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Sampling and analyses of brackish water phytobenthic plant and animal communities in the Grepen area

A method study

Micke Borgiel, Sveriges Vattenekologer AB

April 2004

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Keywords: Forsmark, Analyses, Phytobenthos, SCUBA diving, Line transect, Sea, Sampling, Biomass.

This report concerns a study which was conducted for SKB. The conclusions and viewpoints presented in the report are those of the author and do not necessarily coincide with those of the client.

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Contents

1 Introduction

This document reports the methods and results from sampling and analyses of phytobenthic communities in sea within the Site Investigation programme at Forsmark. The activity is part of the surface ecosystem programme.

In August 2003, this SCUBA divers survey of the plant and animal communities of the vegetation covered substrates (i.e. the phytobenthos) in the vicinity of the candidate area was performed. The phytobenthic plant and animal communities of the Bothnian Sea may contribute to over half of the total production of the coastal zone /Kautsky and Kautsky, 1995/. The distribution and function of the phytobenthic plant and animal communities in the area is therefor of major importance for the understanding of processes within and in the vicinity of the candidate area.

Sampling and analyses of phytobenthic communities was performed at three stations Figure 1-2 and Table 4-1. Data are stored in the database at SKB (SICADA Forsmark field note 320).

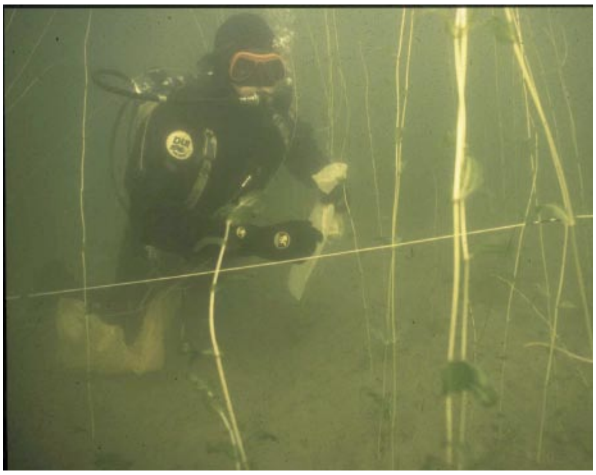

Figure 1-1. *Diver with quantitative 20x20 cm frame sample surronded with mixed growth of phanerogames (left). There is almost a complete lack of the blue mussel (Mytilus edulis) in the Forsmark area (right) (photos H Kautsky).*

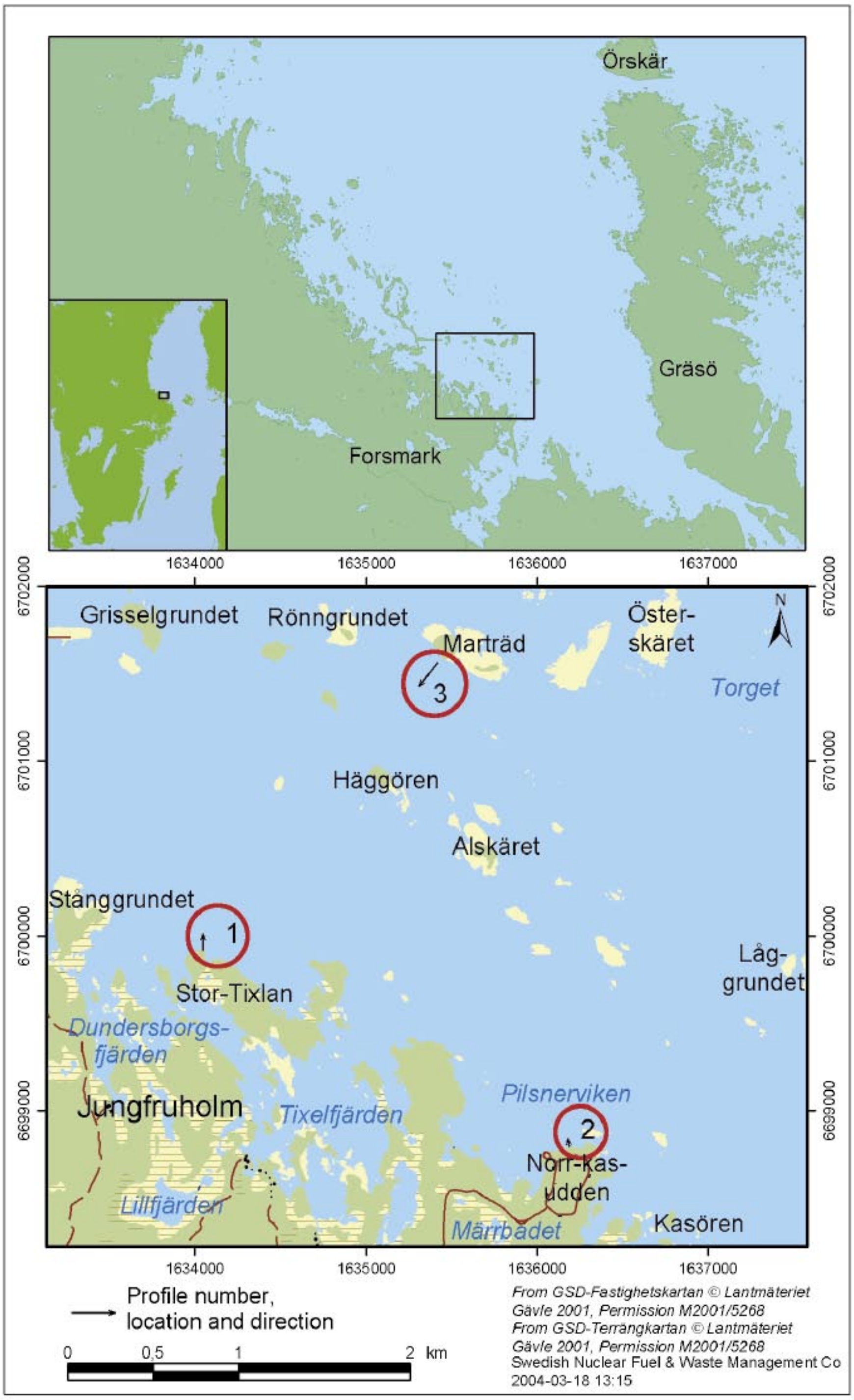

Figure 1-2. *Forsmark 2003. The investigated area. The stations are marked on the detailed map by a red ring. The stations are located at the starting point of the arrows (which indicate the general direction of the transect). For exact position and direction see Table 4-1.*

2 Objective and scope

The primary aim of this investigation was to test the suitability of the method to estimate the depth distribution, coverage and biomass of aquatic plant and animal communities within the Site Investigation programme at Forsmark.

The second aim was to characterise the plant and animal communities of the vegetation covered substrates in the Bothnian Sea. Sampling and analyses were performed at three stations in the vicinity of the candidate area (Figure 1-2).

Data describing the phytobenthic plant and animal communities in the Grepen area are essential for the modelling of the benthic ecosystem.

***Figure 2-1**. Luxuriant growth of bladder wrack (Fucus vesiculosus) is not so common in the Forsmark area, probably mainly due to lack of suitable substrate in the area (photo H Kautsky).*

3 Equipment and facilities

3.1 Description of equipment

Divers used a calibrated depth gauge with an average accuracy of +/– 0.1 m.

Sampling point positions were given from GPS with an average accuracy of +/– 0.5–1.0 m. Water depth from ship was measured using an echo sounder with accuracy of +/– 0.05 m. Divers samling gear and notepads are presented in Figure 3-1 and 3-2.

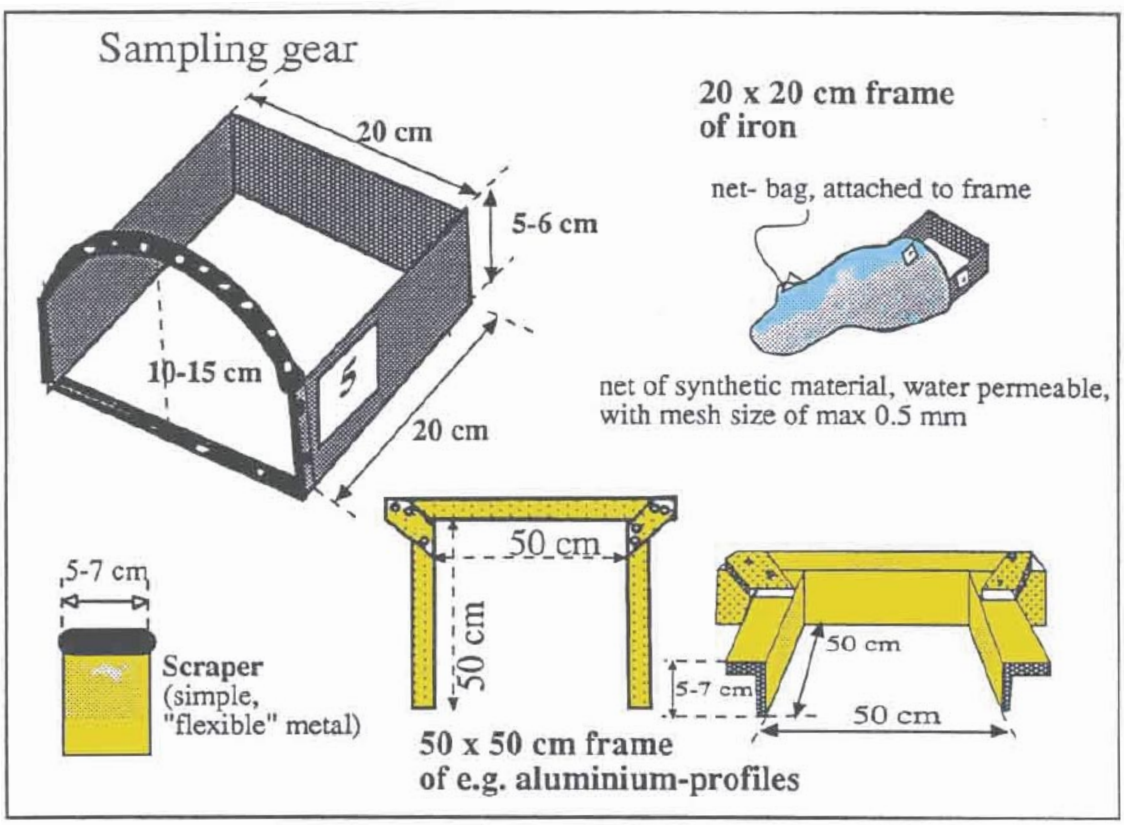

Figure 3-1. *Equipment used for taking quantitative samples in the phytobentic communities /from Kautsky, 1993/.*

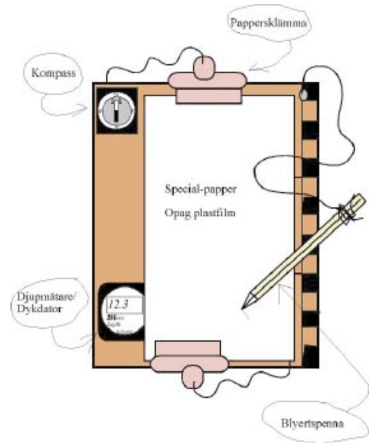

Figure 3-2. *Divers writingplate for notes equipped with compass and calibrated depth gauge.*

4 Performance

The method for sampling and measurements was in accordance with the national monitoring programme of the vegetation covered substrates of the Baltic Sea, run by the Swedish Environmental Protection Agency (Naturvårdsverket) /Kautsky, 1995a; Kautsky, 1999a; Kautsky, 1999b; Naturvårdsverket, 2000/ and HELCOM guidelines /Helcom, 1996/.

4.1 Number and location of stations

The number of stations (transects) was small in comparison to the area surveyed. Therefor, the locations of the stations were not randomly placed but chosen to present different parts of the whole area. The stations were placed and marked in advance on a navigation chart, so that two came close to the candidate area and another were placed at an adjacent island (station 3) (Figure 1-2). The exact position of the transects (no 1 and 2) was then determined using a handheld GPS (Garmin XL 45, +/– 0.5–1.0 m precision). The starting point of the transect no 3 from the island was determined from the boat at some 15 m from shore and a photo. The documentation of the position of each of the stations by GPS-coordinates, a photography of the site and marking in the map makes it possible to revisit the stations exactly (see Figure 1-2, Table 4-1). All the stations were sampled in mid August 2003.

Table 4-1. Forsmark 2003. The station name, position (GPS, RT 90-system), date of sampling, compass direction of divers transect and number of samples taken.

Station no	Name of station	Date	Position X	(GPS) Y	Compass	No of samples
1	Stor Tixlan	18/8	6699911	1634041	360	6
2	NV Storskäret	19/8	6698788	1636187	350	6
3	Ön Marträd	19/8	6701564	1635416	218	6

__Figure 4-1.__ Station no 1, Stor Tixlan. Diver marking starting point of transect (photo T Lindborg).

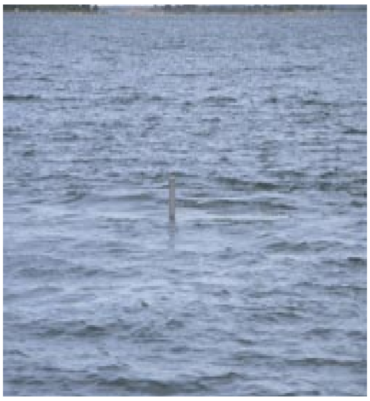

Figure 4-2. *Station no 2, NV Storskäret. GPS-equipment attached to the diver, used for logging transect position vs depth (photo T Lindborg).*

Figure 4-3. *Station no 3, Ön Marträd. Diver marking starting point of transect (photo T Lindborg).*

4.2 Presampling preparation

Before the activity started, the sampling epuipment and diving gear were checked

A field protocol was copied on plastic papers for field notes.

The GPS-units were calibrated at a special reference point in the area. The accurancy had to be within +/– 5 m to be accepted.

4.3 Field sampling

Divers swam along a meter marked line in a given compass direction. Within a 3–5 m wide zone at each side of the transect line (6–10 m width in total, depending on the visibility) the type of substrate and the siltation (loose sediment dust, see below) was described. Divers estimated the depth distribution and cover degree of the dominating and conspicuous species. The interval where the species occurred for the first and last time was determined by noting the distance from shore on the line (or starting point) and depth measured with a calibrated depth gauge. New notes were done as the diver observed any change, e.g. a new species, change in cover degree of the species or a change in substrate. The estimates were done continuously along the transect and not only at distinct intervals of distance nor in frames. Thus an area estimate was obtained describing the entire section. Special attention was made to find the deepest limit of *Fucus vesiculosus.* As different plants species (and *Mytilus edulis)* tend to occur in different distinct and limited depth zones, the estimates resulted in the establishment of vegetation belts along the transect line. The belts were named after the dominating species.

The cover degree of the macroscopic plants and the blue mussel *(Mytilus edulis)* was given in a seven-point scale: + for occurrence (single observation), 5, 10, 25, 50, 75 and 100% As species can overgrow each other, e.g. forming a canopy and a bottom layer, the sum of all the species cover degrees at a given site can be more than 100%. The epiphytes were estimated in the same way as the organisms directly attached on the substrate. The type of substrate was classified into rock, boulders, stones, gravel, sand, soft substrate and/or combinations of these. The siltation on the substrate and on the vegetation, which indicates e.g. water movement, was given in a four-point scale: 1=no silt; 2=small amount, 3=more/much- easily stirred by the hand, but settles after a short while; 4=heavily siltated – the sight of the diver is blurred for long time.

Quantitative samples were collected by tossing frames of the size 0.2x0.2 m (modified frame, see Appendix 3 photo no12) within the identified belts. The divers placed three frames at a given depth within the belt by throwing them haphazardly over the shoulder. The entire content within the frame was scraped into a bag attached to one open side of the frame. The samples were analysed by sorting each species separately and dried in 60 °C to constant weight (at least two weeks). The animals were also counted. If not otherwise stated in the text, biomass is given in g dry weight m^{-2}, including shells when present. In all, 18 quantitative samples were collected.

4.3.1 Deviation of sampling gear and biomass losses

The netbags attached to the 0.2x0.2 m iron frames used for taking the quantitative samles had a mesh size of 1.0 mm, which exceeds the recommended size of max 0.5 mm. This could have resulted in biomass losses of sample fractions close to and less than 1.0 mm in size.

Figure 4-4. *Divers preparing for dive at Station no 3, Ön Marträd (left) (photo T Lindborg). Diver collecting quantitative samples from boulders covered by red algae in the Forsmark area (right) (photo H Kautsky).*

4.4 Sample preparation for further analyses

After termination of the field activity, the samples were transferred to plastic bags, thoroughly marked and frozen for later sorting in lab. The samples were stored in a freezer container, packed transect by transect.

4.5 Data handling

After termination of the activity, the field/dive protocols were quality checked by the responsible diver. Data from diving measurements and estimates, as well as background data, will be incorporated in the database at SKB AB (SICADA).

4.5.1 Supplementary and background data

A current weather report for the sampling occasion, including strength and direction of the wind was also registered.

5 Results and discussion

5.1 Description of the diver transects

The stations are described in the order of the divers notes, from the deepest point of the transect towards the surface. Some photographs are given in Appendix 3. A copy of the divers protocols is given in Appendix 1. A table of the biomass of the quantitative samples is given in Appendix 2.

Figure 5-1. *Forsmark 2003. Station 3. Ön, Marträd. The captain of the diveboat tries to find a path throw the shallow waters to the island Marträd (photo T Lindborg).*

Figure 5-2. *Forsmark 2003. Station 2. NV Storskäret. The co-diver gets ready for another dive (photo T Lindborg).*

5.1.1 Station 1, Stor Tixlan

The station was visited 18 th August.The divers swam in 360° compass direction down to 7.3 m depth, 100 m from shore (Figure 5-3).

At 7.3 m depth, the flat substrate was sandy with gravel and a few small boulders. Loose partly decaying algae (probably *Furcellaria* and *Ceramium*) and few *Macoma*-shells were observed. On top of the small boulders grew short turfs of *Sphacelaria artica, Polysiphonia fucoides* and *Ceramium tenuicorne*. At 50 m from the shoreline the transect turned upwards into a slope of boulders. At the side of the boulders a rich growth of barnacles (*Balanus improvisus*) occurred. Also few blue mussels (*Mytilus edulis*) were observed. The red algae *Polysiphonia fucoides, Ceramium tenuicorne* and *Furcellaria lumbricalis* increased closer to the surface having their maximum coverage between 5.4 and 3.3 m depth. The bladder wrack (*Fucus vesiculosus*) was first observed at 4.5 m depth and then occurred scattered upwards up to 3.0 m depth where a dense *Fucus*-belt started. Between 3.0 and 2.4 m depth bladder wrack covered most of the substrate (50–75%). The *Fucus* individuals grew luxuriantly. Some of the *Fucus*-plants at 2.4 m depth had no bladders. The morphology of the *Fucus*-plants was both the broad thallus form common in the Baltic proper, and the more narrow form characteristic for the Bothnian Sea (as described e.g. by /Waern, 1952; Kautsky and Kautsky, 1995; Kautsky et al, 1992/). Also, the bryophyte *Fontinalis dalecarlica* occurred from 3.0 m depth. This moss is typical for the Gulf of Bothnia. /op cit Kautsky, 1989/. Waern /Waern, 1952/ described it as the Fontinalis-district. From 2.4 m depth the bladder wrack occurred scattered upwards up to 1.2 m depth. A narrow belt of phanerogames
(e.g. *Potamogeton pectinatus*, *Myriophyllum sp* and *Zannichellia palustre*) and the charophyte *Chara sp* grew from 2.4–1.2 m depth and covered 10 to 25% of the substrate. As the charophytes and phanerogames have roots they are dependent on finer fractions of the substrate (gravel or less). The substrate between 1.2 and 0.3 m depth was to 75% covered by *Cladophora glomerata.* The green alga *Enteromorpha sp* occured too. Just before the shoreline from 0.3 m depth, the bluegreen alga *Rivularia atra* occured in low numbers (5% coverage). The remaining substrate was empty.

Both the plant and animal biomass was fairly low, max 74 g and 19 g dry weight m^{-2} respectively (Figure 5-3, Table 5-1). The plant biomass was totally dominated by *Fucus vesiculosus* at the intermediate depths (2 to 2.5 m) with the max biomass 72 g of the total biomass of 74 g dry weight m^{-2}. In the deeper samples (4 to 4.5 m) perennial red algae dominated (mainly *Polysiphonia fucoides).* The biomass was of about the same magnitude as was found further north in the Bothnian Sea outside Norrsundet and Iggesund /Kaustky, 1992a; Kaustky, 1992b; Kaustky, 1995; Kautsky et al, 1988/.

The total animal biomass of 19 g dry weight m^{-2} at the intermediate depths of the transect (2 to 2.5 m) was dominated by herbivores (7 g) and detritivores (7 g). The fresh water snail *Bithynia tentaculata* dominated the herbivore biomass and the Baltic mussel *Macoma baltica* dominated the detritivore. Deeper down (4 to 4.5 m) the total animal biomass of 3 g dry weight m^{-2} was dominated by the herbivorous snail *Theodoxus fluviatilis*. Also, the animal biomass was in the same magnitude as found elsewhere in the Bothnian Sea /e.g. Kautsky et al, 1988/.

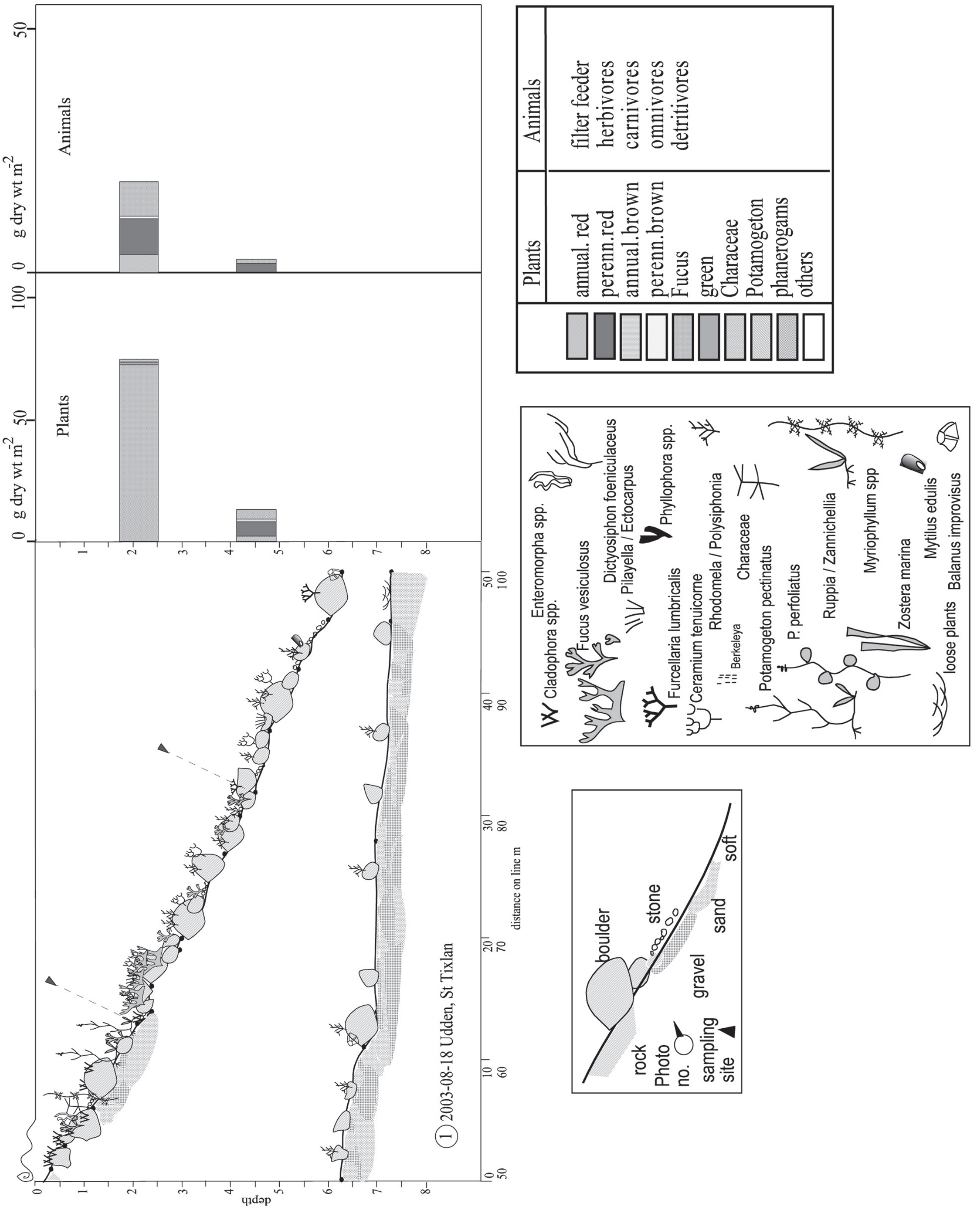

Figure 5-3. *Forsmark 2003. Station 1. Udden, Stora Tixlan. The depth distribution of the transect substrate and plant communities as well as plant and animal biomass.*

Table 5-1. The mean biomass (g dry weight/m2) and standard deviation of plant systematic/functional group and animal trophic group for each sampling depth of the station.

Year	2003		2003		2003		2003		2003		2003	
Station/Profile no.	1		1		2		2		3		3	
Depth	2,1		4,5		2,4		4,2		2,5		4,2	
Plant groups	**Mean**	**Stdev**	**Mean**	**Stdev**	**Mean**	**Stdev**	**Mean**	**Stdev**	**Mean**	**Stdev**	**Mean**	**Stdev**
bluegreen	0,073	0,083	0,135	0,118	0,199	0,199	0,002	0,001	0,110	0,058	0,001	0,001
annual red	0,303	0,314	2,127	1,594	0,120	0,128	0,024	0,040	1,084	0,530	0,688	0,080
perennial red	0,096	0,163	5,785	1,117	0,134	0,136	0,190	0,188	0,791	0,424	7,673	3,185
annual brown	0,104	0,053	1,182	0,710	0,856	0,415	0,831	1,222	2,963	1,576	0,087	0,057
perennial brown	0,000	0,001	0,370	0,170	0,020	0,034	0,167	0,171	0,090	0,090	0,404	0,253
Fucus vesiculosus	72,271	123,830	3,843	6,438	0,000	0,000	0,000	0,000	82,245	122,444	187,895	46,154
green	0,573	0,519	0,107	0,061	0,248	0,145	0,033	0,034	0,775	0,645	0,193	0,279
characeae	0,000	0,000	0,000	0,000	0,000	0,001	0,000	0,000	0,130	0,152	0,000	0,000
Potamogeton spp	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
Zostera	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
phanerogams	0,813	1,409	0,131	0,227	0,000	0,000	0,000	0,000	0,000	0,000	0,069	0,120
others	0,001	0,001	0,001	0,001	0,001	0,001	0,001	0,000	0,000	0,001	0,000	0,001
Sum Plants	***74,233***	***124,487***	***13,679***	***7,397***	***1,578***	***0,353***	***1,247***	***1,412***	***88,189***	***124,313***	***197,010***	***46,620***
Animal trophic groups	**Mean**	**Stdev**	**Mean**	**Stdev**	**Mean**	**Stdev**	**Mean**	**Stdev**	**Mean**	**Stdev**	**Mean**	**Stdev**
filter feeders	3,888	3,264	0,023	0,027	1,059	1,554	2,689	3,803	0,537	0,163	7,702	12,595
herbivores	7,155	6,865	1,947	0,671	1,526	1,084	1,726	0,938	3,741	4,471	8,977	4,198
carnivores	0,000	0,000	0,000	0,001	0,000	0,000	0,000	0,000	0,000	0,001	1,367	2,196
omnivores	0,519	0,831	0,040	0,068	0,006	0,010	0,000	0,000	0,217	0,236	0,233	0,166
detrivores	7,193	12,271	0,874	1,368	0,165	0,286	8,687	14,781	0,172	0,096	15,930	19,492
Mytilus edulis	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,001	0,000	0,000	0,000	0,000
Sum Animals	***18,755***	***20,087***	***2,884***	***1,871***	***2,756***	***2,429***	***13,103***	***13,311***	***4,667***	***4,643***	***34,209***	***38,380***

5.1.2 Station 2, NV Storskäret

The station was visited August the 19th. Divers swam in 350° compass direction, down to 7.0 m depth and 50 m from the shore (Figure 5-4).

The diver estimates started at 7 m depth on a greyish, silt-rich soft substrate with sand and small boulders. The sight was extremely poor (1–2 dm). On top of the small boulders the vegetation was sparse with only few individuals of the brown alga *Sphacelaria artica* and the red alga *Polysiphonia fucoides*. On hard substrates in the Bothnian Sea *Sphacelaria* often forms the lower limit of attached plants /Waern, 1952; Kautsky, 1989/. At the sides of the boulders a growth of barnacles (*Balanus improvisus*) occurred. The Baltic mussel *Macoma baltica* was also observed.

The transect soon became steeper upwards the share of boulders and gravel increased. *Polysiphonia fucoides* increased. At 5.1 m depth the first individuals of *Ceramium tenuicome* occurred and increased upwards to becoming dominating red alga for the remaining transect. At 2.4 m the deepest findingof the bladder wrack (*Fucus vesiculosus*) was made. Only a few individuals were observed along the entire transect and only the narrow form characteristic for the Bothnian Sea was found. The vegetation at this station was heavily overgrown by epithytes and diatoms. Closer to the shore, at 2.4 m depth, large amounts of the filamentous brown algae (*Pillayella/Ectocarpus*) and the filamentous green alga (*Cladophora glomerata*) occurred. Just before the shoreline, at 0.9 to 0.3 m depth these algae covered 100% of the boulder substrate. Small amouts of *Chorda filum*, *Enteromorpha sp* and *Rivularia atra* was also observed close to shore.

The plant biomass was very low with a max.1.6 g dry weight m^{-2}. The magnitude of the biomass was even much lower than was found in the northernmost part of the Bothnian Bay having 7 g m^{-2} on average but where biomass could be up to over 200 g m^{-2} in ice-sheltered areas /Foberg and Kautsky, 1992; Kautsky and Kautsky, 1995/. One of the reasons was the absence of a *Fucus*-belt, which occurred in the other investigated stations. At the quantitatively sampled depths (4.2 and 2.4 m depth) the annual brown algae (*Pillayella/Ectocarpus*) dominated
the biomass, 54 to 66% of total plant biomass for 4.2 and 2.4 m respectively (Figure 5-4, Table 5-1 and Appendix 2).

The animal biomass was fairly low (max 13 g dry weight m^{-2}). At intermediate depth of the transect (2 to 2.5 m) the animal biomass was low with a total of only 3 g dry weight m^{-2}. The biomass was dominated by the herbivorious snail *Theodoxus fluviatilis*. Deeper down, at 4 to 4.5 m depth, the total animal biomass of 13 g dry weight m^{-2} was dominated by the detrivorous Baltic mussel *Macoma baltica* (63% of total animal biomass.The filter feeders contributed with 20% of the total animal biomass, where the barnacle *Balanus improvisus,* alone, constituted 17% of the total animal biomass.

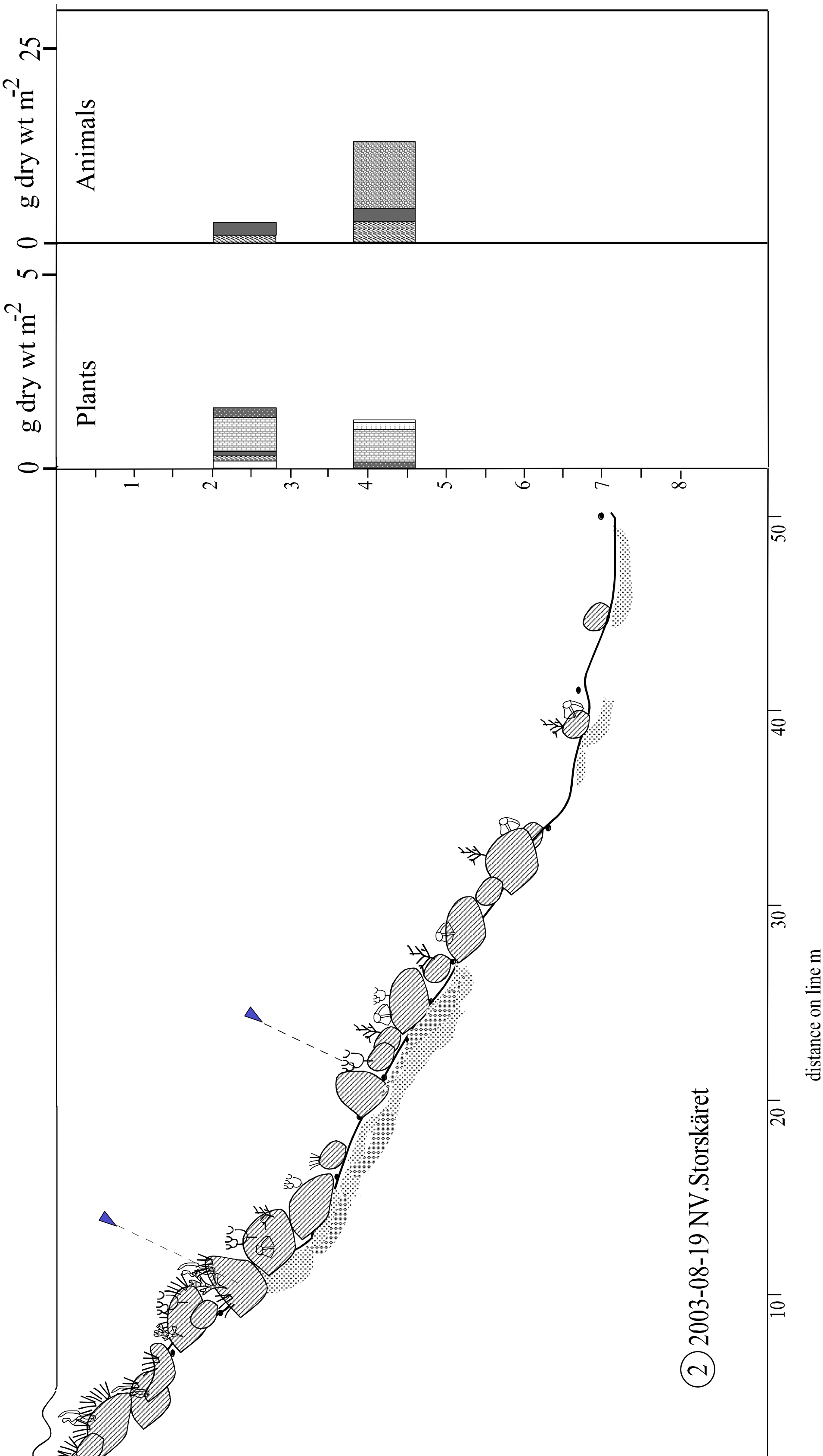

Figure 5-4. *Forsmark 2003. Station 2. NV. Storskäret. The depth distribution of the transect substrate and plant communities as well as plant and animal biomass. For the description of symbols, see legends of Figure 5-3.*

5.1.3 Station 3, Ön, Marträd

This island in the north part of the investigated area was visited 19 August. Divers swam in 218° compass direction, down to 9.7 m depth, 177 m from shore (Figure 5-5).

At 9.7 m depth there was a mixture of soft substrate with sand and small boulders. On several of the few scattered small boulders short turfs of *Sphacelaria artica* grew. The detritvorous Baltic mussel *Macoma baltica* were also observed. At 9.4 to 8.0 m depth red algae (*Polysiphonia fucoides, Furcellaria lumbricalis* and probably *Ceramium nodolosum*) were attached to the boulders and covered the substrate with 10 to 25%. The red algae increased towards the surface with their maximun coverage of 75% between 6.9 and 5.0 m depth, where the dominating red alga was *Polysiphonia fucoides.* The deepest growing bryophyte *Fontinalis dalecarlica* was found at 7.1 m depth. The bladder wrack (*Fucus vesiculosus*) occurred from 6.3 m depth. This was the deepest finding of bladder wrack in this survey. At Skörtena about 2.5 km NE of this Island, /Kautsky et al, 1999/ found *Fucus* down to 7.5 m depth. At Örskär, the northern tip of Gräsö, about 17 km NNE of this site, in 1944 Mats Waern found *Fucus* down to 10 m depth. The present observation and the observation from 1998 of *Fucus* growing at 6.3 to 7.1 m depth indicates the area being fairly unpolluted. On the station, *Fucus* was then present up to 1.0 m depth, with a maximum coverage of 75 to 100% between 3.8 and 3.2 m depth. Both the broad and narrow growing thallus form of *Fucus* appeared along the transect. Closer to the shore (4.3 m depth) *Chara sp* and phanerogames occurred (e.g. *Ruppia sp*). Closer to the surface *Chara sp* and the phanerogames increased, and from about 3.5 m depth, *Ruppia sp*, *Potamogeton perfoliatus*, *P pectinatus*, *Zannichellia palustre* and *Myriophyllum sp* covered 10 to 25% of the substrate. At 3.9 m depth the *Chara sp* grew densely in few scattered plots with coverage up to 25%. Just before the shoreline from 1.0 m depth, large amounts of the green alga *Cladophora glomerata* and the annual brown algae *Pilayella/lEctocarpus* occurred. The transect made a rich and beautiful impression.

This station had the highest plant biomass found in this survey. The plant biomass was totally dominated by *Fucus vesiculosus*. At the intermediate depths, between 2 and 2.5 m, *Fucus* biomass contributed with 82 g (93%) to the total of 88 g dry weight m^{-2}. Apart from *Fucus*, the annual brown algae *Pilayella/lEctocarpus* were the dominating algae followed by the annual red alga *Ceramium tenuicorne* (Figure 5-5, Table 5-1 and Appendix 2). In the deeper samples (4 to 4.5m) the biomass of *Fucus* was 188 g (95%) of a total of 197 g dry weight m^{-2}, followed by mainly the two perennial red algae *Polysiphonia fucoides* and *Furcellaria lumbricalis* with a biomass of 4.5 g and 3.1 g dry weight m^{-2}, respectively. However, this was only 4% of the total plant biomass at that depth.

The animal biomass was low at the intermediate depths of the transect (2 to 2.5 m). The total animal biomass was only 4.7 g dry weight m^{-2}. The total biomass was totally dominated by herbivores, which contributed with 79% (3.7 g dry weight m^{-2}). The herbivorous snail *Theodoxus fluviatilis* alone was 89% of the herbivore biomass. Deeper down (4 to 4.5 m) the animal biomass of 34 g dry weight m^{-2} was the highest recorded in this survey. The biomass was dominated by the detritivorous Baltic mussel *Macoma baltica* (14 g) followed by the herbivorous snail *Theodoxus fluviatilis* (8.6 g) and the filter feeder *Cerastoderma/Cardium sp* (7.7 g) (Figure 5-5, Table 5-1 and Appendix 2).

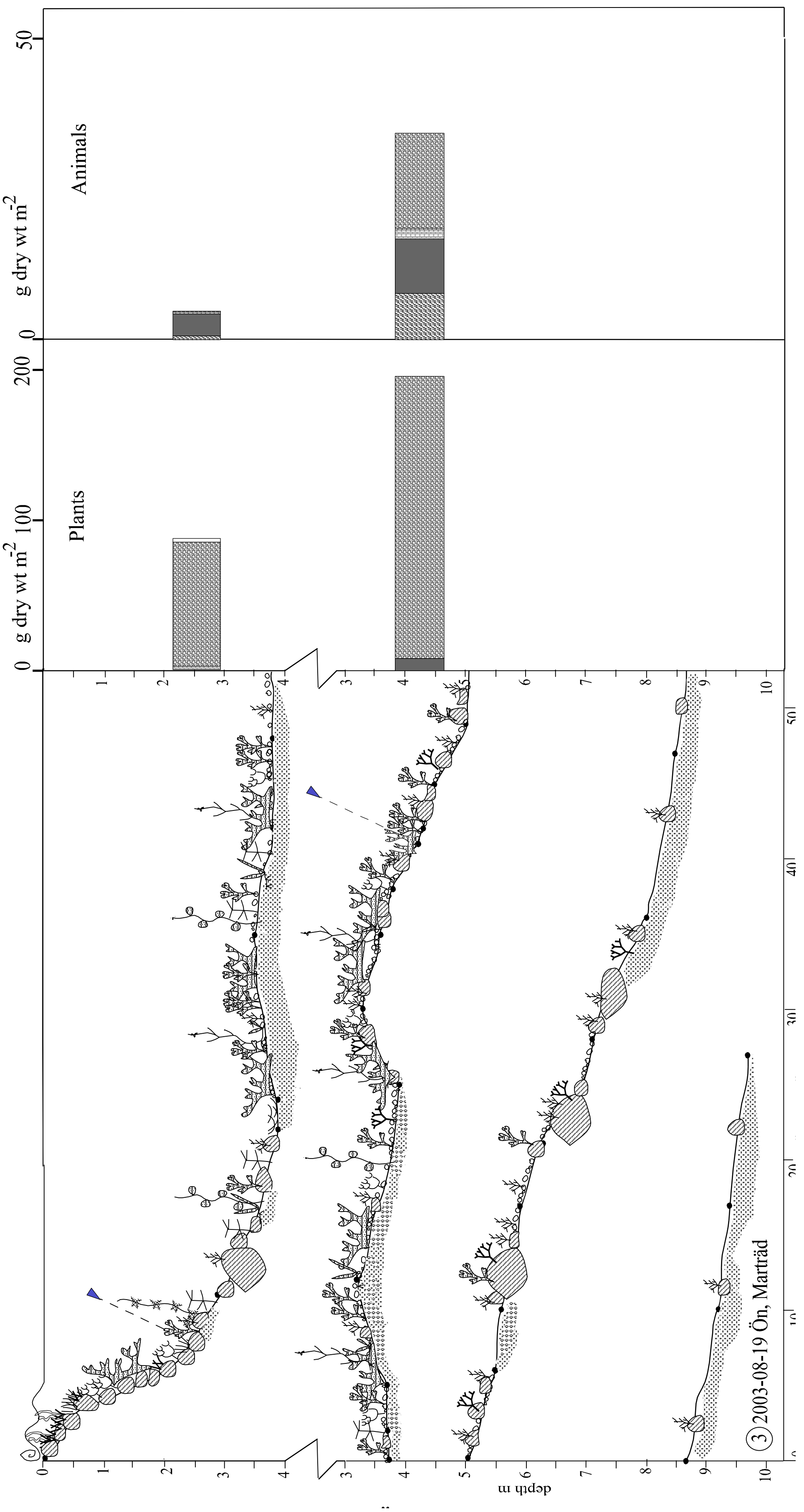

Figure 5-5. *Forsmark 2003. Station 3.Ön, Marträd. The depth distribution of the transect substrate and plant communities as well as plant and animal biomass. For the description of symbols, see legends of Figure 5-3.*

5.2 Comparison with areas nearby

In nearby areas at least four earlier surveys of the phytobentic communities were performed during the last 50 years /i.e. Waern 1952; Kautsky et al, 1984; Kautsky et al, 1998; Eriksson et al, 1998/. In the vicinity of the Forsmark area quantitative data have been collected in the eastern Gräsö–Singö area in the 1940s /Waern, 1952/ and at a revisit of Waerns stations in 1984 /Kautsky, 1989; Kautsky et al, 1986/. The area around SFR was investigated recently where a survey of five stations was performed in the year 1998 /Kautsky et al, 1999/. When comparing our results with the findings of the 1980s and 1990s (Figure 5-6 and 5-7), the mean biomass (Figure 5-8) was much lower at 2 to 2.5 m depth as well as 4 to 4.5 m depth than what was found in the Gräsö–Singö area and considerable lower at 2 to 2.5 m depth found in the SFR area. At 4 to 4.5 m depth the max biomass values were about the same (Figure 5-7 and 5-8). The main reason for the low biomass found in this investigation was the absence of *Fucus vesiculosus*. This was most probably due to the lack of suitable substrate in the area in combination with low salinity along the coast due to freshwater outlets from nearby lakes and streams. Results from the area partly indicated a rich growth of *Fucus* especially on hard substrates at the station 3, on the island Marträd, about 2 km ashore. Here, we found biomass close to those observed at the Station no 5, on the island of Skörtena, which was visited in the year 1999. On Skörtena the mean biomass was around 126 g at 3 m depth. In this study biomass was between 82 and 188 g dry weigth m^{-2} at 2 and 4 m depth, respectively. The unstable substrate of small boulders, stones, gravel and sand dominated in the area and in combination with low salinity probably decreased the biomass. Except for *Fucus,* the annual brown alga *Pilayella littoralis* (Figure 5-8, Table 5-1) dominated between 2 and 2.5 m depth and the perennial red alga *Polysiphonia fucoides* (Figure 5-8, Table 5-1) dominated between 4 and 4.5 m depth. In the Gräsö–Singö area the annual brown alga *Pilayella littoralis* (Figure 5-6) and in the SFR area the red algae (Figure 5-7) dominated between 1 and 6 m depth. The difference in species composition is most probably an effect of the different parts of the year the compared investigations were done. The survey in the Gräsö area from the year 1983 was performed in June–July when annual brown algae usually are more common. The SFR area was visited in August when the annual brown algae usually have detached from the substrate and are replaced by green algae close to the surface and red algae deeper down. However, excluding *Fucus,* at given depths the overall plant biomass found in this survey was lower than in the two earlier investigations of the nearby areas.

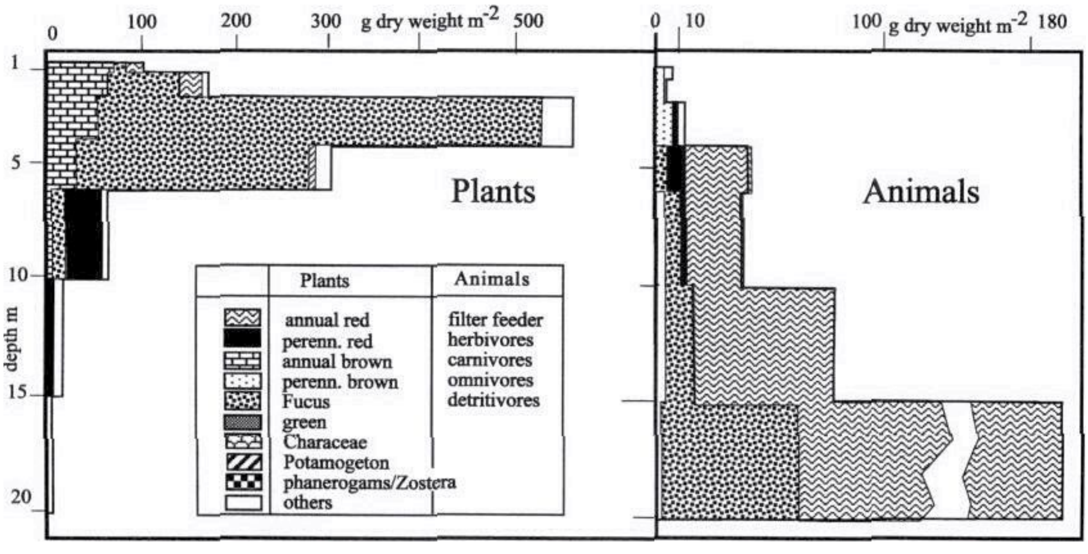

***Figure 5-6.** The total plant and animal biomass distribution of the Gräsö–Singö area /from Kautsky, 1989/.*

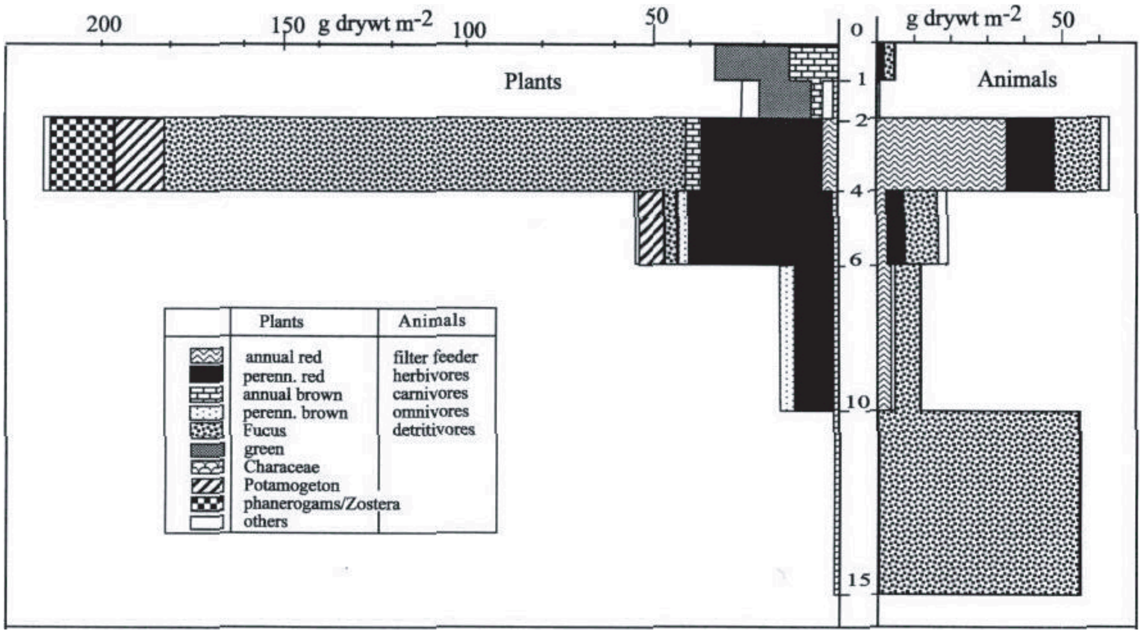

Figure 5-7. SFR area, Forsmark 1998. The total plant and animal biomass depth distribution of the investigated area /from Kautsky et al, 1999/.

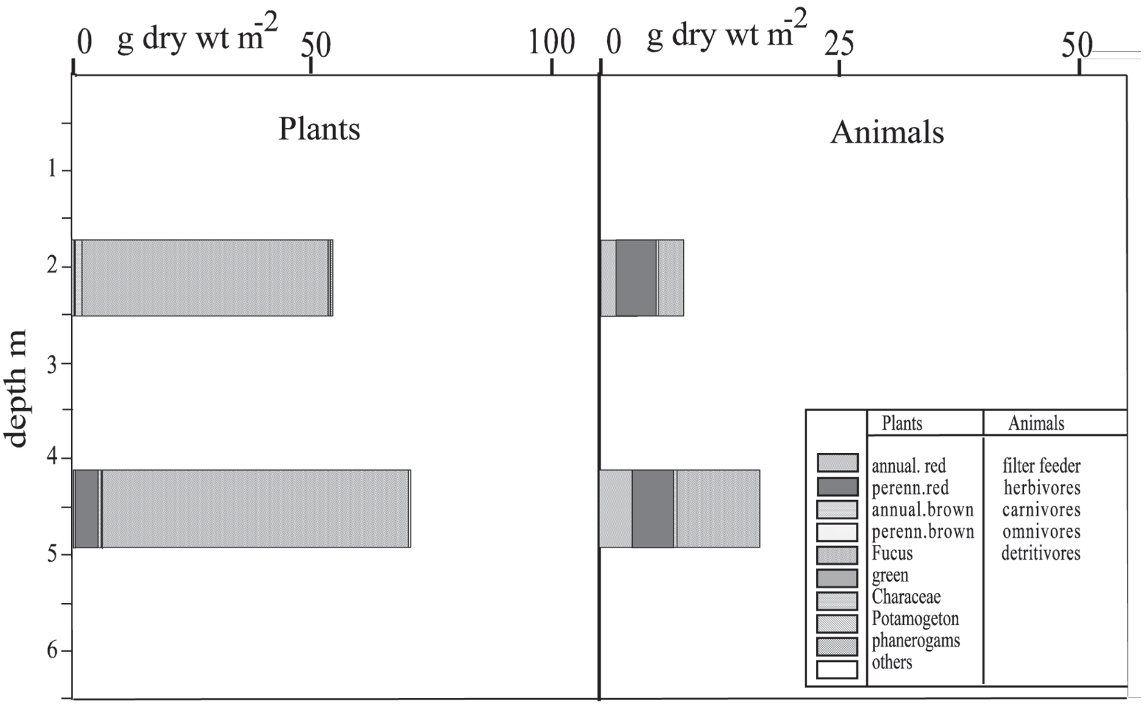

Figure 5-8. Forsmark area 2003. The total plant and animal biomass depth distribution of the investigated area.

The animal biomass at the deeper sites (4.5 m depth) of the Grasö–Singö area (Figure 5-6) was higher than that of the Forsmark area (Figure 5-8) and the SFR area (Figure 5-7). This is due to the almost complete lack of the blue mussel *Mytilus edulis* in the Forsmark area having a maximal mean biomass of less than 1 g dry weight m^{-2} and 1 g in the SFR area (including shells), which is very low in comparison to what is usually found further south, in the Baltic Sea. The nearly complete lack of *Mytilus edulis* might also be due to the low occurrence of stable substrates and low salinity along the cost. However, this is well in accordance with results from other areas in the Bothnian Sea /Kautsky, 1989; Kautsky, 1995b/. As this major filter feeder is lacking in the area and no other species takes its role in the ecosystem, the function is somewhat different in the area compared to the Baltic proper where the filterfeeders (i.e. *Mytilus)* constitute up to 90% of the total animal biomass. The biomass of other animals is of about the same magnitude as those found in the Grasö–Singö and SFR area.

It must be pointed out that only three stations were visited the year 2003 in a relatively wide area and only six quantitative samples per station were taken in two strata on each station, compared with 5 stations and total 54 quantitative samples 1999 and in a geographically smaller area. Due to the low number of replicates the standard deviation is high, and the comparison with the other investigations has no statistical significance. However the prime aim was to test if the method was suitable to estimating the biomass and distribution of aquatic plant and animal communities within the Site Investigation programme at Forsmark. The method is used in the national monitoring programme since 1989 and there is national and international reference data avaible. The metod has been used sice the year 1974 in the Baltic sea /see e.g. Jansson and Kautsky, 1977; Kautsky 1989; Kautsky and Kautsky, 1995/. The Swedish EPA and HELCOM Guidelines recommends the method as standard method. The method is also recommended for soft substrates /Tobiasson, 2001/ which is an advantage in the candidate area, which also has vast areas of soft substrate brackish water bays. The metod has also been used to some extent to characterize aquatic plant and animal communities in lakes.

Figure 5-9. *Happy diver after the final transect dive (photo T Lindborg).*

6 References

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Appendix 1

Copy of the divers protocols

The following is a direct copy of the protocol the divers wrote below the water surface. It is in Swedish.

PRIMÄRPROTOKOLL DYKPROFILER.

Nedan följer en avskrift av dykprotokollen. Varje observation föregås av notis om avstånd från land och djup (t.ex. 30:14.2 betyder 30 m från land och 14.2 meter djupt). Fotografier togs under vatten, vilket indikeras med F samt hur många bilder det togs om fler än en (t.ex. Fx2 betyder två fotografier). I vissa fall har arterna justerats efter genomgång på lab. Dykningarna gjordes från djupaste observerade algförekomst upp mot ytan.

Dykprofil 1 . Udden, Stor Tixlan

Startpos 60° 23' 695" Nord x 18° 14' 204" Ost. Bäring 360°. Datum 2003-08-18, kl ca 15.00. Vattentemp: - Vattenstånd: - . Dykare: Micke Borgiel, Roger Huononen. Not: Mycket dålig sikt.

100:7,3 Sand/grus sed2, tomt, F, lösdrivande alger (Furcellaria, Ceramium.ten)+, macoma+.

96:7,3 Litet block, F, Sphacelria(?) +.

87:7,3 Små block +/5, Cer.t/Poly.nigr 5 på block.

78:7,0 Små block +/5, Cer.t/Sphacelaria 5 på block.

64:7,0 Större block, F, På block Poly.nigr 5-10, sed 2, Balanus 5, Sphacelaria+.

61:6,7 Block små 10, På block Poly.nigr 10, F, Macoma 5, på botten.

50:6,3 Sten/block botten. Balanus 5, F, Poly.nigr 5, Sphacelaria 5.

49:6,3 Block/sten botten, Furcellaria 5, Cer.ten 5, Poly.nigr 5.

46:6,0 F, Block, Poly.nigr 10, Bal 5, sed2, Myt 5, Laomedea+.

42:5,4 Blockbotten, Poly.nigr/röda (Cer.ten) 50, Bal 5, F, Pil 5.

37:4,8 Rödalger 25-50, F, Poly.nigr, Cer.ten.

32:4,5 **Första Fucus (ca 10 cm),** Block, F, Furcellaria 5, Cer.t 5, Pil 5, Poly.nigr 25-50, Rödalger tot ca 50. **Ram 6,** F, Fucus 10, Röda 50. **Ram 3** Röda 25, F. **Ram 2** (på block) Röda 50,F.

30:4.2 Fucus 5, Cer.t /Poly.nigr 25-<u>50</u>, Bal 5, (mkt diatoméer), F.

27:3,9 Röda 25-<u>50</u>, Block /sten, smalbålig Fucus 5.

22:3,3 F, Fucus 5, Chorda +, Röda 25-<u>50</u>, Macoma 5.

20:3,0 Fucus 10, Röda 25.

19:3.0 Fucusbältet börjar, Fx4 (Fucus + Pilayella), Fucus 50-<u>75</u>, Pil 10, Cer.ten 25, Ent +, Fontinalis+.

16:2,4 Fucus <u>75</u>-50 (utan blåsor), Fx4 (Fucus+Fontinalis), Pil/Clad 10, Cer.ten 10, Poly.nigr 5-10, Ent 5.

14:2,4 Fucusbältet slut, F, Fucus 5, Fontinalis 5, Clad 25, Pot.pect 5.

13:2,1 **Ram 5** Clad 25, F, **Ram 1** Clad 25, F, **Ram 4** Fucus 25.

13:2,1 Fucus 5, Pot.pect 10-25, F, Ent 5, Clad 25, Rivularia 5, Balanus 5, Macoma 5, Fontinalis 5, Myriophyllum +, Zanichellia +, Chara +, Fx4, F (Rivularia).

6:1,2 Clad 50-<u>75</u>, Fucus <u>5</u>-10, Ent 5, F, Block.

3:0,6 Clad 75, Ent 5, F.

1:0,3 Tomt, Rivularia 5, F.

Dykprofil 2 . NV. Storskäret

Startpos 60° 23' 048" Nord x 18° 16' 491" Ost. Bäring 350°. Datum 2003-08-19, kl 11.45. Vattentemp: - Vattenstånd: - . Dykare: Micke Borgiel, Roger Huononen. Not. Mycket dålig sikt.

50:7,0 Sand/lerbotten med enstaka, små block 5, F. På block Sphacelaria 10, Macoma 5, Sediment 2.

41:6,7 Som ovan, F, men Poly.nigr + på små block, Balanus 5.

34:6,3 F, Blockbotten börjar, Laomedea 5, Poly.nigr <u>5</u>-10, Bal 5, Sphace 5. (Skiss)

31:5,7 Fx2, Blockbotten, Poly.nigr <u>5</u>-10, Sphace 10, Bal 5, Electra 5.

27:5,1 Sand/grusbotten med block 10, På block Bal 5, Poly.nigr <u>5</u>-10, Sphace 5, Cer.ten 5, F.

25:4,8 På block Cer.ten 10, Poly.nigr 5, Bal 5, Laomedea 5, Sed 2, Sphace 5. På sand/grusbotten Macoma 5, Cardium 5.

23:4,5 Fx2, Poly.nigr 5-<u>10</u>, på block, Cer.ten 10, Bal 5.

21:4,2 **Ram 1**: F, Poly.nigr/Cer.ten 25-<u>50</u>, på block. **Ram 2**: F, Poly.nigr/Cer.ten 10, på block. **Ram 3**: F, Poly.nigr 5 på sten/grusbotten.

19:3,9 Sand/grusbotten, Block 5, på block Pilayella (ludd) 5, Sphacelaria 5, Cer.ten? 5.

16:3,6 Sandbotten, Fx2 (Roger).

13:3,3 Sandbotten med block. På block, F, Bal 5, Cer.ten 10-<u>25</u>, Poly.nigr 5.

11:2,4 Stort block, F**, Första Fucus**, (ca 7cm hög, mkt påväxt), Fucus (smalbålig) 5, Bal 5, Ent 5, Pilayella/(Clad) (ludd) 50-75.

10:2,4 **Ram 6**: F, (2,4m), Pil 75, **Ram 5**: F, (2.1m) Pil 75, **Ram 4**: F, (2.7 m) Pil 25.

9:2,1 Stora block, Pilayella/Clad “ludd” (Cer.ten?) 50-75, Ent 5, Fucus +, F.

7:1,5 Ent 5-10, Rivularia 5, Pil/Clad 75, F, Chorda 5.

4:0,9 Chorda 5-10, Ent 5, Pil/Clad 75-100, F.

2:0,3 Pilayella 100-75, Clad 25-10, Fx4 (med fisk), Rivularia 5, Chorda 5.

Dykprofil 3 . Ön, Marträd

Startpos 60° 24' 557'' Nord x 18° 15' 766'' Ost. Bäring 218°. Datum 2003-08-19, kl -.

Vattentemp: - Vattenstånd: - . Dykare: Micke Borgiel, Roger Huononen.

Not: Dykdator ger ej djup. Pardykare hämtar reservdjupmätare i båt. Därför endast avstånd från land angett tom 91 m. Däremellan endast sporadiska djupangivelser. Botten dock jämn svagt lutande. Bra sikt.

177: 9,7 Ler/sand-botten, Block +. På block Sphacelaria 25, F, Tomt 75-100, Macoma 5.

167: 9,4 Block 5. På block Poly.nigr 5, Sphace 5, Furc +.

160: 9,2 F, Block 10. På block Sphace 10-25, Cer.ten? 25, Poly.nigr 5.

147: 8,5 Sphace 10, Poly.nigr 5-10, Furc 5, Cer.rubrum? 10.

136: 8,0 Samma som ovan.

132: 7,5 Block/stenbotten, Röda 50, Furcellaria 5-10, F.

128: 7,1 Som ovan men Fontinalis 5.

124: 6,9 (Skiss) Röda 50-75, Sphacelaria 5, Furcellaria 5-10.

121: 6,3 **Första Fucus** ,ca 4 cm hög, Fx2.

117: 5,9 Röda (Poly.nigr?) 50-75, Fucus 5, Furcellaria 5, Fontinalis 5.

110: 5,6 Sand/grusbotten tomt.

106: 5,5 Små block/sten, Röda 50-75.

99: 5,0 Fucusbältet börjar, F, Fucus 10, Röda 50.

95: 4,5 Fucus 25-50 (bred+smal), Röda 25-50, Furc +, Chorda +.

92: 43 Fucus 50-75, Dictyosiphon 5, Röda 10-25, Furc 5, Fx2, Chara 5, Ruppia 5.

91: 4,2 **Ram 1**: Fucus 75, F. **Ram 2** Fucus 75, F. **Ram 3**: Fucus 25-50, F.

88: 3,8 Fucus 75, Röda 50 (Cer.ten), Fontinalis 5, Furcellaria 5.

85: 3,6 Fucus 75-100, Röda 25, Pot.pect 10, Fx3.

80: 3,3 Fucus 50-75, annars som ovan.

75: 3,9 Sand/sten/grus. Fucus 50, Pot.pect 5, Pot.perfol 5, Furcellaria 5, Röda (Poly.nigr (Cer.rubr ?)) 25-50, Ruppia 5, Chorda 5, mkt lös Fucus.

62: 3,2 Fucus 75, Pot.pect 10, Röda 10-25, Fx2 (Roger).

55:3,7 Fucus 25, Röda 25, Chara 5, Ruppia 5, Chorda 5.

52:3,7 Fucus 10, Chara 10, Röda 25, Sten/sand, F, Ruppia 5, Chorda 5, Pot.perfol +.

48:3,8 Fucus 50, Fontinalis +, Röda (Cer.ten) 25, Ruppia 5, Pot.pect 5, Pot.perfol 5.

42:3,8 Fucus 10, Pot.perfol 10, Pot.pect 10, Chara 10-25, Ruppia 10-5, F.

35:3,5 Fucus 75, Röda 25, Pot.pect 10.

24:3,9 Lös Fucus 50-75, på sandbotten, Zanichellia 5, Pot.pect 10.

22:3,9 Block små börjar, Fucus 10, Chara 25, Ruppia 5-10, Pot.perfol 5-10, Röda 10-25.

11:2,9 Som ovan, Myriophyllum +.

8:2,5 **Ram 6**: F, Pilayella 75, **Ram 5**: F, Pilayella 50, **Ram 4**: F, Fucus 25.

7:2,3 Skiss, Fucus 25-50, Pil/Clad 10 , Cer.ten 50, F.

4:1,0 Pil/Clad 75, Cer.ten 10, Rivularia +.

3:0,5 Clad 75, Cer.ten 5, Ent 5.

2:0,3 Clad 75, Ent 25.

Appendix 2

Primary data with mean and standard deviation of each sampling depth

Primary data from quantitative sampling. Biomass given in g dry weight m^{-2}

Year	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003
Sample no.	1	2	3	1-3.	1-3.	4	5	6	4-6.	4-6.	7	8	9	7-9.	7-9.
Profile no.	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2
Frame no.	5	1	4	1.4.5	1.4.5	2	3	6	2.3.6	2.3.6	5	4	6	5.4.6	5.4.6
Depth	2,1	2,1	2,1	2,1	2,1	4,5	4,5	4,5	4,5	4,5	2,1	2,7	2,4	2,4	2,4
				Mean	**Stdev**				**Mean**	**Stdev**				**Mean**	**Stdev**
BLUEGREEN	0	0	0,001	0,0003	0,0006	0,001	0,2275	0,1725	0,1337	0,1181	0		0	0,0000	0,0000
Calothrix	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000		0	0	0,0000	0,0000
Rivularia atra	0,0525	0,165	0,001	0,0728	0,0839	0,001	0,001	0,001	0,0010	0,0000	0,415	0,16	0,0225	0,1992	0,1992
Nostoc sp.	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Spirulina sp.	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
RED	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
red spp.	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Ahnfeltia plicata	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Rhodochorton purpureum	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Hildenbrandia rubra (spp.)	0,001	0,001	0,001	0,0010	0,0000	0,001	0,001	0,001	0,0010	0,0000	0	0	0	0,0000	0,0000
Phyllophora spp.	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Coccotylus truncatus	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Phyllophora pseudoceranoides	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Furcellaria lumbricalis	0	0	0	0,0000	0,0000	0,075	0,7075	0,08	0,2875	0,3637	0	0	0	0,0000	0,0000
Polyides rotundus	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Aglaothamnion roseum	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Ceramium spp.	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Ceramium nodolosum	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0,27	0	0,0900	0,1559
Ceramium tenuicorne	0,6625	0,0875	0,1575	0,3025	0,3137	0,2875	2,975	3,1175	2,1267	1,5944	0,05	0,2675	0,0425	0,1200	0,1278
Polysiphonia spp.	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Polysiphonia fucoides	0,2825	0	0,001	0,0945	0,1628	6,8875	4,9425	4,66	5,4967	1,2128	0	0,001	0,13	0,0437	0,0748
Polysiphonia fibrillosa	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Polysiphonia elongata	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Polysiphonia stricta	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Rhodomela conferviodes	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
BROWN	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Dictyosiphon chordaria	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Dictyosiphon foeniculaceus	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Dictyosiphon/Stictyo.	0	0	0	0,0000	0,0000	0,09	0	0	0,0300	0,0520	0	0,1475	0	0,0492	0,0852
Stictyosiphon tortilis	0,1475	0,0425	0	0,0633	0,0759	0	0,9425	1,18	0,7075	0,6241	0	0	0,145	0,0483	0,0837
Pilayella littoralis	0	0,001	0,1175	0,0395	0,0676	0	0,3925	0,6225	0,3383	0,3148	0	0	0	0,0000	0,0000
Ectocarpus siliculosus	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Pilayella/Ectocarpus	0	0	0	0,0000	0,0000	0,3175	0	0	0,1058	0,1833	0,6125	0,4725	1,19	0,7583	0,3803
Elachista fucicola	0	0,001	0,001	0,0007	0,0006	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Eudesme virescens	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Leathesia difformis	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Pseudolithoderma spp.	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Scytosiphon lomentaria	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000

Primary data from quantitative sampling. Biomass given in g dry weight m^{-2}

Year	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003
Sample no.	1	2	3	1-3.	1-3.	4	5	6	4-6.	4-6.	7	8	9	7-9.	7-9.
Profile no.	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2
Frame no.	5	1	4	1.4.5	1.4.5	2	3	6	2.3.6	2.3.6	5	4	6	5.4.6	5.4.6
Depth	2,1	2,1	2,1	2,1	2,1	4,5	4,5	4,5	4,5	4,5	2,1	2,7	2,4	2,4	2,4
				Mean	**Stdev**				**Mean**	**Stdev**				**Mean**	**Stdev**
Sphacelaria spp.	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Sphacelaria arctica	0,001	0	0	0,0003	0,0006	0,175	0,485	0,45	0,3700	0,1698	0,001	0	0,06	0,0203	0,0344
Sphacelaria plumigera	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Sphacelaria radicans	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Chorda filum	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Halosiphon tomentosus	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Fucus serratus	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Fucus vesiculosus	0	1,5575	215,255	72,2708	123,8304	0	0,2525	11,275	3,8425	6,4380	0	0	0	0,0000	0,0000
VAUCHERIALES	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Vaucheria spp	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Vaucheria dicotoma	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
GREEN	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
green spp	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Spirogyra spp.	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Characeae	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Chara aspera	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Chara baltica	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Chara tomentosa	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Chara sp.	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0,001	0	0,0003	0,0006
Nitella flexilis	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Tolypella nidifica	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Acrosiphonia centralis	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Blidingia minima	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Enteromorpha spp.	0,2625	0	0,001	0,0878	0,1513	0	0	0	0,0000	0,0000	0	0,0675	0	0,0225	0,0390
Enteromorpha clatrata	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Enteromorpha compressa	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Enteromorpha prolifera	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Enteromorpha intestinalis	0	0,1725	0	0,0575	0,0996	0	0,0525	0,035	0,0292	0,0267	0,1	0,3225	0,255	0,2258	0,1141
Monostroma balticum	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Spongomorpha aeruginosa (S.pallida)	0,18	0,5275	0	0,2358	0,2681	0,0475	0	0	0,0158	0,0274	0	0	0	0,0000	0,0000
Ulothrix spp.	0	0	0	0,0000	0,0000	0,001	0,001	0	0,0007	0,0006	0	0	0	0,0000	0,0000
Cladophora spp.	0	0,001	0,001	0,0007	0,0006	0	0	0,0575	0,0192	0,0332	0	0	0	0,0000	0,0000
Cladophora aegagrophila	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Cladophora fracta	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Cladophora glomerata	0,5725	0	0	0,1908	0,3305	0,125	0,001	0	0,0420	0,0719	0	0	0	0,0000	0,0000
Cladophora rupestris	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Prasiola spp.	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Chaetomorpha spp.(linum)	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000

Primary data from quantitative sampling. Biomass given in g dry weight m^{-2}

Year	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003
Sample no.	1	2	3	1-3.	1-3.	4	5	6	4-6.	4-6.	7	8	9	7-9.	7-9.
Profile no.	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2
Frame no.	5	1	4	1.4.5	1.4.5	2	3	6	2.3.6	2.3.6	5	4	6	5.4.6	5.4.6
Depth	2,1	2,1	2,1	2,1	2,1	4,5	4,5	4,5	4,5	4,5	2,1	2,7	2,4	2,4	2,4
				Mean	**Stdev**				**Mean**	**Stdev**				**Mean**	**Stdev**
DIATOMEA	0,001	0,001	0	0,0007	0,0006	0	0,001	0,001	0,0007	0,0006	0	0,001	0,001	0,0007	0,0006
Berkeleya rutilans	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
BRYOPHYTA	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Drepanoclaudus spp	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Fontinalis dalecarlica	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Fontinalis.spp.	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Isoetes lacustris	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
PHANEROGAMS	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Callitriche spp	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
C.automnale	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Crassula aquatica	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Scirpus acicularis	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Elodea canadensis	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Limosella aquatica	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Myriphyllum alternipholum	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Myriphyllum spicatum	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
sp	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Potamogeton spp.	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Potamogeton filiformis	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Potamogeton gramineus	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Potamogeton natans	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Potamogeton pectinatus	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Potamogeton perfoliatus	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Potamogeton pucillus	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Potamogeton panormitans	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Ranunculus spp.	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Ranunculus baudotii	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Ranunculus circinatus	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Ranunculus reptans	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Ruppia spp.	0	0	0	0,0000	0,0000	0	0	0,3925	0,1308	0,2266	0	0	0	0,0000	0,0000
Ruppia spiralis	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Ruppia maritima	0	0	2,44	0,8133	1,4087	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Subularia aquatica	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Zannichellia spp.	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Zannichellia major	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Zannichellia palustris	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Zostera marina	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
sum PLANTS	***2,163***	***2,5575***	***217,98***	***74,2325***	***124,4865***	***8,009***	***10,983***	***22,046***	***13,6790***	***7,3966***	***1,1785***	***1,7105***	***1,846***	***1,5783***	***0,3528***

Primary data from quantitative sampling. Biomass given in g dry weight m^{-2}

Year	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003
Sample no.	1	2	3	1-3.	1-3.	4	5	6	4-6.	4-6.	7	8	9	7-9.	7-9.
Profile no.	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2
Frame no.	5	1	4	1.4.5	1.4.5	2	3	6	2.3.6	2.3.6	5	4	6	5.4.6	5.4.6
Depth	2,1	2,1	2,1	2,1	2,1	4,5	4,5	4,5	4,5	4,5	2,1	2,7	2,4	2,4	2,4
				Mean	**Stdev**				**Mean**	**Stdev**				**Mean**	**Stdev**
ANIMALS	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Ephydatia fluviatilis	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Cordylophora	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Laomedea	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Dynamena sp.	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Aurelia aurita	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
PLATHYHELMINTES	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Procerodes litoralis	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Dendrocelum lacteum	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Planaria torva	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
NEMERTINI	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Prostoma obscurum	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Tetrastemma sp	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Nematoda	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
PRIAPULOIDEA	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Halicryptus	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
ECHIUROIDEA-SIPUNCULOIDEA	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
ANNELIDAE	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Harmothoe sarsi	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Pygospio elegans	0	0,001	0	0,0003	0,0006	0,001	0	0	0,0003	0,0006	0	0	0	0,0000	0,0000
Nereis diversicolor	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Oligochaetae	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Tubificidae	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Piscicola geometra	0	0	0	0,0000	0,0000	0	0,001	0	0,0003	0,0006	0	0	0	0,0000	0,0000
MOLLUSCA	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Elysia viridis	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Limapontia capitata	0,04	0	0	0,0133	0,0231	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Bithynia tentaculata	0	5,615	9,4625	5,0258	4,7587	0	0	0	0,0000	0,0000	0,0425	1,5375	0	0,5267	0,8757
Gyraulus acronicus	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Lymnaea spp.	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Lymnaea stagnalis	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Lymnaea peregra	0	0	0	0,0000	0,0000	0	0,0975	0,0125	0,0367	0,0531	0	0	0	0,0000	0,0000
Lymnaea obtusata	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Theodoxus fluviatilis	0,5975	0,89	4,8575	2,1150	2,3796	2,1825	2,37	1,1775	1,9100	0,6413	0,26	0,3725	2,365	0,9992	1,1842
Valvata piscinalis	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Potamopyrgus jenkinsi	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Hydrobia spp.	0	0	0,2525	0,0842	0,1458	0,17	0,001	0,001	0,0573	0,0976	0	0,435	0	0,1450	0,2511

Primary data from quantitative sampling. Biomass given in g dry weight m^{-2}

Year	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003
Sample no.	1	2	3	1-3.	1-3.	4	5	6	4-6.	4-6.	7	8	9	7-9.	7-9.
Profile no.	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2
Frame no.	5	1	4	1.4.5	1.4.5	2	3	6	2.3.6	2.3.6	5	4	6	5.4.6	5.4.6
Depth	2,1	2,1	2,1	2,1	2,1	4,5	4,5	4,5	4,5	4,5	2,1	2,7	2,4	2,4	2,4
				Mean	**Stdev**				**Mean**	**Stdev**				**Mean**	**Stdev**
Hydrobia ventrosa	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Hydrobia ulva	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Physa fontinalis	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Mytilus edulis	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Cardium spp.	0	0	0	0,0000	0,0000	0	0	0,0525	0,0175	0,0303	0,125	2,8525	0,2	1,0592	1,5535
Cardium hauniense	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Cerastoderma/Cardium	6,61	0,2675	4,7845	3,8873	3,2650	0,0125	0	0	0,0042	0,0072	0	0	0	0,0000	0,0000
Mya arenaria	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Macoma balthica	0,2175	0	21,11	7,1092	12,1256	0	2,335	0	0,7783	1,3481	0	0,06	0	0,0200	0,0346
Anodonta sp	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Sphaerium spp.	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
BRYOZOA	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Electra crustulenta	0	0	0	0,0000	0,0000	0	0,001	0,001	0,0007	0,0006	0	0	0	0,0000	0,0000
CRUSTACEANS	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Balanus improvisus	0	0	0	0,0000	0,0000	0	0,001	0	0,0003	0,0006	0	0	0	0,0000	0,0000
Mesidothea enthomon	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Idothea spp.	0	0	0,001	0,0003	0,0006	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Idothea balthica	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Idothea viridis	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Idothea granulosa	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Jaera albifronsspp.	0	0	0,001	0,0003	0,0006	0	0,001	0	0,0003	0,0006	0	0	0	0,0000	0,0000
Asellus aquaticus	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Pontoporeia affinis	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Pontoporeia spp.	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Calliopius rathkei	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Gammarus spp.	0	0,0725	1,4775	0,5167	0,8329	0,1175	0	0	0,0392	0,0678	0	0	0	0,0000	0,0000
Gammarus salinus	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Gammarus zaddachi	0	0	0	0,0000	0,0000	0	0	0,001	0,0003	0,0006	0	0	0	0,0000	0,0000
Gammarus dueberni	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Gammarus locusta	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Gammarus oceanicus	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Pallacea quadrispinata	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Corophium volutator	0	0	0	0,0000	0,0000	0	0,115	0	0,0383	0,0664	0	0	0	0,0000	0,0000
Melita palmata	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Mysidae	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Mysis relicta	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Mysis mixta	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Neomysis vulgaris	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000

Primary data from quantitative sampling. Biomass given in g dry weight m^{-2}

Year	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003
Sample no.	1	2	3	1-3.	1-3.	4	5	6	4-6.	4-6.	7	8	9	7-9.	7-9.
Profile no.	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2
Frame no.	5	1	4	1.4.5	1.4.5	2	3	6	2.3.6	2.3.6	5	4	6	5.4.6	5.4.6
Depth	2,1	2,1	2,1	2,1	2,1	4,5	4,5	4,5	4,5	4,5	2,1	2,7	2,4	2,4	2,4
				Mean	**Stdev**				**Mean**	**Stdev**				**Mean**	**Stdev**
Neomysis integer	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Praunus flexuosus	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Praunus inermis	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Praunus neglecta	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Hemimysis anomalia	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Crangon crangon	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Leander adspersus	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
INSECTA	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Chironomidae	0	0,0075	0	0,0025	0,0043	0	0	0	0,0000	0,0000	0,001	0,0175	0	0,0062	0,0098
Heteroptera	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
other Diptera	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Tricoptera	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Ephemeroptera	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Hemiptera	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Plecoptera	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Coleoptera	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
ACARINA	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
PISCES	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Gobidae	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
sum ANIMALS	***7,465***	***6,8535***	***41,947***	***18,7550***	***20,0868***	***2,4835***	***4,9225***	***1,2455***	***2,8838***	***1,8709***	***0,4285***	***5,275***	***2,565***	***2,7562***	***2,4289***

Primary data from quantitative sa

Year	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003
Sample no.	10	11	12	10-12.	10-12.	13	14	15	13-15.	13-15.	16	17	18	16-18.	16-18.
Profile no.	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3
Frame no.	2	1	3	2.1.3.	2.1.3	5	4	6	5.4.6	5.4.6	3	2	1	3.2.1	3.2.1
Depth	4,2	4,2	4,2	4,2	4,2	2,5	2,5	2,5	2,5	2,5	4,2	4,2	4,2	4,2	4,2
				Mean	**Stdev**				**Mean**	**Stdev**				**Mean**	**Stdev**
BLUEGREEN	0,001	0,001	0,001	0,0010	0,0000	0	0	0	0,0000	0,0000	0	0,001	0	0,0003	0,0006
Calothrix	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Rivularia atra	0,001	0,001	0	0,0007	0,0006	0,11	0,1675	0,0525	0,1100	0,0575	0,001	0	0	0,0003	0,0006
Nostoc sp.	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Spirulina sp.	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
RED	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
red spp.	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Ahnfeltia plicata	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Rhodochorton purpureum	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Hildenbrandia rubra (spp.)	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0,001	0,0003	0,0006
Phyllophora spp.	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Coccotylus truncatus	0	0	0	0,0000	0,0000	0	0,005	0	0,0017	0,0029	0,1775	0	0	0,0592	0,1025
Phyllophora pseudoceranoides	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Furcellaria lumbricalis	0	0	0	0,0000	0,0000	0,001	0,04	0	0,0137	0,0228	6,8575	0,05	2,455	3,1208	3,4522
Polyides rotundus	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Aglaothamnion roseum	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Ceramium spp.	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Ceramium nodolosum	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Ceramium tenuicorne	0,07	0,001	0,001	0,0240	0,0398	0,8825	0,685	1,685	1,0842	0,5296	0,495	0,465	0,7025	0,5542	0,1293
Polysiphonia spp.	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Polysiphonia fucoides	0,3775	0,19	0,001	0,1895	0,1883	0,7075	1,205	0,415	0,7758	0,3994	2,4025	9,535	1,54	4,4925	4,3882
Polysiphonia fibrillosa	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0,1	0,2725	0,0275	0,1333	0,1259
Polysiphonia elongata	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Polysiphonia stricta	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Rhodomela conferviodes	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
BROWN	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Dictyosiphon chordaria	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Dictyosiphon foeniculaceus	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Dictyosiphon/Stictyo.	0,001	0,001	0	0,0007	0,0006	0,07	0	0	0,0233	0,0404	0	0	0	0,0000	0,0000
Stictyosiphon tortilis	0	0	0,001	0,0003	0,0006	0	0,07	0,0325	0,0342	0,0350	0	0	0,115	0,0383	0,0664
Pilayella littoralis	0	0	0,17	0,0567	0,0981	0	4,1925	0	1,3975	2,4205	0	0	0	0,0000	0,0000
Ectocarpus siliculosus	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Pilayella/Ectocarpus	0,08	2,24	0	0,7733	1,2708	1,195	0	3,165	1,4533	1,5982	0,085	0,03	0,02	0,0450	0,0350
Elachista fucicola	0	0	0	0,0000	0,0000	0	0,115	0,05	0,0550	0,0577	0,001	0,001	0,01	0,0040	0,0052
Eudesme virescens	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Leathesia difformis	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Pseudolithoderma spp.	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Scytosiphon lomentaria	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000

Primary data from quantitative sa

Year	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003
Sample no.	10	11	12	10-12.	10-12.	13	14	15	13-15.	13-15.	16	17	18	16-18.	16-18.
Profile no.	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3
Frame no.	2	1	3	2.1.3.	2.1.3	5	4	6	5.4.6	5.4.6	3	2	1	3.2.1	3.2.1
Depth	4,2	4,2	4,2	4,2	4,2	2,5	2,5	2,5	2,5	2,5	4,2	4,2	4,2	4,2	4,2
				Mean	**Stdev**				**Mean**	**Stdev**				**Mean**	**Stdev**
Sphacelaria spp.	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Sphacelaria arctica	0,15	0,345	0,005	0,1667	0,1706	0,001	0,18	0,0875	0,0895	0,0895	0,6625	0,3925	0,1575	0,4042	0,2527
Sphacelaria plumigera	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Sphacelaria radicans	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Chorda filum	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Halosiphon tomentosus	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Fucus serratus	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Fucus vesiculosus	0	0	0	0,0000	0,0000	15,195	223,57	7,97	82,2450	122,4443	146,123	237,443	180,12	187,8950	46,1538
VAUCHERIALES	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Vaucheria spp	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Vaucheria dicotoma	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
GREEN	0	0	0,001	0,0003	0,0006	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
green spp	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Spirogyra spp.	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Characeae	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Chara aspera	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Chara baltica	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Chara tomentosa	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Chara sp.	0	0	0	0,0000	0,0000	0,0925	0	0,2975	0,1300	0,1523	0	0	0	0,0000	0,0000
Nitella flexilis	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Tolypella nidifica	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Acrosiphonia centralis	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Blidingia minima	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Enteromorpha spp.	0	0	0,001	0,0003	0,0006	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Enteromorpha clatrata	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Enteromorpha compressa	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Enteromorpha prolifera	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Enteromorpha intestinalis	0,03	0,0675	0	0,0325	0,0338	0,645	1,475	0,205	0,7750	0,6449	0	0	0	0,0000	0,0000
Monostroma balticum	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Spongomorpha aeruginosa (S.pallida)	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Ulothrix spp.	0	0,001	0	0,0003	0,0006	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Cladophora spp.	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0,001	0,345	0,1153	0,1989
Cladophora aegagrophila	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Cladophora fracta	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Cladophora glomerata	0	0	0	0,0000	0,0000	0,001	0	0	0,0003	0,0006	0,065	0	0	0,0217	0,0375
Cladophora rupestris	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Prasiola spp.	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Chaetomorpha spp.(linum)	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0,1675	0,0558	0,0967

Primary data from quantitative sa

Year	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003
Sample no.	10	11	12	10-12.	10-12.	13	14	15	13-15.	13-15.	16	17	18	16-18.	16-18.
Profile no.	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3
Frame no.	2	1	3	2.1.3.	2.1.3	5	4	6	5.4.6	5.4.6	3	2	1	3.2.1	3.2.1
Depth	4,2	4,2	4,2	4,2	4,2	2,5	2,5	2,5	2,5	2,5	4,2	4,2	4,2	4,2	4,2
				Mean	**Stdev**				**Mean**	**Stdev**				**Mean**	**Stdev**
DIATOMEA	0,001	0,001	0,001	0,0010	0,0000	0,001	0	0	0,0003	0,0006	0	0,001	0	0,0003	0,0006
Berkeleya rutilans	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
BRYOPHYTA	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Drepanoclaudus spp	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Fontinalis dalecarlica	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Fontinalis.spp.	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Isoetes lacustris	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
PHANEROGAMS	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Callitriche spp	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
C.automnale	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Crassula aquatica	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Scirpus acicularis	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Elodea canadensis	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Limosella aquatica	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Myriphyllum alternipholum	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Myriphyllum spicatum	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
sp	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Potamogeton spp.	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Potamogeton filiformis	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Potamogeton gramineus	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Potamogeton natans	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Potamogeton pectinatus	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Potamogeton perfoliatus	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Potamogeton pucillus	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Potamogeton panormitans	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Ranunculus spp.	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Ranunculus baudotii	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Ranunculus circinatus	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Ranunculus reptans	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Ruppia spp.	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Ruppia spiralis	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Ruppia maritima	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0,2075	0,0692	0,1198
Subularia aquatica	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Zannichellia spp.	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Zannichellia major	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Zannichellia palustris	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Zostera marina	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
sum PLANTS	***0,7115***	***2,8485***	***0,182***	***1,2473***	***1,4117***	***18,902***	***231,71***	***13,96***	***88,1888***	***124,3132***	***156,97***	***248,19***	***185,87***	***197,0098***	***46,6204***

Primary data from quantitative sa

Year	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003
Sample no.	10	11	12	10-12.	10-12.	13	14	15	13-15.	13-15.	16	17	18	16-18.	16-18.
Profile no.	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3
Frame no.	2	1	3	2.1.3.	2.1.3	5	4	6	5.4.6	5.4.6	3	2	1	3.2.1	3.2.1
Depth	4,2	4,2	4,2	4,2	4,2	2,5	2,5	2,5	2,5	2,5	4,2	4,2	4,2	4,2	4,2
				Mean	**Stdev**				**Mean**	**Stdev**				**Mean**	**Stdev**
ANIMALS	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Ephydatia fluviatilis	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Cordylophora	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0,001	0,001	0,0007	0,0006
Laomedea	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Dynamena sp.	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Aurelia aurita	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
PLATHYHELMINTES	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Procerodes litoralis	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Dendrocelum lacteum	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Planaria torva	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
NEMERTINI	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Prostoma obscurum	0	0	0	0,0000	0,0000	0	0,001	0	0,0003	0,0006	0	0,001	0	0,0003	0,0006
Tetrastemma sp	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Nematoda	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
PRIAPULOIDEA	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Halicryptus	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
ECHIUROIDEA-SIPUNCULOIDEA	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
ANNELIDAE	0	0	0,001	0,0003	0,0006	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Harmothoe sarsi	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Pygospio elegans	0	0	0,001	0,0003	0,0006	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Nereis diversicolor	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0,14	0	0,0467	0,0808
Oligochaetae	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0,001	0	0,0003	0,0006
Tubificidae	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Piscicola geometra	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
MOLLUSCA	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Elysia viridis	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Limapontia capitata	0	0	0	0,0000	0,0000	0	0,001	0	0,0003	0,0006	0	0	0	0,0000	0,0000
Bithynia tentaculata	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Gyraulus acronicus	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Lymnaea spp.	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Lymnaea stagnalis	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Lymnaea peregra	0	0	0	0,0000	0,0000	0,1225	0,9075	0	0,3433	0,4924	0,3975	0,3325	0,52	0,4167	0,0952
Lymnaea obtusata	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Theodoxus fluviatilis	1,1775	0,6575	2,413	1,4160	0,9017	1,0325	7,6975	1,1625	3,2975	3,8111	6,3575	6,0225	13,2975	8,5592	4,1069
Valvata piscinalis	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Potamopyrgus jenkinsi	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Hydrobia spp.	0,3075	0	0,96	0,4225	0,4902	0,275	0,155	0,085	0,1717	0,0961	0,6225	0,6275	4,42	1,8900	2,1910

Primary data from quantitative sa

Year	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003
Sample no.	10	11	12	10-12.	10-12.	13	14	15	13-15.	13-15.	16	17	18	16-18.	16-18.
Profile no.	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3
Frame no.	2	1	3	2.1.3.	2.1.3	5	4	6	5.4.6	5.4.6	3	2	1	3.2.1	3.2.1
Depth	4,2	4,2	4,2	4,2	4,2	2,5	2,5	2,5	2,5	2,5	4,2	4,2	4,2	4,2	4,2
				Mean	**Stdev**				**Mean**	**Stdev**				**Mean**	**Stdev**
Hydrobia ventrosa	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Hydrobia ulva	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Physa fontinalis	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Mytilus edulis	0	0	0,001	0,0003	0,0006	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Cardium spp.	0,9175	0,32	0,093	0,4435	0,4259	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Cardium hauniense	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Cerastoderma/Cardium	0	0	0	0,0000	0,0000	0,001	0,1925	0,2275	0,1403	0,1219	0,285	0,5725	22,2425	7,7000	12,5950
Mya arenaria	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Macoma balthica	0	0	24,793	8,2643	14,3142	0	0	0	0,0000	0,0000	8,6625	0	33,455	14,0392	17,3635
Anodonta sp	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Sphaerium spp.	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
BRYOZOA	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Electra crustulenta	0	0	0	0,0000	0,0000	0	0,001	0	0,0003	0,0006	0,001	0,001	0,001	0,0010	0,0000
CRUSTACEANS	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Balanus improvisus	0	6,735	0	2,2450	3,8885	0,395	0,305	0,4875	0,3958	0,0913	0	0	0	0,0000	0,0000
Mesidothea enthomon	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	3,9	1,3000	2,2517
Idothea spp.	0	0	0	0,0000	0,0000	0,001	0,06	0,001	0,0207	0,0341	0	0,001	0	0,0003	0,0006
Idothea balthica	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Idothea viridis	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Idothea granulosa	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Jaera albifronsspp.	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0,001	0,0003	0,0006
Asellus aquaticus	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Pontoporeia affinis	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Pontoporeia spp.	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Calliopius rathkei	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Gammarus spp.	0	0	0	0,0000	0,0000	0,1725	0,34	0,001	0,1712	0,1695	0,085	0,1975	0,295	0,1925	0,1051
Gammarus salinus	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Gammarus zaddachi	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Gammarus dueberni	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Gammarus locusta	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Gammarus oceanicus	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Pallacea quadrispinata	0	0	0	0,0000	0,0000	0	0,125	0	0,0417	0,0722	0,001	0,001	0,1175	0,0398	0,0673
Corophium volutator	0	0	0,001	0,0003	0,0006	0	0	0	0,0000	0,0000	0	0,001	0,001	0,0007	0,0006
Melita palmata	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Mysidae	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0,001	0,0003	0,0006
Mysis relicta	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Mysis mixta	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Neomysis vulgaris	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000

Primary data from quantitative sa

Year	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003
Sample no.	10	11	12	10-12.	10-12.	13	14	15	13-15.	13-15.	16	17	18	16-18.	16-18.
Profile no.	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3
Frame no.	2	1	3	2.1.3.	2.1.3	5	4	6	5.4.6	5.4.6	3	2	1	3.2.1	3.2.1
Depth	4,2	4,2	4,2	4,2	4,2	2,5	2,5	2,5	2,5	2,5	4,2	4,2	4,2	4,2	4,2
				Mean	**Stdev**				**Mean**	**Stdev**				**Mean**	**Stdev**
Neomysis integer	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Praunus flexuosus	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Praunus inermis	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0,0225	0	0	0,0075	0,0130
Praunus neglecta	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Hemimysis anomalia	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Crangon crangon	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Leander adspersus	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
INSECTA	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Chironomidae	0	0	0	0,0000	0,0000	0,0075	0,005	0,001	0,0045	0,0033	0,001	0	0,001	0,0007	0,0006
Heteroptera	0	0	0	0,0000	0,0000	0	0		0,0000	0,0000	0	0	0	0,0000	0,0000
other Diptera	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Tricoptera	0,93	0	0	0,3100	0,5369	0	0,2375	0	0,0792	0,1371	0	0,001	0	0,0003	0,0006
Ephemeroptera	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Hemiptera	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Plecoptera	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
Coleoptera	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
ACARINA	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
PISCES	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0,0375	0	0,0125	0,0217
Gobidae	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000	0	0	0	0,0000	0,0000
sum ANIMALS	***3,3325***	***7,7125***	***28,263***	***13,1027***	***13,3106***	***2,007***	***10,028***	***1,9655***	***4,6668***	***4,6430***	***16,436***	***7,938***	***78,254***	***34,2090***	***38,3796***

Appendix 3

Selected photos from the stations in the Forsmark area

Photo no. 1.
Station no.1, 19 m from shore, at 3.0 m depth. The Fucus-belt starts covering 75 % of the boulder substrate (photo M.Borgiel).

Photo no. 2.
Station no.1, 13 m from shore, at 2.1 m depth. Mixed substrate with mixed growth of phanerogames, mainly ***Potamogeton pectinatus*** *(photo M.Borgiel).*

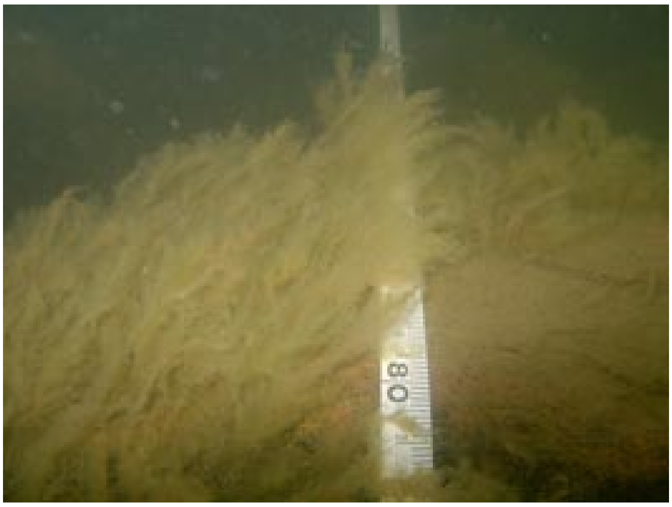

Photo no. 3
Station no.1, 3 m from shore, at 0.6 m depth. The green ***Cladophora glomerata*** *covering the most of the last 1.2 m of depth (photo M.Borgiel).*

Photo no.4.
Station no.1, 1 m from shore, at 0.3 m depth. Rock with some ***Rivularia atra*** *(photo M.Borgiel).*

Photo no.5.
Station no.2, 34 m from shore, at 6.3 m depth. Boulder substrate starts with sparse vegetation of ***Sphacelaria artica*** *and* ***Polysiphonia fucoides.*** *(photo M.Borgiel).*

Photo no.6.
Station no.2, 2 m from shore, at 0.3 m depth. The green ***Cladophora glomerata*** *totally covering the top of the large boulders most of the last 1.5 m of depth (photo M.Borgiel). (photo M.Borgiel).*

Photo no.7.
*Station no.3, 177 m from shore, at 9.7 m depth. A few small boulders with sparse turfs of **Sphacelaria artica** and **Polysiphonia fucoides.** (photo M.Borgiel).*

Photo no.8.
*Station no.3, 132 m from shore, at 7.5 m depth. The boulder sustrate covered by 50% of red algae. This boulder has a beautiful cover of mainly **Furcellaria lumbricalis** (photo M.Borgiel).*

Photo no.9.
*Station no.3, 121 m from shore, at 6.3 m depth. The bladder wrack (**Fucus vesiculosus**) occurred from 6.3 m depth. This was the deepest finding of bladder wrack in this survey. (photo M.Borgiel).*

Photo no.10.
Station no.3, 99 m from shore, at 5.0 m depth. The ***Fucus*** *belt started at 5.0 m depth (photo M.Borgiel).*

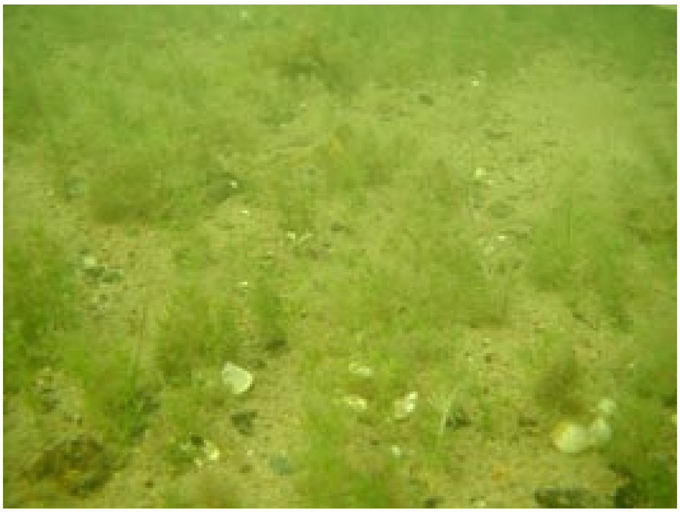

Photo no.11.
Station no.3, 52 m from shore, at 3.7 m depth. Mixed substrate of stone, sand and gravel with mixed growth of phanerogames, mainly ***Chara sp.****(photo M.Borgiel).*

Photo no.12.
Station no.3, 8 m from shore, at 2.5 m depth.Frame no.6 for collecting quantitative sample.The sample consisted mainly of ***Pilayella littoralis, Fucus vesiculosus*** *and* ***Ceramium tenuicorne*** *(photo M.Borgiel).*