

# Copyright ©

---

Es gilt deutsches Urheberrecht.

Die Schrift darf zum eigenen Gebrauch kostenfrei heruntergeladen, konsumiert, gespeichert oder ausgedruckt, aber nicht im Internet bereitgestellt oder an Außenstehende weitergegeben werden ohne die schriftliche Einwilligung des Urheberrechtinhabers. Es ist nicht gestattet, Kopien oder gedruckte Fassungen der freien Onlineversion zu veräußern.

German copyright law applies.

The work or content may be downloaded, consumed, stored or printed for your own use but it may not be distributed via the internet or passed on to external parties without the formal permission of the copyright holders. It is prohibited to take money for copies or printed versions of the free online version.

Kieler Meeresforschungen	Sonderheft 4	Kiel 1978
--------------------------	--------------	-----------

## **The physiognomy and structure of the sublittoral macrophyte communities in Kassari Bay (an area between the Isles of Hiimuaa and Saaremaa)**

**T. Trei**

Eesti NSV Teaduste Akadeemia Zoologia ja Botanika Instituut  
Tartu, UDSSR

### **Abstract**

Kassari Bay is of a specific character, a relatively isolated, sheltered and shallow sea area where the sediment mainly consists of clay and sandy clay. The main communities are the association of the loose-lying red algae *Furcellaria fastigiata* and *Phyllophora brodiaei f. angustissima* and the association *Zosteretum marinae* and its variant which is rich in red algae. Areas with dense vegetation alternate with areas almost without vegetation, or where only single tufts of red algae or some charophytes and phanerogames are found. The floristic list contains 24 taxa, 5 of them are phanerogames. *Sphacelaria radicans* is a new taxon for the Estonian flora.

### **Zusammenfassung**

#### **Die Physiognomie und Struktur der sublittoralen Makrophyten-Gemeinschaft in der Kassari-Bucht zwischen den Inseln Hiimuaa und Saaremaa**

Die Kassari Bucht zeichnet sich durch ihre relativ isolierte Lage in einem geschützten und flachen Seegebiet aus. Das Sediment besteht hauptsächlich aus Ton und sandigem Ton. Die wichtigsten Pflanzengemeinschaften werden von den lose liegenden Rotalgen *Furcellaria fastigiata* und *Phyllophora brodiaei f. angustissima* und der *Zosteretum marinae*-Assoziation gebildet sowie von deren Variante mit zahlreichen Rotalgen. Gebiete mit dichter Vegetation wechseln mit fast vegetationslosen Flächen ab, oder es sind nur vereinzelt Rotalgenbüschel oder einige Charophyten und Phanerogamen vorhanden. Die Artenliste enthält 24 Taxa, unter denen 5 Phanerogamen sind. *Sphacelaria radicans* ist eine neue Art für die estische Flora.

### **Introduction**

Kassari Bay is of a specific character, a relatively isolated, sheltered and shallow sea area, where the circular sea current makes possible the existence of the community of loose-lying red algae. This community, covering the main part of the surface of the bay, is peculiar in our waters; it has great practical importance and is of theoretical interest. The community of loose-lying red algae was discovered and first described by KIREJEVA (1961, 1964). The previous research of the author of this paper showed that the loose-lying algae are mobile, being transported by wave action and currents. Therefore to estimate the abundance it is not right to sum up the data

gathered in different years. The purpose of the present paper is to make the quantitative data more reliable, to describe the plant communities and determine the floristic composition in Kassari Bay.

### Material and Methods

The material (608 samples altogether) was collected by the expedition organized by the Estonian Department of the Baltic Fisheries Research Institute in July 1974 from 316 stations lying all over Kassari Bay at depths between 4–9 m. Some data from previous investigations of the author are taken into consideration.

The investigations consisted of direct underwater observation of plant communities by a diver equipped with an aqualung. The seabottom at a radius of 50–60 (100) m was observed and the character of the seabottom was described. The plant cover was estimated in % and the dominant taxa determined. The structure of benthic communities was examined and the quantitative sample from squares  $0.5 \times 0.5 \text{ m}^2$  (usually 2 samples from the same station) was collected. Later the fresh weight of samples and the percentage of dominant species was determined. The biomass was calculated, taking plant cover into consideration. The microscopic determination of algae was carried out in the laboratory.

### The Study Area

Kassari Bay lies between the Isles of Saaremaa, Hiiumaa and Muhumaa. It is connected with the open sea by the narrow Soela Strait. The depth of Kassari Bay is less than 10 m, the salinity of the water is relatively high ( $\sim 6.5\text{‰}$ ). Permanent west winds may increase the salinity of the water, for the same reason the level of the water may change. In summer the temperature of the water is usually 17–19°C, in warm summers it is even higher. In winter Kassari Bay is covered with ice. The water transparency is low.

A soft bottom of chiefly clay and sandy clay prevails. Only scattered pebbles and stones ( $\varnothing$  1–1.5 m) are found here and there on the sediment bottom. In the outlying districts stony bottoms or sediment bottoms with pebbles and stones occur.

### Results

The main part of the surface of the bay (about 140 km<sup>2</sup>) comprises the community of the loose-lying red algae *Furcellaria fastigiata* and *Phyllophora brodiaei* f. *angustissima* at depths of 5–9 m. The community has a very distinctive physiognomy. The thalli of the algae lying in masses entangled on the seabottom form an algal layer at a height of 5–15 cm. There is no difference between the upper and lower surface of the algal layer because of the mobility of the algae. The plant cover of this community is 50–100%, in places patches without plants occur. The total biomass of this algal layer is about 140000 tons. The *Furcellaria* occurring in the algal layer described above has a shape more or less intermediate between that of the attached form f. *fastigiata* and that of the unattached f. *aegagropila*. The thalli are without organs for attaching and reproduction which characterize f. *fastigiata*, they are also without radial symmetry found in f. *aegagropila*. It is quite natural that under such conditions, a radial symmetry cannot form in entangled algal layers. The average length of the thallus is 4–4.5 cm and the average diameter 0.5–0.8 mm. The branching of the thalli is mainly irregular, but quite often dichotomic branching occurs. The colour of the algae varies from greenish and pale-red to dark reddish brown, the dry specimens are black.

The specimens *Phyllophora brodiaei* f. *angustifolia* have narrow delicate thalli with a diameter varying from 0.5 to 1 mm, the length reaching 6.6 cm; mostly they are 3–5 cm long. The colour varies from pale red to dark red.

The role of the mentioned two algae is different in different parts of the algal layer. Thus, the area of pure *Furcellaria* or a of algae containing 20% *Phyllophora* comprises 33 km<sup>2</sup>, the average biomass is 1006 g/m<sup>2</sup> and the total biomass is about 33 000 tons in gross weight. These algae form the basis of estagar production. Estagar has been produced since 1967.

The area of pure *Phyllophora* or a mixture of algae containing 20% *Furcellaria* comprises 24 km<sup>2</sup>, the average biomass is 730 g/m<sup>2</sup> and the total biomass is about 17 000 tons.

On the remaining territory (83 km<sup>2</sup>) a mixture of algae is found in which the percentage of *Furcellaria* and *Phyllophora* varies from 20–80%, the average biomass is 1100 g/m<sup>2</sup> and the total biomass is about 90 000 tons.

In addition to the two dominant species named above 13 taxa of other species were recorded in this association. These algae lie loose in the algal layer, attach themselves as epiphytes to other plants or to shells, more often to *Mytilus* occurring among the algae. The quantitative importance of these taxa is small.

*Chlorophyta*: Single specimens of *Chaetomorpha linum* and *Rhizoclonium riparium* were found entangled with other algae. The length of *Chaetomorpha* specimens was 10–15 (23 cm) and the diameter 120–130 cm.

*Phaeophyta*: The most frequent taxon is *Sphacelaria arctica*. The thalli at the length of 1.9–2.5 cm are not typical, the branching is irregular. Only the presence of typical rhizoids and the structure of unilocular sporangia show that these algae belong to *Sph. arctica*. *Pilayella littoralis* and *Stictyosiphon tortilis*, the length of thalli 2.5–3.8 (6.7) cm, occurred rarely. The single specimens of *Chorda filum* (length to 10 cm) were found loose among other algae and floating on the water surface. New for the Estonian flora, *Sphacelaria radicans* was found at two stations. At one of them the alga lies loose among other algae and at the second one it grows on stone.

*Rhodophyta*: The most common and abundant species besides the dominant species of this community is *Polysiphonia nigrescens*. The thalli (length to 8.5 cm) are usually sterile. *Polyides rotundus* (length of sterile thalli 1.5–5 cm), *Rhodomela confervoides* f. *tenuior* (length of sterile thalli is commonly 1–2 cm, rarely 4–8 cm) and *Polysiphonia atro-rubescens* (length of sterile thalli 3–5 (9) cm) occur also frequently. *Ceramium tenuicorne* and *Callithamnion roseum* (single sterile specimens) grow mostly epiphytically.

There are not many sessile animals attaching to the algae of this community. The most common and abundant of them are *Mytilus edulis* and *Electra crustulenta* var. *baltica*.

The other most important plant community in Kassari Bay is the association *Zosteretum marinae* and its variant which is rich in red algae at the depths of 2–6 (7) m, comprising an area of about 70 km<sup>2</sup>. *Zostera* does not cover the bottom continuously and uniformly; the plant cover varies from 5–80%, the biomass is mostly below 200 g/m<sup>2</sup>. Often patches without vegetation are found. In our waters *Zostera* reproduces vegetatively, only once a specimen with fruits was found. The length of the specimens is usually 30–50 cm.

The occurrence of other phanerogams (*Potamogeton pectinatus*, *P. perfoliatus*) and charophytes (*Chara aspera*, *Tolypella nidifica*) in this community is of accidental character, they were met with only at single stations. In places, *Zosteretum* bordering with the loose-lying red algae community, the *Zosteretum* variant, rich in red algae, occurs. It is similar to the association *Zostero-Furcellarietum* distinguished by Polish scientists in the Bay of Gdańsk (KORNAŚ, et al. 1960). It is a two-layered community, in the lower *Furcellaria* and *Phyllophora* occur. The plant cover of this layer varies usually from 5–50%.

In Kassari Bay, there occur areas with dense vegetation alternating with areas almost without vegetation or only single tufts or small patches of red algae (plant cover below 10%). In places charophytes *Chara aspera* and *Tolypella nidifica* or some phanerogams (*Potamogeton perfoliatus*, *P. pectinatus*, *Zannichellia major*, *Ruppia maritima*) with plant cover from 5–15% occur.

On stones to a depth of 5 m the *Fucetum vesiculosus* associatum is distributed, rarely *Pilayella littoralis* covers stones.

Deeper than 5 m stones are occupied by the *Furcellarietum fastigiatee* f. *fastigiata* association or its fragments. The most common taxa are red algae *Furcellaria fastigiata* f. *fastigiata*, *Polysiphonia nigrescens*, *Ceramium tenuicorne* and brown alga *Pseudolithoderma* sp.

The floristic list of sublittoral communities of Kassari Bay contains 24 taxa: *Chlorophyta*: 2, *Charophyta*: 2, *Phaeophyta*: 7, *Rhodophyta*: 8 and 5 taxa of phanerogams.

### Discussion

The variant of the association *Zosteretum marinae*, rich in red algae corresponds to *Zostero-Furcellarietum* distinguished by KORNAŚ (1959) and KORNAŚ et al. (1960). These authors consider it to be the final link in the development of vegetation on sediment bottoms because of its most complicated structure and the higher degree of its organization. Pure *Zostera* communities are considered to be an initial link. The author of the present paper is of the opinion that there is no reason to consider this community to be an example of high organization. The coexistence of *Zostera* and red algae is of accidental, mechanical character and this community may occur only in a sheltered bay with a circular sea-current. When *Zostera* grows in places bordering with an area where *Furcellaria* is dominant, in the lower layer of *Zosteretum* also *Furcellaria* is dominant. When *Zostera* grows in places bordering with an area where *Phyllophora* is dominant, in the lower layer of *Zosteretum* also *Phyllophora* is dominant. In places, which lie at some distance from the loose-lying red algae community, pure *Zosteretum marinae* exists. Consequently, *Zosteretum marinae* is the main community which is not in any way primitive or incomplete. *Zostero-Furcellarietum* is only a special variant of the association *Zosteretum marinae* in the sheltered bay, rich in red algae.

### Summary

Kassari Bay (an area between the Isles of Hiiumaa, Saaremaa and Muhumaa) is of a specific character, relatively isolated, sheltered and a shallow sea area. The main part of the surface of the bay (about 140 km<sup>2</sup>) comprises the community of the loose-lying red algae *Furcellaria fastigiata* and *Phyllophora brodiaei* f. *angustissima*. In addition to these two dominant species 13 taxa of other species were recorded in this association. The most frequent species of them are *Polysiphonia nigrescens* and *Sphacelaria arctica*. It is characteristic that specimens in the algal layer have small dimensions and the organs for reproduction are in most cases

lacking. Associations of *Zosteretum marinae* and its variant, rich in red algae, comprises an area of about 70 km<sup>2</sup>. Areas with dense vegetation alternate in Kassari Bay with areas almost without vegetation or where only single tufts or small patches of red algae occur. In places charophytes or some phanerogames are found. On stones to a depth of 5 m the *Fucetum vesiculosus* association is distributed. Deeper than 5 m stones are occupied by the *Furcellarietum fastigiatae* f. *fastigiata* or its fragments. The floristic list of sublittoral communities of Kassari Bay contains 24 taxa, 5 of them are phanerogames. *Sphacelaria radicans* is a new taxon for the Estonian Flora.

### References

- KIREYEVA, M. S.: Fields of *Furcellaria fastigiata* (Huds.) Lamour in the Baltic Sea (the area of the Saaremaa and Hiiumaa Isles) Proc. NIIRH SNH Latv. S.S.R., **3** Riga: 411–417 (1961)
- KIREYEVA, M. S.: Accumulations of loose lying red algae in the seas of the Soviet Union. In: Recourses of marine algae and their exploitation, pp. 3–25 Moscow. (In Russian) (1964)
- KORNAŚ, J.: Sea Bottom Vegetation of the Bay of Gdansk off Rewa. Bull. de l'Acad. Polon. des Sciences Cl. II, **7** (1), 5–10 (1959)
- KORNAŚ, J., E. PANCER and B. BRZYSKI: Studies on Sea Bottom Vegetation in the Bay of Gdansk. Rewa. Fragm. Florist. Geobot., **6**, 1–92 (1960)