Changes in the distribution of charophyte species in enclosed seabays of western Estonia

Kaire Torn^{a,b*} and Georg Martin^a

^a Estonian Marine Institute, University of Tartu, Marja 4D, 10617 Tallinn, Estonia

^b Institute of Botany and Ecology, University of Tartu, Lai 40, 51005 Tartu, Estonia

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Abstract. An overview of the distribution of charophytes in Matsalu, Haapsalu, and Rame bays, western Estonia, is given based on sampling carried out in 2001. Sampling was performed repeating stations investigated during previous investigations. *Chara aspera* was the most frequent charophyte in the three investigated bays. Compared to the former data, its distribution area has decreased in Matsalu Bay. *Chara connivens* was found for the first time in Matsalu Bay. No large-scale changes in charophyte distribution have occurred in Haapsalu Bay during recent decades. The distribution area of *Chara tomentosa* in Rame Bay has moved from east towards north.

Key words: charophytes, Matsalu Bay, Haapsalu Bay, Rame Bay.

INTRODUCTION

Charophytes form a highly developed, unique group of algae. Charophytes usually occur in shallow water with soft bottoms. As compared to other Baltic Sea areas, the importance of charophytes is higher in the Estonian coastal ecosystem. This is reflected by their higher frequency of occurrence and greater share in the total phytobenthos biomass (Waern, 1952; Trei, 1983a, 1991a; Kautsky, 1988). This is explained by favourable conditions created by a unique combination of different geomorphological and hydrological factors (Martin et al., 1998).

Although charophytes can be found all around the Baltic a significant decline of both the number of species and their density and/or areal coverage have been observed during the last decades (Blindow, 2001; Dekere, 2001; Schubert & Yousef, 2001; Sinkeviciene & Jurgilaite, 2001; Zhakova & Balashova, 2001).

* Corresponding author, kairet@klab.envir.ee

Because of the lack of scientific interest in the distribution of charophytes along the Baltic Sea coasts, relevant recent information is missing for most of the area (Dekere, 2001; Nilsen, 2001; Sinkeviciene & Jurgilaite, 2001; Zhakova & Balashova, 2001). The same also applies to the Estonian coastal waters (Martin, 2001).

All the investigated bays – Matsalu, Haapsalu, and Rame – are very shallow, with a soft substrate, and relatively sheltered. Hence, they provide an excellent habitat for charophytes. In these bays detailed phytobenthos surveys have been conducted in the past, which enables to reconstruct the temporal trends in the charophyte distribution. The aim of the present study was to describe the changes in the distribution and species composition of charophytes in Matsalu, Haapsalu, and Rame bays.

MATERIAL AND METHODS

The material was collected in June and July 2001. The total number of stations was 10 in Matsalu Bay, 5 in Haapsalu Bay, and 8 in Rame Bay. Observation sites were chosen to repeat earlier sampling sites (Fig. 1.) Historical data were obtained from the field diaries of T. Trei from investigations carried out in 1962–89.

Fig. 1. Location of the investigated areas and sampling sites.

Sampling was performed by SCUBA diving. For each locality, its GPS position and exact depth were recorded. Among biotic variables the total coverage of benthic vegetation and the coverage of different species were determined at each site. Coverage was estimated visually using percentage scale with 10% accuracy. From abiotic variables water salinity and bottom composition were recorded. The collected charophytes were packed, labelled, and then frozen until sorting and determination in the laboratory. Determination was made using the determination keys by Blindow & Krause (1990) and I. Blindow (unpubl.).

RESULTS AND DISCUSSION

Matsalu Bay

The sampling depth varied from 0.8 to 4 m. Salinity was recorded to be in the interval of 0.64–4.73 PSU (mostly between 2 and 3 PSU). Muddy sand was prevailing in the eastern part of the bay, sand and sandy clay in the middle part. In the northeastern part of the bay the total coverage of plants was 100%, formed mainly by *Chara aspera*. In the rest of the bay the total coverage was quite low (5–25%). During the investigations four species of charophytes were found (Fig. 2a). Charophytes were not found at 2 localities out of 10.

The benthic vegetation of Matsalu Bay has been described several times from the beginning of the 1960s until the end of the 1980s (Trei, 1965, 1970, 1983b, 1985, 1987, 1991a, b).

Compared to the previous data, the distribution area of the *C. aspera* community has decreased. In 1984, the *C. aspera* community was widely spread in the middle and eastern parts of the bay (Trei, 1985, 1991b). Today the area occupied by the community has been reduced mainly to the eastern part, including a small section from the middle of the bay.

Chara connivens, a very rare species in the Baltic Sea, has not been previously recorded from Matsalu Bay. This species occurred in the middle part of the bay where other vegetation was very poor. According to the literature *C. connivens* has previously been found only as single specimens at the southern coast of Saaremaa Island and in the shallow coastal sea of Kihnu Island (Trei, 1991a). In 2001 it was found at several locations in the sea area of the West Estonian Archipelago, and according to present knowledge this species should not be considered as rare any more (authors' pers. obs.).

Chara contraria, a quite unique species for the Estonian coastal sea, occurs mostly in freshwater environments. However, according to different keys (Gollerbach, 1983; Blindow & Krause, 1990) the specimen found could be identified also as *C. baltica* in this particular case. Besides Matsalu Bay, this species has been found from brackish water only once from Kuressaare Bay (Trei, 1991a, b).

(a) Matsalu Bay 1984 2001

(b) Haapsalu Bay 1985 2001

(c) Rame Bay 1983 2001

Fig. 2. Coverage of different charophyte species in recent and historical observations.

Two species, *Chara tomentosa*, which previously occurred in the eastern part of the bay, and *C. canescens*, usually common in *C. aspera* communities, were not found during the present study.

Single specimens of *Tolypella nidifica* have been constantly found from the eastern part of the bay (Trei, 1991b).

Haapsalu Bay

A survey of the benthic vegetation was performed at one location in the part of the bay called Eeslaht (salinity 2.67 PSU) and four locations in the part of the bay called Tagalaht (salinity 1.72–2.27 PSU). All the studied locations were at depths of 0.3–1.6 m and had sandy or muddy bottom. The vegetation coverage degree was mostly 100% in Tagalaht (except for the sampling point H1) with a dominating *C. aspera* community. Single specimens of *C. canescens* and *C. tomentosa* were found between dense *C. aspera* stands (Fig. 2b).

In comparison with the 1960s the distribution area of *C. aspera* dominated communities had declined in the 1970s. Only fragments of this community were encountered in a limited area and some scattered specimens were found. The biomass and distribution area of *C. tomentosa* had undergone similar changes (Trei, 1965, 1984a, b, 1991a). In 1985 the situation had improved considerably and *C. aspera* meadows were observed over large areas again (Trei, 1991a).

No big differences in the distribution of charophytes were observed between the years 1985 and 1989. Changes had taken place only at the sampling point H1, which was under a direct influence of a wastewater outlet. At the end of the 1970s disappearance of benthic vegetation was recorded in this area. In 1985 the community of vascular plants had almost restored in this area. In 1989 the bottom was covered with a dense, 30–40 cm high charophyte community, unfortunately not identified to species level by T. Trei. In 2001 the only plant species found on these bottoms was *Myriophyllum spicatum* growing in distinct aggregations with a total coverage of 50%.

According to the information available for the last couple of decades no large changes occurred in the distribution of charophytes in Haapsalu Bay. A *C. aspera* community has been constantly inhabiting the central part of the bay. It includes also some rare specimens of *C. tomentosa* and *C. canescens*. The last time *C. baltica* was found in Haapsalu Bay before 2001 was in 1962.

Rame Bay

The stations were located mostly at depths of 1–1.2 m, with salinities between 4.4 and 5.3 PSU. The dominating substrate was muddy sand. The total phyto-benthos coverage in the bay was estimated at 15–100%. Charophytes were dominating in most of the cases but in some locations *Potamogeton pectinatus* was found to be abundant as well. Four species of charophytes were found in

Rame Bay. The most widespread species was *C. aspera*, which in some places was covered with epiphytic *Cladophora glomerata*. Single *C. canescens* specimens were also found in *C. aspera* stands. Single specimens of *C. baltica* were found from the *P. pectinatus* community. In the northern part of the bay a dense stand (coverage 100%) of *C. tomentosa* was identified.

During the years 1962 and 1983 the most abundant community in the bay was that of *C. aspera*, which covered the soft bottom of the entire sheltered part of the bay. Single agglomerations of *P. pectinatus* and *C. tomentosa* were also described. The coverage of *C. aspera* varied in space as well as in time (Fig. 2c). In some occasions single specimens of *C. canescens* were observed in the community. Also some specimens of *T. nidifica* were found during the investigations conducted in 1962 (Trei, 1965, 1983a).

In 1983 *C. tomentosa* dominated communities were found as patches between *C. aspera* dominated communities in the eastern part of the bay. According to the data from 2001 this species forms monodominant communities in the northern part of the bay. *C. tomentosa* has quite an uneven and scarce distribution along the Estonian coastline, independent communities with high biomass and coverage have been reported only from single locations such as the Turja harbour area on the southern coast of Saaremaa Island (authors' pers. obs.) and the eastern part of Matsalu Bay (Trei, 1991a).

CONCLUSIONS

The present work showed that *C. aspera* is the most frequent plant species in the investigated sea area. While changes in the charophyte distribution could be observed in Matsalu Bay (occurrence of *C. connivens* and decline of *C. aspera* in the area) and Rame Bay (shift in the distribution of *C. tomentosa*) not any significant changes were recorded in Haapsalu Bay compared to previous investigations.

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Mändvetikate leviku muutused Lääne-Eesti suletud lahtedes

Kaire Torn ja Georg Martin

On antud ülevaade mändvetikate levikust Matsalu, Haapsalu ja Rame lahes. Uuritud lahtedes oli kõige sagedamini esinevaks mändvetikaks *Chara aspera*. Võrreldes varasemate andmetega oli *C. aspera* levikuala Matsalu lahes kahanenud. Samas lahes leiti esimest korda liiki *Chara connivens*. Haapsalu lahes ei olnud viimaste aastakümnete jooksul mändvetikate levikus olulisi muutusi toimunud. Rame lahes oli *Chara tomentosa* levikuala muutnud oma asukohta.