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MARINE RESEARCH

Development of hard substrate fauna in the Princess Amalia Wind Farm

Monitoring 3.5 years after construction

Thomas Vanagt, Liesbeth Van de Moortel and Marco Faasse

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Vanagt T., Van de Moortel L. and Faasse M.

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Authors	Dr. T. Vanagt, Drs. L. Van de Moortel and Ir. Marco Faasse
Contributors	Jannes Heusinkveld (the Fieldwork Company), Wals Diving
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Checked by	Prof. Dr. J. Mees – director international development

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Summary

As part of the Monitoring- and Evaluation Program (MEP) of the Princess Amalia Wind Farm (PAWP) a number of research topics were identified. One of those topics was to characterise the epifauna on the hard substrate of the monopiles and the scour protection.

The Princess Amalia Wind Farm is the second offshore wind farm in the Dutch sector of the North Sea and the first one to be located outside the 12 nautical mile limit. PAWP is located on the Dutch Continental Shelf, at a distance of 23,0 to 26,4 km from the shore (IJmuiden, The Netherlands), and a water depth of 19 to 24 m. A total of 60 monopiles were placed in an area of 14 km². Around the monopiles a scour protection layer was installed, with a diameter of 15 m.

In this report the development of the hard substrate marine fauna and flora communities three years after construction of the wind farm is presented. Four wind tubine generators (WTG) were selected and sampled at the end of October 2011. Two methods were used: a qualitative method, using video footage, and a quantitative method, using scrape samples; both methods were conducted by professional divers.

Three years after construction a species-rich community has settled, a total of 85 species were identified. 81% of these species belonged to four phyla: crustaceans, ringed worms, moss animals and cnidarians. The highest density was found 2 m beneath the water surface (158.824 ± 109.916 ind./m²), consisting mainly of small amphipods. The mean density decreased with increasing depth, caused by lower amphipod densities and a higher occurrence of colony-forming hydrozoans and moss animals. Biomass data were dominated by the presence of bigger species, such as mussels and anemones. Mussels were dominating in biomass in shallow areas, while at greater depths anemones became more important.

The community that has settled on the monopiles could be divided in two zones: an upper splash zone dominated by algae, mussels, isopods and amphipods, and a lower sublittoral zone, dominated by high densities of amphipods, mussels and anemones. On the scour protection rocks moss animals were dominating, sometimes reaching a covering percentage of over 50%.

The typical first colonizers of hard substrate were only present in low densities. More long-lived, slowly growing species, such as anemones, were dominating, with the exception of amphipods: short-living species with a high reproduction rate. This indicates that within three years of construction, the hard substrate in the wind farm has already reached some stage of maturity. The wind farm was already colonized by 75% of the native anemone species of the Dutch coastal waters, and a considerable number of moss animals, amongst which very rare species: one species has never been found so close to the Dutch coast; one species is new to the fauna of the Netherlands. We also found one amphipod that has not been recorded from the North Sea before.

The construction of the Princess Amalia Wind Farm adds 0.12% of substrate to the total soft substrate area, this leads to an added contribution of 10% of animals, and a remarkable 49% of biomass. Density-wise, the largest contribution comes from amphipods that can form dense mats on hard substrates, something we do not find on the soft substrate. In terms of biomass, large species such as Blue mussels, sea urchins, sea stars and sea anemones are frequent on the monopiles, and absent or very rare in the soft substrate. Only two species were shared between soft substrate and hard substrate in the wind farm.

Samenvatting

In het kader van het Meet- en Evaluatie programma (MEP) van het Prinses Amaliawindpark zijn een aantal onderzoeksonderwerpen vastgesteld. Eén van de onderwerpen betreft het karakteriseren van het onderwaterleven op het hard substraat van de turbinepalen en stortstenen.

Het Prinses Amaliawindpark (PAWP) is het tweede offshore windpark in het Nederlandse deel van de Noordzee en het eerste dat zich buiten de 12 nautische mijl limiet bevindt. PAWP is gelegen op het Nederlandse Continentaal Plat, op een afstand van 23 tot 26,4 km van de kust (IJmuiden, Nederland), en een waterdiepte van 19 tot 24 m. In totaal zijn 60 turbines geplaatst in een gebied van 14 km². Rond de turbinepalen is een stortstenen laag aangelegd, met een diameter van 15 meter.

Dit rapport presenteert de ontwikkeling van de hard substraat epifauna en –flora, drie jaar na de constructie van het windpark. Vier turbinepalen werden geselecteerd en bemonsterd op het einde van oktober 2011. Twee methoden werden gebruikt: een kwalitatieve methode, met behulp van video-opnames, en een kwantitatieve methode, met behulp van schraapmonsters, beide methoden werden uitgevoerd door professionele duikers.

Drie jaar na de bouw van het windpark heeft zich reeds een soortenrijke gemeenschap ontwikkeld: in totaal werden 85 soorten gevonden. 81% van deze soorten behoorden tot vier phyla: kreeftachtigen, gelede wormen, mosdiertjes en neteldieren. De hoogste densiteit werd gevonden 2 m onder het wateroppervlak (158.824 ± 109.916 ind./m²), in grote mate toe te schrijven aan de hoge densiteiten van kleine vlokreeftjes. De gemiddelde densiteit nam af met toenemende diepte, veroorzaakt door lagere densiteiten vlokreeftjes en een hoger voorkomen van kolonievormende hydroïdpoliepen en mosdiertjes. Biomassa werd gedomineerd door de aanwezigheid van grotere individuen, zoals de gewone mossel en anemonen. De gewone mossel domineerde in biomassa in de ondiepe zones, terwijl op grotere diepte anemonen dominant waren.

De aanwezige gemeenschap op de turbinepalen kon in twee zones worden onderverdeeld: een bovenste, intergetijden zone gedomineerd door algen, mossels, pissebedden en vlokreeftjes en een onderwater zone, gedomineerd door hoge dichtheden vlokreeftjes, mossels, anemonen en zeesterren. Op de stortstenen werden hoge densiteiten van mosdiertjes gevonden, soms met een bedekkingpercentage hoger dan 50%.

De typische eerste kolonisten van hard substraat werden enkel in lage dichtheden aangetroffen. Langlevende en langzaam groeiende soorten, zoals anemonen domineerden, met uitzondering van de vlokreeftjes: deze zijn kort levende soorten en hebben een snelle reproductie. Dit geeft aan dat de aanwezige hard substraat gemeenschap al een bepaald stadium van volwassenheid heeft bereikt na drie jaar. Het windpark was bijvoorbeeld reeds gekoloniseerd door 75% van de inheemse anemonen en een groot aantal mosdiertjes, waaronder een paar zeer zeldzame en zelfs een nieuwe soort: één soort werd eerder enkel op de Klaverbank, ver van de kust, gevonden en een andere soort is nieuw voor de Nederlandse fauna. Ook werd een vlokreeftje aangetroffen dat nog niet bekend is van de Noordzee.

Alhoewel de bouw van het Prinses Amaliawindpark slechts 0,12% substraat toevoegt aan het totale gebied, dit leidt tot een extra bijdrage van 10% in densiteit, en een opmerkelijke 49% in biomassa aan de bodemfauna. In dichtheid komt de grootste bijdrage van vlokreeftjes die dense matstructuren kunnen vormen, iets wat niet terug te vinden is op een zachte substraat. In termen

van biomassa zijn het vooral grote soorten zoals mossels, zee-egels, zeesterren en anemonen die frequent voorkomen op de turbinepalen, maar niet of nauwelijks op een zachte ondergrond. Slechts twee soorten werden zowel op een zachte ondergrond als op een hard ondergrond gevonden.

1. INTRODUCTION

As part of the Monitoring- and Evaluation Program (MEP) of the Princess Amalia Wind Farm (PAWP) a number of research topics were identified. One of those topics was to characterise the epifauna on the hard substrate of the monopiles and the scour-protection. It was expected that the foundation piles of the wind farm might serve as an artificial reef within an area of only soft sandy sediments. Over time these structures will be colonised by a variety of sessile organisms such as algae, mussels, barnacles, anemones, hydroids and bryozoans. This rich sessile community will attract mobile organisms like small Crustacea, small Polychaeta, sea urchins, starfish, crabs and fish. The hard substrate community that is developing will be totally different from the soft substrate communities previously present.

1.1 Princess Amalia Wind Farm

The Princes Amalia Wind Farm is the second offshore wind farm in the Dutch sector of the North Sea and the first to be located outside the 12 nautical mile limit. PAWP is located in Block Q7 of the Dutch Continental Shelf, at a distance of 23 to 26.4 km from the shore (IJmuiden, The Netherlands; Figure 1), and a water depth of 19 to 24 m. A total of 60 monopiles (diameter 4.0 m) are placed in an area of 14 km², with a minimum distance of 550 m between the turbines. The farm has an annual power production of 435 GWh.

All monopiles have a cathodic corrosion protection. The transition pieces have been painted during construction with two layers. The first layer consists of "Hempel's high protect 35650", a two-component epoxy paint. The outer layer consists of "Hempathane topcoat BS 381C356 55214", a two-component polyurethane paint. Both layers provide a very hard coating. Neither of the paint brands used has anti-fouling properties.

Around the base of the monopiles a scour-protection layer was installed, with a diameter of approximately 15 m. This scour-protection consists of rock dump of various dimensions.

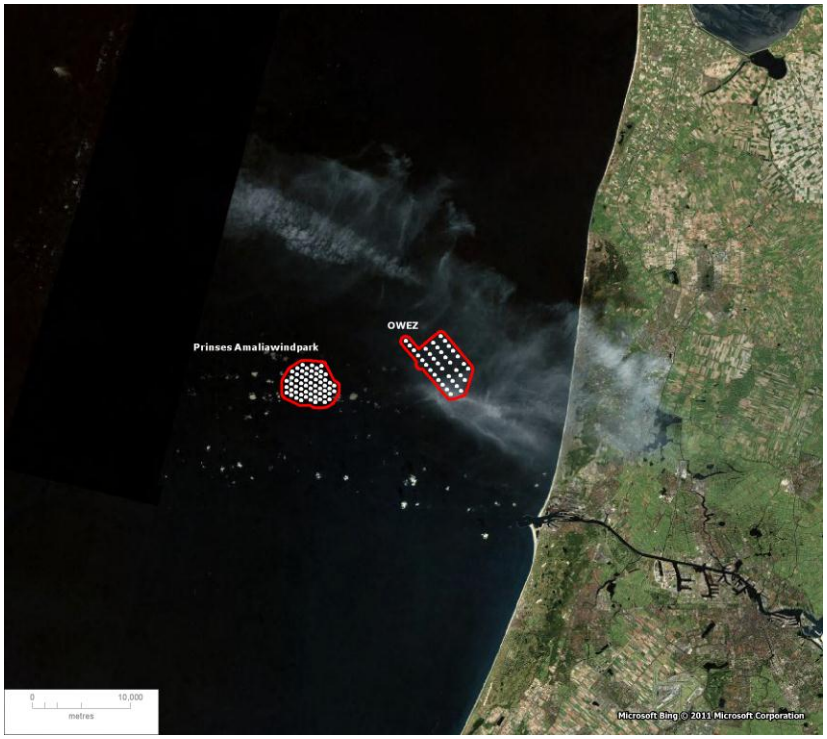


Figure 1: Location of the Princess Amalia Wind Farm off the Dutch Coast

1.2 Objectives

The aims of this study are:

- to gain insight in the development of hard substrate fauna present on the monopiles and the scour-protection of the Princess Amalia Wind Farm, three years after construction;
- to assess the impact of the wind farm and its associated hard substrate fauna on the ecosystem.

2. MATERIAL AND METHODS

For the sampling of the hard substrate in PAWP, two methods were used: a qualitative method, using video footage, and a quantitative method, using scrape samples. For both methods, professional divers were deployed. The ecologist on board of the vessel 'Pollux' guided the divers using live-feed video and audio communication.

The sampling was conducted by divers from Wals Diving & Marine Service. Four wind turbine generators (WTG) were sampled during two days (Figure 2):

Table 1: Information on sampled WTG's

WTG no.	Placement monopile and transition piece	construction WTG finished	WTG cleaned	Sampling date	Tide at sampling
1	23/01/2007	24/04/2008	not yet	28/10/2011	High tide
20	21/11/2006	30/05/2008	not yet	28/10/2011	Low tide
45	28/03/2007	06/05/2008	not yet	29/10/2011	High tide
60	05/02/2007	28/04/2008	not yet	29/10/2011	Low tide

These monopiles were selected to cover both the edges and the core of the wind farm, and to sample the North-South direction. To ensure optimal diving and sampling conditions, the dives were performed at slack tide.

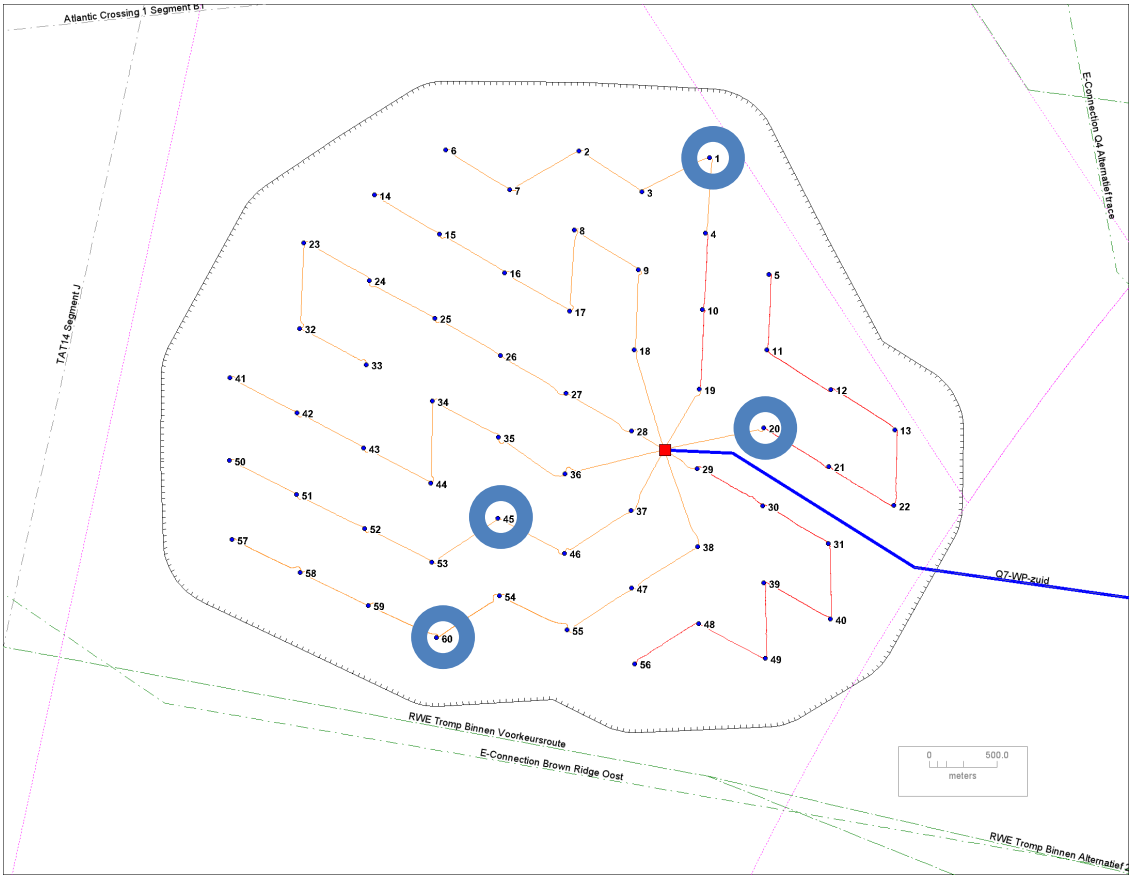


Figure 2: Princess Amalia Wind Farm with indication of the sampled monopiles

2.1 Sample collection

2.1.1 Video footage

Video footage of the monopiles and scour-protection rocks gives a wider picture of the covering percentage of sessile epifaunal over the entire turbine foundation. Moreover, it provides more information on mobile fauna that is not collected in the scrape samples.

Video footage was taken first, to prevent disturbance by the scrape samples. At each monopile two vertical video transects were made (SSW and NNE), from the surface to the seafloor. The scour-protection was also filmed on each side of the monopile. Video images were made using a HD headcam, operated by the diver. Depending on the visibility conditions, a distance of 50-100 cm from the monopile was respected. Filming of one transect took on average four minutes.

2.1.2 Scrape samples

Scrape samples were collected, after the video footage, at five different depths (splash, 2, 5, 10 and 17 m depth[1]) and at both sides of the monopile (NNE and SSW). The splash zone is wet zone that is not permanently inundated (i.e. the intertidal zone and the higher zone that receives wave splash). At each depth a sample surface of 28 cm x 20 cm was selected, and the marine growth was scraped off the monopile with a putty-knife, collecting the material in a specially designed fine-maze net (mesh size 0.25 mm). On board of the ship each scrape sample was stored separately in a sample container and fixated with a buffered 5% formaldehyde solution.

Samples of the organisms present on the rocks of the scour-protection layer were taken through the collection of several small rocks. These rocks were brought to the surface where they were stored and fixated with 5% formaldehyde.

All samples were taken to the laboratory for further analyses.

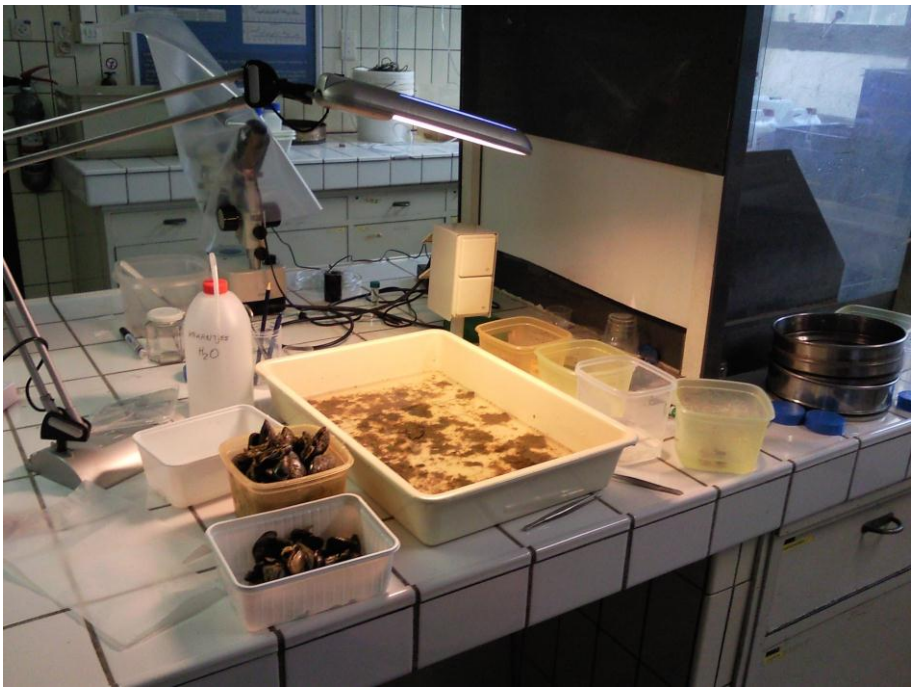
[1] All depths were calculated from NAP; hence, at high tide, the actual sampling depth was approx.. 1.5 meter higher than at low tide.

2.2 Laboratory analyses

2.2.1 Scrape samples

Sorting

In the laboratory the collected samples were sieved on a 0.5 and 1mm mesh-size sieve, and sorted on higher taxon level. The fractions >1mm and 0.5-1 mm were analyzed separately: all 1mm fractions were analyzed, the smaller fraction was used for reference only. From this step onward samples were preserved in 70% ethanol.



Picture 1: Sorting of a sample in the laboratory

Identification

All organisms present were identified to species level whenever possible, and counted. Identification was performed with a binocular microscope and based on the most recent systematic literature; for nomenclature and taxonomy the World Register of Marine Species (WoRMS) (http://www.marinespecies.org/) was followed.

Species of the genera *Jassa* and *Monocorophium* were present in very high densities in most samples. To assess presence of the different species within these genera, subsampling was performed: depending on the total sample volume, 1/4 or 1/8 of the sample was counted, and 25 random specimens of the subsample were identified to species level.

Biomass

Subsequently, biomasses were determined for all species except Algae, Hydrozoa and Bryozoa[2].

The biomasses of Polychaeta and Anthozoa were determined by directly measuring Ash-free Dry Weight (AFDW) through weight loss on ignition. Per sample and per species, each organism was placed in an alloy or porcelain cup. They were dried for at least 48 hours at 60°C. After cooling down in an exsiccator, the cups were weighted (dry weight, DW). Subsequently, they were put in a muffle furnace (2 hours at 520°C) for ignition. They were cooled again in an exsiccator before final weighing (ash weight, AW). The ash-free dry weight (AFDW) can be calculated as the difference between dry weight (DW) and ash weight (AW).

For AFDW of *Mytilus edulis* a regression curve was determined, based on length measurements (Figure 3). In total 130 individuals coming from two depths (2 m and 10 m depth) were divided in 13 length classes between 5 mm and 70 mm. For each length class the AFDW of 5 specimens was determined, using the same method as previously described. Afterwards a polynomial regression curve was fitted, suitable for both depths. For further biomass calculations, the formula of the average curve (green curve) was used.

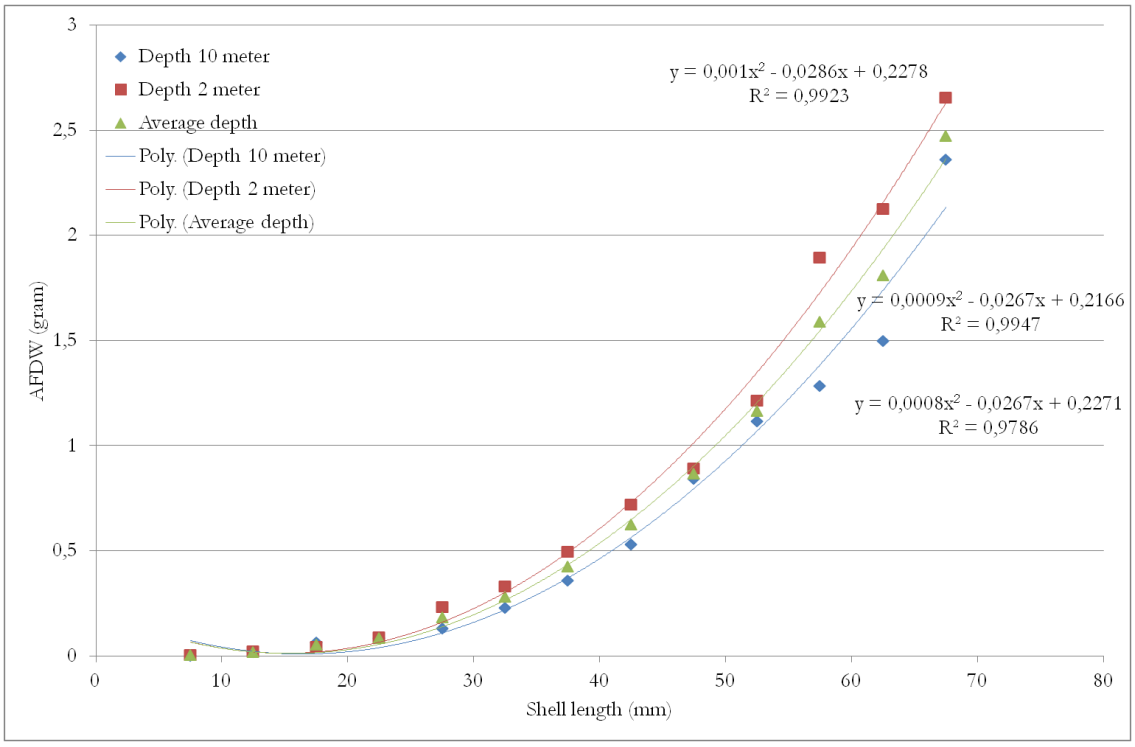


Figure 3: Shell length / Biomass curve for *Mytilus edulis*

Decapoda were divided in smaller (<1 cm) and larger specimens (>1 cm). The biomass of the smaller specimens was identified by determining the biomass of 10 specimens by directly measuring AFDW (method described previously), and then using these as assigned value. For larger

[2] Biomass determination of these taxa is very difficult

individuals, per sample and species AFDW was determined directly. Biomasses of Isopoda were identified using the same method as small Decapoda.

Asterias rubens specimens were divided in three length classes: 0 – 20 mm; 20 – 40 mm; > 40 mm. Specimens of the length class > 40 mm AFDW was determined per sample. For the other two length classes a mean biomass was determined using the same method as described above.

Psammechinus miliaris was divided in smaller (10 – 30 mm) and larger (40 – 50 mm) individuals. For both groups a mean biomass was determined using the same method as described above.

For the biomasses of Amphipoda assigned values from the literature were used.

2.3 Data-analyses

Density and biomass data were standardised to the number of individuals per m^2 (ind./m^2). Density data for colony-forming species, such as Bryozoa and Hydrozoa, were counted as one ind./m^2 in the quantitative analyses. The coverage of these species was included in the qualitative analysis.

Density, biomass and diversity were calculated for each sample, the latter based on various diversity indices (Shannon-Wiener, Pielou's evenness and Simpson index).

Multivariate analyses were carried out with the Primer v6 program (Clarke & Gorley, 2006). Before analysing, the data were fourth-root transformed. Bray-Curtis similarity matrices were used to build up non-metric multidimensional scaling (MDS) plots. MDS plots give information on relationships between data points. SIMPER analyses allow the detection of which species contribute to the distance between certain communities (dissimilarity percentage) and clustering in a community (similarity percentage). ANOSIM analyses (Analysis of Similarities) were performed to determine significant differences ($p<0.05$) between groups (nested designs, using the following three grouping variables: depth, WTG and orientation).

3. RESULTS

3.1 Sampling conditions

Both sampling days were characterized by good weather conditions: on day one, sea state was <1> (wave height 0-0.1m). This was the same on day 2 in the morning; in the afternoon sea state <2> (wave height 0.1-0.5m) was reached.

On day one, air temperature was 11°C; air temperature on day 2 was 7°C. Both days were overcast, without precipitation. On day one, the first sampling (WTG 1) started at sunrise; all other samplings were done during daylight hours (Table 2).

Table 2: Overview of samples, sample depths, orientation and time of sampling; WTG 1 and 45 were sampled at high tide, WTG 20 and 60 at low tide

WTG	Date	Depth (m)	Turbine Scour Splash	Orientation	Time	WTG	Date	Depth (m)	Turbine Scour Splash	Orientation	Time
1	28/10/2011	17	Turbine	NNO	8u40	45	29/10/2011	17	Turbine	NNO	15u13
	28/10/2011	10	Turbine	NNO	8u43		29/10/2011	10	Turbine	NNO	15u16
	28/10/2011	5	Turbine	NNO	8u48		29/10/2011	5	Turbine	NNO	15u19
	28/10/2011	2	Turbine	NNO	8u53		29/10/2011	2	Turbine	NNO	15u23
	28/10/2011	0	Splash	NW	8u56		29/10/2011	0	Splash	NW	15u25
	28/10/2011	23	Scour	NNO			29/10/2011	23	Scour	NNO	15u05
	28/10/2011	17	Turbine	ZZW	9u18		29/10/2011	17	Turbine	ZZW	15u38
	28/10/2011	10	Turbine	ZZW	9u23		29/10/2011	10	Turbine	ZZW	15u42
	28/10/2011	5	Turbine	ZZW	9u27		29/10/2011	5	Turbine	ZZW	15u46
	28/10/2011	2	Turbine	ZZW	9u31		29/10/2011	2	Turbine	ZZW	15u49
	28/10/2011	0	Splash	ZZW	9u36		29/10/2011	0	Splash	ZZW	15u52
	28/10/2011	23	Scour	ZZW			29/10/2011	23	Scour	ZZW	15u32
20	28/10/2011	17	Turbine	NNO	14u42	60	29/10/2011	17	Turbine	NNO	9u06
	28/10/2011	10	Turbine	NNO	14u45		29/10/2011	10	Turbine	NNO	9u12
	28/10/2011	5	Turbine	NNO	14u47		29/10/2011	5	Turbine	NNO	9u16
	28/10/2011	2	Turbine	NNO	14u49		29/10/2011	2	Turbine	NNO	9u19
	28/10/2011	0	Splash	NNO	14u52		29/10/2011	0	Splash	NW	9u27
	28/10/2011	23	Scour	NNO			29/10/2011	22,5	Scour	NNO	8u57
	28/10/2011	17	Turbine	ZZW	15u06		29/10/2011	17	Turbine	ZZW	9u41
	28/10/2011	10	Turbine	ZZW	15u09		29/10/2011	10	Turbine	ZZW	9u45
	28/10/2011	5	Turbine	ZZW	15u11		29/10/2011	5	Turbine	ZZW	9u48
	28/10/2011	2	Turbine	ZZW	15u14		29/10/2011	2	Turbine	ZZW	9u52
	28/10/2011	0	Splash	ZZW	15u17		29/10/2011	0	Splash	ZZW	9u55
	28/10/2011	23	Scour	ZZW			29/10/2011	22,5	Scour	ZZW	9u35

3.2 General diversity – species composition

During the sampling period in October 2011, a total of 85 species were identified on the offshore turbine foundation and the scour protection rocks. The full species list can be found in Annex 1. 79 species were identified in the scrape samples (>1mm), an additional six species were recorded by studying the video footage: *Necora puber*, *Sagartia elegans*, *Diadumene cincta*, *Actinothoe sphyrodeta*, *Aurelia aurita* and *Trisopterus luscus*. Species belonged to 12 phyla, but 81% of the species richness was represented in 4 phyla: Crustacea (Amphipoda, Decapoda, Cirripedia and Isopoda), Annelida, Bryozoa and Cnidaria (Hydrozoa, Anthozoa) (Figure 4).

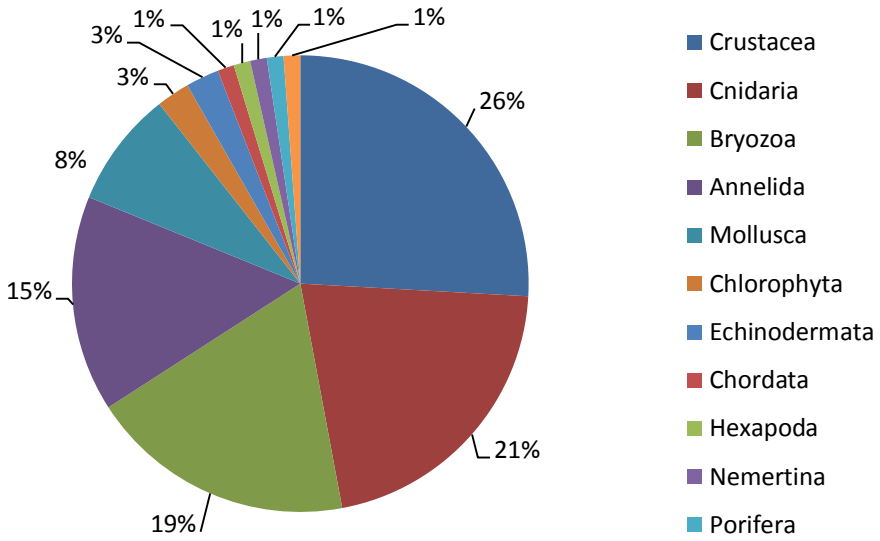


Figure 4: Proportion of species richness of the phyla present in the hard substrate scrape samples and video footage. Percentage represents the relative proportion of the specific phylum.

A 'species accumulation curve' was used to examine if the amount of analysed samples was sufficient to get a representative picture of the biodiversity present (Figure 5). The maximum number of species was estimated using an extrapolation technique (Bootstrapping). The graph shows that, at 48 samples, the estimated number of species is close to an asymptotic value. This means that the sampling effort was sufficient. Looking at estimated versus observed number of species, over all sampling depths together, 78% of the estimated number of species was identified in the samples. In the splash zone was this 73%, at depth 2 78%; at depth 5 76%, at depth 10 71% and on the scour protection 73%.

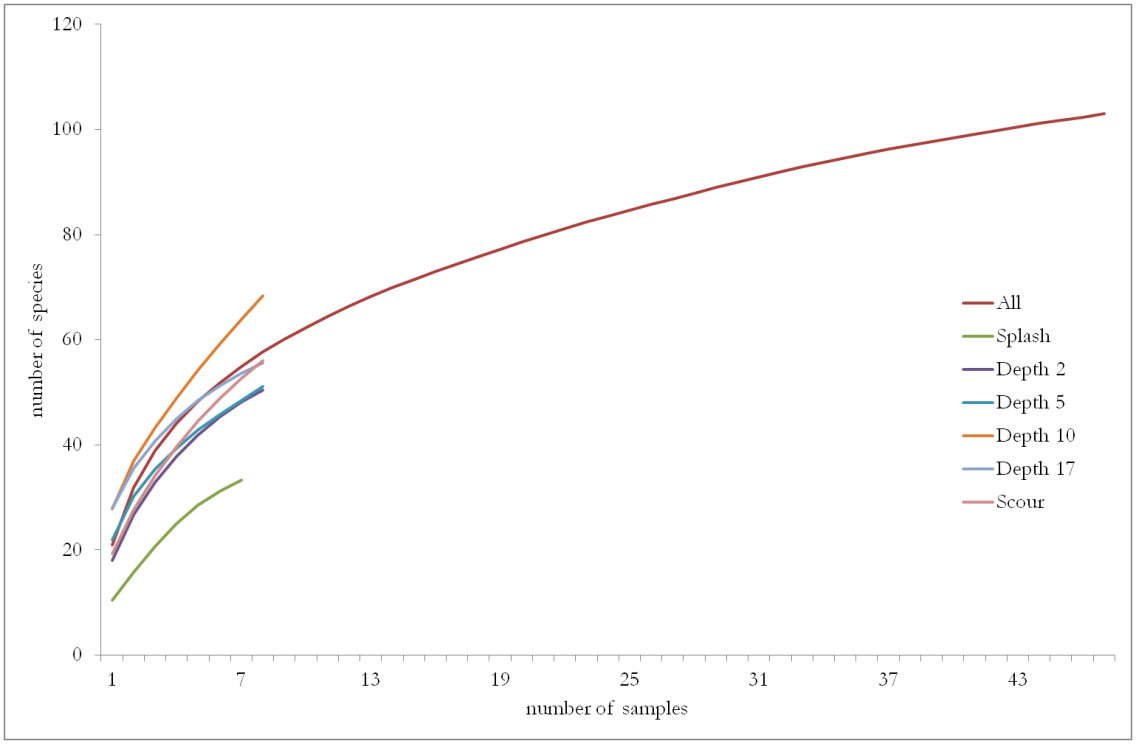


Figure 5: Estimated number of species in relation to the number of samples, determined with Bootstrapping.

3.3 Quantitative assessment

The multivariate ANOSIM data-analyses showed no statistical difference in density between the four turbines or the orientation sides, when a correction for depth was incorporated (nested design; resp. R=-0.06, p=0.87; R=-0.119, p=0.93). Similar results were found for biomass (nested design; resp. R=-0.077, p=0.95; R=-0.12, p=0.95). In both cases the depth factor was highly significant (p=0.0001). This is visualized in Figure 6, a MDS-plot where depth appeared to be the main grouping factor. There is a clear separation of the scour protection samples and the samples on the monopiles themselves. The latter showed a gradual transition from the splash zone to greater depths.

Further analyses will therefore focus on depth as explanatory variable.

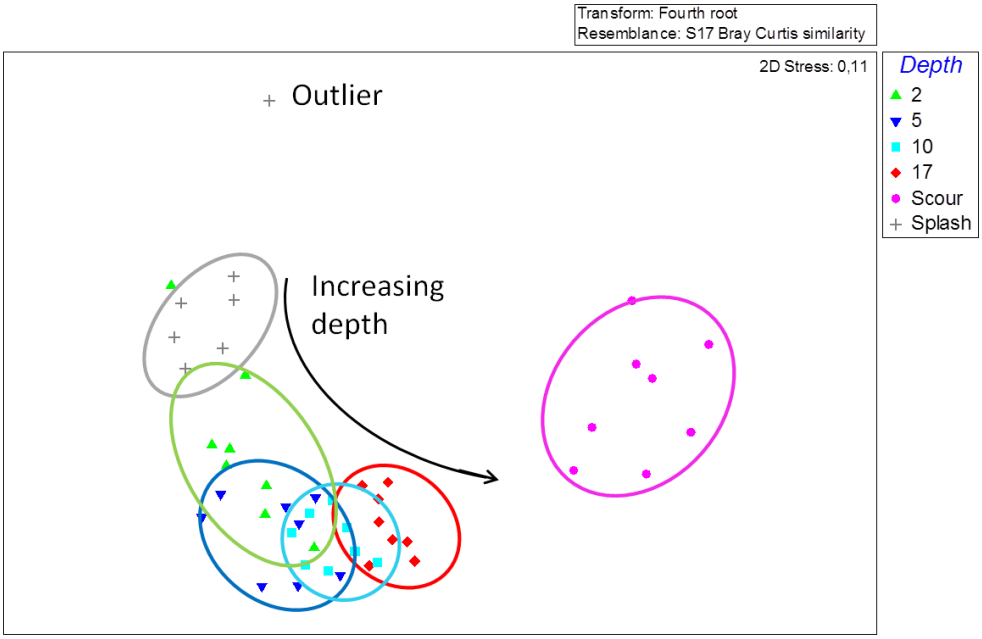


Figure 6: MDS with indication of the different depth groups. The outlier is the Splash sample of WTG1 (see further).

The number of species found in the scrape samples was the highest at depth 10 and the lowest in the splash zone (resp. 48 and 24). The mean number of species in the subtidal scrape samples and scour rocks varies between 17 and 26 species (Table 3).

The generally low biodiversity indices (Pielou's Evenness, Shannon-Wiener Index and Simpson Index) indicate a dominance of one species. For example, *Jassa herdmani* is responsible for 91% of the total density present at depth 5.

Table 3: Biodiversity of the different depth groups.

sample depth	# samples	number of species			Pielou's Evenness	Shannon-Wiener Index	Simpson Index (1-Lambda)
		total	mean	St. Dev			
Splash	8	24	9	2	0,3689	1,1720	0,6110
2	8	39	17	6	0,2026	0,7422	0,4153
5	8	39	20	6	0,1233	0,4516	0,1549
10	8	48	25	3	0,2108	0,8162	0,2904
17	8	46	26	3	0,2850	1,0910	0,3880
Scour	8	41	18	4	0,4000	1,4900	0,6360

Table 4: Density and biomass of the different depth groups. Colony-forming species are counted as 1 ind./m2 and are not included in the biomass.

sample depth	density (ind./m²)		biomass (AFDW, g/m²)	
	mean	St. Dev	mean	St. Dev
Splash	63.031	82.666	265,721	329,056
2	158.824	109.916	586,672	509,901
5	154.134	88.681	530,089	328,140
10	52.799	32.766	643,811	620,055
17	41.750	23.134	592,163	446,263
Scour	1.552	1.326	32,233	28,165

The highest average density was found at depth 2 (158.824 ± 109.916 ind./m²; Table 4), caused by the presence of the several small amphipods (*Jassa herdmani* and *J. marmorata*). The maximum density of *Jassa herdmani* was 288.553 ind./m². The mean density/m² decreased with increasing depth (Figure 7), which was mainly due to lower densities of *Jassa* spp. and higher abundance of colony-forming Hydrozoa and Bryozoa.

Biomass data were dominated by the presence of bigger individuals, like *Mytilus edulis* and Actiniaria spp. At depth 2, 70% of the biomass found consisted of *M. edulis* and only 10% of Actiniaria spp. At depth 10 and 17 *M. edulis* contributed for respectively 40% and 45% and Actiniaria at both depths for about 50% of the total biomass per m².

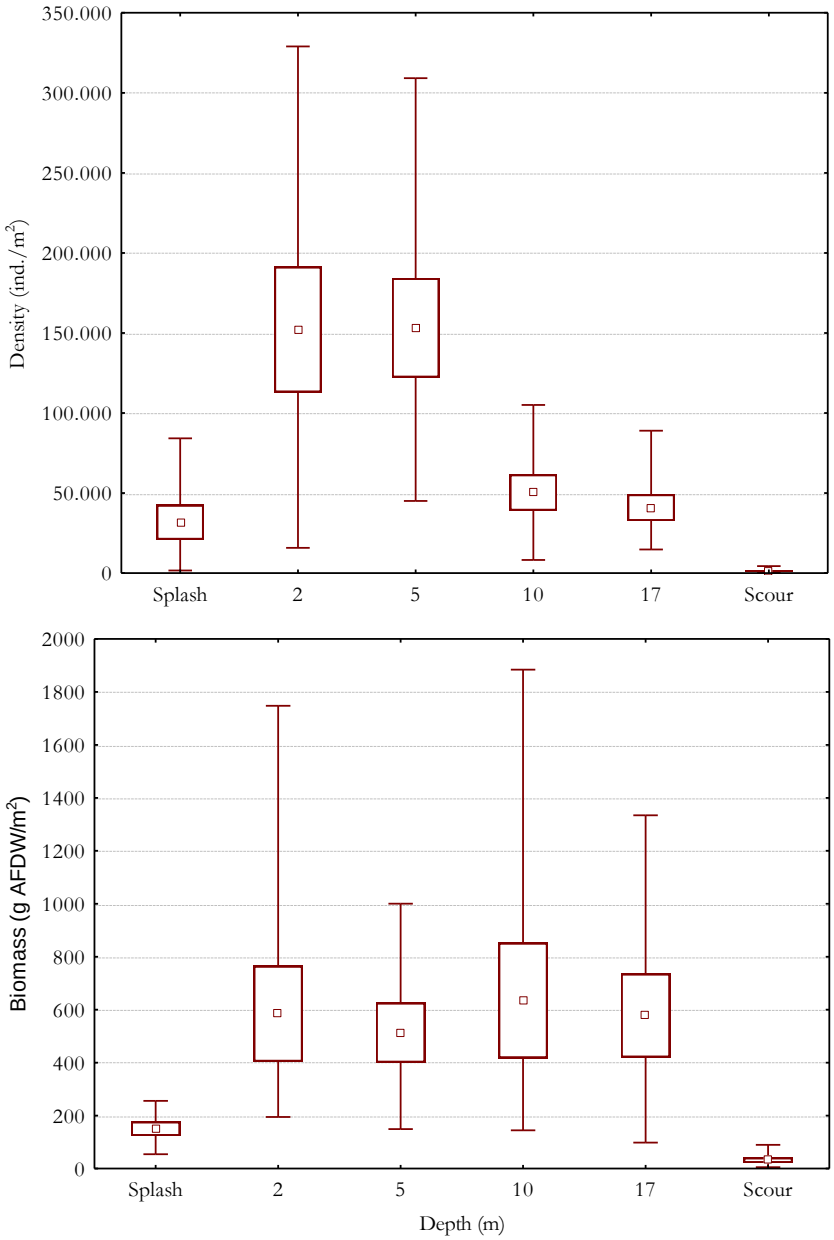


Figure 7: Boxplot of density (upper graph) and biomass (lower graph) according to depth. Box: average value± SE; whisker min. and max. value.

The dissimilarity between different depths was derived from the ANOSIM and SIMPER results (Table 5). The differences between closely related depths were caused by differences in densities of the most abundant species (*Jassa herdmani*, *J. marmorata*, *Monocorophium acherusicum*, *Mytilus edulis*, *Odostomia scalaris*), while between more widely spaced depths it was a combination in density differences and the occurrence of some species. The dissimilarity percentage was the highest between scour and any other scrape sample depth on the WTG. This was caused by the high occurrence of Bryozoa species. When performing these analyses on the biomass data, similar dissimilarity percentages were obtained, although there was a shift in characteristic species. The biomass indicator species were: *Mytilus edulis*, Anthozoa (*Metridium senile*, *Sagartia troglodytes*) and Echinodermata (*Psammechinus miliaris*, *Asterias rubens*).

Picture 2: Algal growth in the splash zone

Picture 3: Marine growth on the monopile

Table 5: Results ANOSIM and SIMPER analyses; left column lists the pair wise compared groups

	R-Statistic	p-value	Dissimilarity (%)	Indicator species
2, 5	0,15	0,058	43,19	*Jassa marmorata, J. herdmani, Mytilus edulis, Odostomia scalaris, Stenothoe valida, Syllis prolifera*
2, 10	0,568	0,001	48,01	*Jassa marmorata, J. herdmani, Stenothoe valida, Actiniaria juv.*
2, 17	0,742	0,001	52,34	*Jassa marmorata, Monocorophium acherusicum, J. herdmani, Phthisica marina*
2, Scour	0,999	0,001	79,87	*Jassa herdmani, J. marmorata, Idotea pelagica, Mytilus edulis*
2, Splash	0,257	0,022	49,39	*Jassa herdmani, J. marmorata, Mytilus edulis, Asterias rubens*
5, 10	0,116	0,106	38,35	*Jassa herdmani, J. marmorata, Odostomia scalaris, Mytilus edulis*
5, 17	0,571	0,001	43,23	*Jassa herdmani, Monocorophium acherusicum, J. marmorata, Phthisica marina*
5, Scour	1	0,001	77,21	*Jassa herdmani, J. marmorata, Monocorophium acherusicum, Stenothoe valida*
5, Splash	0,86	0,001	62,62	*Jassa herdmani, J. marmorata, Asterias rubens, Mytilus edulis*
10, 17	0,399	0,002	35,89	*Monocorophium acherusicum, Jassa marmorata, Odostomia scalaris, J. herdmani, Pisidia longicornis*
10, Scour	0,999	0,001	73,29	*Jassa herdmani, Stenothoe valida, Jassa marmorata, Monocorophium acherusicum*
10, Splash	0,893	0,002	64,96	*Jassa herdmani, J. marmorata, Stenothoe valida, Sagartia troglodytes*
17, Scour	0,975	0,001	65,32	*Jassa herdmani, Stenothoe valida, Actiniaria juv., Mytilus edulis*
17, Splash	0,909	0,001	67,2	*Jassa marmorata, Monocorophium acherusicum, J. herdmani, Actiniaria juv.*
Scour, Splash	1	0,001	84,44	*Jassa marmorata, Idotea pelagica, Mytilus edulis*

Cluster analysis showed a similarity of 55% between the scour-protection samples (Figure 8). Samples taken at depth 17 had almost 70% similarity, this was also visible in the MDS-plot (Figure 6) by a dense clustering of the samples. One sample was identified as an outlier, this was 1-SP-N-2011 (i.e. Splash zone NNE sample of WTG 1). This sample was characterized by low densities of *Jassa* spp., *Idotea pelagica* and *Telmatogeton japonicus*, in contrast to other splash zone samples which also contained other species.

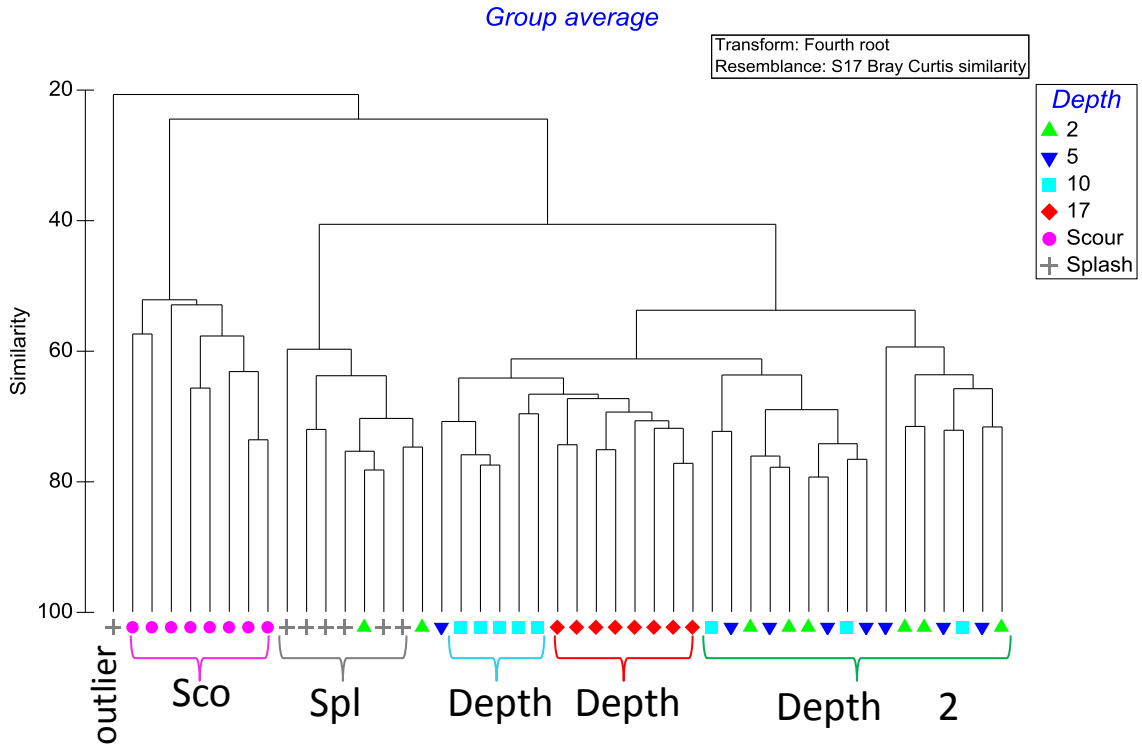


Figure 8: Cluster plot, indicating the depth zones

3.4 Zonation pattern

3.4.1 Monopiles

Based on the quantitative results (densities and biomasses) and the qualitative data (covering percentage, video footage; see Annex 2) a zonation pattern could be derived.

The splash zone of WTG 20, 45 and 60 was dominated by small individuals of *Mytilus edulis* (length 10 – 30 mm) (covering percentage 40 – 90%), *Idotea pelagica* (max densities 5.300 ind./m²), *Jassa herdmani* and *Jassa marmorata* (max densities 8.700 ind./m²). Despite the high densities of the tube building amphipod *Jassa* spp., the mussels were not covered by mats of the amphipod. In contrast, the splash zone of WTG 1 was dominated by algae (*Blidingia minima* and *Ulva* spp.) (covering percentage up to 90%).

Subtidally, the *M. edulis* covering percentage decreased from 70% to 0% with increasing depth, while tube building Amphipods (*Jassa* spp. and *Monocorophium* spp.) and Hydrozoa (*Tubularia indivisa*, *Laomedea flexuosa* and *Ectopleura larynx*) increased in presence (up to 100% coverage). Also Actiniaria (*Metridium senile*, *Sagartia* spp. *Urticina felina* and *Actiniaria* juv.) increased in occurrence and coverage (up to 80% coverage). Besides the sessile organisms, also some mobile organisms occurred, such as *Asterias rubens*, *Psammechinus miliaris* and several Decapoda species (*Cancer pagurus*, *Pilumnus hirtellus* and *Pisidia longicornis*). Dense clusters of *Asterias rubens* could contain over 500 individuals per m².

The density results of *Mytilus edulis* in the scrape samples revealed higher densities then visible on the video footage. This was probably caused by the covering of *M. edulis* with Hydrozoa and mats of the tube building amphipods *Jassa* spp. and *Monocorophium* spp, which made *M. edulis* sometimes difficult to see.

The subtidal pattern, as described above, applies to WTG 20, 45 and 60. WTG 1, however, showed high densities and a high coverage percentages of *Mytilus edulis* over the entire monopile (covering percentage 40 – 100), and a low to medium coverage of Actiniaria (5 – 50% coverage). The high densities of *Jassa* spp. and *Monocorophium* spp. in the scrape samples indicate a high coverage by mats of the tube building amphipods. Still, as seen in the quantitative multivariate analyses, WTG 1 was not identified as having a significantly differing species community.

3.4.2 Scour protection rocks

Conopeum reticulum was the most abundant Bryozoa species present on the scour protection rocks, sometimes reaching over 50% coverage (Table 6). Other Bryozoa species (*Electra pilosa*, *Schizomavella linearis*, *Callopora dumerilii*, *Microporella ciliata*) had a lower covering percentage, maximum 10%. Besides Bryozoa also Actiniaria (*Metridium senile*), Bivalvia (*Mytilus edulis*), Amphipoda (*Jassa* spp. and *Monocorophium* spp.), Polychaeta (*Sabellaria spinulosa*) and Cirripedia (*Verruca stroemia, Balanus crenatus*) were found on the scour protection rocks. On the video footage several mobile organisms were identified between the rocks: *Asterias rubens*, *Psammechinus miliaris*,

Cancer pagurus and *Necora puber*. Close to the monopile high densities of empty mussel shells were visible.

Table 6: Scour protection rocks covering percentage of Bryozoa

WTG	Orientation	*Conopeum reticulum*	*Electra pilosa*	*Schizomavella linearis*	*Callopora dumerilii*	*Microporella ciliata*
1	N	5		15	<5	5
1	S	35	<5	10	5	5
20	N	55	10		5	<5
20	S	<5	<5		10	
45	N	50	<5		5	<5
45	S		<5		<5	<5
60	N	40	10		<5	<5
60	S	20	<5		<5	

4. DISCUSSION

4.1 Development of hard substrate fauna in the Princess Amalia Wind Farm

Three years after construction of the wind farm, a species-rich community has settled on the monopiles as well as on the scour protection rocks. This community can be divided in two zones: an upper, **splash zone** dominated by Algae, *Mytilus edulis*, *Idotea pelagica* and *Jassa* spp. and a **sublittoral zone,** dominated by high densities of the tube dwelling amphipods *Jassa* spp. and *Monocorophium* spp., *Mytilus edulis*, *Asterias rubens*, *Metridium senile* and *Sagartia* spp.

Typical first colonizers of hard substrate, such as *Tubularia indivisa*, *Electra pilosa* and *Pomatoceros triqueter* (Zintzen, 2008; Kerckhof *et al.*, 2010a), were present, but only in low densities. More long-lived, slowly growing species, such as anemones and *Mytilus edulis* were dominating, with the exception of *Jassa* spp., a short-lived species with a high reproduction rate. This indicates that within three years of construction, the hard substrate in the wind farm has already reached some stage of maturity.

The dominance of tube dwelling amphipods (*Jassa* spp. and *Monocorophium* spp.) has been noted in many other studies on artificial substrates in the North Sea, such as shipwrecks (Zintzen 2007) and windmills (Leonhard & Pedersen, 2006 (Horns Rev); Kerkhof *et al.*, 2010a (C-Power); Bouma & Lengkeek, 2009 (OWEZ)). The amphipods construct mats which smother underlying species (such as barnacles, Bryozoa, etc.). Subsequently they make the available surface less suitable for the settlement of other species.

4.2 Comparison with other wind farms in the Southern North Sea

We compared the results of the Princess Amalia Wind Farm with results from three nearby wind farms, where similar studies have been performed:

The Netherlands first offshore wind farm was **OWEZ**, consisting of 36 monopiles located approximately 10 – 18 km offshore in water depths between 6 and 14 m. OWEZ wind farm was constructed between April and August 2006. The marine growth was sampled in September 2008, 2 years after construction of the wind farm (Bouma & Lengkeek, 2009).

The **C-Power** wind farm is located on the Thornton Bank in the Belgian Part of the North Sea (BPNS) and consist of six turbines (constructed in 2008). The Thornton bank is located 30 km offshore in a water depth of 6 - 20 m. The marine growth was sampled in September 2008, only some months after construction (Kerckhof *et al.*, 2009) and during the period February 2009 – 2010 (Kerckhof *et al.*, 2010a; Kerckhof *et al.*, 2010b).

The **Horns Rev** offshore wind farm in Denmark was constructed between March and August 2002. The wind farm consists of 80 monopiles located 14 - 20 km offshore in water depths of 6 - 14 m. The marine growth was sampled in March 2004, 2 years after construction (Leonhard & Peetersen, 2005).

The biodiversity found in the present study of the hard substrate fauna in the PAWP (85 species) was comparable, albeit slightly higher, to the diversity found in Horns Rev and C-Power (81 and 75 species resp.). However, those numbers of species were considerable higher than the numbers found in OWEZ (33 species). All of the above results were obtained 2 years after construction, whereas this study was done 3 years after construction. This could explain the higher biodiversity.

In all four wind farms a distinct depth zonation in marine growth was present, although the pattern varies between the different farms. In Horns Rev a distinct algal zone was present in the splash zone of the monopiles, this zone extends to approximately two m under the water surface. Besides vegetation there was almost a monoculture of *Telmatogeton japonicus*. In the other three wind farms (PAWP, OWEZ, C-Power) the algal band was restricted to approximately 0.5 m depth, and it did not occur on every monopile. A monoculture of *Telmatogeton japonicus* was only recorded in the C-Power wind farm shortly after construction; later on the species was still present, but in combination with other species. In PAWP *Telmatogeton japonicus* was present, but only in low densities; in OWEZ this species was not recorded at all. A barnacle zone just below the algae zone, as described in C-Power, was not present in PAWP.

The sublittoral zone of the monopiles in the different wind farms was dominated by *Mytilus edulis* covered by *Jassa* spp., with a clear presence of *Asterias rubens*. The densities, however, differed substantially between the different wind farms: PAWP and Horns Rev and C-Power showed comparable *Mytilus edulis* densities (approximately 1.600 ind./m²). OWEZ densities of *Mytilus edulis* were slightly lower (average 1.200 ind./m²). *Jassa* spp. occurred in high densities in the PAWP but in even much higher quantities in Horns Rev (average 40.005 and 168.413 ind./m² resp.). In both the splash and sublitoral zone of PAWP high densities of the isopod *Idotea pelagica* were found; this species was not recorded in the other wind farms.

An extensive subtidal zone, characterized by several anemones species (*Metridium senile*, *Sagartia* spp.), *Jassa* spp., several Hydrozoa and Bryozoa species, was identified in the four different wind farms, although their densities were not equal. In all wind farms the subtidal zone was the most species rich area.

4.3 Remarkable findings

After only three years the wind farm has been colonised by a diverse community including several rare species, some species unrecorded from the area and some species not recorded from other wind farms in the area (Table 7).

During this survey several species of Bryozoa were found which are rare or very rare along the eastern seabord of the Southern Bight of the North Sea. *Alcyonidium parasiticum*, *Arachnidium fibrosum*, *Scruparia ambigua* and *Callopora dumerilii* have been recorded only a few times before, mainly from the Eastern Scheldt (Faasse & De Blauwe, 2004). *Microporella ciliata* has been recorded only once before from the Dutch Continental Flat, i.e. from the Cleaver Bank (van Moorsel, 2003), much further offshore. Autochthonous colonies of *Celleporella hyalina* have never been recorded before from the eastern seaboard of the Southern Bight.

Table 7: New and rare species in this study

Species	Remarks
Bryozoa	
Alcyonidium parasiticum	Rare
Arachnidium fibrosum	Rare
Scruparia ambigua	Rare
Callopora dumerilii	Rare
Microporella ciliata	Only known from Cleaver Bank
Celleporella hyalina	New
Crustacea	
Stenothoe sp.	New
Gitana sarsi	Not recorded from wind farms in area
Idotea pelagica	Not recorded from wind farms in area
Mollusca	
Heteranomia squamula	Rare
Odostomia scalaris	Rare
Epitonum clathratulum	Rare

The polychaete ross worm *Sabellaria spinulosa* constructs hard tubes of sand grains. It may aggregate to form reefs. *Sabellaria* reefs used to be present in the international Wadden Sea, but disappeared during the last century (Nehring, 1999). *S. spinulosa* has become a much less common species after the disappearance of the reefs. Hard substrates on sandy bottoms in areas of strong currents have the potential to attract *Sabellaria* larvae and facilitate reef formation. *Sabellaria* reefs are known to develop diverse species communities (Jones, 1998 in Nehring, 1999). During this survey only separate individuals of the ross worm were found, but we cannot exclude that reef formation will take place in the future.

The amphipod *Stenothoe sp.* is probably a species that colonised the North Sea recently or a species which in this area has never been identified to species level.

The bivalve *Heteranomia squamula* is rare on the coast of The Netherlands and more common on hard substrates further offshore (Texel Rough, Cleaver Bank) (de Bruyne *et al.*, in prep.).

Records of the gastropods *Odostomia scalaris* and *Epitonium clathratulum* from coastal waters of The Netherlands are scanty. *Odostomia scalaris* is a parasite of the Blue mussel *Mytilus edulis* and is supposed to be sensitive to low water temperatures (de Bruyne *et al.*, in prep.). *Epitonium clathratulum* is a parasite of sea anemones, which was first recorded in situ from this area in 1966 (Texel Rough), followed by scattered records from 1994 onwards (Wetsteijn & Nieuwenhuizen, 1996; de Bruyne *et al.*, in prep.).

The rapid colonisation of the Princess Amalia Wind Farm by high species numbers of certain taxonomical groups indicates a high biodiversity potential. In three years the wind farm has been colonised by 75% (6 of 8) of the native Anthozoa species (sea anemones and soft corals) and a considerable number of Bryozoa species, among which very rare and new ones. The distance of the wind farm to the coast is relatively high, which means that colonisation by species without a dispersive stage may take more time. Nevertheless, several of these slow dispersers (Amphipoda, Isopoda, Ascidiacea) were found. Some of them (*Idotea pelagica*, *Gitana sarsi, Stenothoe tergestina*) have not been recorded from wind farms in the area before.

A higher distance from the coast will result in a more stable temperature and salinity, which may ultimately lead to an even higher species number.

4.4 Importance of the offshore wind farms for hard substrate fauna, and the relevance to the ecosystem

Assessing the role a wind farm can play for the specific hard substrate fauna, and for the local marine ecosystem, can be done at many different levels, which is beyond the scope of this report. Also, a sound analysis would require more points in time. Still, there are a number of interesting observations we can elaborate on.

As discussed in chapter 4.3, it is clear that having an artificial hard substrate close to the Dutch coast, gives ground for the rapid development of a rich associated hard substrate fauna. This specific fauna is relatively scarce in the Netherlands: ship wrecks, offshore constructions and hard coastal defense structures are the only notable exceptions.

A different approach is to look at the before and after situation. Before the construction of the wind farm, the area was known as a relatively homogenous sandy ecosystem. The benthos of the area was investigated prior to the construction, in 2003 (Jarvis et al., 2004). Within the boundaries of the future wind farm, they found a total of 109 invertebrate species. The average density was 1.183 ind./m^2, resulting in a biomass of 1,03 g/m^2 (AFDW).

In 2007-2008, in an area of 14 km^2 of this sandy habitat, a total of 61 monopiles (60 WTG and one HVS[3]) were positioned. In a mainly 2D landscape, at least for benthos, these monopiles added a vertical dimension. With a diameter of 4 m, and an average water depth of 22 m, one monopile adds approximately 275 m^2 of subtidal substrate. If we ignore the scour protection, for which biomass determination was only indicative, we can make a rough estimate of how much density and biomass of benthos these 61 times 275 m^2 have added to the area. These calculations are listed in Table 8. The numbers turn out to be quite staggering. Adding 0,12% of substrate to the total area, leads to an added contribution of 10% of animals, and a remarkable 49% of biomass. Note that this is even an underestimation, since colony-forming animals, which are almost non-existent in soft sediments, were counted as 1 ind./m^2 for the monopiles, and the biomass of some sessile organisms was not included in the current study.

[3] HVS = High Voltage Substation

Table 8: Comparison between hard and soft substrate benthos for the wind farm area. Hard substrate data from this report; soft substrate data from Jarvis et al. (2004).

		per m^2	per monopile	wind farm	contribution
Hard substrate	biomass (in gram)	588,00	162.559	9.916.073	49%
	density (in ind.)	101.877	28.164.931	1.718.060.795	10%
Soft substrate	biomass (in gram)	1,45		20.300.000	
	density (in ind.)	1.183		16.562.000.000	

Density-wise, the largest contribution comes from the Amphipoda that can form dense mats on hard substrates, something we do not find on the soft substrate. In terms of biomass, large species such as Blue mussels (*M. edulis*), sea urchins, sea stars and sea anemones are frequent on the monopiles, and absent or very rare in the soft substrate.

If we look at the species list, of the 109 soft substrate species and 85 hard substrate species, only two were shared: the opportunistic sea star *Asterias rubens* and the tube building Polychaeta *Lanice conchilega*. Some of the hard substrate species are also known to occur on soft substrate. It is now very interesting to see if during the soft substrate sampling in the Amalia Wind Farm, some of the species that were absent in the T0 and are now present on the hard substrate, will also be found in the soft substrate. This could mean that the hard substrate serves as a sort of distributor for some soft sediment species.

The significance of the biomass present as a food source for fish and birds is largely unknown. In the video footage the only fish species observed is pouting (*Trisopterus luscus*). It was filmed above the scour protection rocks. Another benthos feeding fish species known to be attracted to wind farms is cod *Gadus morhua* (see Reubens et al., 2010). Part of the biomass found is not available for consumption by vertebrate predators. Sea anemones, hydrozoans and bryozoans typically are only eaten by specialized invertebrate taxa like nudibranchs. Echinoderms (starfish and sea urchins) have few or no predators. Crustaceans and blue mussels in principle make an excellent food source for echinoderms, birds and fish. Crustacean biomass principally consists of mats of amphipods (*Jassa* spp.). In a Belgian windfarm Reubens et al. (2011) found that *Jassa herdmani*, together with the porcelain crab *Pisidia longicornis*, constitutes the main food item for pouting. These food species do not occur on surrounding soft substrates. Other food items in pouting stomachs were crabs, skeleton shrimps and mussels.The mussel biomass would in principle be a rich food source for birds and fish. It is not clear to what extent this source is utilized. The high number of empty mussel shells around the monopiles could be an indication of predation by vertebrates. Alternatively, predation by starfish and natural mortality of mussels could easily account for this accumulation, in view of the high number of living mussels present. The main avian predators of mussels are herring gulls *Larus argentatus*, oystercathchers *Haematopus ostralegus* and eiders *Somateria mollissima*. Only eiders, for which mussels are the main prey item, prey upon mussels under water (Hilgerloh, 1997). Dunthorn (1971) reports predation of eiders on rope-cultured mussels, which proves eider predation is not restricted to mussels on the bottom. In conclusion, the mussels on the monopiles could potentially be an important food source for eiders. Clumps of large mussels are relatively safe against fish predation. Small mussels constitute a food source for fish. In a Belgian windfarm mussels were frequently found in stomachs of pouting (Reubens et al., 2010).

5. CONCLUSIONS

The goals of this study were to investigate the development of the hard substrate fauna in the Princess Amalia Wind Farm and to assess the impact of the wind farm and its associated hard substrate fauna on the ecosystem.

During the survey, four monopiles - and their associated scour protection - were sampled, with 12 samples per monopile. Statistical analyses showed that this sampling effort was sufficient to encounter three quarters of the expected fauna.

We have observed that, only three years after construction, a very rich fauna has developed on the monopiles and scour protection. More species were found than in nearby wind farms, possibly due to the maturity stage of the faunal development: there are indications that we can already speak about a mature fauna composition, with a combination of rapid and slow colonizers and typical early colonizing species were almost absent.

The video footage showed that the vast majority of the available substrate has been colonized by one or more species: coverage was on average higher than 80%. There is thus a very high utilization grade of the available artificial substrate. A rough estimate of what this high utilization by hard substrate fauna could mean for the ecosystem showed that the biomass, available as food source for predators, in the wind farm area could easily be 50% higher than before the construction of the wind farm.

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Annex 1: species list[1]

Kingdom	Phylum	Class	species
Plantae	Chlorophyta	Chlorophyceae	*Blidingia minima*
			Ulva spp.
Animalia	Annelida	Polychaeta	*Eulalia viridis*
			Eunereis longissima
			Harmothoe extenuata
			Harmothoe impar
			Lanice conchilega
			Lepidonotus squamatus
			Nereis pelagica
			Phyllodoce laminosa
			Phyllodoce mucosa
			Pomatoceros triqueter
			Sabellaria spinulosa
			Spirorbidae
			Syllis prolifera
	Bryozoa	Bryozoa	*Alcyonidium cf. mamillatum*
			Alcyonidium cf. parasiticum
			Alcyonidium condylocinereum
			Alcyonidium parasiticum
			Arachnidium fibrosum
			Bowerbankia spp.
			Callopora dumerilii
			Celleporella hyalina
			Conopeum reticulum
			Electra pilosa
			Farrella repens
			Fenestrulina delicia
			Microporella ciliata
			Schizomavella linearis
			Scruparia ambigua
			Smittoidea prolifica
	Chordata	Gadidae	*Trisopterus luscus* (1) (2)
	Cnidaria	Actiniaria	*Actinothoe sphyrodeta* (1)
			Diadumene cincta (1)
			Metridium senile
			Sagartiogeton undatus
			Sagartia elegans (1)
			Sagartia troglodytes
			Urticina felina

[1] (1): Species only identified on video footage; (2): species not included in diversity analyses.

Kingdom	Phylum	Class	Species
		Hydrozoa	*Campanulariidae*
			Clytia hemisphaerica
			Ectopleura larynx
			Hydractinia echinata
			Laomedea flexuosa
			Laomedea longissima
			Obelia dichotoma
			Tubularia indivisa
		Octocorallia	*Alcyonium digitatum*
		Scyphozoa	*Aurelia aurita* (1)
	Crustacea	Amphipoda	*Abludomelita obtusata*
			Caprella linearis
			Gitana sarsi
			Jassa herdmani
			Jassa marmorata
			Monocorophium acherusicum
			Monocorophium sextonae
			Phthisica marina
			Stenothoe sp.
			Stenothoe monoculoides
			Stenothoe valida
		Cirripedia	*Balanus crenatus*
			Megabalanus coccopoma
			Semibalanus balanoides
			Verruca stroemia
		Copepoda	*Calanoida* spp.
		Decapoda	*Cancer pagurus*
			Necora puber (1)
			Pilumnus hirtellus
			Pinnotheres pisum
			Pisidia longicornis
		Isopoda	*Idotea pelagica*
		Ostracoda	*Podocopina spp.*
	Echinodermata	Asteroidea	*Asterias rubens*
		Echinoidea	*Psammechinus miliaris*
	Hexapoda	Insecta	*Telmatogeton japonicus*
	Mollusca	Bivalvia	*Heteranomia squamula*
			Mytilus edulis
			Ostrea edulis
			Venerupis senegalensis
		Gastropoda	*Aeolidia papillosa*
			Epitonium clathratulum
			Odostomia scalaris
	Nemertina	Nemertea	*cf. Emplectonema gracile*
	Porifera	Porifera	*Leucosolenia variabilis*
	Tunicata	Ascidiacea	*Diplosoma listerianum*

Annex 2: Video footage data

Covering percentage on the monopiles.

X: species (Amphipoda or Hydrozoa) are present, but exact coverage percentage was not possible to determine on the video footage.

The presence of mobile organisms is indicated with 'i'. Where these mobile organisms blocked the view of the underlying structures, this is listed in the column 'not visible'.

			Sessile organisms							Mobile organisms	
WTG	Orientation	Depth	*Mytilus edulis*	Anemones *(Metridium senile, Sagartia* spp.*)*	Tube builing Amphipoda (*Jassa* spp. and *Corophium* spp.)	Hydrozoa spp.	Algae	Total coverage	Not visible	*Asterias rubens*	*Psammechinus miliaris*
1	N	Splash					80	80			
		2	80					80			
		5	95	5	x			100			
		10	40	50	x			100	10	i	i
		17	70	25	x			95			
	S	Splash					90	90			
		2	100		x			100			
		5	80	10				90			
		10	90	10	x			100			
		17	90		x	x		90			
20	N	Splash	70					70			
		2	70		30	x		100			
		5			100	x		100		i	
		10		10	90	x		100			
		17		5	90	x		100	5	i	

			Sessile organisms							Mobile organisms	
WTG	Orientation	Depth	*Mytilus edulis*	Anemones (*Metridium senile*, *Sargatia* spp.)	Tube builing Amphipoda (*Jassa* spp. and *Corophium* spp.)	Hydrozoa spp.	Algae	Total coverage	Not visible	*Asterias rubens*	*Psammechinus miliaris*
	S	Splash	40				10	50			
		2		10	90	i		100		i	i
		5			70	i		100	30	i	i
		10		70	30	i		100		i	
		17		20	80	i		100			
45	N	Splash	40					40			
		2		15	85	i		100			
		5			90	i		100	10	i	i
		10		20	70	i		100	10	i	i
		17		80	20	i		100			
	S	Splash	50					50			
		2	60		20	i		80			
		5		10		70		100	5		i
		10		40	i	30		95	10	i	i
		17		5	i	95		100			
60	N	Splash	90					90			
		2	60					60		i	
		5	50	20	i			100	10	i	i
		10		40	i	50		90			
		17		30	i	70		100			
	S	Splash	90					90			
		2	97	3	i	i		100			
		5	100	i	i	i		100			
		10		10	i	90		100		i	
		17		80	i	20		100			

Annex 3: Raw density data (ind/m²)

WTG	1								
Orientation	N						S		
Depth	Splash	2	5	10	17	Scour	Splash	2	5
Species									
Abludomelita obtusata									
Acontiaria juv.			5071		982				
Aeolidia papillosa				54					
Alcyonidium cf. mamillatum									
Alcyonidium cf. parasiticum									
Alcyonidium condylocinereum						present			
Alcyonidium parasiticum									
Alcyonium digitatum						31			
Arachnidium fibrosum									
Asterias rubens			339	36		51		179	250
Balanus crenatus		36		36	18			18	
Blidingia minima	357	179							
Bowerbankia spp.									present
Calanoida spp.									
Callopora dumerilii						present			
Campanulariidae spp.						present			
Cancer pagurus								18	18
Caprella linearis									
Celleporella hyalina									
cf. Arachnidium fibrosum									present
cf. Clytia hemisphaerica									
cf. Emplectonema gracile									
cf. Laomedea flexuosa									
Clytia hemisphaerica				present		present			
Conopeum reticulum			present	present		present			
Diplosoma listerianum				present	present			present	
Ectopleura larynx			present	present	present			present	present
Electra pilosa			present	present	present	present		present	present
Epitonium clathratulum									
Eulalia viridis			304	339	214			214	250
Eunereis longissima				18					18
Farrella repens									
Fenestrulina delicia									
Gitana sarsi									
Harmothoe extenuata			54	89				71	36
Harmothoe impar			161	304	71			143	107
Heteranomia squamula									
Hydractinia echinata									
Hydrozoa spp.								present	
Hydrozoa spp. 2									
Idotea pelagica	446	4143	1071	71	125			321	89
Jassa herdmani	429	11036	288554	91429	40875	282		213964	107429
Jassa marmorata	107	8679	12018		1696			18607	
Jassa spp.	214								
Lanice conchilega			71		36			89	36
Laomedea flexuosa		present							

WTG	1								
Orientation	N						S		
Depth	Splash	2	5	10	17	Scour	Splash	2	5
Species									
Laomedea longissima									
Lepidonotus squamatus			393	500	196			125	214
Leucosolenia spp.									
Leucosolenia variabilis									
Megabalanus coccopoma								18	
Metridium senile			429	107	393	98		36	89
Microporella ciliata						present			
Monocorophium acherusicum					571	376			
Monocorophium sextonae					304				
Monocorophium spp.					286	690		571	
Mytilus edulis		3196	4536	2768	839	8		4232	4536
Nemertea spp.				36					
Nereis pelagica			18	18				18	18
Obelia dichotoma									
Odostomia scalaris			446	7625	3268			1393	6911
Ostrea edulis									
Phthisica marina				54	1000	20			
Phyllodoce laminosa									
Phyllodoce mucosa								54	
Phyllodocidae spp.									
Pilumnus hirtellus			71	54	71			107	18
Pinnotheres pisum				18					
Pisidia longicornis			54		36	24			
Podocopina spp.									
Polynoidae spp.									
Pomatoceros triqueter						4			
Porifera spp.									
Psammechinus miliaris			18	18					18
Sabellaria spinulosa									
Sagartia troglodytes			89	304	71			71	36
Schizomavella linearis						present			
Scruparia ambigua			present						present
Scruparia spp.									
Semibalanus balanoides									
Smittoidea prolifica									
Spirorbidae spp.								18	
Stenothoe monoculoides			36	125	1714	20		36	1161
Stenothoe spp.			18						
Stenothoe valida			71	964	125			18	
Syllis prolifera			464	125	71			429	696
Telmatogeton japonicus	232	54							
Tubularia indivisa									
Ulva spp.	89								
Utricina felina								18	18
Venerupis senegalensis				18				18	
Verruca stroemia						12			

WTG	20
Orientation	N

Depth Species	10	17	Scour	Splash	2	5	10	17
Abludomelita obtusata								
Acontiaria juv.	2357	54					536	321
Aeolidia papillosa	18	107					18	54
Alcyonidium cf. mamillatum	present							
Alcyonidium cf. parasiticum								
Alcyonidium condylocinereum								
Alcyonidium parasiticum								
Alcyonium digitatum			24					
Arachnidium fibrosum								
Asterias rubens		36	40		179	1054	107	36
Balanus crenatus				36				
Blidingia minima								
Bowerbankia spp.		present						
Calanoida spp.								
Callopora dumerilii			present					present
Campanulariidae spp.								
Cancer pagurus		18					18	
Caprella linearis					18			36
Celleporella hyalina			present					
cf. Arachnidium fibrosum							present	
cf. Clytia hemisphaerica							present	
cf. Emplectonema gracile	18							
cf. Laomedea flexuosa	present			present				
Clytia hemisphaerica	present							
Conopeum reticulum	present	present	present					
Diplosoma listerianum		present			present			present
Ectopleura larynx	present	present			present	present	present	present
Electra pilosa	present	present	present	present		present	present	present
Epitonium clathratulum								
Eulalia viridis	54	107	13		321	36	196	357
Eunereis longissima		18						
Farrella repens								
Fenestrulina delicia								
Gitana sarsi								
Harmothoe extenuata		18						18
Harmothoe impar	125	179	3	18	18		89	214
Heteranomia squamula								
Hydractinia echinata								
Hydrozoa spp.	present							
Hydrozoa spp. 2	present							
Idotea pelagica	179	18		5679	304	232		54
Jassa herdmani	44000	32286	162	15821	273607	250286	32911	77714
Jassa marmorata	571			26911	52107		1375	
Jassa spp.	14911			29429				
Lanice conchilega	18							36
Laomedea flexuosa								
Laomedea longissima								
Lepidonotus squamatus	196	375	7		54	179	179	179
Leucosolenia spp.	present							
Leucosolenia variabilis								

Orientation				N				
Depth	10	17	Scour	Splash	2	5	10	17
Species								
Megabalanus coccopoma								
Metridium senile	304	71	27		107	18	143	143
Microporella ciliata			present					
Monocorophium acherusicum		18	310					5161
Monocorophium sextonae								1732
Monocorophium spp.								54
Mytilus edulis	1786	2357	13	5446	1857		89	54
Nemertea spp.								
Nereis pelagica	36	18	3		54		36	36
Obelia dichotoma								
Odostomia scalaris	3089	4071		286			36	
Ostrea edulis								
Phthisica marina	4571	1946					643	125
Phyllodoce laminosa								
Phyllodoce mucosa					18			
Phyllodocidae spp.								
Pilumnus hirtellus	36	107			125	161	18	571
Pinnotheres pisum	18							
Pisidia longicornis		321		18		36		571
Podocopina spp.								
Polynoidae spp.								
Pomatoceros triqueter								
Porifera spp.			present					
Psammechinus miliaris						18		
Sabellaria spinulosa								
Sagartia troglodytes	196	18	44		36		464	196
Sagartiogeton undatus		18	10				54	54
Schizomavella linearis			present					
Scruparia ambigua	present	present			present			
Scruparia spp.								
Semibalanus balanoides								
Smittoidea prolifica								
Spirorbidae spp.								
Stenothoe monoculoides	607	696	40	286	54	36	18	589
Stenothoe spp.		54					18	
Stenothoe valida	36	911			18	554	321	1018
Syllis prolifera	161	125		36	125	18		
Telmatogeton japonicus	18							
Tubularia indivisa	present					present		present
Ulva spp.								
Utricina felina	54						18	
Venerupis senegalensis								
Verruca stroemia								

WTG									
Orientation		S						45 N	
Depth	Scour	Splash	2	5	10	17	Scour	Splash	2
Species									
Abludomelita obtusata									
Acontiaria juv.		18			571	411			
Aeolidia papillosa			18	18	18	18			
Alcyonidium cf. mamillatum									
Alcyonidium cf. parasiticum									
Alcyonidium condylocinereum									
Alcyonidium parasiticum									
Alcyonium digitatum	12					54			
Arachnidium fibrosum									
Asterias rubens			143	518	107	54	8		143
Balanus crenatus		18			18			71	
Blidingia minima									
Bowerbankia spp.									
Calanoida spp.									
Callopora dumerilii	present						present		
Campanulariidae spp.									
Cancer pagurus									
Caprella linearis									
Celleporella hyalina	present								
cf. Arachnidium fibrosum									
cf. Clytia hemisphaerica									
cf. Emplectonema gracile									
cf. Laomedea flexuosa									
Clytia hemisphaerica									
Conopeum reticulum	present						present		
Diplosoma listerianum	present				present	present			
Ectopleura larynx			present	present	present				present
Electra pilosa	present	present	present		present		present	present	present
Epitonium clathratulum					18				
Eulalia viridis			89	71	304	143		18	89
Eunereis longissima									
Farrella repens									
Fenestrulina delicia									
Gitana sarsi									
Harmothoe extenuata						18			
Harmothoe impar				18	89	107	16		
Heteranomia squamula									
Hydractinia echinata									
Hydrozoa spp.									
Hydrozoa spp. 2									
Idotea pelagica		3518	250	161	18	54		5304	1089
Jassa herdmani	70	22232	62107	156661	23714	14036	277	8679	102857
Jassa marmorata		57196	67446	13625		2679		4893	9143
Jassa spp.							65		52571
Lanice conchilega					18				
Laomedea flexuosa		present						present	
Laomedea longissima	present								
Lepidonotus squamatus				36	214	107		18	36
Leucosolenia spp.					present				
Leucosolenia variabilis	present						present		

WTG									
Orientation		S						45 N	
Depth	Scour	Splash	2	5	10	17	Scour	Splash	2
Species									
Megabalanus coccopoma		18							18
Metridium senile	70		214			54		18	
Microporella ciliata	present						present		
Monocorophium acherusicum	843				143	1286	277		
Monocorophium sextonae	47					161	65		
Monocorophium spp.	70						33		
Mytilus edulis		1214	250		179	18		6732	321
Nemertea spp.									
Nereis pelagica					18	18			
Obelia dichotoma								present	
Odostomia scalaris					286				
Ostrea edulis									
Phthisica marina	47				54	71			
Phyllodoce laminosa									
Phyllodoce mucosa					36				
Phyllodocidae spp.									
Pilumnus hirtellus					143	54			
Pinnotheres pisum									
Pisidia longicornis						18			
Podocopina spp.									
Polynoidae spp.									
Pomatoceros triqueter									
Porifera spp.									
Psammechinus miliaris			18	36	36				18
Sabellaria spinulosa									
Sagartia troglodytes				36	964	125	49		125
Sagartiogeton undatus						36			
Schizomavella linearis									
Scruparia ambigua									
Scruparia spp.									
Semibalanus balanoides									
Smittoidea prolifica									
Spirorbidae spp.			18						
Stenothoe monoculoides					518	18	65		18
Stenothoe spp.								18	
Stenothoe valida				54	321	143		18	107
Syllis prolifera			36	18		18			18
Telmatogeton japonicus									
Tubularia indivisa									
Ulva spp.									
Utricina felina			18						54
Venerupis senegalensis							8		
Verruca stroemia	35								

WTG									
Orientation					S				
Depth	5	10	17	Scour	Splash	2	5	10	17
Species									
Abludomelita obtusata									
Acontiaria juv.	54	732	786	41			232	179	321
Aeolidia papillosa								18	54
Alcyonidium cf. mamillatum									
Alcyonidium cf. parasiticum									
Alcyonidium condylocinereum									
Alcyonidium parasiticum									
Alcyonium digitatum									54
Arachnidium fibrosum	present	present	present						
Asterias rubens	1589	643	18	20		196	321	161	18
Balanus crenatus				5		18			
Blidingia minima									
Bowerbankia spp.									
Calanoida spp.			18						
Callopora dumerilii				present					present
Campanulariidae spp.									
Cancer pagurus	36		18				18		
Caprella linearis									
Celleporella hyalina				present					present
cf. Arachnidium fibrosum									
cf. Clytia hemisphaerica									
cf. Emplectonema gracile									
cf. Laomedea flexuosa						present			
Clytia hemisphaerica									
Conopeum reticulum				present					
Diplosoma listerianum	present	present	present					present	present
Ectopleura larynx	present	present	present			present	present	present	present
Electra pilosa	present	present		present		present		present	present
Epitonium clathratulum									
Eulalia viridis	71	446	89					161	161
Eunereis longissima									18
Farrella repens									
Fenestrulina delicia									
Gitana sarsi								18	857
Harmothoe extenuata		54						71	
Harmothoe impar	36	268	18			18	18	36	179
Heteranomia squamula									
Hydractinia echinata									
Hydrozoa spp.									
Hydrozoa spp. 2									
Idotea pelagica	214	179	125		750	3768	161	54	161
Jassa herdmani	74286	67821	25000	347	9875	106607	111911	54304	28411
Jassa marmorata		5893			5554	135679	4661	7411	3875
Jassa spp.									
Lanice conchilega									
Laomedea flexuosa					present				
Laomedea longissima									
Lepidonotus squamatus	161	429	71			36		89	214
Leucosolenia spp.	present								
Leucosolenia variabilis									

WTG									
Orientation					S				
Depth	5	10	17	Scour	Splash	2	5	10	17
Species									
Megabalanus coccopoma									
Metridium senile	36		1321	36		71	161	161	214
Microporella ciliata				present					
Monocorophium acherusicum			321	388					10018
Monocorophium sextonae				41					
Monocorophium spp.				143					
Mytilus edulis	36	54	857		1500	2000			71
Nemertea spp.	18								
Nereis pelagica	18	54	18			54		18	36
Obelia dichotoma					present				
Odostomia scalaris			571			18			
Ostrea edulis									
Phthisica marina	18	232	1393	31					339
Phyllodoce laminosa		18							
Phyllodoce mucosa							18	18	36
Phyllodocidae spp.		18							
Pilumnus hirtellus	36					125		18	
Pinnotheres pisum									
Pisidia longicornis		18	36		18	36			
Podocopina spp.									
Polynoidae spp.									
Pomatoceros triqueter									
Porifera spp.									
Psammechinus miliaris	36	89				54	54	36	36
Sabellaria spinulosa				5					
Sagartia troglodytes	71	393		5				71	321
Sagartiogeton undatus									36
Schizomavella linearis									
Scruparia ambigua									
Scruparia spp.									
Semibalanus balanoides									
Smittoidea prolifica									
Spirorbidae spp.									
Stenothoe monoculoides	6857	232	18					89	1161
Stenothoe spp.			232				107		
Stenothoe valida	4321	2393	946				214	500	839
Syllis prolifera	18	18	18						18
Telmatogeton japonicus									
Tubularia indivisa	present	present						present	
Ulva spp.									
Utricina felina						18	54	54	
Venerupis senegalensis									
Verruca stroemia				31					

WTG		60							
Orientation		N						S	
Depth	Scour	Splash	2	5	10	17	Scour	Splash	2
Species									
Abludomelita obtusata									
Acontiaria juv.	34		18	750	125	1375	26	18	71
Aeolidia papillosa				18		18			
Alcyonidium cf. mamillatum									
Alcyonidium cf. parasiticum						present			
Alcyonidium condylocinereum									
Alcyonidium parasiticum									
Alcyonium digitatum	181								
Arachnidium fibrosum					present	present			
Asterias rubens	25			196	393	89	26		125
Balanus crenatus	4			18					
Blidingia minima								present	
Bowerbankia spp.									
Calanoida spp.									
Callopora dumerilii	present					present	present		
Campanulariidae spp.				present					
Cancer pagurus									18
Caprella linearis				18	36	232			
Celleporella hyalina	present					present			
cf. Arachnidium fibrosum									
cf. Clytia hemisphaerica									
cf. Emplectonema gracile									
cf. Laomedea flexuosa									
Clytia hemisphaerica					present		present		
Conopeum reticulum							present		
Diplosoma listerianum						present	present		
Ectopleura larynx				present	present	present			
Electra pilosa	present		present	present	present	present	present		
Epitonium clathratulum	4								
Eulalia viridis	4		54	89	54	357		18	54
Eunereis longissima									18
Farrella repens	present								
Fenestrulina delicia	present						present		
Gitana sarsi									
Harmothoe extenuata						18			36
Harmothoe impar				89	143	268			18
Heteranomia squamula									
Hydractinia echinata					present				
Hydrozoa spp.	present								
Hydrozoa spp. 2									
Idotea pelagica		2732	2518	250	411	107		1161	161
Jassa herdmani	1887	964	5768	34857	21946	10571	68	1089	106286
Jassa marmorata		2036	4518	589	911			25786	
Jassa spp.				857					
Lanice conchilega						36			18
Laomedea flexuosa			present						
Laomedea longissima									
Lepidonotus squamatus	8		18	250	89	179			36
Leucosolenia spp.				present		present	present		present
Leucosolenia variabilis									

WTG		60							
Orientation		N						S	
Depth	Scour	Splash	2	5	10	17	Scour	Splash	2
Species									
Megabalanus coccopoma									
Metridium senile	46			268	250	143	43		179
Microporella ciliata	present						present		
Monocorophium acherusicum	1942					107	1882		
Monocorophium sextonae	80					18	162		
Monocorophium spp.						54			
Mytilus edulis	4	3643	2750	1357	54	179		625	1625
Nemertea spp.									
Nereis pelagica				18	36	36			
Obelia dichotoma									
Odostomia scalaris	13	36	18	375		161			107
Ostrea edulis			18					18	
Phthisica marina	34	36		54	161	929	85	36	36
Phyllodoce laminosa		18							
Phyllodoce mucosa									
Phyllodocidae spp.					18	36			
Pilumnus hirtellus	8			18		36	9		54
Pinnotheres pisum				18					
Pisidia longicornis	13			54		54	9		54
Podocopina spp.	4								
Polynoidae spp.					18		9		
Pomatoceros triqueter									
Porifera spp.									
Psammechinus miliaris				36	36				
Sabellaria spinulosa	8								
Sagartia troglodytes	8				89	125	17		
Sagartiogeton undatus	8								
Schizomavella linearis									
Scruparia ambigua									
Scruparia spp.								present	
Semibalanus balanoides									
Smittoidea prolifica	present						present		
Spirorbidae spp.									
Stenothoe monoculoides	34		18	71	71	18	17		89
Stenothoe spp.					18				
Stenothoe valida		107	36	1179	1911	1036		54	36
Syllis prolifera		18	71	5000	250	54		54	2696
Telmatogeton japonicus		107	18	286				54	
Tubularia indivisa				present	present	present			
Ulva spp.								present	
Utricina felina									
Venerupis senegalensis									36
Verruca stroemia	72								

WTG Orientation Depth Species	5	10	17	Scour
Abludomelita obtusata				5
Acontiaria juv.	143	125	1536	
Aeolidia papillosa	54	54	36	
Alcyonidium cf. mamillatum				
Alcyonidium cf. parasiticum				
Alcyonidium condylocinereum				
Alcyonidium parasiticum		present		
Alcyonium digitatum				
Arachnidium fibrosum		present		
Asterias rubens	107	286		29
Balanus crenatus				
Blidingia minima				
Bowerbankia spp.				
Calanoida spp.				
Callopora dumerilii				present
Campanulariidae spp.				
Cancer pagurus	36			
Caprella linearis			36	
Celleporella hyalina				present
cf. Arachnidium fibrosum				
cf. Clytia hemisphaerica				
cf. Emplectonema gracile				
cf. Laomedea flexuosa				
Clytia hemisphaerica				present
Conopeum reticulum			present	present
Diplosoma listerianum	present	present	present	
Ectopleura larynx	present	present		
Electra pilosa		present		present
Epitonium clathratulum				
Eulalia viridis	143	857	179	
Eunereis longissima				
Farrella repens				
Fenestrulina delicia				
Gitana sarsi			18	
Harmothoe extenuata	36	18		
Harmothoe impar	179	89	107	
Heteranomia squamula			143	
Hydractinia echinata			present	
Hydrozoa spp.				
Hydrozoa spp. 2				
Idotea pelagica	268	89	232	
Jassa herdmani	102071	2286	26143	63
Jassa marmorata	4286	196		
Jassa spp.				
Lanice conchilega	18	18	18	
Laomedea flexuosa				
Laomedea longissima				
Lepidonotus squamatus	304	589	107	5
Leucosolenia spp.	present	present		
Leucosolenia variabilis				

WTG Orientation Depth Species	5	10	17	Scour
Megabalanus coccopoma				
Metridium senile	107	89	161	15
Microporella ciliata				present
Monocorophium acherusicum			839	19
Monocorophium sextonae				
Monocorophium spp.				
Mytilus edulis	2786	321	536	
Nemertea spp.				
Nereis pelagica	54	18	18	
Obelia dichotoma				
Odostomia scalaris	6321	54	179	
Ostrea edulis				
Phthisica marina	18	411	429	19
Phyllodoce laminosa				
Phyllodoce mucosa			18	
Phyllodocidae spp.		18		
Pilumnus hirtellus	143			
Pinnotheres pisum	18			
Pisidia longicornis	71		18	5
Podocopina spp.				
Polynoidae spp.		18		
Pomatoceros triqueter				
Porifera spp.				
Psammechinus miliaris	18	18		
Sabellaria spinulosa				
Sagartiogeton undatus			18	
Sagartia troglodytes	89	71	357	15
Schizomavella linearis				
Scruparia ambigua		present		
Scruparia spp.				
Semibalanus balanoides				5
Smittoidea prolifica				
Spirorbidae spp.				
Stenothoe monoculoides	107	196	36	
Stenothoe spp.				
Stenothoe valida	89	2357	1161	
Syllis prolifera	2929	196	196	
Telmatogeton japonicus				
Tubularia indivisa		present		
Ulva spp.				
Utricina felina				
Venerupis senegalensis	18			
Verruca stroemia				

Annex 4: Raw biomass data (g AFDW/m²)

WTG	1								
Orientation	N						S		
Depth	Splash	2	5	10	17	Scour	Splash	2	5
Species									
Abludomelita obtusata									
Acontiaria juv.			25,541		13,929				
Aeolidia papillosa				4,688					
Alcyonidium cf. mamillatum									
Alcyonidium cf. parasiticum									
Alcyonidium condylocinereum						present			
Alcyonidium parasiticum									
Alcyonium digitatum						0,519			
Arachnidium fibrosum									
Asterias rubens			14,567	0,262		1,626		11,851	39,885
Balanus cf. crenatus									
Balanus crenatus		1,654		1,751	1,751			1,751	
Blidingia minima	present								
Blidingia minima		present							
Bowerbankia spp.									present
Calanoida spp.									
Callopora dumerilii						present			
Campanulariidae									
Campanulariidae spp.						present			
Cancer pagurus								1,355	1,355
Caprella linearis									
Celleporella hyalina									
cf. Arachnidium fibrosum									present
cf. Balanus crenatus									
cf. Clytia hemisphaerica									
cf. Emplectonema gracile									
cf. Laomedea flexuosa									
Clytia hemisphaerica				present		present			
Conopeum reticulum			present	present		present			
Diplosoma listerianum				present	present			present	
Ectopleura larynx			present	present	present			present	present
Electra pilosa			present	present	present	present		present	present
Epitonium clathratulum									
Eulalia viridis			1,321	1,357	0,459			1,313	1,352
Eunereis longissima				0,177					0,229
Farrella repens									
Fenestrulina delicia									
Gitana sarsi									
Harmothoe extenuata			2,946	4,968				3,677	1,111
Harmothoe impar			0,193	0,496	0,059			0,254	0,245
Heteranomia squamula									
Hydractinia echinata									
Hydrozoa spp.								present	
Hydrozoa spp. 2									
Idotea pelagica	52,679	48,886	12,643	0,843	1,475			3,793	1,054
Jassa herdmani	1,286	3,311	86,566	27,429	12,263	0,085		64,189	32,229
Jassa marmorata	0,321	2,604	3,605		0,509			5,582	

WTG	1								
Orientation	N						S		
Depth	Splash	2	5	10	17	Scour	Splash	2	5
Species									
Jassa spp.	0,643								
Laemedea flexuosa									
Lanice conchilega			0,052		0,061			0,300	0,087
Laomedea flexuosa		present							
Laomedea longissima									
Lepidonotus squamatus			4,359	7,386	2,645			2,725	5,168
Leucosolenia variabilis									
Megabalanus coccopoma								6,077	
Metridium senile			23,089	140,536	38,527	77,451		13,332	8,327
Microporella ciliata						present			
Monocorophium acherusicum					0,171	0,113			
Monocorophium sextonae					0,091				
Monocorophium spp.					0,086	0,207		0,171	
Mytilus edulis		138,313	381,030	948,465	555,638	5,267		550,813	567,479
Nemertea spp.				0,241					
Nereis pelagica			0,107	0,509				1,804	2,057
Obelia dichotoma									
Odostomia scalaris			0,091	1,907	0,956			0,406	1,382
Ostrea edulis									
Phthisica marina				0,016	0,300	0,006			
Phyllodoce laminosa									
Phyllodoce mucosa								0,255	
Phyllodocidae spp.									
Pilumnus hirtellus			2,335	2,298	0,150			2,410	0,038
Pinnotheres pisum				0,038					
Pisidia longicornis			0,113		0,075	0,049			
Podocopina spp.									
Polynoidae spp.									
Pomatoceros triqueter						0,171			
Porifera spp.									
Psammechinus miliaris			2,250	2,250					2,250
Sabellaria spinulosa									
Sagartiogeton undatus									
Sagartia troglodytes			3,977	23,325	24,961			21,461	10,771
Schizomavella linearis						present			
Scruparia ambigua			present						present
Scruparia spp.									
Semibalanus balanoides									
Smittoidea prolifica									
Spirorbidae								0,078	
Stenothoe monoculoides			0,011	0,038	0,514	0,006		0,011	0,348
Stenothoe spp.			0,005						
Stenothoe valida			0,021	0,289	0,038			0,005	
Syllis prolifera			0,204	0,048	0,023			0,125	0,270
Telmatogeton japonicus	0,070	0,002							
Tubularia indivisa									
Ulva spp.	present								
Utricina felina								93,929	11,738
Venerupis senegalensis				0,416				1,254	
Verruca stroemia						4,258			
WTG	1								

Orientation	N						S		
Depth	Splash	2	5	10	17	Scour	Splash	2	5
Species									
Jassa spp.	0,643								
Laemedea flexuosa									
Lanice conchilega			0,052		0,061			0,300	0,087
Laomedea flexuosa		present							
Laomedea longissima									
Lepidonotus squamatus			4,359	7,386	2,645			2,725	5,168
Leucosolenia variabilis									
Megabalanus coccopoma								6,077	
Metridium senile			23,089	140,536	38,527	77,451		13,332	8,327
Microporella ciliata						present			
Monocorophium acherusicum					0,171	0,113			
Monocorophium sextonae					0,091				
Monocorophium spp.					0,086	0,207		0,171	
Mytilus edulis		138,313	381,030	948,465	555,638	5,267		550,813	567,479
Nemertea spp.				0,241					
Nereis pelagica			0,107	0,509				1,804	2,057
Obelia dichotoma									
Odostomia scalaris			0,091	1,907	0,956			0,406	1,382
Ostrea edulis									
Phthisica marina				0,016	0,300	0,006			
Phyllodoce laminosa									
Phyllodoce mucosa								0,255	
Phyllodocidae spp.									
Pilumnus hirtellus			2,335	2,298	0,150			2,410	0,038
Pinnotheres pisum				0,038					
Pisidia longicornis			0,113		0,075	0,049			
Podocopina spp.									
Polynoidae spp.									
Pomatoceros triqueter						0,171			
Porifera spp.									
Psammechinus miliaris			2,250	2,250					2,250
Sabellaria spinulosa									
Sagartiogeton undatus									
Sagartia troglodytes			3,977	23,325	24,961			21,461	10,771
Schizomavella linearis						present			
Scruparia ambigua			present						present
Scruparia spp.									
Semibalanus balanoides									
Smittoidea prolifica									
Spirorbidae								0,078	
Stenothoe monoculoides			0,011	0,038	0,514	0,006		0,011	0,348
Stenothoe spp.			0,005						
Stenothoe valida			0,021	0,289	0,038			0,005	
Syllis prolifera			0,204	0,048	0,023			0,125	0,270
Telmatogeton japonicus	0,070	0,002							
Tubularia indivisa									
Ulva spp.	present								
Utricina felina								93,929	11,738
Venerupis senegalensis				0,416				1,254	
Verruca stroemia						4,258			
WTG				20					
Orientation				N					

Depth Species	10	17	Scour	Splash	2	5	10	17	Scour
Laomedea flexuosa									
Laomedea longissima									present
Lepidonotus squamatus	2,295	4,220	0,015		0,321	0,495	0,825	1,307	
Leucosolenia variabilis									present
Megabalanus coccopoma									
Metridium senile	355,714	96,914	1,524		50,348	45,455	8,071	8,213	12,077
Microporella ciliata			present						present
Monocorophium acherusicum		0,005	0,093					1,548	0,253
Monocorophium sextonae								0,520	0,014
Monocorophium spp.								0,016	0,021
Mytilus edulis	1262,765	991,399	29,731	174,041	334,001		4,241	2,447	
Nemertea spp.									
Nereis pelagica	0,550	0,134	0,011		5,277		0,857	0,407	
Obelia dichotoma									
Odostomia scalaris	0,812	1,880		0,071			0,009		
Ostrea edulis									
Phthisica marina	1,371	0,584					0,193	0,038	0,014
Phyllodoce laminosa									
Phyllodoce mucosa					0,062				
Phyllodocidae spp.									
Pilumnus hirtellus	0,075	3,612			0,263	0,338	0,038	1,200	
Pinnotheres pisum	0,038								
Pisidia longicornis		0,675		0,038		0,075		1,200	
Podocopina spp.									
Polynoidae spp.									
Pomatoceros triqueter									
Porifera spp.			present						
Psammechinus miliaris						28,929			
Sabellaria spinulosa									
Sagartiogeton undatus		3,223	1,681				8,902	21,334	
Sagartia troglodytes	26,077	0,043	7,865		8,573		155,867	26,670	
Schizomavella linearis			present						
Scruparia ambigua	present	present			present				
Scruparia spp.									
Semibalanus balanoides									
Smittoidea prolifica									
Spirorbidae									
Stenothoe monoculoides	0,182	0,209	0,012	0,086	0,016	0,011	0,005	0,177	
Stenothoe spp.		0,016					0,005		
Stenothoe valida	0,011	0,273			0,005	0,166	0,096	0,305	
Syllis prolifera	0,038	0,039		0,013	0,048	0,004			
Telmatogeton japonicus	0,001								
Tubularia indivisa	present					present		present	
Ulva spp.									
Utricina felina	217,707						64,299		
Venerupis senegalensis									
Verruca stroemia									12,714

WTG				20					
Orientation				N					
Depth	10	17	Scour	Splash	2	5	10	17	Scour
Species									
Laomedea flexuosa									
Laomedea longissima									present
Lepidonotus squamatus	2,295	4,220	0,015		0,321	0,495	0,825	1,307	
Leucosolenia variabilis									present
Megabalanus coccopoma									
Metridium senile	355,714	96,914	1,524		50,348	45,455	8,071	8,213	12,077
Microporella ciliata			present						present
Monocorophium acherusicum		0,005	0,093					1,548	0,253
Monocorophium sextonae								0,520	0,014
Monocorophium spp.								0,016	0,021
Mytilus edulis	1262,765	991,399	29,731	174,041	334,001		4,241	2,447	
Nemertea spp.									
Nereis pelagica	0,550	0,134	0,011		5,277		0,857	0,407	
Obelia dichotoma									
Odostomia scalaris	0,812	1,880		0,071			0,009		
Ostrea edulis									
Phthisica marina	1,371	0,584					0,193	0,038	0,014
Phyllodoce laminosa									
Phyllodoce mucosa					0,062				
Phyllodocidae spp.									
Pilumnus hirtellus	0,075	3,612			0,263	0,338	0,038	1,200	
Pinnotheres pisum	0,038								
Pisidia longicornis		0,675		0,038		0,075		1,200	
Podocopina spp.									
Polynoidae spp.									
Pomatoceros triqueter									
Porifera spp.			present						
Psammechinus miliaris						28,929			
Sabellaria spinulosa									
Sagartiogeton undatus		3,223	1,681				8,902	21,334	
Sagartia troglodytes	26,077	0,043	7,865		8,573		155,867	26,670	
Schizomavella linearis			present						
Scruparia ambigua	present	present			present				
Scruparia spp.									
Semibalanus balanoides									
Smittoidea prolifica									
Spirorbidae									
Stenothoe monoculoides	0,182	0,209	0,012	0,086	0,016	0,011	0,005	0,177	
Stenothoe spp.		0,016					0,005		
Stenothoe valida	0,011	0,273			0,005	0,166	0,096	0,305	
Syllis prolifera	0,038	0,039		0,013	0,048	0,004			
Telmatogeton japonicus	0,001								
Tubularia indivisa	present					present		present	
Ulva spp.									
Utricina felina	217,707						64,299		
Venerupis senegalensis									
Verruca stroemia									12,714

WTG									
Orientation	S						45 N		
Depth	Splash	2	5	10	17	Scour	Splash	2	5
Species									
Abludomelita obtusata									
Acontiaria juv.	0,655			12,779	0,109				16,093
Aeolidia papillosa		0,050	0,346	0,629	1,950				
Alcyonidium cf. mamillatum									
Alcyonidium cf. parasiticum									
Alcyonidium condylocinereum									
Alcyonidium parasiticum									
Alcyonium digitatum					0,886				
Arachnidium fibrosum									present
Asterias rubens		15,908	31,952	10,051	2,324	0,119		17,385	74,088
Balanus cf. crenatus									
Balanus crenatus	0,845			2,780			8,732		
Blidingia minima									
Blidingia minima									
Bowerbankia spp.									
Calanoida spp.									
Callopora dumerilii						present			
Campanulariidae									
Campanulariidae spp.									
Cancer pagurus									2,710
Caprella linearis									
Celleporella hyalina									
cf. Arachnidium fibrosum									
cf. Balanus crenatus									
cf. Clytia hemisphaerica									
cf. Emplectonema gracile									
cf. Laomedea flexuosa									
Clytia hemisphaerica									
Conopeum reticulum						present			
Diplosoma listerianum				present	present				present
Ectopleura larynx		present	present	present				present	present
Electra pilosa	present	present		present		present	present	present	present
Epitonium clathratulum				0,004					
Eulalia viridis		0,207	0,120	1,314	0,548		0,020	0,689	0,468
Eunereis longissima									
Farrella repens									
Fenestrulina delicia									
Gitana sarsi									
Harmothoe extenuata					0,396				
Harmothoe impar			0,037	0,430	0,239	0,018			0,043
Heteranomia squamula									
Hydractinia echinata									
Hydrozoa spp.									
Hydrozoa spp. 2									
Idotea pelagica	41,511	2,950	1,896	0,211	0,632		62,582	12,854	2,529
Jassa herdmani	6,670	18,632	46,998	7,114	4,211	0,083	2,604	30,857	22,286
Jassa marmorata	17,159	20,234	4,088		0,804		1,468	2,743	
Jassa spp.						0,020		15,771	
Laemedea flexuosa							present		
Lanice conchilega				0,084					

WTG							45		
Orientation	S						N		
Depth	Splash	2	5	10	17	Scour	Splash	2	5
Species									
Laomedea flexuosa	present								
Laomedea longissima									
Lepidonotus squamatus			0,114	2,175	1,129		0,052	0,179	0,586
Leucosolenia variabilis						present			
Megabalanus coccopoma	0,630							6,077	
Metridium senile		1,457			551,086		0,813		121,607
Microporella ciliata						present			
Monocorophium acherusicum				0,043	0,386	0,083			
Monocorophium sextonae					0,048	0,020			
Monocorophium spp.						0,010			
Mytilus edulis	142,448	116,111		5,350	2,335		57,444	49,144	2,478
Nemertea spp.									0,121
Nereis pelagica				0,466	0,152				0,432
Obelia dichotoma							present		
Odostomia scalaris				0,071					
Ostrea edulis									
Phthisica marina				0,016	0,021				0,005
Phyllodoce laminosa									
Phyllodoce mucosa				0,104					
Phyllodocidae spp.									
Pilumnus hirtellus				0,300	0,113				1,168
Pinnotheres pisum									
Pisidia longicornis					0,038				
Podocopina spp.									
Polynoidae spp.									
Pomatoceros triqueter									
Porifera spp.									
Psammechinus miliaris		28,929	57,857	4,500				2,250	4,500
Sabellaria spinulosa									
Sagartiogeton undatus					15,084				
Sagartia troglodytes			5,938	108,571	34,616	4,661		28,168	5,666
Schizomavella linearis									
Scruparia ambigua									
Scruparia spp.									
Semibalanus balanoides									
Smittoidea prolifica									
Spirorbidae		0,078							
Stenothoe monoculoides				0,155	0,005	0,020		0,005	2,057
Stenothoe spp.							0,005		
Stenothoe valida			0,016	0,096	0,043		0,005	0,032	1,296
Syllis prolifera		0,011	0,002		0,007			0,005	0,005
Telmatogeton japonicus									
Tubularia indivisa									present
Ulva spp.									
Utricina felina		25,536						159,821	
Venerupis senegalensis						0,255			
Verruca stroemia									

WTG									
Orientation				S					
Depth	10	17	Scour	Splash	2	5	10	17	Scour
Species									
Abludomelita obtusata									
Acontiaria juv.	12,052	27,041	0,978			69,736	6,548	8,339	0,495
Aeolidia papillosa							0,055	1,250	
Alcyonidium cf. mamillatum									
Alcyonidium cf. parasiticum									
Alcyonidium condylocinereum									
Alcyonidium parasiticum									
Alcyonium digitatum								0,886	2,786
Arachnidium fibrosum	present	present							
Asterias rubens	26,093	0,262	0,299		16,729	30,440	8,512	1,801	0,371
Balanus cf. crenatus									4,574
Balanus crenatus			0,500		1,751				
Blidingia minima									
Blidingia minima									
Bowerbankia spp.									
Calanoida spp.									
Callopora dumerilii			present					present	present
Campanulariidae									
Campanulariidae spp.									
Cancer pagurus		1,355				1,355			
Caprella linearis									
Celleporella hyalina			present					present	present
cf. Arachnidium fibrosum									
cf. Balanus crenatus									
cf. Clytia hemisphaerica									
cf. Emplectonema gracile									
cf. Laomedea flexuosa					present				
Clytia hemisphaerica									
Conopeum reticulum			present						
Diplosoma listerianum	present	present					present	present	
Ectopleura larynx	present	present			present	present	present	present	
Electra pilosa	present		present		present		present	present	present
Epitonium clathratulum									0,001
Eulalia viridis	1,777	0,264					0,682	0,580	0,006
Eunereis longissima								0,132	
Farrella repens									present
Fenestrulina delicia									present
Gitana sarsi							0,005	0,257	
Harmothoe extenuata	0,921						0,259		
Harmothoe impar	0,491	0,087			0,023	0,057	0,171	0,464	
Heteranomia squamula									
Hydractinia echinata									
Hydrozoa spp.									present
Hydrozoa spp. 2									
Idotea pelagica	2,107	1,475		8,850	44,461	1,896	0,632	1,896	
Jassa herdmani	20,346	7,500	0,104	2,963	31,982	33,573	16,291	8,523	0,566
Jassa marmorata	1,768			1,666	40,704	1,398	2,223	1,163	
Jassa spp.									
Laemedea flexuosa									
Lanice conchilega									

WTG									
Orientation				S					
Depth	10	17	Scour	Splash	2	5	10	17	Scour
Species									
Laomedea flexuosa				present					
Laomedea longissima									
Lepidonotus squamatus	1,945	0,398			0,155		0,486	2,359	0,021
Leucosolenia variabilis									
Megabalanus coccopoma									
Metridium senile		879,286	13,028		29,563	562,500	114,643	58,884	29,486
Microporella ciliata			present						present
Monocorophium acherusicum		0,096	0,116					3,005	0,583
Monocorophium sextonae			0,012						0,024
Monocorophium spp.			0,043						
Mytilus edulis	2,221	442,524		131,832	299,010			2,818	0,013
Nemertea spp.									
Nereis pelagica	1,626	0,132			8,066		0,102	0,432	
Obelia dichotoma				present					
Odostomia scalaris		0,143			0,004				0,003
Ostrea edulis									
Phthisica marina	0,070	0,418	0,009					0,102	0,010
Phyllodoce laminosa	0,604								
Phyllodoce mucosa						0,050	0,063	0,127	
Phyllodocidae spp.	0,074								
Pilumnus hirtellus					2,448		0,038		0,018
Pinnotheres pisum									
Pisidia longicornis	0,038	0,075		0,038	0,075				0,027
Podocopina spp.									
Polynoidae spp.									
Pomatoceros triqueter									
Porifera spp.									
Psammechinus miliaris	22,500				60,107	86,786	57,857	4,500	
Sabellaria spinulosa			0,021						0,017
Sagartiogeton undatus								12,630	2,661
Sagartia troglodytes	84,796		0,387				9,436	70,945	2,254
Schizomavella linearis									
Scruparia ambigua									
Scruparia spp.									
Semibalanus balanoides									
Smittoidea prolifica									present
Spirorbidae									
Stenothoe monoculoides	0,070	0,005					0,027	0,348	0,010
Stenothoe spp.		0,070				0,032			
Stenothoe valida	0,718	0,284				0,064	0,150	0,252	
Syllis prolifera	0,014	0,018						0,004	
Telmatogeton japonicus									
Tubularia indivisa	present						present		
Ulva spp.									
Utricina felina					16,102	159,821	311,059		
Venerupis senegalensis									
Verruca stroemia			11,080						4,574

WTG	60								
Orientation	N						S		
Depth	Splash	2	5	10	17	Scour	Splash	2	5
Species									
Abludomelita obtusata									
Acontiaria juv.		0,077	2,984	0,509	33,267	0,210	0,193	0,839	0,516
Aeolidia papillosa			0,127		0,809				1,481
Alcyonidium cf. mamillatum									
Alcyonidium cf. parasiticum					present				
Alcyonidium condylocinereum									
Alcyonidium parasiticum									
Alcyonium digitatum									
Arachnidium fibrosum				present	present				
Asterias rubens			4,420	25,784	4,387	1,476		7,988	6,188
Balanus cf. crenatus									
Balanus crenatus									
Blidingia minima							present		
Blidingia minima									
Bowerbankia spp.									
Calanoida spp.									
Callopora dumerilii					present	present			
Campanulariidae			present						
Campanulariidae spp.									
Cancer pagurus								1,355	2,710
Caprella linearis			0,005	0,011	0,070				
Celleporella hyalina					present				
cf. Arachnidium fibrosum									
cf. Balanus crenatus			19,389						
cf. Clytia hemisphaerica									
cf. Emplectonema gracile									
cf. Laomedea flexuosa									
Clytia hemisphaerica				present		present			
Conopeum reticulum						present			
Diplosoma listerianum					present	present			present
Ectopleura larynx			present	present	present				present
Electra pilosa		present	present	present	present	present			
Epitonium clathratulum									
Eulalia viridis		0,109	0,377	0,184	1,348		0,095	0,339	1,118
Eunereis longissima								0,013	
Farrella repens									
Fenestrulina delicia						present			
Gitana sarsi									
Harmothoe extenuata					0,195			2,225	1,413
Harmothoe impar			0,161	0,314	0,854			0,086	0,443
Heteranomia squamula									
Hydractinia echinata				present					
Hydrozoa spp.									
Hydrozoa spp. 2									
Idotea pelagica	32,239	29,711	2,950	4,846	1,264		13,696	1,896	3,161
Jassa herdmani	0,289	1,730	10,457	6,584	3,171	0,020	0,327	31,886	30,621
Jassa marmorata	0,611	1,355	0,177	0,273			7,736		1,286
Jassa spp.			0,257						
Laemedea flexuosa									
Lanice conchilega					0,051			0,095	0,007

WTG	60								
Orientation	N						S		
Depth	Splash	2	5	10	17	Scour	Splash	2	5
Species									
Laomedea flexuosa		present							
Laomedea longissima									
Lepidonotus squamatus		0,107	1,988	0,588	2,196			0,716	4,555
Leucosolenia variabilis									
Megabalanus coccopoma									
Metridium senile			65,714	660,000	262,857	3,876		38,929	18,830
Microporella ciliata						present			
Monocorophium acherusicum					0,032	0,565			
Monocorophium sextonae					0,005	0,049			
Monocorophium spp.					0,016				
Mytilus edulis	45,259	138,400	249,317	4,109	11,499		16,437	1659,952	886,695
Nemertea spp.									
Nereis pelagica			0,546	0,679	1,259				3,139
Obelia dichotoma									
Odostomia scalaris	0,018	0,004	0,055		0,040			0,039	1,554
Ostrea edulis		136,607					136,607		
Phthisica marina	0,011		0,016	0,048	0,279	0,026	0,011	0,011	0,005
Phyllodoce laminosa	0,604								
Phyllodoce mucosa									
Phyllodocidae spp.				0,074	0,074				
Pilumnus hirtellus			0,038		0,075	0,018		0,113	1,393
Pinnotheres pisum			0,038						0,038
Pisidia longicornis			0,113		0,113	0,018		0,113	0,150
Podocopina spp.									
Polynoidae spp.				0,074		0,035			
Pomatoceros triqueter									
Porifera spp.									
Psammechinus miliaris			57,857	4,500					28,929
Sabellaria spinulosa									
Sagartiogeton undatus									
Sagartia troglodytes				11,063	31,360	0,480			5,761
Schizomavella linearis									
Scruparia ambigua									
Scruparia spp.							present		
Semibalanus balanoides									
Smittoidea prolifica						present			
Spirorbidae									
Stenothoe monoculoides		0,005	0,021	0,021	0,005	0,005		0,027	0,032
Stenothoe spp.				0,005					
Stenothoe valida	0,032	0,011	0,354	0,573	0,311		0,016	0,011	0,027
Syllis prolifera	0,007	0,025	1,617	0,105	0,027		0,018	1,330	0,868
Telmatogeton japonicus	0,003	0,001	0,009				0,002		
Tubularia indivisa			present	present	present				
Ulva spp.							present		
Utricina felina									
Venerupis senegalensis								0,558	0,005
Verruca stroemia									

WTG Orientation Depth Species	10	17	Scour
Abludomelita obtusata			0,001
Acontiaria juv.	1,157	21,009	
Aeolidia papillosa	0,543	0,486	
Alcyonidium cf. mamillatum			
Alcyonidium cf. parasiticum			
Alcyonidium condylocinereum			
Alcyonidium parasiticum	present		
Alcyonium digitatum			
Arachnidium fibrosum	present		
Asterias rubens	4,191		3,036
Balanus cf. crenatus			
Balanus crenatus			
Blidingia minima			
Blidingia minima			
Bowerbankia spp.			
Calanoida spp.			
Callopora dumerilii			present
Campanulariidae			
Campanulariidae spp.			
Cancer pagurus			
Caprella linearis		0,011	
Celleporella hyalina			present
cf. Arachnidium fibrosum			
cf. Balanus crenatus			
cf. Clytia hemisphaerica			
cf. Emplectonema gracile			
cf. Laomedea flexuosa			
Clytia hemisphaerica			present
Conopeum reticulum		present	present
Diplosoma listerianum	present	present	
Ectopleura larynx	present		
Electra pilosa	present		present
Epitonium clathratulum			
Eulalia viridis	3,475	0,555	
Eunereis longissima			
Farrella repens			
Fenestrulina delicia			
Gitana sarsi		0,005	
Harmothoe extenuata	0,902		
Harmothoe impar	0,196	0,232	
Heteranomia squamula		0,005	
Hydractinia echinata		present	
Hydrozoa spp.			
Hydrozoa spp. 2			
Idotea pelagica	1,054	2,739	
Jassa herdmani	0,686	7,843	0,019
Jassa marmorata	0,059		
Jassa spp.			
Laemedea flexuosa			
Lanice conchilega	0,045	0,029	

WTG Orientation Depth Species	10	17	Scour
Laomedea flexuosa			
Laomedea longissima			
Lepidonotus squamatus	4,250	0,886	0,020
Leucosolenia variabilis			
Megabalanus coccopoma			
Metridium senile	114,286	89,643	2,877
Microporella ciliata			present
Monocorophium acherusicum		0,252	0,006
Monocorophium sextonae			
Monocorophium spp.			
Mytilus edulis	17,926	163,745	
Nemertea spp.			
Nereis pelagica	1,686	0,296	
Obelia dichotoma			
Odostomia scalaris	0,013	0,080	
Ostrea edulis			
Phthisica marina	0,123	0,129	0,006
Phyllodoce laminosa			
Phyllodoce mucosa		0,023	
Phyllodocidae spp.	0,074		
Pilumnus hirtellus			
Pinnotheres pisum			
Pisidia longicornis		0,038	0,010
Podocopina spp.			
Polynoidae spp.	0,074		
Pomatoceros triqueter			
Porifera spp.			
Psammechinus miliaris	28,929		
Sabellaria spinulosa			
Sagartiogeton undatus		2,218	
Sagartia troglodytes	3,536	51,054	1,000
Schizomavella linearis			
Scruparia ambigua	present		
Scruparia spp.			
Semibalanus balanoides			5,258
Smittoidea prolifica			
Spirorbidae			
Stenothoe monoculoides	0,059	0,011	
Stenothoe spp.			
Stenothoe valida	0,707	0,348	
Syllis prolifera	0,095	0,089	
Telmatogeton japonicus			
Tubularia indivisa	present		
Ulva spp.			
Utricina felina			
Venerupis senegalensis			
Verruca stroemia			