Common Marine Macrozoobenthos Species in The Netherlands, their Characteristics and Sensitivities to Environmental Pressures

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Cover photo:
From top left to bottom right the cover plate figures the common whelk *Buccinum undatum*; the scaleworm *Harmothoe imbricata;* the Brown crab *Cancer pagurus*; and the sea anemone *Urticina felina*

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Summary

In this report and associated database, a selection of approximately 300 most common marine benthos species in the Netherlands is given and some of their most important characteristics and sensitivities to pressures. This study was commissioned by RWS Waterdienst to GiMaRIS, as a part of the design, calibration and intercalibration project for a redesigned marine benthos WFD metric (the BEQI-2) for the Netherlands (see Boon et al., 2011).

The most common marine benthos species were selected based on their relatively high abundances or biomassa in the national MWTL benthos dataset. In order to supplement this species selection, which mostly focuses on endofauna, a selection of the most important epifauna species was made using a few other datasets.

For approximately 300 species, reference data were collected for the AMBI (AZTI Marine Biotic Index), AMBI Sedimentation and AMBI Fisheries (two newly designed indicators based on the AMBI), Infaunal Trophic Index (ITI), r/K strategy and non-native species data. The reference data in de database are supported by approximately 500 literature references.

The resulting species database with reference information will be available for Dutch and European benthos laboratories, on the condition that these laboratories will yearly contribute a few new species records for this database. In this way, we hope that this database will become a commonly used and expanding tool for the Dutch and European marine benthos assessments.

1. A list of the common, marine macrozoobenthos species of The Netherlands

This study was commissioned by RWS Waterdienst to GiMaRIS, as a part of the design, calibration and intercalibration project for a redesigned marine benthos WFD metric (the BEQI-2) for RWS Waterdienst (see Boon *et al*., 2011). For this project, there was a need to get clear information on the common marine benthos species in the Netherlands and a selection of important species properties for benthos assessments. Besides for the WFD, the results of the study presented here are expected to be useful for the Marine Strategy, the WFD discussions on non-native species and other RWS marine projects.

The list presented in Table 1 includes the common macrozoobenthos species of The Netherlands, their characteristics and their sensitivities for environmental pressures. This list, which is also included in a database, can be used for the calibration of macrozoobenthos metrics, which have been developed in the Netherlands to comply with the European Water Framework Directive (Loon et al., 2011a-c), for the Marine Framework Directive and for large marine projects of Rijkswaterstaat. The species list is based on a variety of datasets, databases and other lists of organisms that have been and/or are monitored along the Dutch coasts and in the Dutch estuaries. These data sources and more specifically the species selected from them, can be found in table 1 and in the appendix. Only the ‘common’ macrozoobenthos species that have been identified down to the species level and belong to the Animalia, were included.

The MWTL dataset includes monitoring data from 1984 to 2008 collected in the Delta area, the North Sea and Wadden Sea. The benthic organisms that are best represented in this data-set concern endofauna, because the MWTL sampling is aimed at soft-bottom endofauna, and not

at epifauna. Furthermore, sessile epifauna like sponges, ascidians, bryozoans, echinoderms and cnidarians are often not identified at the species level due to formalin conservation. Most molluscs, worms and crustaceans are identified to the species level however. Species in the MWTL-database (Table 1) are considered to be "common" if they were scored in all the three major ecosystems that are monitored along the Dutch coast, i.e. the Delta area, North Sea and Wadden Sea, and/or if their average density in the samples in which they were scored, was higher or equal to 3% of the density of the species with the highest average density in the dataset that was analysed. For biomass the threshold value of 2 % was chosen. These threshold values of 3 % and 2 % for respectively density and biomass were chosen because many more, e.g. about 100 when considering density, relatively rare species would be considered to be "common species" with selection criteria of respectively 2% or 1% (Table 1). This is also illustrated in Figure 1, in which one can see (for density) that the threshold value of 3% is more or less chosen at the place where the graphs starts to flatten. When selecting the common species, the datasets from the Delta area, North Sea and Wadden Sea were considered separately. As an example, this selection method is illustrated in figure 1 in which "density" is used as the abundance measure. This figure shows how most species in these datasets are relatively rare, and that the relative amount of rare species appears to be area specific. Relatively seen, considering the densities of species, there seem to be only a few common species in the Wadden Sea, while there are relative many common species in the Delta area (Figure 1). In figure 2 the parameter biomass is used for selecting the common species.

In the MWTL macrozoobenthos monitoring programme of RWS epifauna is poorly represented because the monitoring is designed for infauna and not for epifauna. In order to fill this epifauna gap for common species, a few other Dutch marine data sources were used.

Since 1994 volunteer scuba-divers of the MOO-project of the ANEMOON foundation score every species they see during their dives, which

Table 1. The data sources used in the present study. The total number of Dutch benthic species in these sources is mentioned in addition to the number of species that were identified down to the species level, and the numbers of species that are found to be "common" under various selection criteria described in more detail in the main text. The "Nederlands Soortenregister", i.e. www.soortenregister.nl, is an official list of all species that occur in The Netherlands and is compatible with the World Register of Marine Species (WoRMS, www.marinespecies.org), which is the source for the marine TWN-codes (http://www.idsw.nl) that are used by the Netherlands ministry of Traffic and Water management. It is added here to give an indication of the total number of benthic, marine animal species in The Netherlands. WoRMS was used as a standard for the taxonomical names.

Source dataset	Abundance:	Total number of species	Identified to species level	> 1% max. abundance	> 2% max. abundance	> 3% max. abundance	> 5% max. abundance	> 4% cover
MWTL, 1990-2008 data, Delta area	Density (/m^2)	415	275	272	211	148	91	-
MWTL, 1990-2008 data, Delta area	Biomass (mg/m^2)	402	271	15	6	4	3	-
MWTL, 1984-2008 data, North Sea	Density (/m^2)	612	452	359	176	107	40	-
MWTL, 1984-2008 data, North Sea	Biomass (mg/m^2)	583	432	60	38	30	19	-
MWTL, 1989-2008 data, Wadden Sea	Density (/m^2)	104	101	6	4	3	2	-
MWTL, 1989-2008 data, Wadden Sea	Biomass (mg/m^2)	108	105	19	15	13	10	-
ANEMOON Foundation, MOO-project	-	105	105	-	-	-	-	-
ANEMOON Foundation, Het Duiken Gebruiken 2	-	163	155	-	-	-	-	-
SETL project, all species	Cover (1-25)	160	91	-	-	-	-	66
SETL project, Delta area	Cover (1-25)	128	78	-	-	-	-	57
SETL project, North Sea	Cover (1-25)	62	40	-	-	-	-	31
SETL project, Wadden Sea	Cover (1-25)	62	42	-	-	-	-	30

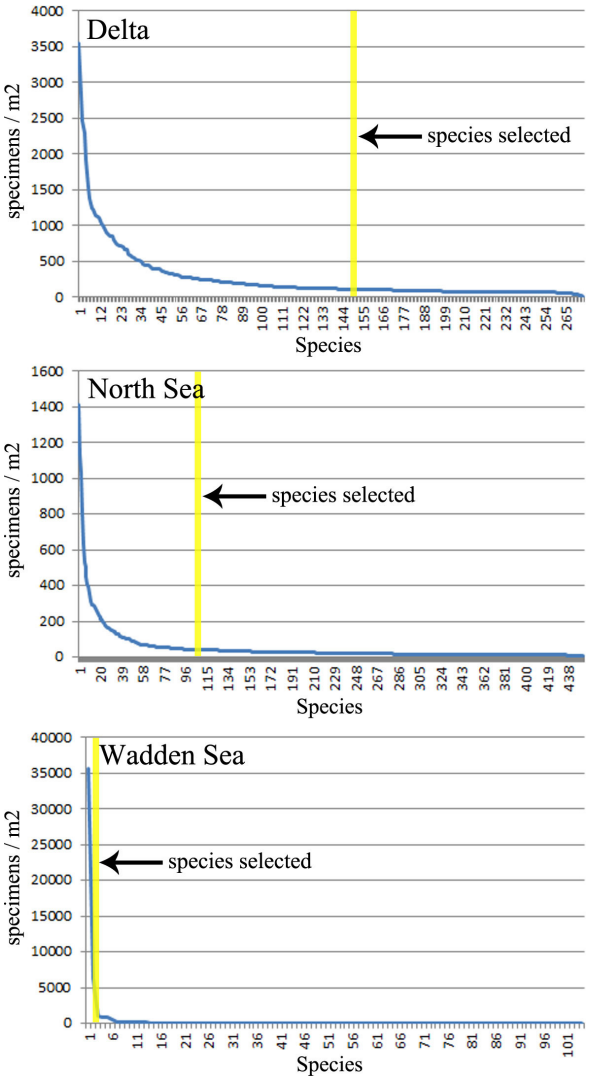

Fig. 1. The average densities (specimens /m²) in which species were recorded in respectively the Delta area, the North Sea and the Wadden Sea in the MWTL database. The species are ordered from the most abundant species to the least abundant species. All species left of the yellow line were considered to be "common"species, and selected in the present study to be included in the list of the common, marine, benthic species of The Netherlands. Their abundances are 3% or more of that of the most abundant species.

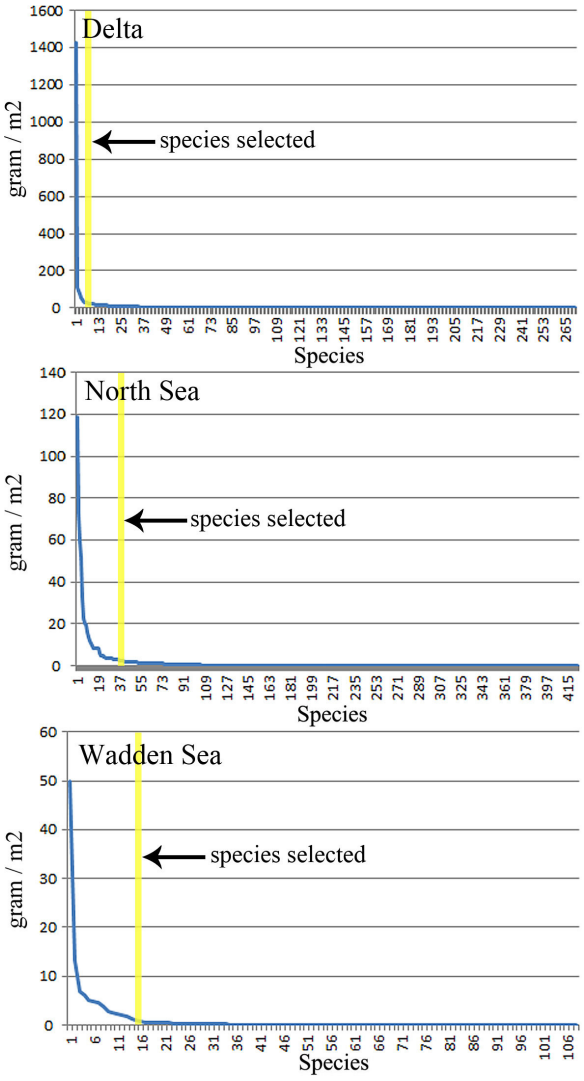

Fig. 2. The average biomass (g /m2) in which species were recorded in respectively the Delta area, the North Sea and the Wadden Sea in the MWTL database. The species are ordered from the most abundant species to the least abundant species. All species left of the yellow line were considered to be "common"species, and selected in the present study to be included in the list of the common, marine, benthic species of The Netherlands. Their abundances are 2% or more of that of the most abundant species.

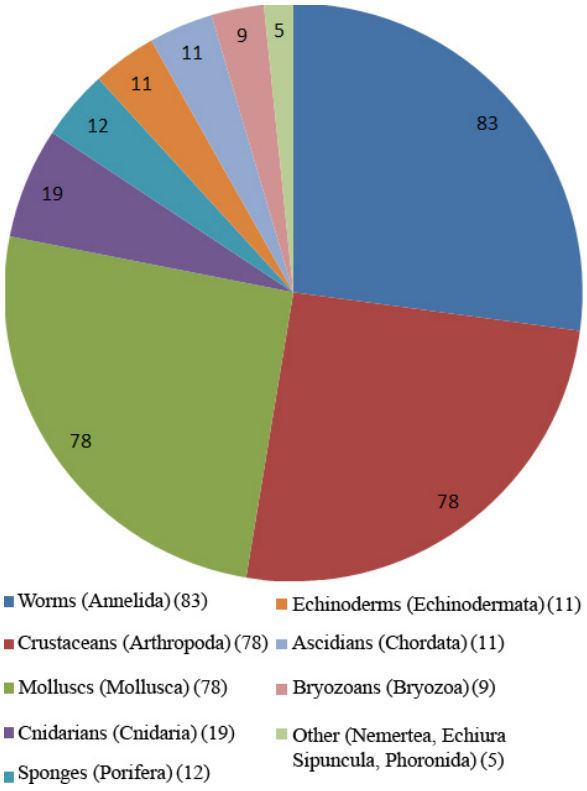

Fig. 3. Number of species per species group that was included in the final list of the common, marine, benthic, animal species of The Netherlands (Table 2).

are mostly made in the Delta area. The benthic species that were included from this project concern the common, for divers easily visible species. Although endofauna is badly scored, the common epifauna species are well represented, among which also many of the species of sponges, ascidians, bryozoans, echinoderms and cnidarians that are not identified to the species level in the MWTL database. The species on the lists of the marine volunteer projects of the ANEMOON foundation were all assumed to be "common species"

As a final source of common marine species, the SETL-dataset was used. During the fouling community study SETL, species (> 1 mm) on about 200 14x14 PVC plates are scored every three months since 2006. They are deployed at various places along the Dutch coast, from the Delta area to the Wadden Sea. Especially benthic epifauna species like barnacles, hydroids, bryozoans, flatworms and sponges are well represented in this monitoring project. Most of these species are not identified to the species level in the MWTL database and are missed by divers in the above described MOO-project because they are too small. For each of these species a measure for cover, i.e. 1-25 (25 = 100% cover) is noted for each plate. In the present study the SETL data-set from 2006 to 2009 was used. "Common species" in this dataset were considered to be the species with an average cover of more than 1. Although the organisms scored in this project were growing on a floating object, they all concern benthic species that under natural conditions would be found on the bottom.

The final list of common marine benthic species in The Netherlands includes 312 species (Table 2). Most of these species concern worms (Annelida), crustaceans (Arthropoda) and Molluscs (Mollusca), although the most common sponges (Porifera), echinoderms (Echinoderms), seasquirts (Ascidians) and Bryozoans (Bryozoans) are also included (Figs 3-4).

The World Register of Marine Species (WORMS: www.marinespecies.org) is used as a standard for the taxonomy. Worms is also the standard source for the marine TWN-codes (http://www.idsw.nl), i.e. the standardized species names that are used by The Netherlands ministry of Traffic and Water management, and for the Dutch Species Register, which includes all species that occur in The Netherlands (www.soortenregister.nl).

In addition table 2 shows the distribution of the selected species over the Delta area, the North Sea and the Wadden Sea according to the MWTL-database. In the final list 144, 168, and 87 species were included of the 281, 458, and 112 species that were identified down to the species level in these three areas respectively, i.e. the Delta area, the North Sea and the Wadden Sea.

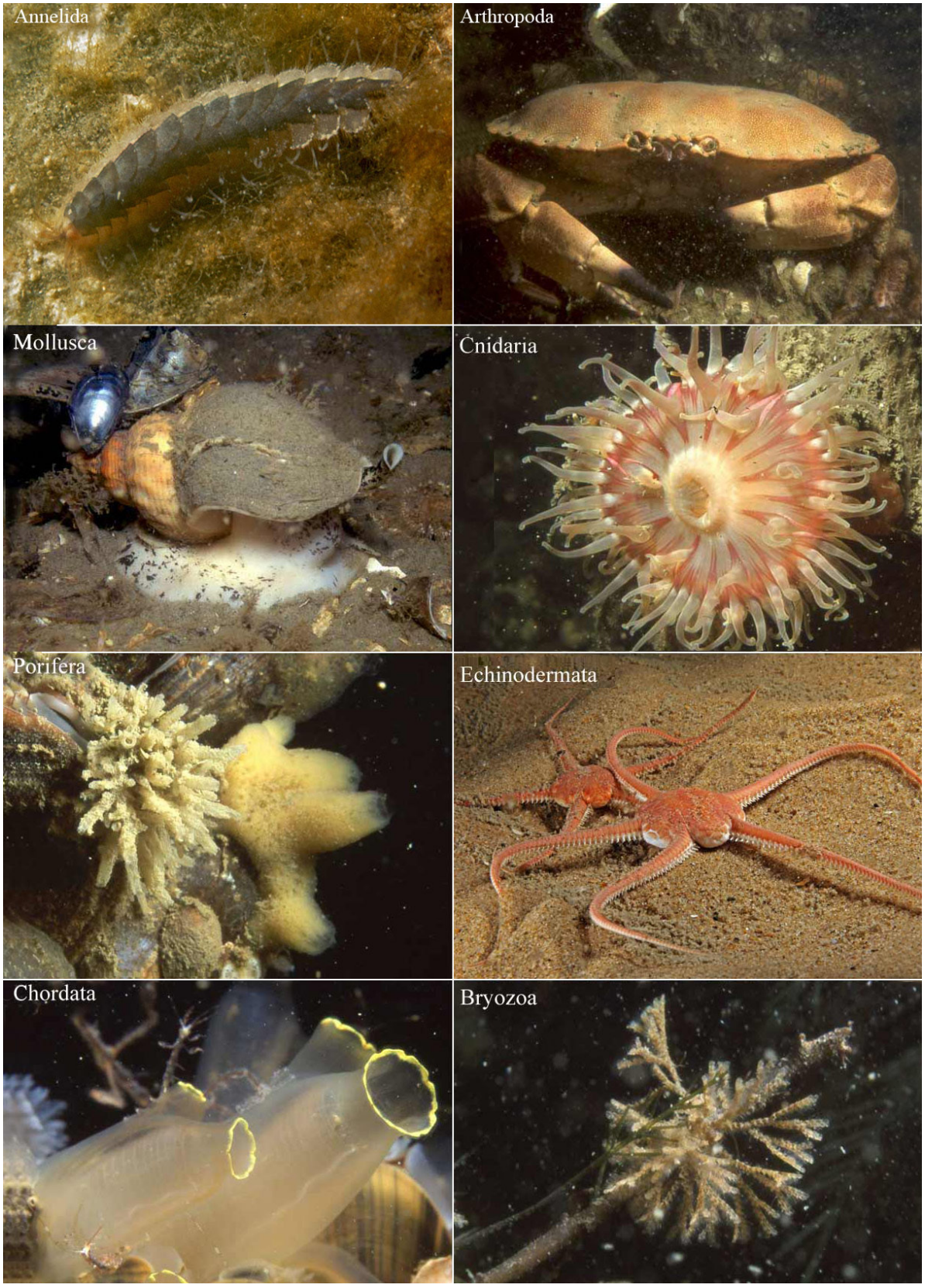

Fig 4. For each of the species groups in Fig. 3 a species is illustrated i.e. respectively *Harmothoe imbricata, Cancer pagurus, Buccinum undatum, Urticina felina, Haliclona xena & Leucosolenia variabilis, Ophiura ophiura, Ciona intestinalis and Bugula stolonifera.*

Table 2. Occurrence of 307 common, marine, benthic, animal species in The Netherlands. The World Register of Marine Species (WoRMS : www.marinespecies.org) was used to standardize the taxonomical names. The distribution of the species in the Delta area, the North Sea and the Wadden Sea is added based on the MWTL benthos data. Many species that appear to be absent in all three areas, concern common species, but were not identified down to the species level in the MWTL-database. For the samples in which a specific species was present, the average densities and biomasses were calculated and are presented in the classes [1 = >0 to 10], [2 = >10 to 100], [3 = >100 to 1000], [4 = >1000 to 10,000] and [5 = > 10,000] specimens/m^2 for the densities and mg/m^2 for the biomass values.

		Occurrence (x)			Density (specimens/m^2)			Biomass (mg/m^2)		
WoRMS standardized name	**Common name**	**Delta area**	**North Sea**	**Wadden Sea**	**Delta area**	**North Sea**	**Wadden Sea**	**Delta area**	**North Sea**	**Wadden Sea**
Abludomelita obtusata	Crustaceans	x	x		3	2		2	2	
Abra alba	Molluscs	x	x	x	3	3	1	3	4	2
Acanthocardia echinata	Molluscs	x	x		2	2		5	4	
Acanthocardia paucicostata	Molluscs	x			3			3		
Acanthodoris pilosa	Molluscs									
Acrocnida brachiata	Echinoderms		x			2			4	
Actinia equina	Cnidarians									
Aeolidia papillosa	Molluscs									
Aeolidiella glauca	Molluscs									
Aequipecten opercularis	Molluscs									
Alcyonium digitatum	Cnidarians									
Alitta succinea	Worms	x	x	x	3	3	2	3	3	3
Alitta virens	Worms	x	x	x	2	2	1	5	4	3
Alvania lactea	Molluscs		x			3			3	
Ampelisca brevicornis	Crustaceans	x	x		3	2		2	2	
Ampharete acutifrons	Worms	x	x		3	2		2	1	
Amphiura chiajei	Echinoderms		x			3			3	
Amphiura filiformis	Echinoderms		x			3			4	
Aonides paucibranchiata	Worms		x			2			2	
Aora gracilis	Crustaceans		x			2			2	
Aphelochaeta marioni	Worms	x	x	x	4	2	3	3	2	2
Aphrodita aculeata	Worms	x	x		2	2		1	4	
Aplidium glabrum	Ascidians									
Arctica islandica	Molluscs		x			2			4	
Arenicola defodiens	Worms	x		x	4			5		3
Arenicola marina	Worms	x	x	x	2	2	2	4	4	4
Aricidea minuta	Worms	x	x	x	3	2	1	2	2	1
Ascidiella aspersa	Ascidians	x			3			5		
Astarte montagui	Molluscs		x			2			3	
Asterias rubens	Echinoderms	x	x	x	2	2	1	5	4	4
Athanas nitescens	Crustaceans	x			2			3		
Atherospio disticha	Worms		x			3			2	
Atherospio guillei	Worms		x			2			2	
Balanus crenatus	Crustaceans	x	x	x	4	3	3			
Balanus improvisus	Crustaceans	x	x		4	3				
Bathyporeia elegans	Crustaceans	x	x		3	3		3	2	
Bathyporeia guilliamsoniana	Crustaceans									
Bathyporeia pilosa	Crustaceans	x	x	x	3	2	2	3	1	1
Bathyporeia sarsi	Crustaceans	x	x	x	3	2	1	2	1	1
Bathyporeia tenuipes	Crustaceans		x			2			2	
Bembidion (Cillenus) laterale	Crustaceans	x			3			2		
Bodotria scorpioides	Crustaceans	x	x	x	3	2	1	2	1	1

		Occurrence (x)			Density (specimens/m²)			Biomass (mg/m²)		
WoRMS standardized name	**Common name**	**Delta area**	**North Sea**	**Wadden Sea**	**Delta area**	**North Sea**	**Wadden Sea**	**Delta area**	**North Sea**	**Wadden Sea**
Botrylloides violaceus	Ascidians									
Botryllus schlosseri	Ascidians	x			2			4		
Brissopsis lyrifera	Echinoderms		x			2			4	
Buccinum undatum	Molluscs		x			2			5	
Bugula plumosa	Bryozoans									
Bugula simplex	Bryozoans									
Bugula stolonifera	Bryozoans									
Bylgides sarsi	Worms	x	x	x	2	1	1	3	1	2
Callianassa subterranea	Crustaceans		x			2			4	
Callinectes sapidus	Crustaceans									
Cancer pagurus	Crustaceans	x	x		2	2		5		
Capitella capitata	Worms	x	x	x	3	3	2	3	2	2
Caprella mutica	Crustaceans									
Carcinus maenas	Crustaceans	x	x	x	2	2	1	5	4	3
Cephalothrix rufifrons	Flatworms									
Cerastoderma edule	Molluscs	x	x	x	2	3	2	4	5	4
Cerastoderma glaucum	Molluscs	x			3			4		
Cerianthus lloydii	Cnidarians	x	x		2	2		5	4	
Chaetopterus variopedatus	Worms		x			2			4	
Ciona intestinalis	Ascidians	x			3			5		
Cliona celata	Sponges									
Conopeum reticulum	Bryozoans			x			1			1
Corbula gibba	Molluscs	x	x		3	3		3	3	
Corophium multisetosum	Crustaceans	x			3			2		
Corophium volutator	Crustaceans	x	x	x	4	4	4	3	4	4
Coryphella gracilis	Molluscs									
Corystes cassivelaunus	Crustaceans		x			2			4	
Crangon crangon	Crustaceans	x	x	x	2	2	2	3	3	3
Crassostrea gigas	Molluscs			x			1			4
Crepidula fornicata	Molluscs	x		x	3		1	4		1
Cryptosula pallasiana	Bryozoans									
Cumopsis goodsir	Crustaceans	x	x	x	2	1	1	1	1	1
Cuthona amoena	Molluscs									
Cuthona concinna	Molluscs									
Cuthona foliata	Molluscs									
Cuthona gymnota	Molluscs									
Cuthona nana	Molluscs									
Dendronotus frondosus	Molluscs									
Diadumene cincta	Cnidarians									
Diastylis bradyi	Crustaceans	x	x	x	2	2	1	2	2	1
Diastylis lucifera	Crustaceans	x	x		2	2		2		
Didemnum vexillum	Ascidians									
Diplosoma listerianum	Ascidians									
Dipolydora coeca	Worms	x	x	x	3	2	2	2	1	1
Donax vittatus	Molluscs		x	x		2	1		4	1
Doris pseudoargus	Molluscs									
Doto fragilis	Molluscs									
Echinocardium cordatum	Echinoderms	x	x	x	2	2	1	5		2
Echinocyamus pusillus	Echinoderms		x			2			2	

		Occurrence (x)			Density (specimens/m²)			Biomass (mg/m²)		
WoRMS standardized name	**Common name**	**Delta area**	**North Sea**	**Wadden Sea**	**Delta area**	**North Sea**	**Wadden Sea**	**Delta area**	**North Sea**	**Wadden Sea**
Echiurus echiurus	Echiura		x			3			3	
Ectopleura larynx	Cnidarians									
Electra pilosa	Bryozoans									
Elminius modestus	Crustaceans			x			2			3
Elysia viridis	Molluscs	x			3			4		
Emplectonema echinoderma	Flatworms									
Ennucula tenuis	Molluscs		x			2				
Ensis directus	Molluscs	x	x		3	3		5	5	
Ensis ensis	Molluscs	x	x		2	2		4	4	
Ensis magnus	Molluscs	x	x		2	2		5	5	
Ensis minor	Molluscs		x			2			5	
Ensis siliqua	Molluscs		x			2			5	
Epitonium clathratulum	Molluscs	x			2			2		
Epitonium clathrus	Molluscs	x			2			4		
Eteone flava	Worms	x	x		3	2		2	2	
Eteone longa	Worms	x	x	x	2	2	2	3	2	2
Eualus cranchii	Crustaceans									
Eubranchus exiguus	Molluscs									
Eubranchus pallidus	Molluscs									
Euclymene droebachiensis	Worms		x			2			3	
Eudendrium album	Cnidarians									
Eulalia viridis	Worms	x	x		3	2		2	4	
Eumida sanguinea	Worms	x	x	x	3	3	2	3	2	2
Eunereis longissima	Worms	x	x	x	2	2	1	4	4	3
Eunoe nodosa	Worms		x			3				
Euspira catena	Molluscs		x			2				
Exogone (Exogone) naidina	Worms	x	x		3	2		1	1	
Facelina bostoniensis	Molluscs									
Ficopomatus enigmaticus	Worms	x			3			3		
Flabellina gracilis	Molluscs									
Galathea squamifera	Crustaceans									
Galathowenia oculata	Worms		x			2			2	
Gammarus locusta	Crustaceans	x	x	x	3	2	2	3	1	2
Gammarus zaddachi	Crustaceans	x			3			3		
Gattyana amondseni	Worms		x			3				
Gattyana cirrhosa	Worms	x	x		3	2		4	2	
Geitodoris planata	Molluscs									
Glycera alba	Worms	x	x	x	2	2	1	3	2	1
Glycera lapidum	Worms		x			2			2	
Golfingia (Golfingia) vulgaris vulgaris	Sipuncula		x			2			3	
Goniadella bobretzkii	Worms		x			3			2	
Goniodoris castanea	Molluscs									
Gonionemus vertens	Cnidarians									
Goodallia triangularis	Molluscs		x			2			2	
Halecium halecinum	Cnidarians									
Halichondria (Halichondria) bowerbanki	Sponges									
Halichondria (Halichondria) panicea	Sponges									

		Occurrence (x)			Density (specimens/m²)			Biomass (mg/m²)		
WoRMS standardized name	**Common name**	**Delta area**	**North Sea**	**Wadden Sea**	**Delta area**	**North Sea**	**Wadden Sea**	**Delta area**	**North Sea**	**Wadden Sea**
Haliclona (Haliclona) oculata	Sponges									
Haliclona (Soestella) xena	Sponges									
Harmothoe imbricata	Worms	x	x	x	3	2	1	3	3	2
Harmothoe impar	Worms	x	x	x	3	2	1	3	2	2
Harpinia antennaria	Crustaceans		x			2			2	
Haustorius arenarius	Crustaceans	x	x		3	2		3	2	
Hediste diversicolor	Worms	x	x	x	3	2	3	4	4	4
Hemigrapsus sanguineus	Crustaceans									
Hemigrapsus takanoi	Crustaceans			x			1			3
Hemimysis lamornae	Crustaceans									
Hermaea bifida	Molluscs									
Hesionura elongata	Worms		x			2				
Heteromastus filiformis	Worms	x	x	x	4	2	3	4	3	4
Hippolyte varians	Crustaceans	x	x		2	2		3		
Homarus gammarus	Crustaceans									
Hyala vitrea	Molluscs		x			2			2	
Hyas araneus	Crustaceans									
Hyas coarctatus	Crustaceans									
Hydractinia echinata	Cnidarians									
Hydrobia ulvae	Molluscs	x	x	x	4	2	5	4	1	5
Hymeniacidon perlevis	Sponges									
Idotea linearis	Crustaceans	x	x	x	2	1	1	2	2	
Inachus phalangium	Crustaceans	x								
Janolus cristatus	Molluscs									
Janolus hyalinus	Molluscs									
Jassa falcata	Crustaceans	x	x		2	2		2		
Jassa marmorata	Crustaceans		x			2			1	
Jorunna tomentosa	Molluscs									
Kurtiella bidentata	Molluscs	x	x	x	3	3	1	2	2	1
Lanice conchilega	Worms	x	x	x	3	3	3	4	4	4
Lepidochitona (Lepidochitona) cinerea	Molluscs	x		x	2		1	3		2
Leptomysis lingvura	Crustaceans									
Leucosolenia variabilis	Sponges									
Liocarcinus depurator	Crustaceans	x			3			5		
Liocarcinus holsatus	Crustaceans	x	x		2	2		5	4	
Liocarcinus marmoreus	Crustaceans		x			2			4	
Liocarcinus navigator	Crustaceans									
Littorina littorea	Molluscs	x		x	2		2	4		4
Lumbrineris latreilli	Worms	x	x		2	2		2	3	
Lutraria lutraria	Molluscs		x			2			5	
Macoma balthica	Molluscs	x	x	x	2	3	2	3	4	3
Macropodia rostrata	Crustaceans									
Mactra stultorum	Molluscs		x			2			3	
Magelona filiformis	Worms		x			3			2	
Magelona johnstoni	Worms		x	x		3			3	1
Magelona papillicornis	Worms	x	x		3	3		3	3	
Malmgreniella ljungmani	Worms		x			2			2	
Marenzelleria viridis	Worms	x		x	3		4	3		4

		Occurrence (x)			Density (specimens/m²)			Biomass (mg/m²)		
WoRMS standardized name	**Common name**	**Delta area**	**North Sea**	**Wadden Sea**	**Delta area**	**North Sea**	**Wadden Sea**	**Delta area**	**North Sea**	**Wadden Sea**
Mediomastus fragilis	Worms									
Membranipora membranacea	Bryozoans									
Metopa alderi	Crustaceans		x			3			5	
Metridium senile	Cnidarians			x			1			3
Microphthalmus fragilis	Worms	x			3			1		
Microphthalmus sczelkowii	Worms	x	x		3	2		1	1	
Microphthalmus similis	Worms	x	x	x	3	3	1	1	1	1
Microprotopus maculatus	Crustaceans	x	x		3	2		1	1	
Molgula manhattensis	Ascidians	x		x	3		1	3		3
Molgula socialis	Ascidians									
Mya arenaria	Molluscs	x	x	x	2	2	2	4	4	5
Mya truncata	Molluscs		x			2			4	
Mycale (Carmia) micracanthoxea	Sponges									
Myrianida langerhansi	Worms	x	x		3	2		1	1	
Myriochele danielsseni	Worms		x			3			2	
Mytilus edulis	Molluscs	x	x	x	3	3	3	5	2	4
Nassarius reticulatus	Molluscs	x	x		2	2		4	4	
Necora puber	Crustaceans									
Neoamphitrite figulus	Worms	x		x	3		1	4		1
Neodexiospira brasiliensis	Worms									
Neomysis integer	Crustaceans	x		x	3		1	3		1
Nephrops norvegicus	Crustaceans		x			2			5	
Nephtys caeca	Worms	x	x	x	2	2	1	4	4	3
Nephtys cirrosa	Worms	x	x	x	2	2		3	3	2
Nephtys hombergii	Worms	x	x	x	2	2	2	3	4	3
Nephtys longosetosa	Worms	x	x	x	2	2	1	4	3	2
Notomastus latericeus	Worms	x	x		1	2		4	4	
Nucella lapillus	Molluscs									
Nucula nitidosa	Molluscs		x			2			3	
Obelia bidentata	Cnidarians	x	x		2	2		2	3	
Obelia dichotoma	Cnidarians									
Obelia geniculata	Cnidarians									
Obelia longissima	Cnidarians			x			1			2
Onchidoris bilamellata	Molluscs			x			1			1
Onchidoris muricata	Molluscs									
Ophelia rathkei	Worms	x	x		3	2		2	2	
Ophiothrix fragilis	Echinoderms	x			3			4		
Ophiura albida	Echinoderms	x	x	x	2	2	1	4	3	2
Ophiura ophiura	Echinoderms		x	x		3			3	2
Orchomenella nana	Crustaceans		x			4			2	
Ostrea edulis	Molluscs	x			3			5		
Owenia fusiformis	Worms	x	x		3	2		4	3	
Pagurus bernhardus	Crustaceans	x	x	x	2	2	1	4	4	3
Palaemon adspersus	Crustaceans	x			2			4		
Palaemon elegans	Crustaceans	x			2			4		
Palaemon macrodactylus	Crustaceans									
Palaemon serratus	Crustaceans									
Pandalus montagui	Crustaceans									

		Occurrence (x)			Density (specimens/m²)			Biomass (mg/m²)		
WoRMS standardized name	**Common name**	**Delta area**	**North Sea**	**Wadden Sea**	**Delta area**	**North Sea**	**Wadden Sea**	**Delta area**	**North Sea**	**Wadden Sea**
Paradoneis fulgens	Worms	x			3			2		
Pariambus typicus	Crustaceans		x			2			1	
Patella vulgata	Molluscs									
Pectinaria (Lagis) koreni	Worms	x	x	x	3	3	1	4	3	2
Pelonaia corrugata	Ascidians		x			2			5	
Perioculodes longimanus	Crustaceans		x			2			1	
Petricola pholadiformis	Molluscs	x	x	x	3	3	1	4	5	3
Pherusa flabellata	Worms	x			3			2		
Pholoe minuta	Worms	x	x	x	1	2	1	2	2	1
Phoronis hippocrepia	Phoronida									
Photis longicaudata	Crustaceans		x			2			2	
Phoxichilidium femoratum	Crustaceans	x	x	x	2	2	1	2	1	
Phyllodoce (Anaitides) groenlandica	Worms		x			2			3	
Phyllodoce laminosa	Worms		x			3			3	
Phyllodoce lineata	Worms		x			2			2	
Phyllodoce maculata	Worms	x	x		3	3		3	2	
Phyllodoce mucosa	Worms	x	x	x	3	3	2	3	3	2
Pilumnus hirtellus	Crustaceans									
Pinnotheres pisum	Crustaceans	x			3			3		
Pisidia longicornis	Crustaceans	x	x		2	2		3		
Pisione remota	Worms		x			3			2	
Polycirrus medusa	Worms	x	x		3	2		3	2	
Polydora ciliata	Worms	x	x		3	3		2	2	
Polydora cornuta	Worms	x	x	x	3	2	2	3	1	2
Pomatoceros triqueter	Worms		x			2			1	
Praunus flexuosus	Crustaceans	x		x	3		1	3		1
Propebela turricula	Molluscs									
Protosuberites denhartogi	Sponges									
Psammechinus miliaris	Echinoderms	x	x		2	2		5	4	
Pseudopolydora pulchra	Worms	x	x		3	2		2	2	
Pseudopotamilla reniformis	Worms	x			3			4		
Pycnogonum litorale	Crustaceans	x			3			4		
Pygospio elegans	Worms	x	x	x	4	3	3	3	2	2
Retusa obtusa	Molluscs	x		x	3		2	2		2
Sabella pavonina	Worms									
Sagartia elegans	Cnidarians									
Sagartia troglodytes	Cnidarians		x	x		2	1		5	3
Sagartiogeton undatus	Cnidarians	x			3			5		
Saxicavella jeffreysi	Molluscs		x			2			2	
Scalibregma inflatum	Worms	x	x		3	2		3	2	
Schistomysis kervillei	Crustaceans	x	x	x	2	2	1	2	2	1
Scolelepis (Scolelepis) foliosa	Worms	x	x	x	2	2	1	4	3	3
Scolelepis (Scolelepis) squamata	Worms									
Scoloplos (Scoloplos) armiger	Worms	x	x	x	3	3	3	3	3	3
Scopelocheirus hopei	Crustaceans		x			2			2	
Scrobicularia plana	Molluscs	x	x	x	2	2	1	4		3
Scrupocellaria scruposa	Bryozoans									

		Occurrence (x)			Density (specimens/m²)			Biomass (mg/m²)		
WoRMS standardized name	**Common name**	**Delta area**	**North Sea**	**Wadden Sea**	**Delta area**	**North Sea**	**Wadden Sea**	**Delta area**	**North Sea**	**Wadden Sea**
Spio filicornis	Worms	x	x		3	3		2	2	
Spio martinensis	Worms	x	x	x	3	2	2	2	2	2
Spiophanes bombyx	Worms	x	x	x	3	3	1	3	3	1
Spirorbis (Spirorbis) tridentatus	Worms	x			3			2		
Spisula subtruncata	Molluscs	x	x	x	3	4	1	4		1
Stenothoe marina	Crustaceans	x	x		3	2		2	1	
Streblospio shrubsolii	Worms	x	x	x	3	1	1	2		1
Styela clava	Ascidians	x			3			5		
Suberites massa	Sponges									
Sycon ciliatum	Sponges									
Sycon scaldiense	Sponges									
Tellimya ferruginosa	Molluscs	x	x		3	2			2	
Tellina fabula	Molluscs	x	x	x	2	2	1	3	4	2
Tellina pygmaea	Molluscs		x			2			2	
Tellina tenuis	Molluscs	x	x	x	2	2	1	3	3	3
Tergipes tergipes	Molluscs			x			1			
Thecacera pennigera	Molluscs									
Thyasira flexuosa	Molluscs					2				
Tricellaria inopinata										
Trivia arctica	Molluscs									
Tryphosella sarsi	Crustaceans		x			3			2	
Tryphosites longipes	Crustaceans		x			2			2	
Tubularia indivisa	Cnidarians									
Upogebia deltaura	Crustaceans		x			2			4	
Urothoe brevicornis	Crustaceans	x	x		3	2		2	2	
Urothoe poseidonis	Crustaceans	x	x	x	3	3	3	3	2	3
Urticina felina	Cnidarians									
Venerupis senegalensis	Molluscs	x			2			5		

2. AMBI, AMBI Sedimentation and AMBI Fisheries

The AMBI, AMBI Sedimentation and AMBI Fisheries which are described in this chapter are candidate indicators for the newly designed BEQI-2 Dutch marine benthos metric for the WFD (Boon et al., 2011). In this study, these indicator values for the 300 common marine benthic species are validated (for the AMBI) or are designed (for the AMBI Sedimentation and Fisheries). For each of the species an AMBI score of I to V was given for its relative sensitivity to organic enrichment, sedimentation and fisheries, i.e. physical disturbances (Table 3). These three pressures were chosen, because we consider them to be closely linked to the presence of organisms in various aquatic environments. Although they can be induced by natural phenomena to some degree, substantial changes in these pressures are usually induced by humans. For the AMBI, the score definitions of Borja were used as a basis (Borja et al., 2000). The AMBI Sedimentation and AMBI Fisheries that were used for sedimentation and fisheries pressures are presented here aiming at setting up a formula similar to the AMBI. The classifications used for the AMBI, AMBI Sedimentation and AMBI Fisheries are described in more detail below. All AMBI values were set based on the expert opinions of three macrozoobenthos scientists on the basis of their own experiences in the field and literature. Literature references and field observations of special importance were added in the database behind the AMBI values. When an AMBI value differed between the independent expert opinions, it was discussed among the experts after which they agreed which value would be best to use. This "conclusion" value is given in table 3. The original AMBI values that were given by each of the experts separately can be found in the database.

Table 3 The list of common marine macro-fauna of The Netherlands, with their AMBI scores

	AMBI Borja	AMBI review	AMBI Sedimentation review	AMBI Fisheries review
Abludomelita obtusata	III	II	III	III
Abra alba	III	III	IV	I
Acanthocardia echinata	I	I	II	II
Acanthocardia paucicostata	I	II	II	II
Acanthodoris pilosa		II	II	II
Acrocnida brachiata	I	II	II	II
Actinia equina	I	II	II	II
Aeolidia papillosa	I	II	I	I
Aeolidiella glauca		II	III	I
Aequipecten opercularis	I	I	I	I
Alcyonium digitatum		I	II	II
Alitta succinea	III	III	III	III
Alitta virens	III	III	III	III
Alvania lactea		I	II	III
Ampelisca brevicornis	I	II	II	I
Ampharete acutifrons	II	II	III	III
Amphiura chiajei	II	II	II	I
Amphiura filiformis	II	II	III	I
Aonides paucibranchiata	III	III	III	III
Aora gracilis	I	II	II	II
Aphelochaeta marioni	IV	IV	IV	III
Aphrodita aculeata	I	II	II	II
Aplidium glabrum		II	I	II
Arctica islandica	III	II	III	II
Arenicola defodiens	I	I	III	III
Arenicola marina	III	III	III	III
Aricidea minuta	I	I	IV	IV
Ascidiella aspersa	III	III	II	I
Astarte montagui	I	I	II	II
Asterias rubens	III	III	II	IV
Athanas nitescens	I	II	II	II
Atherospio disticha		IV	III	III
Atherospio guillei	IV	IV	III	III
Balanus crenatus		II	II	II
Balanus improvisus		III	II	II
Bathyporeia elegans	I	II	III	II
Bathyporeia guilliamsoniana	I	II	II	
Bathyporeia pilosa	I	II	III	II
Bathyporeia sarsi	I	II	III	II
Bathyporeia tenuipes	I	I	III	II
Bembidion laterale		III	III	III
Bodotria scorpioides	II	II	III	III
Botrylloides violaceus		III	I	II

	AMBI Borja	AMBI review	AMBI Sedimentation review	AMBI Fisheries review
Botryllus schlosseri	I	II	I	II
Brissopsis lyrifera	I	I	II	II
Buccinum undatum	II	II	II	II
Bugula plumosa		III	II	II
Bugula simplex		III	II	II
Bugula stolonifera		III	II	II
Bylgides sarsi	I	I	III	III
Callianassa subterranea	III	III	III	II
Callinectes sapidus	I	II	III	IV
Cancer pagurus	III	II	II	II
Capitella capitata	V	V	IV	IV
Caprella mutica		II	II	II
Carcinus maenas	III	III	III	IV
Cephalothrix rufifrons		II	II	II
Cerastoderma edule	III	III	II	IV
Cerastoderma glaucum	III	III	II	IV
Cerianthus lloydii	I	I	II	II
Chaetopterus variopedatus	I	I	III	II
Ciona intestinalis	III	III	II	I
Cliona celata		III	II	III
Conopeum reticulum	II	II	I	II
Corbula gibba	IV	IV	II	II
Corophium multisetosum	III	III	III	II
Corophium volutator	III	III	III	II
Coryphella gracilis		II	II	II
Corystes cassivelaunus	I	I	II	IV
Crangon crangon	I	II	II	IV
Crassostrea gigas	III	III	II	II
Crepidula fornicata	III	III	II	III
Cryptosula pallasiana	II	II	I	II
Cumopsis goodsir	II	II	III	III
Cuthona amoena		II	II	II
Cuthona concinna		II	II	II
Cuthona foliata		II	II	II
Cuthona gymnota		II	II	II
Cuthona nana		II	II	II
Dendronotus frondosus		II	II	II
Diadumene cincta		II	II	II
Diastylis bradyi	II	II	III	III
Diastylis lucifera	III	II	III	III
Didemnum vexillum		III	I	II
Diplosoma listerianum		III	II	II
Dipolydora coeca	IV	IV	III	III
Donax vittatus	I	I	II	II
Doris pseudoargus		II	II	II

	AMBI Borja	AMBI review	AMBI Sedimentation review	AMBI Fisheries review
Doto fragilis		II	II	II
Echinocardium cordatum	I	II	II	IV
Echinocyamus pusillus	I	I	II	II
Echiurus echiurus	II	II		
Ectopleura larynx	I	II	II	II
Electra pilosa	II	II	I	II
Elminius modestus	II	II	II	II
Elysia viridis		II	II	II
Emplectonema echinoderma		III	II	II
Ennucula tenuis	II	II	II	II
Ensis directus	I	II	II	II
Ensis ensis	I	II	II	I
Ensis magnus		II	II	II
Ensis minor	I	II	II	II
Ensis siliqua	I	II	II	I
Epitonium clathratulum	I	I	II	III
Epitonium clathrum	I	I	II	III
Eteone flava	III	III	II	III
Eteone longa	III	III	III	III
Eualus cranchii		II	II	II
Eubranchus exiguus		II	II	II
Eubranchus pallidus		II	II	II
Euclymene droebachiensis	III	III	III	III
Eudendrium album		II	II	II
Eulalia viridis	II	II	II	III
Eumida sanguinea	II	II	III	III
Eunereis longissima	III	III	III	III
Eunoe nodosa	II	II	III	III
Euspira catena	II	II	II	II
Exogone naidina	II	II	III	III
Facelina bostoniensis		II	II	II
Ficopomatus enigmaticus	III	III	II	II
Flabellina gracilis		II	II	II
Galathea squamifera	I	I	II	II
Galathowenia oculata	III	II	IV	III
Gammarus locusta	I	II	II	II
Gammarus zaddachi	III	III	III	II
Gattyana amondseni	III	III	III	III
Gattyana cirrhosa	III	III	III	III
Geitodoris planata		II	II	II
Glycera alba	IV	III	II	III
Glycera lapidum	II	II	II	III
Golfingia vulgaris	I	II	II	II
Goniadella bobretzkii	II	II	II	III
Goniodoris castanea		II	II	II

	AMBI Borja	AMBI review	AMBI Sedimentation review	AMBI Fisheries review
Gonionemus vertens		II	I	II
Goodallia triangularis	II	II	II	II
Halecium halecinum		II	II	II
Halichondria bowerbanki		II	II	II
Halichondria panicea	I	II	I	II
Haliclona oculata		II	II	II
Haliclona xena		II	II	II
Harmothoe imbricata	II	II	II	III
Harmothoe impar	II	II	III	III
Harpinia antennaria	I	II	III	II
Haustorius arenarius	I	II	II	II
Hediste diversicolor	III	III	III	II
Hemigrapsus sanguineus		II	II	IV
Hemigrapsus takanoi		II	II	IV
Hemimysis lamornae		II	II	II
Hermaea bifida		II	II	II
Hesionura elongata	II	II	IV	III
Heteromastus filiformis	IV	IV	IV	IV
Hippolyte varians	I	I	II	II
Homarus gammarus		I	II	II
Hyala vitrea	I	I	III	II
Hyas araneus	I	II	IV	II
Hyas coarctatus	I	II	IV	II
Hydractinia echinata		II	I	II
Hydrobia ulvae	III	III	III	II
Hymeniacidon perlevis		II	II	II
Idotea linearis	II	II	II	II
Inachus phalangium		I	II	IV
Janolus cristatus		II	II	II
Janolus hyalinus		II	II	II
Jassa falcata	V	V	I	III
Jassa marmorata	V	V	III	III
Jorunna tomentosa		II	II	II
Kurtiella bidentata	III	III	II	II
Lagis koreni	IV	III	IV	II
Lanice conchilega	II	III	IV	IV
Lepidochitona cinerea	II	II	II	III
Leptomysis lingvura		II	II	II
Leucosolenia variabilis		II	II	II
Liocarcinus depurator	I	II	III	I
Liocarcinus holsatus	I	II	III	IV
Liocarcinus marmoreus	I	II	II	II
Liocarcinus navigator	I	II	II	II
Littorina littorea	II	II	II	III

	AMBI Borja	AMBI review	AMBI Sedimentation review	AMBI Fisheries review
Lumbrineris latreilli	II	II	III	III
Lutraria lutraria	I	I	II	II
Macoma balthica	III	III	II	II
Macropodia rostrata	I	II	II	IV
Mactra stultorum		II	II	II
Magelona filiformis	I	I	IV	II
Magelona johnstoni	I	I	IV	II
Magelona papillicornis	I	I	IV	II
Malmgreniella ljungmani	II	II	III	III
Marenzelleria viridis	II	II	III	III
Mediomastus fragilis	III	III	IV	IV
Membranipora membranacea	I	II	I	II
Metopa alderi	II	II	II	III
Metridium senile		II	II	II
Microphthalmus fragilis	II	II	II	II
Microphthalmus sczelkowii	II	II	II	II
Microphthalmus similis	II	II	III	III
Microprotopus maculatus	I	II	III	III
Molgula manhattensis	I	III	III	I
Molgula socialis		III	III	I
Mya arenaria	II	II	II	II
Mya truncata	II	II	II	II
Mycale micracanthoxea		II	II	II
Myrianida langerhansi	II	II	III	III
Myriochele danielsseni	III	III	IV	III
Mytilus edulis	III	III	II	II
Nassarius reticulatus	II	II	III	IV
Necora puber	I	II	II	IV
Neoamphitrite figulus	I	II	IV	III
Neodexiospira brasiliensis		II	II	II
Neomysis integer	II	III	II	II
Nephrops norvegicus	I	I	II	II
Nephtys caeca	II	II	III	II
Nephtys cirrosa	II	II	IV	II
Nephtys hombergii	II	II	II	II
Nephtys longosetosa	II	II	III	II
Notomastus latericeus	III	III	II	II
Nucella lapillus		I	II	II
Nucula nitidosa	I	I	IV	II
Obelia bidentata	II	II	II	II
Obelia dichotoma	II	II	II	II
Obelia geniculata	II	I	II	II
Obelia longissima	II	II	II	II
Onchidoris bilamellata		II	II	II

	AMBI Borja	AMBI review	AMBI Sedimentation review	AMBI Fisheries review
Onchidoris muricata	I	I	II	II
Ophelia rathkei	I	I	II	II
Ophiothrix fragilis	I	II	II	II
Ophiura albida	II	II	IV	IV
Ophiura ophiura	II	II	IV	II
Orchomenella nana	II	II	III	IV
Ostrea edulis	I	II	I	I
Owenia fusiformis	II	II	III	II
Pagurus bernhardus	II	II	II	IV
Palaemon adspersus		II	II	II
Palaemon elegans	I	I	II	II
Palaemon macrodactylus		II	II	II
Palaemon serratus	I	I	II	II
Pandalus montagui	II	II	II	II
Paradoneis fulgens	III	III	II	II
Pariambus typicus	III	III	II	II
Patella vulgata		II	I	III
Pelonaia corrugata		II	II	II
Perioculodes longimanus	II	II	III	III
Petricola pholadiformis	I	II	I	II
Pherusa flabellata	I	I	IV	III
Pholoe minuta	II	II	II	III
Phoronis hippocrepia	II	II	III	II
Photis longicaudata	I	I	III	II
Phoxichilidium femoratum	I	I	II	II
Phyllodoce groenlandica	IV	III	IV	II
Phyllodoce laminosa	II	II	IV	II
Phyllodoce lineata	II	II	IV	II
Phyllodoce maculata	II	II	IV	II
Phyllodoce mucosa	III	III	IV	II
Pilumnus hirtellus	I	II	II	III
Pinnotheres pisum		II	II	II
Pisidia longicornis	I	I	II	I
Pisione remota	I	II	III	III
Polycirrus medusa	IV	IV	IV	III
Polydora ciliata	IV	IV	III	III
Polydora cornuta	IV	IV	III	IV
Pomatoceros triqueter	II	II	II	II
Praunus flexuosus	I	II	II	II
Propebela turricula		II	II	III
Protosuberites denhartogi		II	II	II
Psammechinus miliaris	I	II	II	IV
Pseudopolydora pulchra	IV	IV	III	II
Pseudopotamilla reniformis	II	II	III	II

	AMBI Borja	AMBI review	AMBI Sedimentation review	AMBI Fisheries review
Pycnogonum litorale	II	II	II	III
Pygospio elegans	III	III	III	IV
Retusa obtusa	II	II	III	III
Sabella pavonina	I	II	III	II
Sagartia elegans		II	I	II
Sagartia troglodytes	I	II	II	II
Sagartiogeton undatus		II	III	II
Saxicavella jeffreysi	I	I	II	II
Scalibregma inflatum	III	III	IV	IV
Schistomysis kervillei	II	III	II	II
Scolelepis foliosa	III	II	III	III
Scolelepis squamata	III	II	II	III
Scoloplos armiger	III	II	IV	II
Scopelocheirus hopei		II	III	III
Scrobicularia plana	III	III	II	III
Scrupocellaria scruposa	I	II	II	II
Spio filicornis	III	III	IV	IV
Spio martinensis	III	III	IV	IV
Spiophanes bombyx	III	III	IV	IV
Spirorbis tridentatus		II	III	II
Spisula subtruncata	I	II	IV	IV
Stenothoe marina	II	II	II	II
Streblospio shrubsolii	III	III	III	II
Styela clava	II	II	II	II
Suberites massa		II	II	II
Sycon ciliatum		I	II	II
Sycon scaldiense		I	II	II
Tellimya ferruginosa	II	II	II	II
Tellina fabula	I	I	II	II
Tellina pygmaea	I	I	IV	II
Tellina tenuis	I	I	II	II
Tergipes tergipes		II	II	II
Thecacera pennigera		II	II	II
Thyasira flexuosa	III	III	II	II
Tricellaria inopinata		III	II	II
Trivia arctica	I	I	II	III
Tryphosella sarsi	I	II	III	III
Tryphosites longipes	I	II	III	III
Tubularia indivisa		II	II	II
Upogebia deltaura	I	II	III	II
Urothoe brevicornis	I	I	II	IV
Urothoe poseidonis	I	II	II	IV
Urticina felina		II	II	II
Venerupis senegalensis	I	II	II	II

2.1 AMBI: AZTI Marine Biotic Index

The AMBI was developed by Borja et al. (2000) and was initially designed for the pressure Organic Enrichment. However, it has been demonstrated that the AMBI is also more or less sensitive for other types of pressures. The class definitions of the AMBI are given below. In some cases the AMBI scores that are proposed in this report and in the database, differ from the ones set by Borja, because the three experts that were used to set these scores in the present report disagreed with the value set by Borja. Whenever this was the case, a short explanation and/or a literature reference is given in the database. In most cases this concerns species that are scored in group I (very sensitive to pollution) by Borja, while these species are known, at least in The Netherlands, to occur in highly polluted areas. An example of such a species is the razor shell *Ensis directus*, which can be found in high densities in The Netherlands in relatively polluted regions (for example in Rotterdam Harbour). Although Borja gave this species a score of I, we propose to give it a score of II.

Group I
Species very sensitive to organic enrichment and present under unpolluted conditions (initial state). They include the specialist carnivores and some deposit-feeding tubicolous polychaetes.

Group II
Species indifferent to enrichment, always present in low densities with non-significant variations with time (from initial state, to slight unbalance). These include suspension feeders, less selective carnivores and scavengers.

Group III
Species tolerant to excess organic matter enrichment. These species may occur under normal conditions, but their populations are stimulated by organic enrichment (slight unbalance situations). They are surface deposit-feeding species, as tubicolous spionids.

Group IV
Second-order opportunistic species (slight to pronounced unbalanced situations). Mainly small sized polychaetes: subsurface deposit-feeders, such as cirratulids.

Group V
First-order opportunistic species (pronounced unbalanced situations). These are deposit-feeders, which proliferate in reduced sediments.

2.2 AMBI Fisheries

The AMBI Fisheries is a newly designed indicator that describes the sensitivity of species to physical disturbance. As bottom fisheries are the main human activity that disturbs the bottom, this AMBI was called “AMBI Fisheries”. None of the selected species (Table 3) was a first-order opportunistic species, i.e. an AMBI score V species that is not only insensitive to fisheries, but even significantly increases in population size because of intense fisheries. Quite some species, like the snail Nassarius reticulatus got a score of IV, indicating that although they may be sensitive to fisheries at first, their population size may increase in areas with intense fisheries. This group of species includes scavengers, i.e. species that are attracted to animals/prey, that lie hurt or dead on the sea floor. It is assumed that bottom disturbing fisheries increase the number of such prey in an area, and therefore increases the population sizes of certain scavengers.

For the AMBI Fisheries, we propose to use the following definitions comparable with the AMBI class definitions:

Group I
Species very sensitive to fisheries in which the bottom is disturbed. Their populations do not easily recover.

Group II
Species sensitive to fisheries in which the bottom is disturbed, but their populations recover relatively quickly.

Group III
Species to fisheries in which the bottom is disturbed. Their populations do not show a significant decline or increase.

Group IV
Second-order opportunistic species, which are sensitive to fisheries in which the bottom is disturbed. Their populations recover relatively quickly however and benefit from the disturbance, causing their population sizes to increase significantly in areas with intense fisheries.

Group V
First-order opportunistic species, insensitive to fisheries in which the bottom is disturbed. Their population significantly increases in areas with intense fisheries.

2.3 AMBI Sedimentation

The AMBI Sedimentation is a newly designed indicator that describes the sensitivity of species to matter (sand and mud) that sediments onto the macrozoobenthos. Benthic species that live in an area where a lot of sediment sinks to the bottom should be able clean this sediment of themselves to make sure that they do not suffocate. This ability and therefore the sensitivity of a species to sedimentation is at least partly depended on the trophic group of a species, as is explained in the next chapter, which describes the ITI values.

Group I
Species very sensitive to sedimentation in general. In clear waters, the species is present in relatively high densities.

Group II
Species sensitive to high sedimentation. They prefer to live in areas with some sedimentation, but don't easily recover from strong fluctuations in sedimentation.

Group III
Species insensitive to higher amounts of sedimentation, but don't easily recover from strong fluctuations in sedimentation.

Group IV
Second-order opportunistic species, insensitive to higher amounts of sedimentation. Although they are sensitive to strong fluctuations in sedimentation, their populations recover relatively quickly and even benefit. This causes their population sizes to increase significantly in areas after a strong fluctuation in sedimentation.

Group V
First-order opportunistic species. Species, which are significantly benefitting from higher amounts of sedimentation and fluctuations in sedimentation.

3. r/K strategist and Infaunal Trophic Index

3.1 r/K strategist

Species in the database were considered to be r- or K-strategists based on the publications of Lavaleye (1999), Holtmann (2000) and Kater (2007). The definitions of either r- and K-strategists were first used by MacArthur & Wilson (1967). In these publications it is assumed that it depends on the environment, which strategy is most successful. A K-strategist, who invests in a long development and a long lifespan, is more successful in a stable, predictable environment. In an unpredictable and unstable environment, the r-strategist that produces many more offspring and has a short development time, is more profitable. Although deciding whether a species is a r- or a K-strategist may seem somewhat subjective at first, virtually no disagreements on what strategy a species follows, is found in literature. The general parameters that are used to identify a species either as a r- or a K-strategist are illustrated in table 4 (Lavaleye, 1999).

Table 4. r/K strategist characters after Lavaleye (1999).

Property	**r-strategy**	**K-strategy**
Environment	Variable	Stable/constant
mortality	Sometimes catastrophic	Density dependent
Population size	Variable over time	Relatively stable
Intra- and interspecific competition	Little	High
Growth	Fast	Slow
Reproduction	In an early stage	At a later age
Body size	Small	Large
Age	Often less than a year	Multiple years

3.2 ITI values

The Infaunal trophic index (ITI) is an index which a gives an indication of the amount of mostly physical disturbances in the environment (Lavaley, 1999, Holtman, 2000; Kater, 2007)). The index is determined using the presence of species divided in four major feeding types. The main disadvantage of the ITI is that predators and scavengers are not taken into consideration however.

The four feeding types that were distinguished for the ITI are (Kater, 2007):

1: Suspension feeders
This group feeds on suspended materials, using their tentacles, arms or mucous nets and threads. Suspension feeders prefer environments with relatively much phytoplankton and not too much sand/mud, because this may clog their filtration systems. They also prefer relatively strong currents, which provide phytoplankton.

2: Interface feeders
Interface feeders can obtain their food from the water column (suspension feeding) as well as from the bottom (deposit feeding). An advantage of this strategy is that it is more flexible and that interface feeders can adapt their feeding behaviour to the availability of food.

3: Surface deposit feeders
Surface deposit feeders get their food from the upper layer of the sediment. This layer is usually rich in organic matter. Food is being sucked (siphons) or scraped (tongue scraper) from the top layer.

4: Subsurface deposit feeders
Subsurface deposit feeders live buried in the soil and feed on sediment. This group is characteristic of eutrophic areas with high sediment dynamics.

The ITI always has a value between 0 and 100 and is calculated with the following equation:

$ITI = 100 - (100/3 * (0n_1 + 1n_2 + 2n_3 + 3n_4)/(n_1 + n_2 + n_3 + n_4))$, in which n_1 is the number of suspension feeders, n_2 is the number of interface feeders, n_3 is the number of surface feeders and n_4 the number of subsurface feeders.

In an undisturbed environment suspension feeders will dominate the species composition. As a result of mostly physical disturbances, direct damage can be imposed by fisheries and sedimentation can increase, smothering the suspension feeders in favour of the interface feeders. If the sedimentation that sinks to the bottom is too much to be processed by the interface feeders, surface and subsurface deposit feeders will prosper. In an undisturbed environment, especially when the suspension and interface feeders dominate, the index will be close to 100. When suspension is high due to continuing human activities, the species composition will shift towards the (sub)surface deposit feeders, and the ITI index will approach zero (Kater, 2007).

4. Correlation analysis of indicators

Some of the indices and parameters that were scored for each of the species are independent, while others seem to be related to each other as is indicated in Table 5. The AMBI scores do not strongly correlate with any of the other parameters (correlations of less than 0.21). Both the AMBI Sedimentation and the AMBI Fisheries correlate relative strongly with the ITI, respectively 0.49 and 0.48, but not so much with each other, i.e. 0.31. This is logical as the trophic groups separated by the ITI, distinguish themselves from each other on the basis of how they process the suspended (organic) matter in the water column, i.e. explaining the correlation with the AMBI Sedimentation values. The correlation with the AMBI Fisheries can probably be explained by the fact that the trophic groups that feed on suspended material (suspension feeders) tend to live close to the surface, being more exposed and therefore more sensitive to fisheries than the subsurface feeders that tend to live buried deeper in the sand. Being either a r- or a K-strategist also correlates to some degree with the ITI, i.e. 0.37, although the r/K strategist metric does not strongly correlate with any of the other metrics (correlations of less than 0.21). Subsurface deposit feeders which tend to live deeper in the sand than e.g. suspension feeders, live in a more stable, predictable environment. As was already described in paragraph 3.1 such an environment tends to attract more K-strategists, which may explain the correlation found.

Table 5. Correlations between the indices and parameters that were scored for each of the common marine macrozoobenthos species that are included in the present study.

	AMBI	AMBI sedimentation	AMBI Fisheries	r/K	ITI
AMBI	1.00	0.19	0.20	0.20	0.09
AMBI sedimentation	-	1.00	0.31	0.16	0.49
AMBI Fisheries	-	-	1.00	0.02	0.48
r/K	-	-	-	1.00	0.37
ITI	-	-	-	-	1.00

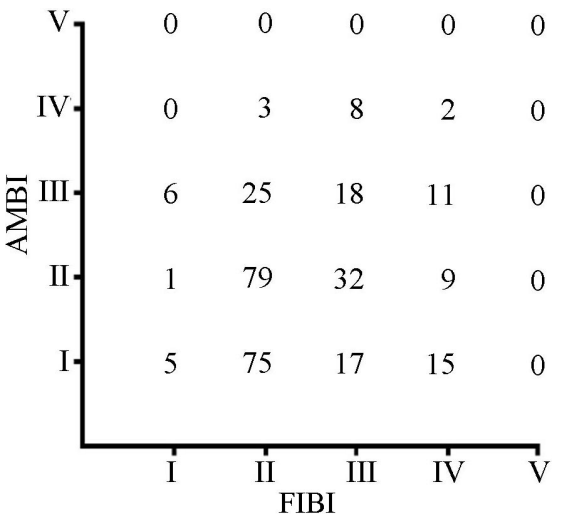

Figure 5. Correlation between the AMBI and AMBI Fisheries

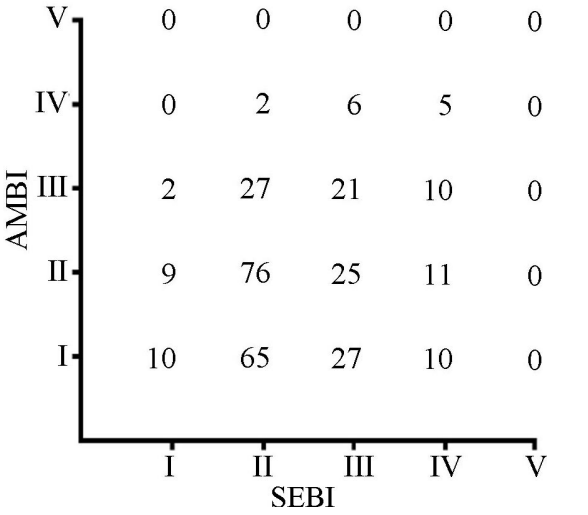

Figure 6. Correlation between the AMBI and AMBI sedimentation

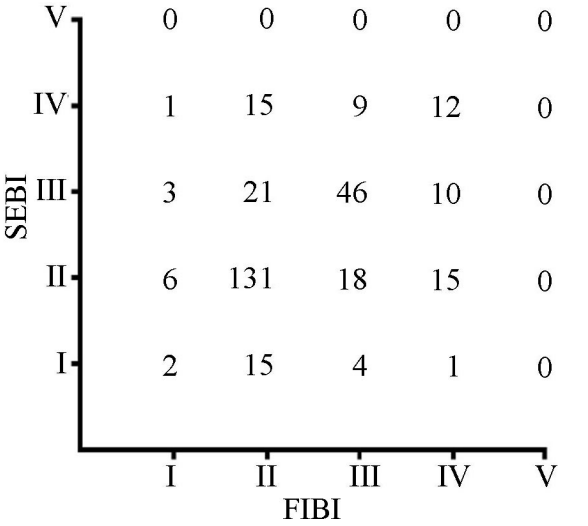

Figure 7. Correlation between the AMBI sedimentation and AMBI Fisheries

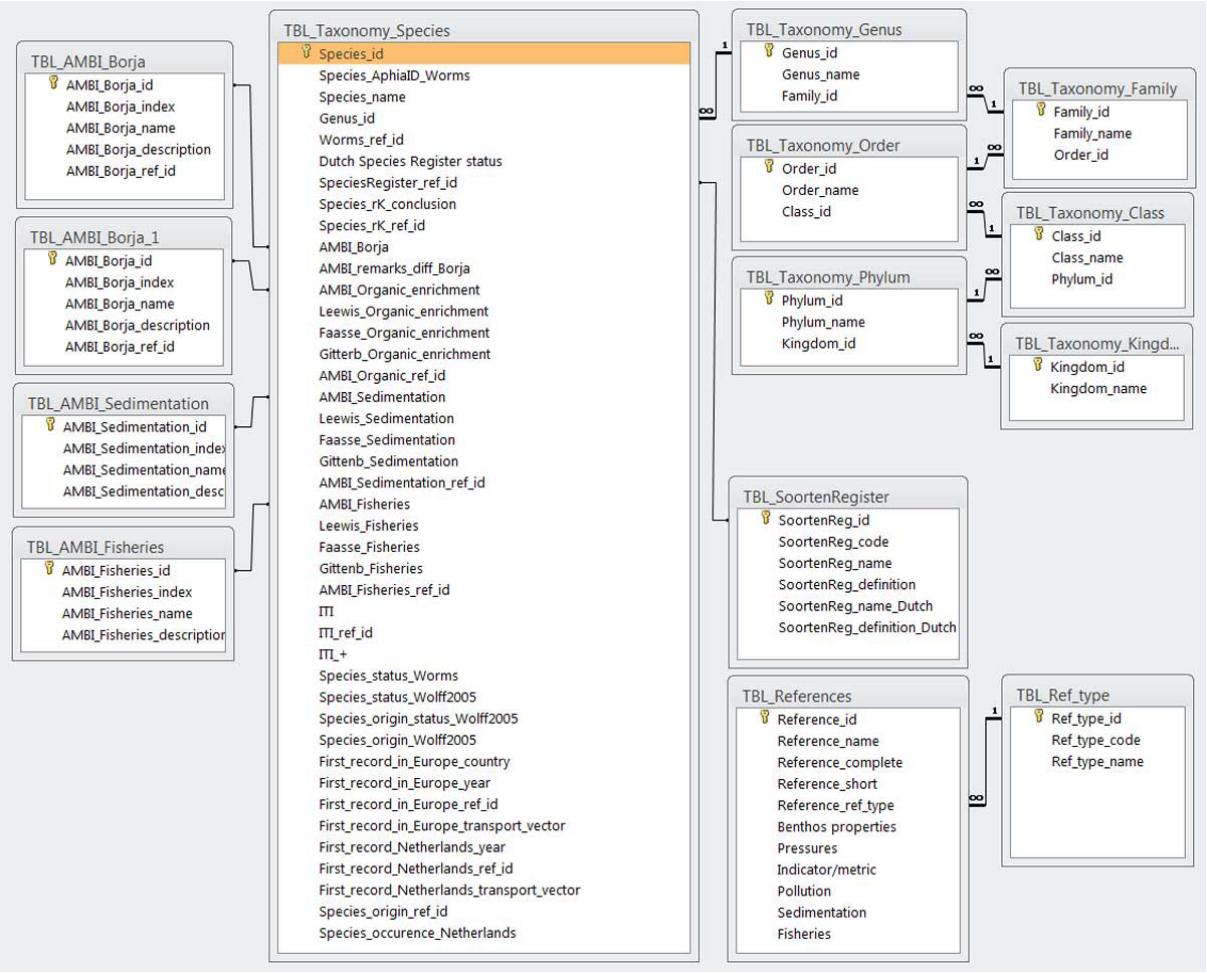

Figure 8. The tables of the Common, marine, benthic, animal species in The Netherlands database and the relationships between them. All "...ref_id" fields are linking to the reference table.

5. Non-native species

Of the 309 common macrozoobenthos species of the Netherlands that are described in the present report, twenty-nine are non-native. Most of these species (11) were introduced from the Pacific (Wolff, 2005). In the database (see chapter 6) for each of these species, the first country where it was encountered in Europe, is indicated including the year that it was first sighted there, the most probable import vector and the literature reference that was used as a source. Similarly the year that it was first sighted in The Netherlands is added, the most probable import vector to the Netherlands and the literature reference that was used as a source.

6. The species database

The design of the database of common macrozoobenthos species, including the tables and relationships between them, was developed to minimize the chance of redundant information and type mismatches. These tables and the relationships between them are illustrated in figure 8.

For the users a set of queries has been designed that enables easy access to the information in the database. The queries can also be used for data input, output and editing. The queries are described below.

6.1 Query: All_Sp_AMBIs_ITIs_r/Kstrategist

This table presents an overview of the main metrics & characters of the species in the database. These include the AMBI Organic enrichment, the AMBI Sedimentation, the AMB Fisheries, the r/K strategy and the ITI.

6.2 Query: AMBI fisheries

This table presents the AMBI Fisheries values for the species in the database including the descriptions of these AMBIs. It also presents the references and the three independent expert opinions on the basis of which these values were chosen. Where the experts differed in their expert opinions, they discussed the species and set the 'best' AMBI value in mutual agreement

6.3 Query: AMBI

This table presents the AMBI Organic enrichment values for the species in the database including the descriptions of these AMBIs. It also presents the references and the three independent expert opinions on the basis of which these values were chosen. Where the experts differed in their expert opinions, they discussed the species and set the 'best' AMBI value in mutual agreement. Because the AMBI Organic enrichment was based on the AMBI described by Borja et al. (2000), Borja's AMBI values were also included and a remark and/or reference was added where Borja's AMBI differed from the AMBI Organic enrichment value.

6.4 Query: AMBI sedimentation

This table presents the AMBI Sedimentation values for the species in the database including the descriptions of these AMBIs. It also presents the references and the three independent expert opinions on the basis of which these values were chosen. Where the experts differed in their expert opinions, they discussed the species and set the 'best' AMBI value in mutual agreement.

6.5 Query: ITIs_r/Kstrategist

This table presents an overview of the ITI values for the species in the database according to Holtmann (2000) and ITI values according to Holtmann (2000) and/or the expert opinion of the author of this report. Furthermore it is indicated whether a species should be considered to be a r- or a K-strategist according to Holtmann (2000), Kater (2007), Lavaleye (1999) and/or the expert opinion of the author of this report.

6.6 Query: Non_natives

This table presents data on the origin of the species in the database with a focus on the non-native species. This includes the species status according to the Dutch register of species (www.soortenregister.nl), the literature reference on which that status was based, the species status according to Worms, i.e. the world register of marine species (www.marinespecies.org), and the species status and origin according to Wolff (2005). Where known, the first country where the exotic species was encountered in Europe is indicated including the year that it was first sighted there, the most probable import vector and the literature reference that was used as a source. Similarly the year that it was first sighted in The Netherlands is added, the most probable import vector to the Netherlands and the literature reference that was used as a source.

6.7 Query: References

This table presents an overview of all references, in short and complete. As an indication of the quality the reference type, e.g. SCI-journal, report, etc. was included. To aid searching the ref-

erence list for literature on a certain subject, it is indicated for each article whether the topics "benthos properties", "pressures", indicators/ metrics", "pollution", "sedimentation" and/or "fisheries" are described.

6.8 Query: Taxonomy

This table presents the complete taxonomy of each species, as it is presented in the World Register of Marine Species, i.e. WoRMS: www.marinespecies.org.

6.9 Owner, Maintenance and Use of the Database

The Dutch marine macrozoobenthos database has been developed within an RWS project and therefore is property of RWS. GiMaRIS, as the developer of this database, aims at performing the maintenance of this database, especially the update with new species and reference data. Other Dutch and European marine laboratories can obtain a copy of this database on request, if they agree to send updates (e.g. other species and reference data) for this database to GiMaRIS, in order to improve the database. See webpage www.gimaris.com/benthosdatabase.html. In this way, we hope that the macrozoobenthos database will become a current Dutch tool with reference data for marine macrozoobenthos assessments.

7. References

All 520 references that were used in the present study can be found in the reference table of the database. Below, only the references that were used in this report, are included.

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Borja, A., Franco, J. & V. Perez, 2000. A marine biotic index to establish the ecological quality of soft-bottom benthos within European estuarine and coastal environments. Marine pollution bulletin 40(12): 1100-1114.

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Lavaleye, M.S.S., 1999. Rapport Graadmeters van de Noordzee. Infaunal Trophic Index (ITI) van het macrobenthos en Structuur macrobenthos gemeenschap (verhouding r- en K-strategen). GONZ-rapport. NIOZ, Texel: 40 pp.

Loon, W.M.G.M. van, Verschoor, A. & A. Gittenberger 2011a. Benthic Ecosystem Quality Index 2: Design and Calibration of the Dutch BEQI-2 WFD metric for Marine Benthos in Transitional Waters, Report, RWS Waterdienst.

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APPENDIX: Data sources

MWTL, 1990-2008 data, Delta area
Density data (specimens/m^2)

Source dataset	Abundance:	Total number of species	Identified to species level	> 1% max. abundance	> 2% max. abundance	> 3% max. abundance	> 5% max. abundance
MWTL, 1990-2008 data, Delta area	Density (/m^2)	415	275	272	211	148	91

Species selected >3% max density	Density
Hydrobia ulvae	3539
Corophium volutator	2833
Pygospio elegans	2467
Corophium lacustre	2289
Aphelochaeta marioni	1925
Balanus improvisus	1520
Arenicola defodiens	1380
Heteromastus filiformis	1243
Idotea chelipes	1220
Corophium insidiosum	1137
Malacoceros tetracerus	1119
Balanus crenatus	1108
Alkmaria romijni	1017
Corophium sextonae	995
Bathyporeia pilosa	931
Janira maculosa	900
Polydora ciliata	867
Streblospio shrubsolii	845
Ficopomatus enigmaticus	845
Didemnum candidum	790
Corophium arenarium	742
Polydora quadrilobata	733
Malacoceros fuliginosus	721
Polydora cornuta	708
Hydrobia ventrosa	699
Manayunkia aestuarina	664
Microdeutopus gryllotalpa	662
Microdeutopus anomalus	588
Spirorbis tridentatus	583
Jaera albifrons	561
Lanice conchilega	544
Corophium acherusicum	535
Capitella capitata	518
Bathyporeia elegans	502
Chironomus salinarius	486
Urothoe poseidonis	462
Molgula manhattensis	450
Cyathura carinata	440
Aora typica	435

Species selected >3% max density	Density
Exogone naidina	406
Melita pellucida	400
Gyptis rosea	400
Psammodrilus balanoglossoides	398
Gammarus locusta	391
Platynereis dumerilii	385
Corbula gibba	365
Mytilus edulis	363
Sphaeroma hookeri	344
Cossura pygodactylata	333
Eumida sanguinea	329
Eumida bahusiensis	321
Parapleustes assimilis	316
Abra nitida	308
Eteone longa	300
Siphonoecetes striatus	300
Crepidula fornicata	293
Nereis diversicolor	279
Syllidia armata	279
Gammarus salinus	277
Bathyporeia sarsi	272
Microdeutopus damnoniensis	270
Scoloplos armiger	269
Fabricia stellaris stellaris	257
Microphthalmus similis	256
Elysia viridis	256
Harmothoe imbricata	255
Syllis gracilis	247
Spio martinensis	247
Proceraea cornuta	245
Harmothoe impar	242
Scalibregma inflatum	240
Spisula subtruncata	239
Cossura longocirrata	231
Corophium bonnellii	227
Melita palmata	224
Polycirrus medusa	224
Ascidiella aspersa	223
Ciona intestinalis	205

Species selected >3% max density	Density
Aricidea minuta	204
Mysella bidentata	203
Phyllodoce maculata	200
Leucothoe incisa	200
Sabellaria spinulosa	200
Nereis succinea	200
Spiophanes bombyx	195
Abludomelita obtusata	194
Malmgreniella lunulata	192
Microprotopus maculatus	187
Sphaeroma rugicauda	187
Pleusymtes glaber	185
Pherusa plumosa	183
Autolytus langerhansi	177
Dodecaceria concharum	175
Abra alba	173
Eurydice pulchra	172
Pseudopolydora pulchra	171
Tryphosella sarsi	167
Owenia fusiformis	166
Flabelligera affinis	162
Amphipholis squamata	158
Boccardiella ligerica	158
Montacuta ferruginosa	158
Abra tenuis	156
Cheirocratus sundevallii	156
Autolytus prolifer	149
Kefersteinia cirrata	149
Ophiothrix fragilis	145
Microphthalmus sczelkowii	139
Gastrosaccus spinifer	138
Marenzelleria viridis	136
Phyllodoce mucosa	135
Spio filicornis	134
Adyte pellucida	133

Species selected >3% max density	Density
Achelia laevis	133
Exogone hebes	133
Ampharete acutifrons	133
Acanthocardia paucicostata	132
Pycnogonum littorale	130
Gattyana cirrosa	130
Corophium multisetosum	127
Microphthalmus fragilis	126
Cerastoderma lamarcki	125
Ampelisca brevicornis	123
Neoamphitrite figulus	122
Petricola pholadiformis	120
Eulalia viridis	119
Bembidion laterale	119
Bodotria scorpioides	119
Ostrea edulis	118
Pinnotheres pisum	118
Ophelia rathkei	117
Pontocrates longimanus	116
Praunus flexuosus	116
Paradoneis fulgens	115
Pseudopotamilla reniformis	114
Stenothoe marina	114
Neomysis integer	114
Pectinaria koreni	114
Gammarus zaddachi	112
Retusa obtusa	112
Eteone flava	112
Urothoe brevicornis	112
Magelona papillicornis	112
Liocarcinus depurator	111
Pherusa flabellata	111
Styela clava	111
Scolelepis squamata	108
Haustorius arenarius	107

MWTL, 1990-2008 data, Delta area
Biomass data (mg AFDW/m^2)

Source dataset	Abundance:	Total number of species	Identified to species level	> 1% max. abundance	> 2% max. abundance	> 3% max. abundance	> 5% max. abundance
MWTL, 1990-2008 data, Delta area	Biomass (mg/m^2)	402	271	15	6	4	3

Species selected >3% max biomass	Avarage biomass
Cancer pagurus	1428247
Arenicola defodiens	110112
Liocarcinus depurator	74523
Ensis directus	54220

MWTL, 1984-2008 data, North Sea
Density data (specimens/m^2)

Source dataset	Abundance:	Total number of species	Identified to species level	> 1% max. abundance	> 2% max. abundance	> 3% max. abundance	> 5% max. abundance
MWTL, 1984-2008 data, North Sea	Density (/m^2)	612	452	359	176	107	40

Species selected >3% max density	Density
Spisula subtruncata	1415
Corophium volutator	1132
Orchomene nanus	1032
Spiophanes bombyx	810
Amphiura filiformis	629
Lanice conchilega	527
Balanus improvisus	500
Microphthalmus similis	451
Cerastoderma edule	406
Balanus crenatus	397
Capitella capitata	353
Abra alba	315
Pisione remota	291
Macoma balthica	290
Mytilus edulis	287
Magelona papillicornis	271
Mysella bidentata	261
Polydora ciliata	242
Phyllodoce mucosa	234
Pectinaria koreni	222
Urothoe poseidonis	213
Tryphosella sarsi	211
Corbula gibba	194
Magelona johnstoni	192
Ensis directus	179
Echiurus echiurus	169
Scoloplos armiger	163
Metopa alderi	161
Alvania lactea	158
Spio filicornis	153
Ophiura texturata	150
Eumida sanguinea	145
Atherospio disticha	141
Phyllodoce laminosa	135
Myriochele danielsseni	133
Bathyporeia elegans	130
Nereis succinea	126
Goniadella bobretzkii	117
Amphiura chiajei	114

Species selected >3% max density	Density
Pygospio elegans	112
Magelona filiformis	109
Harmothoe nodosa	107
Petricola pholadiformis	104
Phyllodoce maculata	104
Gattyana amondseni	103
Heteromastus filiformis	100
Tellina fabula	97
Goodallia triangularis	93
Ensis americanus	88
Autolytus langerhansi	86
Pholoe minuta	86
Pariambus typicus	84
Montacuta ferruginosa	83
Exogone naidina	76
Acrocnida brachiata	73
Phyllodoce lineata	70
Callianassa subterranea	70
Hyala vitrea	69
Nephtys cirrosa	68
Tellina pygmaea	67
Aonides paucibranchiata	67
Hesionura elongata	67
Sagartia troglodytes	66
Euclymene droebachiensis	64
Atherospio guillei	64
Microprotopus maculatus	63
Bathyporeia guilliamsoniana	63
Obelia bidentata	62
Aora gracilis	59
Donax vittatus	57
Photis longicaudata	57
Myriochele oculata	57
Echinocyamus pusillus	55
Harpinia antennaria	55
Urothoe brevicornis	54
Nereis diversicolor	53
Spio martinensis	53
Nuculoma tenuis	53

Species selected >3% max density	Density
Nereis longissima	53
Pseudopolydora pulchra	53
Jassa falcata	52
Nephtys hombergii	52
Hydrobia ulvae	51
Harmothoe ljungmani	51
Abludomelita obtusata	51
Owenia fusiformis	50
Thyasira flexuosa	49
Aphelochaeta marioni	49
Bathyporeia tenuipes	48
Golfingia vulgaris	47
Scopelocheirus hopei	46
Saxicavella jeffreysi	45

Species selected >3% max density	Density
Tryphosites longipes	45
Mediomastus fragilis	45
Melita obtusata	45
Lumbrineris latreilli	45
Notomastus latericeus	44
Jassa dentex	44
Diastylis lucifera	44
Microphthalmus sczelkowii	44
Psammechinus miliaris	44
Phyllodoce groenlandica	44
Nucula nitidosa	44
Glycera lapidum	44
Polycirrus medusa	43
Scalibregma inflatum	43
Astarte montagui	43

MWTL, 1984-2008 data, North Sea
Biomass data (mg/m^2)

Source dataset	Abundance:	Total number of species	Identified to species level	> 1% max. abundance	> 2% max. abundance	> 3% max. abundance	> 5% max. abundance
MWTL, 1984-2008 data, North Sea	Biomass (mg/m^2)	583	432	60	38	30	19

Species selected >3% max biomass	Avarage biomass
Lutraria lutraria	119
Buccinum undatum	75
Ensis directus	73
Nephrops norvegicus	60
Ensis siliqua	52
Ensis minor	33
Sagartia troglodytes	23
Metopa alderi	20
Pelonaia corrugata	20
Ensis arcuatus	16
Ensis americanus	14
Cerastoderma edule	12
Petricola pholadiformis	11
Mya truncata	10
Chaetopterus variopedatus	9

Species selected >3% max biomass	Avarage biomass
Mya arenaria	9
Venerupis senegalensis	8
Upogebia deltaura	8
Brissopsis lyrifera	8
Gattyana amondseni	6
Arenicola marina	5
Asterias rubens	5
Liocarcinus holsatus	5
Ensis ensis	4
Carcinus maenas	4
Amphiura filiformis	4
Liocarcinus marmoreus	4
Lanice conchilega	4
Donax vittatus	4
Cerianthus lloydii	4

MWTL, 1989-2008 data, Wadden Sea
Density data (specimens/m^2)

Source dataset	Abundance:	Total number of species	Identified to species level	> 1% max. abundance	> 2% max. abundance	> 3% max. abundance	> 5% max. abundance
MWTL, 1989-2008 data, Wadden Sea	Density (/m^2)	104	101	6	4	3	2

Species selected >3% max density	Density
Hydrobia ulvae	35641
Corophium volutator	6212
Marenzelleria viridis	1090

MWTL, 1989-2008 data, Wadden Sea
Biomass data (mg/m^2)

Source dataset	Abundance:	Total number of species	Identified to species level	> 1% max. abundance	> 2% max. abundance	> 3% max. abundance	> 5% max. abundance
MWTL, 1989-2008 data, Wadden Sea	Biomass (mg/m^2)	108	105	19	15	13	10

Species selected >3% max biomass	Avarage biomass
Mya aranaria	49914
Hydrobia ulvae	13338
Mya arenaria	6822
Ensis americanus	6144
Crassostrea gigas	5020
Mytilus edulis	4774
Marenzelleria viridis	4480
Arenicola marina	3949
Cerastoderma edule	2811
Lanice conchilega	2683
Nereis diversicolor	2194
Heteromastus filiformis	2128
Corophium volutator	1890

ANEMOON Foundation, MOO-project

Source dataset	Total number of species	Identified to species level
ANEMOON Foundation, MOO-project	105	105

Acanthodoris pilosa	*Facelina bostoniensis*	*Mytilus edulis*
Actinia equina	*Flabellina gracilis*	*Necora puber*
Aeolidia papillosa	*Galathea squamifera*	*Nucella lapillus*
Aeolidiella glauca	*Geitodoris planata*	*Onchidoris bilamellata*
Aequipecten opercularis	*Goniodoris castanea*	*Ophiothrix fragilis*
Alcyonium digitatum	*Halecium halecinum*	*Ophiura texturata*
Amphitrite spec.	*Halichondria bowerbanki*	*Ostrea edulis*
Aplidium glabrum	*Halichondria panicea*	*Pagurus bernhardus*
Ascidiella spec.	*Haliclona oculata*	*Palaemon adspersus*
Asterias rubens	*Haliclona xena*	*Palaemon elegans*
Athanas nitescens	*Haliplanella lineata*	*Palaemon macrodactylus*
Aurelia aurita (Poliep)	*Hemigrapsus penicillatus*	*Palaemon serratus*
Botrylloides violaceus	*Hemigrapsus sanguineus*	*Pandalus montagui*
Botryllus schlosseri	*Hemimysis lamornae*	*Phoronis hippocrepia*
Buccinum undatum	*Hermaea bifida*	*Pilumnus hirtellus*
Cancer pagurus	*Hinia reticulata*	*Pisidia longicornis*
Caprella mutica	*Hippolyte varians*	*Praunus flexuosus*
Carcinus maenas	*Homarus gammarus*	*Prosuberites epiphytum*
Cerianthus lloydii	*Hyas araneus*	*Psammechinus miliaris*
Ciona intestinalis	*Hyas coarctatus*	*Sabella pavonina*
Cliona celata	*Hydractinia echinata*	*Sagartia elegans*
Crangon crangon	*Hymeniacidon perlevis*	*Sagartia troglodytes*
Crassostrea gigas	*Inachus phalangium*	*Sagartiogeton undatus*
Crepidula fornicata	*Janolus cristatus*	*Sarsia tubulosa*
Cuthona nana	*Janolus hyalinus*	*Scypha ciliata*
Dendronotus frondosus	*Lanice conchilega*	*Styela clava*
Diadumene cincta	*Lepidochitona cinerea*	*Suberites massa*
Didemnum spec.	*Leucosolenia variabilis*	*Tergipes tergipes*
Diplosoma listerianum	*Liocarcinus arcuatus*	*Thecacera pennigera*
Elysia viridis	*Liocarcinus depurator*	*Thoralus cranchii/Eualus spec.*
Ensis directus	*Liocarcinus holsatus*	*Trinchesia amoena*
Epitonium clathratulum	*Macropodia spec.*	*Trinchesia gymnota*
Epitonium clathrus	*Metridium senile*	*Tubularia indivisa*
Eubranchus exiguus	*Molgula manhattensis*	*Tubularia larynx*
Eubranchus pallidus	*Mycale micracanthoxea*	*Urticina felina*

ANEMOON Foundation, Het Duiken Gebruiken 2

Source dataset	Total number of species	Identified to species level
ANEMOON Foundation, Het Duiken Gebruiken 2	163	155

Acanthodoris pilosa	*Dendronotus frondosus*	*Necora puber*
Actinia equina	*Diadumene cincta*	*Nucella lapillus*
Aeolidia papillosa	*Dicentrarchus labrax*	*Oenopota turricula*
Aeolidiella glauca	*Didemnum lahillei*	*Onchidoris bilamellata*
Aequipecten opercularis	*Diplosoma listerianum*	*Onchidoris muricata*
Aequorea vitrina	*Doto fragilis*	*Ophiothrix fragilis*
Alcyonium digitatum	*Elysia viridis*	*Ophiura texturata*
Alloteuthis spec./Loligo spec.	*Eubranchus exiguus*	*Ostrea edulis*
Amphitrite spec.	*Eubranchus pallidus*	*Pagurus bernhardus*
Anguilla anguilla	*Facelina bostoniensis*	*Palaemon adspersus*
Aplidium glabrum	*Gadus morhua*	*Palaemon elegans*
Archidoris tuberculata	*Galathea squamifera*	*Palaemon serratus*
Ascidiella aspersa	*Gasterosteus aculeatus*	*Pandalus montagui*
Ascidiella scabra	*Geithodoris plana*	*Parablennius gattorugine*
Asterias rubens	*Gobius niger*	*Patella vulgata*
Athanas nitescens	*Goniodoris castanea*	*Pholis gunnellus*
Atherina presbyter	*Gonionemus vertens*	*Phoronis hippocrepia*
Aurelia aurita	*Halecium halecinum*	*Pilumnus hirtellus*
Beroë gracilis	*Halichondria bowerbanki*	*Platichthys flesus*
Beroë spec.	*Halichondria panicea*	*Pleurobrachia pileus*
Biglossidium luteum	*Haliclona oculata*	*Pleuronectes platessa*
Bolinopsis infundibulum	*Haliclona xena*	*Pollachius pollachius*
Botrylloides leachi	*Haliplanella lineata*	*Pomatoschistus minutus*
Botrylloides violaceus	*Hemigrapsus enicillatus*	*Praunus flexuosus*
Botryllus schlosseri	*Hemimysis lamornae*	*Prosuberites epiphytum*
Bryopsis plumosa	*Hermaea bifida*	*Psammechinus miliaris*
Buccinum undatum	*Hippocampus hippocampus*	*Raniceps raninus*
Callinectus sapidus	*Hippocampus ramulosus*	*Rhizostoma pulmo*
Callionymus lyra	*Hippocampus spec.*	*Sabella pavonina*
Cancer pagurus	*Hippolyte varians*	*Sagartia troglodytes*
Caprella macho	*Homarus gammarus*	*Sagartiogeton undatus*
Caprella spec.	*Hyas araneus*	*Sargassum muticum*
Carcinus maenas	*Janolus cristatus*	*Scypha ciliata*
Cerianthus lloydii	*Janolus hyalinus*	*Sepia officinalis*
Chelon labrosus	*Jorunna tomentosa*	*Sepiola atlantica*
Chrysaora hysoscella	*Labrus bergylta*	*Solea solea*
Ciliata mustela	*Lanice conchilega*	*Sprattus sprattus*
Ciona intestinalis	*Laomedea spec.*	*Styela clava*
Clione celata	*Lepidochitona cinerea*	*Syngnathus acus*
Clupea harengus	*Leptomysis lingvura*	*Syngnathus rostellatus*
Codium fragile	*Leucosolenia variabilis*	*Syngnathus spec.*
Coryphella gracilis	*Limanda limanda*	*Taurulus bubalis*
Crangon crangon	*Liocarcinus arcuatus*	*Tergipes tergipes*
Crassostrea gigas	*Liocarcinus depurator*	*Thecacera pennigera*
Crassostrea gigas	*Liocarcinus holsatus*	*Thoralus cranchii*
Crenilabrus melops	*Liparis liparis*	*Trisopterus luscus*
Crepidula fornicata	*Liza ramada*	*Trisopterus minutus*
Ctenolabrus rupestris	*Macropodia rostrata*	*Trivia arctica*
Cuthona amoena	*Merlangius merlangus*	*Trivia spec.*
Cuthona concinna	*Metridium senile*	*Tubularia indivisa*
Cuthona foliata	*Microstomus kitt*	*Tubularia larynx*
Cuthona gymnota	*Molgula manhattensis*	*Urticina felina*
Cuthona nana	*Myoxocephalus scorpius*	*Zoarces viviparus*
Cyanea lamarckii	*Mytilus edulis*	
Cyclopterus lumpus	*Nassarius reticulatus*	

SETL project, all species

Source dataset	Total number of species	Identified to species level	surface cover >1
SETL project, all species	160	91	66

Species selected, surface cover >1	
Polydora ciliata	16.00
Neodexiospira brasiliensis	15.66
Balanus crenatus	15.15
Balanus improvisus	13.91
Bryopsis plumosa	13.00
Sabella pavonina	12.50
Aurelia aurita	12.19
Mytilus edulis	11.64
Spirorbis tridentatus	11.03
Scrupocellaria scruposa	10.45
Diplosoma listerianum	10.44
Bugula stolonifera	10.40
Bugula plumosa	10.39
Obelia dichotoma	9.66
Ascidiella aspersa	9.52
Ciona intestinalis	8.00
Obelia longissima	7.78
Botrylloides violaceus	7.33
Elminius modestus	7.26
Botryllus schlosseri	7.15
Ficopomatus enigmaticus	6.49
Obelia geniculata	6.44
Electra pilosa	6.34
Scytosiphon lomentaria	6.00
Molgula socialis	5.92
Sycon scaldiensis	5.72
Halichondria bowerbanki	5.48
Molgula manhattensis	5.32
Didemnum vexillum	5.28
Haliclona oculata	5.00
Conopeum reticulum	4.57
Membranipora membranacea	4.50
Bugula simplex	4.42
Sycon ciliatum	4.38
Ostrea edulis	4.16
Aplidium glabrum	4.14
Eudendrium album	4.00
Tricellaria inopinata	4.00
Caprella mutica	3.96
Ectopleura larynx	3.86
Crassostrea gigas	3.72
cf Antithamnion cruciatum	3.57
Cryptosula pallasiana	3.54
Styela clava	3.31

Species selected, surface cover >1	
Jassa falcata	3.27
Metridium senile	3.18
Haliclona xena	3.17
Halichondria panicea	3.11
Molgula socialis	3.00
Goniodoris castanea	2.92
Macropodia rostrata	2.67
cf Bryopsis plumosa	2.50
Actinia equina	2.20
Tergipes tergipes	2.13
Ceramium rubrum	1.86
Emplectonema echinoderma	1.75
Diadumene cincta	1.58
Pomatoceros triqueter	1.50
Corophium volutator	1.40
Sagartiogeton undatus	1.40
Hemigrapsus takanoi	1.33
Crepidula fornicata	1.30
Cephalothrix rufifrons	1.25
Asterias rubens	1.22
Hemigrapsus sanguineus	1.11
Hediste diversicolor	1.05

SETL project, Delta area

Source dataset	Total number of species	Identified to species level	surface cover >1
SETL project, Delta area	128	78	57

Species selected, surface cover >1	
Polydora ciliata	16.00
Neodexiospira brasiliensis	15.49
Aurelia aurita	14.04
Balanus crenatus	13.85
Bryopsis plumosa	13.00
Balanus improvisus	12.58
Sabella pavonina	12.50
Bugula stolonifera	11.44
Spirorbis tridentatus	11.03
Scrupocellaria scruposa	10.81
Diplosoma listerianum	10.54
Bugula plumosa	10.39
Ascidiella aspersa	9.75
Obelia dichotoma	9.25
Obelia longissima	8.66
Ciona intestinalis	8.11
Halichondria bowerbanki	7.87
Botrylloides violaceus	7.36
Elminius modestus	7.05
Electra pilosa	7.00
Scytosiphon lomentaria	6.00
Botryllus schlosseri	5.97
Sycon scaldiensis	5.72
Haliclona oculata	5.00
Membranipora membranacea	4.50
Bugula simplex	4.42
Sycon ciliatum	4.38
Ostrea edulis	4.31
Mytilus edulis	4.26
Obelia geniculata	4.16
Conopeum reticulum	4.15
Aplidium glabrum	4.14
Tricellaria inopinata	4.00
Ectopleura larynx	3.86
Cryptosula pallasiana	3.77
Metridium senile	3.64
Jassa falcata	3.27
Crassostrea gigas	3.19
Haliclona xena	3.17
Halichondria panicea	3.04
Goniodoris castanea	2.92
Caprella mutica	2.80
Molgula manhattensis	2.72
Macropodia rostrata	2.67

Species selected, surface cover >1	
cf Bryopsis plumosa	2.50
Actinia equina	2.47
Styela clava	2.04
Crepidula fornicata	1.75
Corophium volutator	1.67
Diadumene cincta	1.65
Ficopomatus enigmaticus	1.50
Sagartiogeton undatus	1.50
Hemigrapsus takanoi	1.50
cf Antithamnion cruciatum	1.33
Molgula socialis	1.33
Cephalothrix rufifrons	1.25
Ceramium rubrum	1.18

SETL project, North Sea

Source dataset	Total number of species	Identified to species level	surface cover >1
SETL project, North Sea	62	40	31

Species selected, surface cover >1	
Scrupocellaria scruposa	25.00
Balanus improvisus	18.82
Neodexiospira brasiliensis	18.00
Balanus crenatus	16.23
Mytilus edulis	14.71
Botryllus schlosseri	12.14
Obelia dichotoma	11.30
Ficopomatus enigmaticus	8.96
Molgula socialis	7.44
Obelia longissima	7.42
Obelia geniculata	7.02
Crassostrea gigas	6.82
Molgula manhattensis	5.74
Elminius modestus	4.45
cf Antithamnion cruciatum	4.35
Conopeum reticulum	4.07
Ascidiella aspersa	3.50
Tergipes tergipes	2.86
Ostrea edulis	2.75
Halichondria panicea	2.75
Pomatoceros triqueter	2.00
Botrylloides violaceus	2.00
Electra pilosa	2.00
Ceramium rubrum	1.79
Cryptosula pallasiana	1.70
Caprella mutica	1.50
Styela clava	1.33
Hemigrapsus takanoi	1.25
Ciona intestinalis	1.20
Hemigrapsus sanguineus	1.13
Hediste diversicolor	1.06

SETL project, Wadden Sea

Source dataset	Total number of species	Identified to species level	surface cover >1
SETL project, Wadden Sea	62	27	30

Species selected, surface cover >1	
Balanus crenatus	18.04
Mytilus edulis	15.43
Balanus improvisus	12.17
Caprella mutica	8.57
Elminius modestus	8.46
Obelia dichotoma	7.66
Obelia geniculata	7.24
Obelia longissima	7.19
Botryllus schlosseri	6.78
Aurelia aurita	6.75
Molgula manhattensis	6.66
Conopeum reticulum	5.31
Styela clava	4.54
Eudendrium album	4.00
Ficopomatus enigmaticus	3.67
Crassostrea gigas	3.42
Halichondria panicea	3.40
Ceramium rubrum	3.29
Scrupocellaria scruposa	2.68
Halichondria bowerbanki	2.57
Pomatoceros triqueter	2.00
Emplectonema echinoderma	1.75
Ascidiella aspersa	1.71
Electra pilosa	1.57
Asterias rubens	1.40
Actinia equina	1.33
Corophium volutator	1.33
Molgula socialis	1.33
Tergipes tergipes	1.14
Diadumene cincta	1.13