium coccineum	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	<i>wb</i>
Atractophora? sp.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	<i>sa</i>
Conchocelis rosea	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	<i>sa</i>
158	60	76	61	121	80	49	63	73	68	38	62	27	62	41	32	26	
	81		129		82		70		62								

Boreal-arctic Group, *ba*, common in the Arctic Sea, and the Boreal area of the Atlantic at least to North-Africa.

Cold-boreal Group, *cb*, from West-France and England northwards to South-Iceland, the Færøes and Nordland-Finmark. Some species occasionally found in the Arctic Sea, especially in the White Sea and the Murman Sea.

Warm-boreal Group, *wb*. Some species go so far north as to South Iceland, the Færøes or Northern Norway, and at least as far south as to the Mediterranean and North Africa. Other species are distributed from North Scotland and West-Norway southward. And a number of species have their northern limit in South-Scotland.

North Sea (Ns) and Skagerak (Sk).

REINKE declared in 1889 (Berichte deutsch. bot. Ges. p. 367) that the south-eastern part of the North Sea was a desert without plants, in which Helgoland forms a luxuriant oasis. This paucity of vegetation is due to the fact that the bottom in this district is movable, consisting of sand and detritus, whereas at Helgoland it consists of rocks. This has been fully confirmed by my investigations; in particular in the part of the North Sea situated off the southern part of Jutland all the dredgings showed the bottom entirely devoid of vegetation, although in some places, especially in the Horns Rev, it contained small stones and also shells (comp. M. A. D. 1924 p. 288). And in some 30 other dredgings made in the neighbourhood from the S.S. "Dana" (Dr. A. C. JOHANSEN) at various depths, from Lat. N $55^{\circ}00'$ to $56^{\circ}08'$ from Long. E $6^{\circ}07'$ to $8^{\circ}16'$, the bottom was likewise without vegetation. Only in the shallow water within Fanø and Rømø (Vadehavet) are the conditions a little better, and the moles at Esbjerg and the bridges at Nordby in Fanø and in Rømø yield good places for the fixation of Algæ; but the total number of species of that district is remarkably low, namely only 10: *Porphyra umbilicalis*, *Goniotrichum elegans*, *Rhodochorton virgatum*, *Melobesia Lejolisii*, *Polysiphonia urceolata*, *Pol. elongata*, *Pol. nigrescens*, *Chondrus crispus*, *Phyllophora Brodiaei*, *Ceratocolax Hartzii*. It is even doubtful whether *Chondrus crispus* and *Phyllophora Brodiaei* have been really found fixed to the substratum. This great poverty is perhaps in part due to the small number of species occurring in the surrounding waters, but it is certainly principally due to the great amount of deposited particles in the sea-water. This discloses itself by many algæ, e. g. the *Fucus* species, being covered with a layer of clay, and it is probable that many algæ cannot withstand such a covering. Farther north, the amount of deposited particles is less, and the stones become gradually more numerous on the bottom. Spots with vegetation are met with, but they occur principally at great distances from the land and at great depths, where the finer particles of the bottom are not so easily washed up by the waves, and the water therefore is more clear blue-green, whereas nearer the land it is greyish. Such dredging places with vegetation are ZQ, Jutland Reef, 24.5 meters, aG, 38 m, aF, 31 m, and aD, 23.5 m (comp. p. 23 and chart I). A considerable number of species have within this district (Ns) only been met with in such localities, viz. *Erythrotrichia carnea* (31 m), *Erythrocladia subintegra* (31 m), *Rhodochorton Thuretii* (31 m), *Rh. efflorescens* (28 m), *Rh. pectinatum* (38 m), *Rhododermis elegans* (27 m), *Lithothamnion læve*, *Lith. Sonderi* (36 m), *Callithamnion corymbosum* (31 m), *Antithamnion cruciatum* (23 m), *Ant. Plumula* (31 m), *Heterosiphonia plumosa* (31 m), *Phyllophora Traillii* (31 m), *Lomentaria clavellosa* (24.5 m), *Conchocelis rosea* (24 m).

The groins on the isthmus of the Limfjord yield good points of attachment for the algæ; that they only bear a restricted number of species, must be due to the fact that these localities are exposed to a very violent beating of the waves, which certainly excludes the existence here of several species. It is so also for the mole at Vorupør, where mag. S. LUND has made investigations. At Klitmøller there are plenty

of lime-stones near land and at a distance of at least one mile, but the vegetation is, however, not abundant.

Table B. Species occurring only in the North Sea and Skagerak.

	Ns	Sk	
Rhodochorton leptonema		—	
— endozoicum		—	
— emergens		—	
Helminthocladia purpurea		—	wb
Scinaia furcellata		—	wb
Lithophyllum Corallinæ		—	wb
Chondria dasyphylla		—	wb
Gracilaria confervoides		—	wb
Plocamium coccineum	—	—	wb

Of the 158 Rhodophyceæ recorded from the Danish waters 60 have been met with in the North Sea, 76 in the Skagerak, and 81 from the two districts together. As shown in table B, 9 of the species have only been met with in Ns and Sk (none only in the Ns). These are all warm-boreal species. They have not been recorded from Greenland, Iceland and the Færøes, with the exception of *Plocamium coccineum*, which occurs at the Færøes and S.W. Iceland.

In the Skagerak the conditions are more favourable than in the North Sea, there is more stony ground, in some places stony reefs, and the water is more limpid. The stones are in many places present in considerable quantities. At Hanstholm there are plenty of lime-stones, or partly lime-rock near to land, however, usually with rather scarce vegetation, but close to land there are to be found single boulders with abundant vegetation. Here, at Helshage, a harbour has for some years been in course of building.

Bragerne, farther east, is the name of a bank with two stony reefs at three and two meters depth situated about 1½ miles from land, at Lild Strand. Various algæ. Off Løkken and Lønstrup several localities with stony bottom at 7 to 13 metres' depth, partly with fairly abundant vegetation, up to 4 miles from land, were present. At Løkken, *Scinaia furcellata* was met with on the beach. At Hirtshals there are, too, several stony banks at 4.5 to 15 metres' depth, up to 2½ miles from land, more or less covered with algæ. Here are also stony reefs reaching the beach, bearing a dense vegetation. In 1879—80 a stony mole was built here, it was prolonged 20 years later, and a harbour was built in connection with it in 1920—1925.

On the coast from Hirtshals to Skagen the conditions for the growth of algæ are less favourable owing to the want of larger stones. Within the inner shoals, however, pebbles occur with a vegetation of *Chorda Filum*, *Polysiphonia Brodiaei*, and *P. atrorubescens*. And near land *Gracilaria confervoides* and *Helminthocladia purpurea* may also be met with.

Small narrow-leaved specimens of *Zostera marina* are frequently thrown ashore on the coast of Skagerak, but that species does not grow in this water; the specimens have all been conveyed by the current from the Kattegat.

The Limfjord (Lf).

The number of species recorded in the Limfjord is smaller than in the Skagerak, although the salinity is about the same as in the Skagerak and the conditions of the protection much better, — namely 61 against 76, and it is scarcely greater than in the North Sea. The low number of species is probably in a great measure due to the very variable temperature of the shallow fjord which has only over a small extent more than 10 meters' depth. The summer temperature may be proportionally high, in particular in calm weather, and the winter temperature very low. The deficient renewal of the water through the narrow channels connecting the fjord with the North Sea and the Kattegat and perhaps the consequent want of certain nutritious elements may also play an important rôle. The great density of the plankton in the Limfjord where it has a particular propagation, as showed by C. G. JOH. PETERSEN (Beretning fra den danske biologiske Station. VII, 1897, 1898), seems too to be a competitive factor which may influence the occurrence of the *Rhodophyceæ*. A historical circumstance must also be taken into consideration. Before the moment when the isthmus of Agger was broken through in 1825, the western part of the Limfjord was filled with fresh-water or with water of extremely small salinity which excluded the occurrence of the Rhodophyceæ or at least most of them. After the penetration of the water of the North Sea these algæ were gradually enabled to immigrate, but the access has not been favourable, and it is not to be wondered at that the number of species met with in Thisted Bredning is still very low.

Table C. Species only occurring in the North Sea, Skagerak and the Limfjord.

	Ns	Sk	Lf	
<i>Gloiosiphonia capillaris</i>	—	—	—	<i>wb.</i> Once found in the harbour of Frederikshavn (1923)

Table C shows that only one species, *Gloiosiphonia capillaris*, enters from the North Sea into the Limfjord where it has its boundary. It has only once been met with in the much explored harbour of Frederikshavn, not otherwise recorded within Skagen.

Table D shows 6 species having only been recorded in the Limfjord. They are mostly rare in part provisionally endemic species. *Rhodochorton Nematlonis* has a southern distribution. All the species recorded in Tables C and D must be considered as having a warm-boreal distribution, among them the provisionally endemic

species *Rhodochorton attenuatum*, *Melobesia trichostoma*, *Ceramium cimbricum* and *Polysiphonia orthocarpa*.

Table D. Species only met with in the Limfjord.

	Ns	Sk	Lf	
<i>Rhodochorton attenuatum</i>			—	
— <i>Nemalionis</i>			—	<i>wb</i>
<i>Lithothamnion colliculosum</i>			—	<i>wb</i>
<i>Melobesia trichostoma</i>			—	
<i>Ceramium cimbricum</i>			—	
<i>Polysiphonia orthocarpa</i>			—	

Of the numerous species lacking in the Limfjord the following may be emphasized:

<i>Rhodochorton Rothii</i>	<i>ba</i>	<i>Antithamnion boreale</i>	<i>sa</i>
— <i>efflorescens</i>	<i>sa</i>	<i>Polysiphonia Brodiaei</i>	<i>wb</i>
<i>Dilsea edulis</i>	<i>cb</i>	<i>Odonthalia dentata</i>	<i>sa</i>
<i>Lithothamnion læve</i>	<i>sa</i>	<i>Phycodrys rubens</i>	<i>sa</i>
— <i>norvegicum</i>	<i>cb</i>	<i>Delesseria sanguinea</i>	<i>cb</i>
— <i>calcareum</i>	<i>wb</i>	<i>Membranoptera alata</i>	<i>cb</i>
— <i>polymorphum</i>	<i>cb</i>	<i>Phyllophora epiphylla</i>	<i>wb</i>
<i>Callithamnion Hookeri</i>	<i>cb</i>	<i>Rhodymenia palmata</i>	<i>sa</i>
— <i>tetragonum</i>	<i>wb</i>	<i>Lomentaria clavellosa</i>	<i>wb</i>
<i>Plumaria elegans</i>	<i>cb</i>	<i>Chylocladia kaliformis</i>	<i>wb</i>
<i>Antithamnion Plumula</i>	<i>wb</i>	<i>Plocamium coccineum</i>	<i>wb</i>

6 of this list are of subarctic, 1 of boreal arctic, 7 of cold-boreal and 9 of warm-boreal distribution. It is characteristic that all the *Delesseriaceæ* are entirely wanting, likewise *Rhodochorton efflorescens* which is wide spread in the Arctic Sea, and in the Danish waters as far as **Bb**.

It is characteristic that the following species have only been recorded in the western part of Nissum Bredning, near the entrance from the North Sea:

<i>Rhodochorton attenuatum</i>	<i>Lithothamnion colliculosum</i>
<i>Polyides rotundus</i>	— <i>Granii</i>
<i>Cruoriella Dubyi</i>	<i>Melobesia trichostoma</i>
<i>Cruoriopsis danica</i>	<i>Corallina rubens</i>
<i>Rhododermis elegans</i>	<i>Ceratocolax Hartzii</i> .

The common species do not reach their maximal size in the Limfjord; they usually attain greater length in the waters within Skagen, a testimony that the conditions in the Limfjord are not the most favourable.

It may here be added that of the Phæophyceæ the *Laminariæ* are wanting¹ and likewise *Ascophyllum nodosum*, and *Halidrys siliquosa* is very rare.

The northern (Kn) and the eastern Kattegat (Ke).

The total number of species recorded in the northern Kattegat is very large: 121 (77.8 p. c.), larger than in any other district. That must be owing to the comparatively high salinity of the water, to the great number of places with stony ground at smaller or greater depths, and to a good protection against violent movements of the water.

Table E. Species entering into the Northern Kattegat and having their boundary there.

	Ns	Sk	Lf	Kn	
<i>Erythrotrichia reflexa</i>				—	
<i>Erythrocladia irregularis</i>		—		—	
<i>Rhodochorton rhipidandrum</i>				—	
— <i>polyblastum</i>				—	
— <i>reductum</i>				—	
— <i>immersum</i>				—	
— <i>Polyidis</i>				—	
<i>Kylinia rosulata</i>		—		—	
<i>Helminthora divaricata</i>				—	<i>wb</i>
<i>Cruoriella codana</i>				—	
<i>Melobesia Fosliei</i>		—		—	
— <i>minutula</i>				—	<i>wb</i>
<i>Choreonema Thuretii</i>		—		—	
<i>Corallina rubens</i>		—	—	—	<i>wb</i>
<i>Callithamnion Brodiaei</i>				—	<i>wb</i>
<i>Ceramium Deslongchampsii</i>			—	—	<i>cb</i>
— <i>atlanticum</i>				—	
— <i>robustum</i>				—	
— <i>rescissum</i>				—	<i>cb</i>
— <i>vendlicum</i>				—	
— <i>Boergesenii</i>			—	—	<i>cb</i>
— <i>fruticulosum</i>	—	—		—	<i>wb</i>
— <i>septentrionale</i>				—	<i>sa</i>
— <i>furcatum</i>				—	
<i>Polysiphonia Brodiaei</i>	—	—		—	<i>wb</i>
<i>Atractophora</i> sp.				—	

¹ *Laminaria digitata* has been recorded on the moles at Hals at the eastern entrance to the Limfjord. Dr. R. SPÄRCK has communicated me a specimen of *Laminaria hyperborea* and a small specimen of *Lam. saccharina* from Nissum Bredning. It cannot be brought to light whether these specimens have grown in the Limfjord or whether they have been introduced by currents from the North Sea. Otherwise I have not met with *Laminariæ* in the Limfjord.

Table E shows that 26 species enter **Kn** but have their boundary here, 22 of these have a warm-boreal, 3 a cold-boreal and 1 a subarctic distribution.

As table F shows, 15 species go farther into **Ke** but have their boundary here. Most of these species (11) have a warm-boreal, 3 a cold-boreal and 1 a subarctic distribution.

Table F. Species entering the Eastern Kattegat and having their boundary there.

	Ns	Sk	Lf	Kn	Ke	
<i>Porphyropsis coccinea</i>				—	—	<i>cb</i>
<i>Erythrocladia subintegra</i>	—	—		—	—	
<i>Halarachnion ligulatum</i>		—		—	—	<i>wb</i>
<i>Lithophyllum pustulatum</i>					—	<i>wb</i>
<i>Callithamnion bipinnatum</i>					—	<i>wb</i>
<i>Ceramium abyssale</i>	—	—		—	—	
<i>Bonnemaisonia asparagoides</i>				—	—	<i>wb</i>
<i>Heterosiphonia plumosa</i>	—	—		—	—	<i>wb</i>
<i>Polysiphonia atrorubescens</i>	—	—	—	—	—	<i>cb</i>
<i>Apoglossum ruscifolium</i>				—	—	<i>wb</i>
<i>Phyllophora Traillii</i>	—			—	—	<i>wb</i>
<i>Euthora cristata</i>					—	<i>sa</i>
<i>Rhodophyllis bifida</i>		—		—	—	<i>wb</i>
<i>Lomentaria rosea</i>					—	<i>cb</i>
<i>Chylocladia kaliformis</i>				—	—	<i>wb</i>

The total number of species recorded in **Ke** is 80, much lower than in **Kn**. That might partly be due to the fact that the area has not been so closely investigated as **Kn**, but it may chiefly arise from the want of stony grounds in shallow water, whereas stony localities in deep water with salt water and slightly varying temperature are numerous.

When taken as a whole **Kn** and **Ke** together have a total number of 129 species (81.6 pCt.), 41 species having their boundary in these districts (25.9 pCt.). It is therefore a very rich district. Of the 41 species 2 are *sa*, 6 *cb* and 33 *wb*.

A number of the species do not extend to the southern limit of **Kn** but have their inner boundary in this district more north, probably because the salinity at the bottom in the southern region is lower. The following species have their southern boundary at:

Skagen: *Ceramium atlanticum*

Herthas Flak and Tønneberg Banke: *Halarachnion ligulatum*

Apoglossum ruscifolium

Bonnemaisonia asparagoides

Rhodophyllis bifida

North side of Hirsholmene: *Erythrotrichia irregularis*
 — *subintegra*
Callithamnion Brodiei.

And some species with an easterly distribution do not occur west of Trindelen and Læsø, evidently because they only in the easterly part find the hydrographical conditions necessary for their success, in deep water with great salinity and slightly varying temperature. The following species are only recorded in the following localities:

Trindelen: *Cruoriella codana*
 Fladen: *Callithamnion bipinnatum*
Euthora cristata
 Groves Flak: *Lomentaria rosea*.

As an example of the flora in deep water I here give a list of the species met with in July 1892 and 1896 from several dredgings in Herthas Flak in the northern Kattegat, an isolated ground with gravelly and stony bottom at 19 to 22.5 metres' depth:

Rhodochorton Thuretii	<i>wb</i>	Ceramium abyssale	<i>wb</i>
— efflorescens	<i>sa</i>	Bonnemaisonia asparagoides	<i>wb</i>
Dilsea edulis	<i>cb</i>	Polysiphonia urceolata	<i>cb</i>
Halarachnion ligulatum	<i>wb</i>	— elongata	<i>ba</i>
Cruoria pellita	<i>wb</i>	— violacea	<i>cb</i>
Cruoriella Dubyi	<i>cb</i>	Phycodrys rubens	<i>sa</i>
Hildenbrandia prototypus	<i>ba</i>	Apoglossum ruscifolium	<i>wb</i>
Lithothamnion Sonderi	<i>wb</i>	Delesseria sanguinea	<i>cb</i>
— lævigatum	<i>cb</i>	Membranoptera alata	<i>cb</i>
Callithamnion corymbosum	<i>wb</i>	Phyllophora membranifolia	<i>cb</i>
— roseum	<i>cb</i>	— epiphylla	<i>wb</i>
— Furcellariæ	<i>wb</i>	Cystoclonium purpureum	<i>cb</i>
Scirospora Griffithsiana	<i>wb</i>	Rhodophyllis bifida	<i>wb</i>
Antithamnion Plumula	<i>wb</i>	Lomentaria clavellosa	<i>wb</i>

2 *sa*, 2 *ba*, 10 *cb*, 14 *wb*.

Otherwise the bottom in the northern part of **Kn** is soft and without vegetation.

For comparison is given a list of the species met with in several dredgings on Groves Flak in the eastern Kattegat at 22.5 and 32 metres' depth, on gravelly and stony bottom:

Porphyropsis coccinea	<i>cb</i>	Halarachnion ligulatum	<i>wb</i>
Rhodochorton efflorescens	<i>sa</i>	Cruoria pellita	<i>wb</i>
— pectinatum	<i>wb</i>	Cruoriella Dubyi	<i>cb</i>
— penicilliforme	<i>sa</i>	Lithothamnion Granii	<i>wb</i>
— membranaceum	<i>ba</i>	— calcareum	<i>wb</i>
Dilsea edulis	<i>cb</i>	— lævigatum	<i>cb</i>

Corallina officinalis	cb	Phycodrys rubens	sa
Trailliella intricata	wb	Delesseria sanguinea	cb
Callithamnion Hookeri	cb	Phyllophora membranifolia	cb
— Furcellariæ	wb	— Brodiaei	sa
Antithamnion Plumula	wb	— epiphylla	wb
Bonnemaisonia asparagoides	wb	Cystoclonium purpureum	cb
Polysiphonia urceolata	cb	Euthora cristata	sa
— elongata	ba	Rhodophyllis bifida	wb
— nigrescens	cb	Lomentaria clavellosa	wb
Brongniartella byssoides	wb	— rosea	cb
Odonthalia dentata	sa	Conchocelis rosea	sa

7 sa, 2 ba, 12 cb, 13 wb.

At Læsø Trindels lightship and $1\frac{1}{4}$ miles from it at 23.5 metres' depth the vegetation on stony bottom with round stones consisted principally of incrusting algæ e. g. *Cruoriella Dubyi*, *Cr. codana*, *Cruoria pellita*, *Lithothamnion Granii*, *Lith. Sonderi*, and further *Lithoderma fatiscens* and *Cutleria (Aglaozonia reptans)*. The character of the vegetation may perhaps be due to the strong current in these localities.

The central (Km) and southern (Ks) Kattegat and the Samsø area (Sa).

In the central and the southern Kattegat only very few (3) species have their inner boundary; they have all a warm-boreal distribution. A greater number (9) have their inner boundary in the Samsø area. Two of these 12 species have a cold-boreal, ten a warm-boreal distribution. Of the species listed in table G, the following

Table G. Species entering the central and southern Kattegat and the Samsø area respectively and having their boundary there.

	Ns	Sk	Lf	Kn	Ke	Km	Ks	Sa	
Trailliella intricata	—	—	—	—	—	—			wb
Lithothamnion calcareum				—	—	—			wb
Antithamnion cruciatum	—		—	—			—		wb
Goniothrichum elegans		—	—	—		—		—	wb
Rhodochorton strictum						—	—	—	
Lithothamnion norvegicum				—				—	cb
Melobesia subplana								—	
— limitata			—	—				—	
— microspora								—	
Seirospora Griffithsiana				—				—	wb
Laurencia pinnatifida		—	—	—		—		—	wb
Gigartina mamillosa			—	—				—	cb

may be emphasized: *Lithothamnion calcareum* in a locality in the northern part of **Km**; *Lithothamnion norvegicum*, in some localities in the northern **Sa**, far from the locality in **Kn**, in some places in great quantities; *Antithamnion cruciatum*; *Seirospora Griffithsiana*; *Laurencia pinnatifida* and *Gigartina mamillosa*. The two latter species occur in shallow water in the Samsø area.

The total numbers of the species recorded in these three districts are lower than in the foregoing ones, namely 49, 63, 73 respectively. When taken as a whole the three districts **Km**, **Ks** and **Sa** have in all 82 species, much lesser than **Kn** and nearly the same as **Ke**.

The Little Belt (Lb) and the South Fyn water (Sf).

As mentioned in M. A. D. p. 16, there is only a small difference between the salinity at the surface and in deep water in the Little Belt, and there is generally a strong current, especially in the narrowest part of the Belt.

Table H. Species entering the Little Belt and South Fyn water and having their boundary there.

	Ns	Sk	Lf	Kn	Ke	Km	Ks	Sa	Lb	Sf	
Rhodochorton gynandrum				—					—		
— Macula						—	—	—	—		
— pectinatum	—	—		—	—				—		
Platoma Bairdii									—		<i>wb</i>
Cruoriopsis danica			—	—	—				—		
— gracilis									—		
Rhododermis elegans	—	—	—	—		—	—	—	—		<i>cb</i>
Hildenbrandia Crouani									—		<i>wb</i>
Lithophyllum macrocarpum f. intermedia .			—	—			—	—		—	<i>cb</i>
Ceramium tenuissimum		—	—	—	—	—	—	—	—	—	
— rubriforme				—						—	

The total number of species recorded in the Little Belt and the South Fyn water is 68 and 38 respectively, in the two districts together 70. 11 species have their southern boundary, 8 in **Lb**, 3 in **Sf**. It is strange that four rare species have been recorded on a stony bottom at Lyngsodde near Snoghøj at a great depth (15—20 metres) in the always streaming sound. The three species have only been met with in this spot in the Danish waters, namely *Platoma Bairdii*, *Cruoriopsis gracilis* and *Hildenbrandia Crouani*, the fourth, *Cruoriopsis danica*, has also been found in other places in the Danish waters. 2 of the 11 species in Table H have a cold-boreal distribution, 9 a warm-boreal.

A list of all the species met with in the said locality at Lyngsodde is given here:

Rhodochorton pectinatum.....	<i>wb</i>	Lithothamnion lævigatum.....	<i>wb</i>
Platoma Bairdii.....	<i>wb</i>	Brongniartella byssoides.....	<i>wb</i>
Furcellaria fastigiata.....	<i>cb</i>	Phycodrys rubens.....	<i>sa</i>
Polyides rotundus.....	<i>cb</i>	Delesseria sanguinea.....	<i>cb</i>
Petrocelis Hennedyi.....	<i>cb</i>	Chondrus crispus.....	<i>wb</i>
Cruoriopsis danica.....	<i>wb</i>	Phyllophora membranifolia.....	<i>cb</i>
— gracilis.....	<i>wb</i>	— Brodiaei.....	<i>sa</i>
Rhododermis elegans.....	<i>cb</i>	Ahnfeltia plicata.....	<i>ba</i>
Hildenbrandia Crouani.....	<i>wb</i>	Cystoclonium purpureum.....	<i>cb</i>
Lithothamnion Lenormandi.....	<i>cb</i>	Conchocelis rosea.....	<i>sa</i>

3 *sa*, 1 *ba*, 8 *cb*, 8 *wb*.

The Great Belt (Sb) and the Smaaland Sea (Sm).

The total number of species occurring in the Great Belt (Sb) is 62, 27 in Sm. 10 species have their southern boundary in this district; of them one has a subarctic,

Table I. Species entering the Great Belt and the Smaaland Sea and having their boundary there.

	Ns	Sk	Lf	Kn	Ke	Km	Ks	Sa	Lb	Sf	Sb	Sm	
Conchocelis rosea.....	—	—	—	—	—	—	—	—	—	—	—	—	<i>sa</i>
Rhodochorton Thuretii.....	—	—	—	—	—	—	—	—	—	—	—	—	
— Daviesii.....	—	—	—	—	—	—	—	—	—	—	—	—	<i>cb</i>
— humile.....	—	—	—	—	—	—	—	—	—	—	—	—	
Rhododermis Georgii.....	—	—	—	—	—	—	—	—	—	—	—	—	
Corallina officinalis.....	—	—	—	—	—	—	—	—	—	—	—	—	<i>cb</i>
Ceramium Rosenvingii.....	—	—	—	—	—	—	—	—	—	—	—	—	
Lomentaria clavellosa.....	—	—	—	—	—	—	—	—	—	—	—	—	
Lithothamnion Sonderi.....	—	—	—	—	—	—	—	—	—	—	—	—	<i>wb</i>
Melobesia Lejolisii.....	—	—	—	—	—	—	—	—	—	—	—	—	<i>wb</i>

two a cold-boreal and seven a warm-boreal distribution. There is a marked difference between the surface layer and the bottom layer with high salinity and low summer temperature. *Lomentaria clavellosa* has only been dredged once more than sixty years ago by MAGNUS in a deep channel. *Corallina officinalis* is rather rare in the two Belts. It has only been met with in two places in shallow water in the northern part of the Little Belt, and at Als (REINKE). And in the Great Belt it has only been recorded in a few places and in small quantities. *Lithothamnion Granii* has been recorded near the boundary of its extension in flat encrusting forms with very low tubercles (fig. 3).

The Øresund (Su).

The total number of species recorded in the Øresund (Su) is 62, the same as in the Great Belt. It has a great part of the species in common with the Great Belt, but there are remarkable differences. A considerable number of species (20) have their southern boundary in the Sound. The boundary between the surface water and the bottom water is distinct, and the salinity of the bottom water is very high, in particular in the northern part where the salinity at Lappegrund at 23 metres' depth varies from 28.3—34.0 p. m. But south of Hven also the salinity of the bottom water is relatively high. The ten species marked *n* in table K have only been met with

Table K. Species entering the Sound (Su) and having their southern boundary there.

	Ns	Sk	Lf	Kn	Ke	Km	Ks	Sa	Lb	Sf	Sb	Sm	Su	
<i>Bangia fusco-purpurea</i>	—	—	—	—	—				—		—		—	<i>ba</i>
<i>Porphyra umbilicalis</i>	—	—	—	—			—	—	—		—		<i>n</i>	<i>ba</i>
— <i>atropurpurea</i>		—		—									—	<i>wb</i>
<i>Rhodochorton cytophagum</i>													—	<i>n</i>
— <i>Dumontiæ</i>					—								—	<i>n</i>
<i>Dilsea edulis</i>	—	—		—	—								—	<i>h</i> <i>cb</i>
<i>Cruoria pellita</i>		—		—	—	—	—	—	—		—		—	<i>h</i> <i>wb</i>
<i>Cruoriella Dubyi</i>		—	—	—	—			—					—	<i>h</i> <i>cb</i>
<i>Lithothamnion læve</i>	—				—		—						—	<i>n</i> <i>sa</i>
— <i>Granii</i>				—	—	—	—	—	—		—		—	<i>wb</i>
— <i>lævigatum</i>	—	—	—	—	—			—	—		—		—	<i>n</i> <i>cb</i>
<i>Lithophyllum orbiculatum</i>				—	—		—						—	<i>h</i> <i>wb</i>
<i>Callithamnion tetragonum</i>				—	—						—		—	<i>n</i> <i>wb</i>
— <i>roseum</i>				—	—								—	<i>cb</i>
<i>Plumaria elegans</i>				—									—	<i>n</i> <i>cb</i>
<i>Ptilota plumosa</i>		—			—		—						—	<i>n</i> <i>sa</i>
<i>Antithamnion Plumola</i>	—	—		—	—	—	—	—	—		—		—	<i>n</i> <i>wb</i>
<i>Brongniartella byssoides</i>	—	—	—	—	—	—	—	—	—		—		—	<i>h</i> <i>wb</i>
<i>Odonthalia dentata</i>				—	—		—	—					—	<i>h</i> <i>sa</i>
<i>Phyllophora epiphylla</i>	—	—		—	—	—	—						—	<i>n</i> <i>wb</i>

in the northern part of the Sound, not south of Helsingør, and the six species marked *h* have only been dredged south of the isle of Hven at depths of over 20 metres. Most of these species have not been recorded from the Great Belt. The three species: *Bangia fuscopurpurea*, *Porphyra atropurpurea* and *Callithamnion roseum* have been recorded near low-water mark at Copenhagen, but only of the late years, by mag. S. LUND, their occurrence here is probably due to the fact that the new moles of the harbour are carried farther out into the stream than before. Of the twenty species having their boundary in the Sound, 3 have a sub-boreal, 2 a boreal-arctic, 5 a cold-

boreal and 10 a warm-boreal distribution. These figures show a distinct increase of the subarctic and the boreal-arctic species in proportion to the warm-boreal species.

In the following list the species dredged on a stony ground bM south of Hven, in the salt bottom current at 22.5 metres' depth are recorded:

Rhodochorton efflorescens	sa	Polysiphonia elongata	ba
Dilsea edulis	cb	— nigrescens	cb
Cruoria pellita	wb	Odonthalia dentata	sa
Cruoriella Dubyi	Phycodrys rubens	sa
Hildenbrandia prototypus	ba	Delesseria sanguinea	cb
Lithothamnion Granii	wb	Membranoptera alata	cb
Lithophyllum orbiculatum	wb	Cystoclonium purpureum	cb
Anthamion boreale	sa	Rhodymenia palmata	sa
Polysiphonia urceolata	cb		

5 sa, 2 ba, 6 cb, 4 wb.

The number of the warm-boreal species is here smaller than the subarctic and the cold-boreal ones.

The western Baltic Sea (Bw).

In the Western Baltic Sea the total number of species is only 41. 12 species have their boundary in this district; of these 3 species have a subarctic distribution, 2 a boreal-arctic, 4 a cold-boreal and 3 a warm-boreal. Here a decrease of the warm-

Table L. Species entering and having their boundary in the western Baltic Sea.

	Ns	Sk	Lf	Kn	Ke	Km	Ks	Sa	Lb	Sf	Sb	Sm	Su	Bw
Erythrotrichia carnea	—	—	—	—	—	—	—	—	—	—	—	—	—	cb
Rhodochorton hallandicum	—	—	—	—	—	—	—	—	—	—	—	—	—	
— penicilliforme	—	—	—	—	—	—	—	—	—	—	—	—	—	sa
— membranaceum	—	—	—	—	—	—	—	—	—	—	—	—	—	ba
Epilithon membranaceum	—	—	—	—	—	—	—	—	—	—	—	—	—	wb
Spermothamnion repens	—	—	—	—	—	—	—	—	—	—	—	—	—	cb
Callithamnion Hookeri	—	—	—	—	—	—	—	—	—	—	—	—	—	cb
— corymbosum	—	—	—	—	—	—	—	—	—	—	—	—	—	wb
Ceramium Areschougii	—	—	—	—	—	—	—	—	—	—	—	—	—	ba
Ceratocolax Hartzii	—	—	—	—	—	—	—	—	—	—	—	—	—	sa
Cystoclonium purpureum	—	—	—	—	—	—	—	—	—	—	—	—	—	cb
Rhodymenia palmata	—	—	—	—	—	—	—	—	—	—	—	—	—	sa

boreal species in proportion to the subarctic and cold-boreal species must be noted. In some localities south of Falster the gravelly or stony bottom was to a great extent

covered with *Mytilus edulis* together with various algæ. The greater part of Gedser Rev has a sandy bottom and no vegetation.

A list of the species found on a stony ground, Øjet (UL) in Femernbelt at 20 metres' depth in the deep current is given here:

Rhodochorton efflorescens	sa	Phycodrys rubens	sa
Furcellaria fastigiata	cb	Delesseria sanguinea	cb
Epilithon membranaceum	wb	Membranoptera alata	cb
Antithamnion boreale	sa	Harveyella mirabilis	sa
Ceramium rubrum balticum	cb	Chondrus crispus	wb
Rhomomela subfusca	sa	Phyllophora Brodiaei	sa

6 sa, 4 cb, 2 wb.

The number of warm-boreal species is only $\frac{1}{3}$ of the subarctic and $\frac{1}{2}$ of the cold-boreal species.

The Baltic Sea around Møen (Bm).

In the Baltic Sea around Møen the total number of species recorded is 32. 10 species have here their inner boundary; of these 1 species has a boreal-arctic, 4 a cold-boreal and 5 a warm-boreal distribution.

Table M. Species entering the Baltic Sea around Møen and having their boundary there.

	Ns	Sk	Lf	Kn	Ke	Km	Ks	Sa	Lb	Sf	Sb	Sm	Su	Bw	Bm
Rhodochorton moniliforme															
Nemalion multifidum															wb
Polyides rotundus															cb
Lithothamnion polymorphum															cb
Ceramium danicum															
— aborescens															cb
— scandinavicum															wb
Polysiphonia urceolata															cb
Chondrus crispus															wb
Ahnfeltia plicata															ba

The Baltic Sea around Bornholm (Bb).

In the innermost district around Bornholm (Bb) the total number of species is 26; of these 7 have a subarctic distribution, 3 a boreal-arctic, 12 a cold-boreal and only 4 a warm-boreal. These figures are remarkably different from those of most of the other districts, the warm-boreal species being very few, while the subarctic and the cold-boreal species are proportionally numerous.

Table N. Species occurring in the Baltic Sea around Bornholm.

	Ns	Sk	Lf	Kn	Ke	Km	Ks	Sa	Lb	Sf	Sb	Sm	Su	Bw	Bm	Bb	
* <i>Asterocystis ramosa</i>								—									<i>wb</i>
<i>Rhodochorton balticum</i>																	
* — <i>virgatulum</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	<i>sa</i>
— <i>efflorescens</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	<i>sa</i>
* — <i>Rothii</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	<i>ba</i>
<i>Dumontia incrassata</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	<i>cb</i>
* <i>Furcellaria fastigiata</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	<i>cb</i>
<i>Petrocelis Henedyi</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	<i>cb</i>
* <i>Hildenbrandia prototypus</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	<i>ba</i>
<i>Lithothamnion Lenormandi</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	<i>cb</i>
* <i>Callithamnion Furcellariæ</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	<i>wb</i>
<i>Antithamnion boreale</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	<i>sa</i>
* <i>Ceramium diaphanum</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	<i>cb</i>
* — <i>strictum</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	<i>cb</i>
— <i>vertebrale</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
* — <i>rubrum</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	<i>cb</i>
<i>Polysiphonia elongata</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	<i>ba</i>
* — <i>violacea</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	<i>cb</i>
* — <i>nigrescens</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	<i>cb</i>
* <i>Rhodomela subfusca</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	<i>sa</i>
* <i>Phycodrys rubens</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	<i>sa</i>
<i>Delesseria sanguinea</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	<i>cb</i>
* <i>Membranoptera alata</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	<i>cb</i>
* <i>Harveyella mirabilis</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	<i>sa</i>
* <i>Phyllophora membranifolia</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	<i>cb</i>
* — <i>Brodiaei</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	<i>sa</i>

In Davids Banke, a stony ground North of Bornholm the following species were met with at 15 to 29 metres' depth in July:

<i>Rhodochorton efflorescens</i>	<i>sa</i>	<i>Rhodomela subfusca</i>	<i>sa</i>
— <i>Rothii</i>	<i>ba</i>	<i>Phycodrys rubens</i>	<i>sa</i>
<i>Furcellaria fastigiata</i>	<i>cb</i>	<i>Delesseria sanguinea</i>	<i>cb</i>
<i>Hildenbrandia prototypus</i>	<i>ba</i>	<i>Harveyella mirabilis</i>	<i>sa</i>
<i>Ceramium strictum</i>	<i>cb</i>	<i>Phyllophora Brodiaei</i>	<i>sa</i>

5 of the species are *sa*, 2 *ba*, 3 *cb*, and the *wb* are entirely wanting.

The species which are recorded in the Eastern Baltic Sea (**Bi**)¹ have been marked with an * in the list, Table N. It will be seen from this that 9 species do not enter

¹ SVEDELIUS, Studier öfver Östersjöns hafsalgflora. 1901. RIDELIUS, Några märkligare havsalfgynd från Gotland. Sv. Bot. Tids. 27, p. 93. MARCHEWIANKA, Z flory glonów polskiego Bałtykn. LAKOWITZ, Die Algenflora der gesamten Ostsee, Danzig, 1929, p. 335.

into the Eastern Baltic, that they must thus be supposed to have their boundary in the **Bb**. Of these, 2 species are *sa*, 1 *ba*, 4 *cb*, 2 probably endemic (*wb*). 17 species are recorded in the inner Baltic Sea; of these, 5 species are *sa*, 2 *ba*, 8 *cb*, and 2 *wb*. The proportion of the groups is in both cases almost similar to that of **Bb**.

Conclusions.

The figures given above from all the districts of the Danish waters are collected here in Table O. These figures show clearly that the number of species of the districts

Table O. Survey of the distribution of the species in the districts of the Danish waters.

District	Total number of species	Percentage number	Number of species having their boundary here	Repartition of the types of Geographical distribution after Børgesen and Jonsson			
				<i>sa</i>	<i>ba</i>	<i>cb</i>	<i>wb</i>
Ns	60	51.3	9				9
Sk	76						
Lf	61	38.6	7 (only in Lf 6)				7
Kn	121	77.8 } 81.6	26 } 41	2		6	33
Ke	80						
Km	49	51.9	12			2	10
Ks	63						
Sa	73						
Lb	68	44.3	11			2	9
Sf	38						
Sb	62	39.2	10	1		2	7
Sm	27						
Su	62	39.2	20	3	2	5	10
Bw	41	25.9	12	3	2	4	3
Bm	32	21.5	10		1	4	5
Bb	26	20.2	9	7	3	12	4
				2	1	4	2
Bi	17	10.7		5	2	8	2

decrease gradually from the northern Kattegat to the Bornholm district, and that the warm-boreal species decrease much more than the other groups in the first districts. Not until we reach the western Baltic Sea do the other groups together decrease more than the warm-boreal group, with the consequence that the Bornholm part of the Baltic contains only 4 warm-boreal, but 6 subarctic and 13 cold-boreal species. This appears too from Table P which shows that the percentage number of the warm-boreal group decreases considerably from the northern Kattegat to the Bornholm district

Table P.

	Total number of species	subarctic		boreal-arctic		cold-boreal		warm-boreal	
			in per ct.		in per ct.		in per ct.		in per ct.
In all the Danish waters.	158	16	10.1	7	4.4	40	25.3	95	60
In Kn	121	13	10.7	7	5.7	37	30.6	64	52.9
In Bb	26	6	23.1	3	11.5	13	50	4	15.4

whereas the other groups increase. The number of warm-boreal species in the northern Kattegat is more than double that of the other groups together. The flora of the Bornholm district has principally a cold-boreal and subarctic character.

It is interesting to compare the 26 species occurring in this part of the Baltic Sea with those occurring in Hekla Havn, Scoresby Sound, East Greenland, at 20 metres' depth and deeper, where the temperature varied during the year between $+0.5^{\circ}$ and -1.5° , and the salinity at greater depths must be supposed to vary between 3.2 and 3.3 ‰¹. Of the 21 species met with here, 11 also occur in the Danish waters, thus more than 50 ‰ and of these Hekla Havn has 7 ($33\frac{1}{3}$ ‰) in common with **Bb**, namely:

Rhodochorton efflorescens	Phycodrys rubens
— Rothii	Harveyella mirabilis
Antithamnion boreale	Phyllophora Brodiaei.
Rhodomela subfusca ²	

These 7 species make 26.9 ‰ of the species of the district. *Ceratocolax Hartzii* may be added, as it has been recorded from **Bm**.

What I have here advanced is in good accordance with what SVEDELIUS³ has stated for the flora of the Eastern Baltic Sea, that this flora has a mainly arctic character in comparison with the floras of the Kieler Bucht and the Kristiania Fjord. He finds especially for the Rhodophyceæ, that the Kristiania Fjord has 84.6 ‰ Atlantic and 15.4 ‰ arctic species, the Kieler Bucht 85.1 ‰ atlantic, 10.6 ‰ subarctic and 4.3 ‰ endemic species, while the Eastern Baltic Sea has 70.6 ‰ atlantic, 23.5 ‰ subarctic and 5.9 ‰ endemic species.

Most of the species occurring in **Bb** are also distributed in the other districts. Excepted are *Asterocytis ramosa*, *Rhodochorton balticum* and *Ceramium vertebrale*, which seem to be adapted to a lesser degree of salinity. *Rhodochorton balticum* and *Ceramium vertebrale* are perhaps endemic species in the Baltic Sea.

As the flora of the Danish waters must be supposed to have immigrated after the glacial period from the North Sea and the Skagerak it may be expected at the outset that the bulk of the species have been recorded in **Ns**, **Sk**, **Lf**, **Kn** or **Ke**. And that

¹ L. KOLDERUP ROSENVINGE, Om Algevegetationen ved Grønlands Kyster. Meddelelser om Grønland. XX. 1889, p. 231.

² *Rhodomela lycopodioides* is considered as a form of *Rh. subfusca*.

³ N. SVEDELIUS, Studier öfver Östersjöns hafsalgflora. 1901.

is really so: The algæ must have been introduced by the inward running currents from the North Sea to the Northern and Eastern Kattegat, carrying also algæ from the Swedish coast. 145 of the 158 species have been recorded in one or more of these districts. Of the remaining 13 species, two have been mentioned above as possibly endemic in the Baltic Sea (*Rhodochorton balticum*, *Ceramium vertebrale*). *Asterocytis ramosa* is adapted to brackish water and is also otherwise dependent on this condition. Some rare species have only been met with in a deep dredging with strong current in the Little Belt (*Platoma Bairdii*, *Cruoriopsis gracilis* and *Hildenbrandia Crouanii*). It is probably the peculiar character of this locality with the ever streaming water which favours these rare species which have also been recorded rarely from other localities out of the Danish waters. Of the remaining species *Rhodochorton strictum* has been met with by KYLIN near Kristineberg at the coast of Bohuslän. The following species: *Rhodochorton Macula*, *R. humile*, *R. cytophagum*, *Melobesia subplana*, *M. microspora*, *Ceramium danicum* H. Ptrs., which have not been recorded in the outer districts, have all been described as new species in my paper and have, as far as is known, not hitherto been observed out of the Danish waters. There is scarcely any reason to believe that they are endemic in the Danish waters; their distribution must be settled by further investigations.

If we ask on what it depends that the flora is so much altered when passing from the northern Kattegat to the Bornholm district, it is evident that it is due to the greatly diminished salinity that the number of species is so much decreased inward to the Baltic Sea. Some of the species are satisfied with the very low salinity at Bornholm, though they are often much reduced, but most of these species also grow in the salt water of the North Sea or at least in the Northern Kattegat (comp. Table N); they are then euryhaline. Other species require high salinity and cannot withstand great variations in the salinity; they are stenohaline. Such species must be sought in deep water in the northern and eastern Kattegat, where the variation of this factor is proportionally small.

The salinity and the temperature are according to daily observations

	Tp.	Salinity
at Skagens Revs lightship		
in 20 meters depth.....	3°—15°	32.3 ⁰ / ₀₀ —33.8°
- 38 — —	4°—13.9°	33.3 ⁰ / ₀₀ —34.5°
at Læsø Trindels lightship		
in 10 meters depth.....		28 ⁰ / ₀₀ —29 ⁰ / ₀₀
- 20 — —		31 ⁰ / ₀₀ —32 ⁰ / ₀₀
at Anholts Knobs lightship		
in 10 meters depth.....		23 ⁰ / ₀₀ —25 ⁰ / ₀₀
- 20 — —		29 ⁰ / ₀₀ —31 ⁰ / ₀₀
- 28 — —	4.2°—13.5°	

At Herthas Flak, 19 to 22.5 metres' depth, situated near Skagen Rev and at Groves Flak, at 22.5 and 32 metres' depth, in the eastern Kattegat between Læsø

Trindel and Anholt Knob, the following species were met with and were only found in these localities or in some cases too in a similar neighbouring locality:

Halarachnion ligulatum	<i>wb</i>	Rhodophyllis bifida	<i>wb</i>
Lithothamnion calcareum	<i>wb</i>	Euthora cristata	<i>sa</i>
Bonnemaisonia asparagoides	<i>wb</i>	Lomentaria rosea	<i>cb</i>
Apoglossum ruscifolium	<i>wb</i>		

Most of these species are *wb*, as might be expected, but *Lomentaria rosea* is *cb* as it occurs at the Færøes and SW. Iceland, and *Euthora cristata* is widespread in the Arctic Sea and is therefore included among the *sa* species. For all the species the boundary is at Groves Flak.

It is not to be wondered at that the warm-boreal species cannot endure great variations in the salinity, as the northern Atlantic Ocean has a rather constant salinity. It is easily intelligible that the species with warm-boreal distribution in great part have their boundary in the outer Danish waters, and that they are proportionally few in the inner districts, especially around Bornholm.

The algæ which occur in the Arctic Sea are often exposed to great variations in salinity, the upper layer of water in summer, near the land, when the snow and the ice are melting, becoming fresh or of extremely low salinity down to several metres' depth, and the species which grow at so high a level that they are reached by the fresh-water, will perish if they are not able to endure the strong diminishing of the salinity. The presence of icebergs must also cause a mingling with fresh-water at greater depths. This may explain why the subarctic species are generally more resistant to variations in salinity than the warm-boreal species. But the question is more complicated. As we have seen above, subarctic species may also be stenohaline, e. g. *Euthora cristata*. This species, however, principally occurs in the deeper sublittoral region at Greenland, in particular from 15 to 30 metres' depth (K. ROSENVINGE, Grønlands Havalger 1893, p. 813). In Trondhjem Fjord, PRINTZ found the bulk of the species between 8 and 18 metres' depth (Algveg. des Trondhjemsfjordes, 1926, p. 69). The species seems to avoid the very low degrees of salinity by growing at low levels. There is a great field for further investigations in studying the dependence of the particular species on the outer conditions. But the particular species must be studied separately in relation to the local hydrographical conditions.

Most of the species of the Danish waters have the boundary of their extension within the limits of the Danish territory. Some species go to the boundary without great alterations in size or shape or in the mode of reproduction, other species are more plastic. Most of the species continuing to the boundary of the inner district are gradually diminished, becoming shorter and thinner, e. g. *Furcellaria fastigiata* (M. A. D. fig. 90), *Phycodrys rubens* (fig. 436), *Delesseria sanguinea* (Plate VII figs. 1—4), *Membranoptera alata* (Plate VII figs. 5—7). *Polysiphonia elongata* appears in three very different forms which, however, are connected by intermediate forms: The f. *typica*

with robust main stems goes from the outer districts to **Bw**, β , *Schuebelerii* is spread from the Samsø area to **Bm**, and γ , *baltica* is spread from the Sound and **Bw** to **Bb**. The latter form is very slender with thin main axes (Plate V, fig. 3). *Rhodomela subfusca* is also very variable; *a*, *genuina* mostly occurs on the coast at small depths, *f. virgata* mostly in deeper water, especially in the belts, and *f. tenuior* is dominant at Bornholm, though not rarely it approaches to *f. genuina* or to *f. virgata*; finally a very thin form, *f. abyssicola* has been met with once at a great depth in the southern Little Belt. — The number of pericentral cells in *Polysiphonia nigrescens* is less at Bornholm than in the outer areas (p. 441). — *Lithothamnion Granii* has near its southern boundary in Store Belt been met with in an incrusting form with few and extremely low tubercles (fig. 3), whereas in Kattegat it is much branched (M. A. D. 1917, plate IV, figs. 1—4).

Loose algæ living for a long time lying on the bottom are mentioned in M. A. D. IV p. 609. There, however, only the species contained in the 4th part of my paper are quoted, but the following species mentioned in the foregoing parts must be added: *Furcellaria fastigiata* (f. *ægagropila*), *Polyides rotundus* (f. *ægagropila*), *Polysiphonia violacea* (f. *aculeata*), *Polysiphonia nigrescens*. Of the loose forms only *Phyllophora epiphylla* f. *Bangii* and *Gracilaria confervoides* (f. *tenuissima*) are included in table A in a parenthesis as they occur far outside the boundary of the normal species and they are transformed.

The loose algæ are usually detached by stormy weather or by the fishing nets of the fishermen. Most of the specimens perish shortly afterwards or are thrown ashore, but some keep alive in a loose state for a long time, being often much deformed, but always sterile. Such loose algæ are often retained between *Zostera* rhizomes or between attached algæ, frequently several species together. In some places they are particularly common, e. g. in the Limfjord, north of Djursland, in the middlemost Kattegat south of Anholt and north-east of the isle of Møen.

In connection with the loose algæ *Lithothamnion norvegicum*, *L. calcareum* and *L. Granii* must be named, as they are loose-lying on the bottom, the latter species, however, not always. As these species must be supposed to be transported by the movements of the water for short distances only, the conditions seem to be other than for the remaining loose algæ, and besides these are fructiferous.

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