# SENSITIVITIES OF MARINE MACROZOOBENTHOS TO ENVIRONMENTAL PRESSURES IN THE NETHERLANDS

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**The relative sensitivities of 309 common invertebrate species in Dutch marine waters are presented for environmental and anthropogenic pressures like organic enrichment, sedimentation and fisheries. The species were furthermore appointed to trophic groups like suspension and deposit feeders. The Dutch Ministry of Infrastructure and the Environment uses these data when calculating the Benthic Ecosystem Quality Index 2 and the Infaunal Trophic Index. These metrics aid in the mandatory monitoring of ecological quality for example for the European Water Framework Directive. The common Dutch species were selected based on their abundance according to, 1. the MWTL dataset including results of on-going monitoring programs issued by the Ministry, 2. the monitoring by volunteer scuba-divers for the ANEMOON Foundation and 3. the monitoring of fouling plates for the project SETL.**

## INTRODUCTION

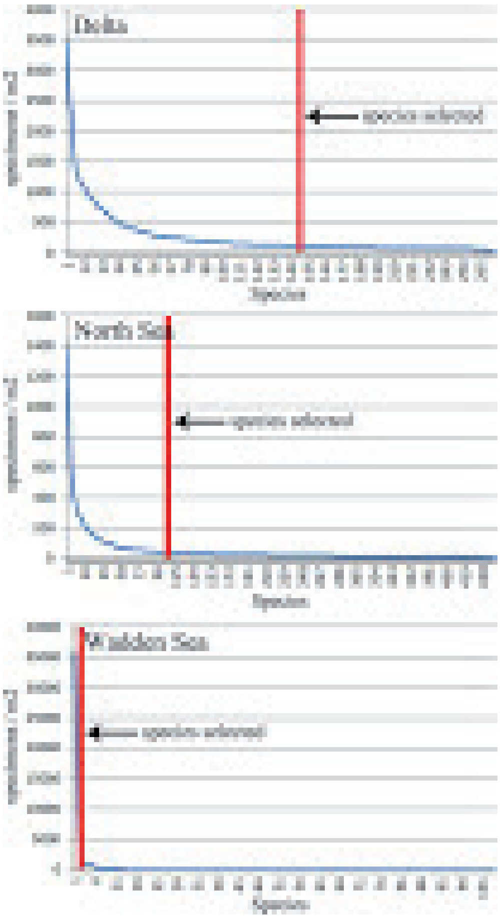
This study was commissioned by the Dutch Ministry of Infrastructure and the Environment (Rijkswaterstaat (RWS) Waterdienst) to GiMaRIS as a part of the design, calibration and intercalibration of the marine benthos metric BEQI-2 (Boon et al. 2011). This metric aims at fulfilling the demands set by the European Water Framework Directive (WFD) and can potentially be applied for the future Marine Strategy Framework Directive and for Dutch national marine projects. The BEQI-2 metric makes use of the RWS benthos monitoring data (focussed on endofaunal species) obtained from benthic communities in the Dutch Delta, North Sea and Wadden Sea from 1990 onwards (Rijkswaterstaat 2012). On the basis of the data, changes in marine communities along the Dutch coast can be analysed over space and time. In order to evaluate the quality of benthic communities and changes thereof, detailed knowledge of the species sensitivities to human pressures is necessary.

Therefore, RWS Waterdienst commissioned a study for the review of species sensitivity classifications for the already existing AMBI indicator, an indicator primarily designed for the pressure organic enrichment, and the design of two new indicators for the pressures sedimentation and fisheries, respectively. These species sensitivity classifications are used for the calibration of macrozoobenthic BEQI-2 metric, which has been developed in the Netherlands for the WFD, for the Marine Framework Directive and for large marine projects of Rijkswaterstaat (Gittenberger & Van Loon 2011, Van Loon et al. 2011, 2012).

The present study therefore focused on the following questions: 1. what are common marine benthos species in the Netherlands?, 2. what are their ecological characteristics and sensitivities?, and 3. how can these characteristics and sensitivities be generalized and indexed in such a way that monitoring datasets can be linked to environmental pressures on benthic communities? The AMBI index (AZTI Marine Biotic Index) is one of the indices that has already proven itself in this field and is used in several Western European WFD benthos metrics (Borja et al. 2000). Although it is sensitive to organic enrichment and related environmental pressures like pollution, it may not be particularly sensitive for the pressures sedimentation (both natural and antropogenically

## ABBREVIATIONS USED IN THIS PAPER / AFKORTINGEN GEBRUIKT IN DIT ARTIKEL

| | | |
|---|---|---|
| AMBI | AZTI Marine Biotic Index. An index that provides a measure for the sensitivity of species to the pressure organic enrichment (Borja et al. 2000). | Een index gericht op het vaststellen van de gevoeligheid van soorten in een gebied voor de omgevingsfactor eutrofiëring/organische belasting. |
| BEQI-2 | Benthic Ecosystem Quality Index 2. Metric for assessing the marine benthos state for the European Water Framework Directive (Boon et al. 2011). | Een maatlat voor marien benthos die door Rijkswaterstaat is ontwikkeld om te voldoen aan de verplichtingen van de Europese Kader Richtlijn Water. |
| FIBI | Fisheries Biotic Index. An indicator that describes the sensitivity of species to the pressure fisheries. | Een index gericht op het vaststellen van de gevoeligheid van soorten voor omgevingsfactoren die door de visserij beïnvloed worden. |
| ITI | Infaunal Trophic Index. An indicator for disturbances of benthic habitats based on the feeding types of the benthic organisms (Word 1978). | Een indicator voor de verstoring van habitats gebaseerd op de trofische groepen van de aanwezige benthos-soorten. |
| MWTL | Monitoring Waterstaatkundige Toestand des Lands. Program of the Dutch Ministry of Infrastructure and the Environment that monitores the chemical and biological water qualities in Dutch water systems. | Meetprogramma van Rijkswaterstaat Waterdienst met als doel trends en toestandsbeschrijving van watersystemen te komen, zowel chemisch als biologisch. |
| MOO | Monitoring Onderwater Oever project. This project of the ANEMOON Foundation promotes scuba-divers to fill in monitoring forms after each dive they make. | Bij dit project van Stichting ANEMOON vullen sportduikers na hun duik een monitoringsformulier in waarop ze aangeven welke soorten gezien zijn. |
| SEBI | Sedimentation Biotic Index. An indicator that describes the sensitivity of species to suspended matter (especially sand and mud) that precipitates onto macrozoobenthos. | Een index gericht op het vaststellen van de gevoeligheid van soorten voor omgevingsfactor sedimentatie. |
| SETL | SEtTLement project. Within this project organised by GIMARIS in cooperation with the ANEMOON Foundation, about 200 settlement plates deployed along the Dutch coast are checked for species every three months. | Binnen dit project, georganiseerd door GIMARIS in samenwerking met Stichting ANEMOON, worden ongeveer 200 PVC-plaatjes die langs de Nederlandse kust in het water zijn gehangen, elke drie maanden gecontroleerd op de aangroei van organismen. |
| WFD | European Water Framework Directive. | Europese Kaderrichtlijn Water. |
| WORMS | The World Register of Marine Species (www.marinespecies.org). | Wereldregister van mariene soorten (www.marinespecies.org). |



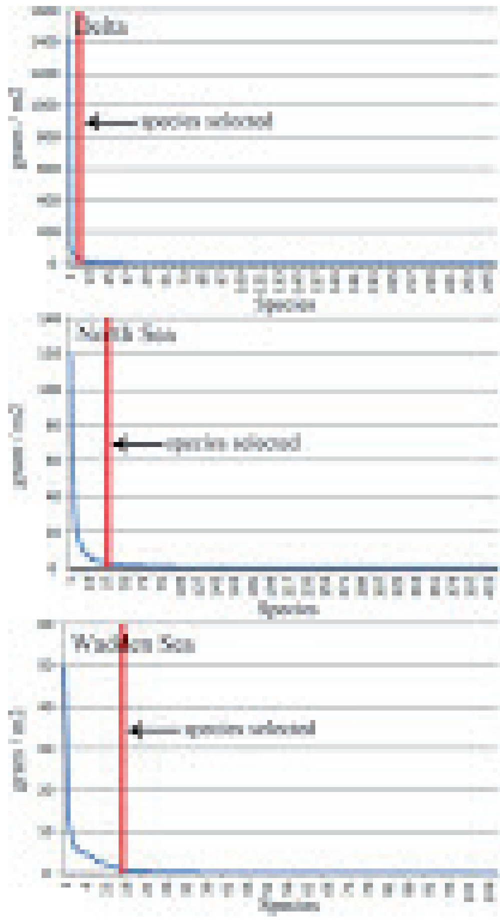




Figure 1. The average densities (specimens /m²) in which species were recorded in respectively the Delta area, the North Sea and the Wadden Sea in the MWTL dataset. The species are ordered from most abundant to least abundant. All species left of the red line (≥ 3% of the most abundant species) were selected as 'common' species in Dutch marine sediments.

Figuur 1. De gemiddelde dichtheden (individuen /m²) waarbij soorten in respectievelijk het Delta gebied, de Noordzee en in de Waddenzee zijn gescoord gebaseerd op de MWTL dataset. Soorten zijn geordend van hoogste naar lichtste dichtheid. Alle soorten links van de rode lijn (met een dichtheid van ≥ 3% van de meest algemeen voorkomende soort), werden in de huidige studie geselecteerd als 'algemeen' voorkomende benthische soorten in de Nederlandse wateren.

Figure 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 dataset. The species are ordered from the most abundant species to the least abundant species. All species left of the red line (≥ 2% of the most abundant species) were selected as 'common' species in Dutch marine sediments.

Figuur 2. De gemiddelde biomassa (g/m²) waarbij soorten in respectievelijk het Delta gebied, de Noordzee en in de Waddenzee zijn gevonden gebaseerd op de MWTL dataset. Soorten zijn geordend van links naar rechts op hun biomassa, van hoog naar laag. Alle soorten links van de rode lijn (met een biomassa van ≥ 2% van de soort met de hoogste gemiddelde biomassa), werden in de huidige studie geselecteerd als 'algemeen' voorkomende benthische soorten in de Nederlandse wateren.

induced) and fisheries. Many marine species are known to be sensitive to sedimentation caused by for example dredging activities (Rosenberg 1977, Saiz Salinas & Urdangarin 1994, Warwick et al. 1991), and fisheries like bottom trawling (Atkinson 1989, Ball et al. 2000, Hauton et al. 2003). Therefore two indices were developed and scored here for the first time. They have a similar calculation model as the AMBI but with species classifications specifically designed for the pressures sedimentation (Sediment Biotic Index, SEBI) and fisheries (Fisheries Biotic Index, FIBI). For the first results of the application of these SEBI and FIBI see Van Loon et al. (2011).

The Infaunal Trophic Index (ITI) is a relatively old indicator (Word 1978) for disturbances of benthic habitats and is based on the feeding

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' using various selection criteria.
Tabel 1. De databronnen die gebruikt zijn in de huidige studie. Hierbij wordt verder per bron aangegeven: het totale aantal Nederlandse benthos-soorten; het aantal soorten wat tot het soortniveau is gedetermineerd en het aantal soorten dat wordt beschouwd 'algemeen' te zijn volgens verschillende selectiecriteria.

| 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 (/m²) | 415 | 275 | 272 | 211 | 148 | 91 | - |
| MWTL, 1990-2008 data, Delta area | Biomass (mg/m²) | 402 | 271 | 15 | 6 | 4 | 3 | - |
| MWTL, 1991-2008 data, North Sea | Density (/m²) | 612 | 452 | 359 | 176 | 107 | 40 | - |
| MWTL, 1991-2008 data, North Sea | Biomass (mg/m²) | 583 | 432 | 60 | 38 | 30 | 19 | - |
| MWTL, 1989-2008 data, Wadden Sea | Density (/m²) | 104 | 101 | 6 | 4 | 3 | 2 | - |
| MWTL, 1989-2008 data, Wadden Sea | Biomass (mg/m²) | 108 | 105 | 19 | 15 | 13 | 10 | - |
| ANEMOON Foundation, MOO-project | - | 105 | 105 | - | - | - | - | - |
| ANEMOON Foundation, Het Duiken Gebruiken 2 | - | 163 | 155 | - | - | - | - | - |
| SETL project, 2006-2009, all species | Cover (1-25) | 160 | 91 | - | - | - | - | 66 |
| SETL project, 2006-2009, Delta area | Cover (1-25) | 128 | 78 | - | - | - | - | 57 |
| SETL project, 2006-2009, North Sea | Cover (1-25) | 62 | 40 | - | - | - | - | 31 |
| SETL project, 2006-2009, Wadden Sea | Cover (1-25) | 62 | 42 | - | - | - | - | 30 |

types of the benthic organisms. The ITI has been applied by RWS to Dutch marine data with good results (Kabuta & Hartgens 2003), and a renewed international interest can be seen in several recent publications (Mavraganis et al. 2010, Putro 2009). In the BEQI-2 project (Van Loon et al. 2011) good results were obtained with the ITI, but the AMBI was preferred as its indicator performance was comparably good and the AMBI is used more frequently in Western Europe.

## MATERIAL AND METHODS

### Selection of common species

The common marine macrozoobenthos species included in the present study were selected based on the RWS MWTL dataset (Rijkswaterstaat 2012), the fouling community project SETL (Gittenberger & Moons 2011, Gittenberger & Van Stelt 2011, Lindeyer & Gittenberger 2011) and species lists used by scuba-divers monitoring for the ANEMOON Foundation (www.anemoon.org), aiming at including species that have been and/or are monitored along the Dutch coasts including the estuaries. These data sources are described in more detail below and in table 1. Choosing which of species are considered to be common depends on one's definition of the word 'common'.
The present study aims at including at the least the species that are 'most commonly' identified in Dutch marine monitoring projects. A species in the MWTL-dataset was considered to be 'common' if it complied with at least one of the three criteria described below: 1. The species was scored in all the three major regions that are monitored along the Dutch coast, i.e. the Delta area, North Sea and Wadden Sea, 2. The average density of a species in the samples of at least one of the major regions in which it was scored, was higher or equal to 3% of the density of the species with the highest average density in that ecosystem and 3. For biomass the threshold value of 2% was chosen. These threshold values approximately correspond to breakpoints in the species-abundance and species-biomass curves, which are here used as criteria to distinguish common from rare species. This is illustrated in figure 1, in which one can see that the threshold value of 3% (for density) is more or less chosen at the place where the graphs starts to flatten, which we refer to as the breakpoint. 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 regionally 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 (fig. 1). In figure 2 the parameter biomass is used for selecting the common species.

Finally, the resulting number of species (approx. 300) in the list of common marine macrozoobenthos species that was selected, was considered practically feasible to process in this literature study. Only macrozoobenthos species that have been identified down to the species level were included.

For the present study we used the MWTL benthos monitoring data that was collected between 1989 and 2008 in the Delta area, the North Sea and Wadden Sea (table 1). 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 were often not identified to the species level in this dataset, due to formalin conservation which makes the identification of these taxa more difficult. Most molluscs, worms and crustaceans are identified to the species level however.

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, 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 are mostly made in the Delta area. The benthic species that were included from this project concern common species, which can be easily detected by divers and are therefore included on the standard monitoring form of the MOO-project. 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 dataset. Therefore the species scored by scuba-divers of the MOO-project (Gmelig Meyling & De Bruyne 2003) were added to the 'common species' list.

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 14×14 PVC plates are scored every three months since 2006 (Gittenberger & Moons 2011, Gittenberger & Van Stelt 2011, Lindeyer & Gittenberger 2011). 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. Many of these species are not identified to the species level in the MWTL dataset and are missed by divers in the above described MOO-project because they are too small and/or cryptic.
In the SETL-project, for each of these species a measure for cover, i.e. 1-25 (25 = 100% cover) is noted for each plate in each season of the year. 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, i.e. species that on average were scored on more than 1/25 of the SETL-plate's surface. 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 World Register of Marine Species (WORMS: www.marinespecies.org) was used as the standard for the nomenclature. Worms is also the standard source for the marine TWN-codes (www.idsw.nl), i.e. the standardized species names that are used by Rijkswaterstaat; and for the Dutch Species Register, which includes all species that occur in the Netherlands (www.nederlandse-soorten.nl).

### AMBI, SEBI, FIBI and ITI species classification scores

The AMBI, SEBI, FIBI and ITI, which are described in this chapter were candidate indicators for the newly designed BEQI-2 Dutch marine benthos metric for the WFD (Boon et al. 2011). In this study, the species classifications were validated for the AMBI, designed for the SEBI and FIBI, and supplemented for the ITI. For each of the selected common species a score of I to V was given for its relative sensitivity to organic enrichment, sedimentation and fisheries, respectively (table 3). These three pressures were chosen because they were considered to be important for Dutch marine macrozoobenthos. Although these pressures can to some degree be induced by natural phenomena, substantial changes in these pressures are usually induced by humans. For the AMBI, the standardized species classifications of Borja (2011) were used. Species classifications for the newly designed indicators SEBI and FIBI are presented here for the first time. For these two indicators, a similar formula as for the AMBI is used, but the species classifications focus on the pressures sedimentation and fisheries.

AMBI, SEBI and FIBI values were set for all species in the list of common marine macrozoobenthos species by the expert opinions of three macrozoobenthos scientists, i.e. R.J. Leewis, M.A. Faasse and the first author, on the basis of literature and their own experiences in the field. When a value differed between the experts, it was discussed among the experts, after which they agreed upon which value was considered the best.

### AMBI: AZTI Marine Biotic Index

The AMBI was developed by Borja et al. (2000) and was initially designed as an indicator for the pressure 'Organic Enrichment'. However, it has been demonstrated that the AMBI is also to some degree sensitive for other types of pressures such as dredging and high flow velocities. The class definitions of species for calculating the AMBI are given below.

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 (slightly unbalanced situations). They are surface deposit-feeding species, as tubicolous spionids.

Group IV
Second-order opportunistic species (slightly 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.

The AMBI of a benthic sample is calculated using the percentages of abundance of each ecological group, where AMBI = ((0 × % group I) + (1.5 × % group II) + (3 × % group III) + (4.5 × % group IV) + (6 × % group V))/100 (Borja et al. 2000).

The present article concentrates on determining the AMBI species classifications of the selected common marine macrozoobenthos species.

### FIBI: Fisheries Biotic Index

The Fisheries Biotic Index (FIBI) is based on the sensitivities of species to fisheries. It is a newly designed indicator for bottom disturbing fisheries pressures.

For the FIBI, we propose to use the following definitions, which are focused on the sensitivities of marine species to the pressure bottom disturbing fisheries.

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 not sensitive 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.

The FIBI for an area is calculated upon the percentages of abundance of each FIBI group,

within each sample, where FIBI = ((0 × % group I) + (1.5 × % group II) + (3 × % group III) + (4.5 × % group IV) + (6 × % group V))/100.
The present article concentrates on determining the FIBI groups to which the species in the selected common marine macrozoobenthos species list belong.

**SEBI: Sedimentation Biotic Index**

The SEBI is a newly designed indicator that describes the sensitivity of species to suspended matter (especially sand and mud) that precipitates onto the macrozoobenthos.
Benthic species that live in an area where a lot of sediment sinks to the bottom should be able to clean themselves of this sediment to prevent suffocation and blocking of food intake. This ability and therefore the sensitivity of a species to sedimentation is at least partly dependent 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, who however don't recover easily 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.

The SEBI for an area is calculated upon the percentages of abundance of each FIBI group, within each sample, where SEBI = ((0 × % group I) + (1.5 × % group II) + (3 × % group III) + (4.5 × % group IV) + (6 × % group V))/100. The present paper concentrates on determining the SEBI groups to which the species in the selected common marine macrozoobenthos species list belong.

**ITI values**

The Infaunal trophic index (ITI) is an index that represent the relative amounts of benthic trophic classes, and may be sensitive to several human disturbances in the environment (Word 1978, Lavaleye 1999, Holtman 2000, Kater 2007).
The index is determined using the presence of species divided in four major feeding types. A disadvantage of the ITI is that predators and scavengers are not taken into consideration. Furthermore, in the BEQI-2 (Boon et al. 2011) project it was found that the ITI systematically gives lower scores than the AMBI due to the use of a 4-class scale instead of a 5-class scale as in the AMBI (results not presented). This systematic difference can be eliminated by using a 5-class ITI scale. Therefore, we have added a fifth feeding class to the ITI, consisting of predators and scavengers such as crabs and brittle stars. This updated ITI with an added fifth class is referred to as ITI-V.

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

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 fifth additional 'feeding' class that is distinguished in the present study concerns:

5. Predators and scavengers.
The ITI-V always has a value between 0 and 100 and is calculated with the following equation:
$ITI\text{-}V = 100 - (100/4 * (0 * n1 + 1 * n2 + 2 * n3 + 3 * n4 + 4 * n5)/(n1 + n2 + n3 + n4 + n5))$,
in which n1 is the number of suspension feeders, n2 is the number of interface feeders, n3 is the number of surface feeders and n4 the number of subsurface feeders. To include the fifth 'Predator and scavenger' class in the calculation of the ITI-V, n5 is added to the equation above.

In an undisturbed environment suspension feeders will dominate the species composition. Fisheries can impose direct physical damage to the organisms and increase sedimentation, smothering the suspension feeders in favour of the interface feeders. If the suspended matter 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

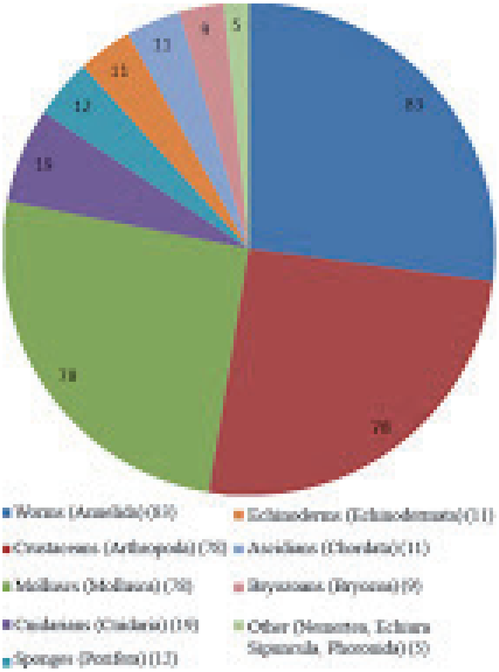


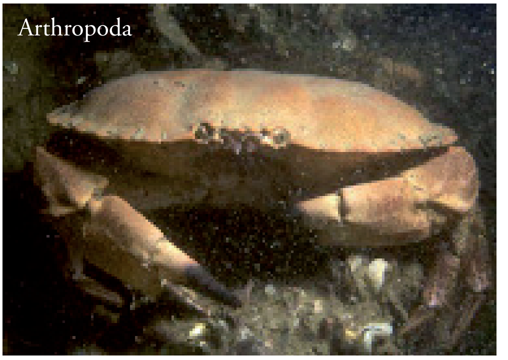
Figure 3. Number of species per species group that was included in the final list of the common, marine, benthic, animal species of the Netherlands (table 2).
Figuur 3. Aantal soorten per taxonomische hoofdgroep, opgenomen in de uiteindelijke lijst van algemene mariene, Nederlandse benthos diersoorten (tabel 2).

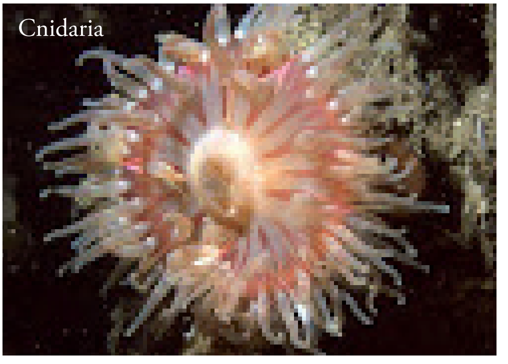
100. When suspension is high due to continuing human activities, and/or other physical pressures are high, the species will shift towards the (sub) surface deposit feeders, and the ITI index will approach a value of zero (Kater 2007).

## RESULTS AND DISCUSSION

### Common marine macrobenthos species and their distribution

The final list of common marine benthic species in the Netherlands that were selected includes 309 species, which are listed in tables 2 and 3. Table 2 presents the abundances in densities and biomass of these species over the Delta area, the North Sea and the Wadden Sea as present in the MWTL-dataset. Most of the species concern


Annelida

Arthropoda

Mollusca

Cnidaria

Porifera

Echinodermata

Chordata

Bryozoa

worms (Annelida), crustaceans (Arthropoda) and molluscs (Mollusca) as these are most commonly found in the MWTL marine monitoring programs focusing on endofauna along the Dutch coast (fig. 3-4).

For ninety macrozoobenthos species no abundance data for the three regions was present in the MWTL-dataset, although many of these species are very common. These macrozoobenthos are not found in the MWTL-dataset as they concern epifaunal species and/or species of taxa that are missed or not identified down to the species level in the MWTL monitoring programs. Sea-anemones, ascidians and sponges are for example usually not identified to the species level although they can locally be the most common benthic species present in the Delta area, the North Sea and the Wadden Sea regions. Benthic epifaunal species like the most common sponges (Porifera), sea-anemones (Cnidaria), echinoderms (Echinodermata), sea-squirts (Ascidiacea, Chordata) and bryozoans (Bryozoa) were included in the here presented list of common marine macrozoobenthos species (fig. 3-4) as they are commonly recorded in fouling community studies like the SETL-project and by scuba-divers within the MOO-project of the ANEMOON Foundation.

**Sensitivities to environmental pressures**

For all species the AMBI, SEBI, FIBI, and if possible ITI-classifications, were collected in table 3. Borja (2000) did not score AMBI values for all common marine benthos species in the Netherlands however, and for some species the experts in the present review deviated from the value the AMBI value listed by Borja (2011), based on their own experiences in the field and/or literature (Bagge 1969, Beukema 1989, Beyer 1968, Bryan et al. 1987, Chevreux & Fage 1925, Cowie et al. 2000, Daan et al. 1994, Desgarrado Pereira et al. 1997, Desprez 2000, Eagle 1973, Enequist 1949, Faasse & Stikvoort 2002, Goud 2004, Gray 1976, Halcrow et al. 1973, Henriksson 1969, Hiscock et al. 2004, Hoare & Hiscock 1974, Johnston & Keough 2002, Jones 1973, Karez et al. 2004, Kingston et al. 1995, Leppakoski 1975, Levell et al. 1989, Matthiessen et al. 1999, Mattson & Linden 1983, McLusky et al. 1986, Mees et al. 1993, Moore 1998, Newell 1985, Newell et al. 1984, Olsgard & Gray 1995, Oug et al. 1998, Pearson & Black 2001, Pearson 1975, Pearson et al. 1985, Read 2010a,b,c, Read 1987, Rosenberg 1972, Rosenberg 2010, Rutt et al. 1998, Rygg 1985, Shillabeer & Tapp 1990, Smith 1968).
To illustrate where the AMBI of Borja et al. (2000) and the one that was decided upon in the present review deviated from each other, both values are presented in table 3. These deviations may at least partly be explained by differences in sensitivities to pressures within species, depending on the marine region concerned, i.e. Borja probably based his scores mostly on species populations in south-western European waters while the present study focused on the populations of these species in the Dutch part of the North Sea. In most cases it concerned species that are scored in group I (very sensitive to pollution) by Borja et al. (2000), while these species are known, at least in the Netherlands, to occur in highly polluted areas.

◀ Figure 4. For each of the species groups in figure 3 a species is illustrated i.e. respectively *Harmothoe imbricata* (Annelida), *Cancer pagurus* (Arthropoda), *Buccinum undatum* (Mollusca), *Urticina felina* (Cnidaria), *Leucosolenia variabilis & Haliclona xena* (Porifera), *Ophiura ophiura* (Echinodermata), *Ciona intestinalis* (Chordata) and *Bugula stolonifera* (Bryozoa). All photos Adriaan Gittenberger.

Figuur 4. Voor elke taxonomische hoofdgroep in figuur 3 wordt hierbij een soort geïllustreerd van links boven naar rechts onder respectievelijk *Harmothoe imbricata* (Annelida), *Cancer pagurus* (Arthropoda), *Buccinum undatum* (Mollusca), *Urticina felina* (Cnidaria), *Leucosolenia variabilis & Haliclona xena* (Porifera), *Ophiura ophiura* (Echinodermata), *Ciona intestinalis* (Chordata) en *Bugula stolonifera* (Bryozoa). Alle foto's Adriaan Gittenberger.

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. Although Borja et al. (2000) gave this species a score of I we propose to give it a score of II.

In addition to the AMBI-scores, to calculate the FIBI, the sensitivities of the selected species to fisheries were scored (table 3) on the basis of expert opinion and literature (Atkinson 1989, Ball et al. 2000, Bergman & Hup 1992, Bergman & van Santbrink 2000, Beukema 1995, Boyd et al. 2003, Bradshaw et al. 2002, Cowie et al. 2000, Craeymeersch et al. 2000, Desprez 2000, Eleftheriou & Robertson 1992, Ferns et al. 2000, Gray et al. 1990, Hall et al. 1990, Hauton et al. 2003, Hiscock et al. 2004,. 2005, Kaiser & Spencer 1996, Kaiser et al. 1998, Kaiser et al. 2000, Kenny & Rees 1994, Lindeboom & De Groot 1998, Millner et al. 1977, Moore 1991, Rumohr & Kujawski 2000, Shelton & Rolfe 1972, Southern Science 1992, Van Dalfsen et al. 2000, Veale et al. 2000). None of the species in the selected common marine macrozoobenthos list (table 3) was found to be a first-order opportunistic species (FIBI score V), which would be insensitive to fisheries in which the bottom is disturbed, and would significantly increase in population size in areas with 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 wounded 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.

Finally, the sensitivities of the selected species to sedimentation, i.e. for the calculation of the SEBI, was scored in table 3 on the basis of expert opinion and literature (Bamber 1989, Hiscock et al. 2004, 2005, Hyslop et al. 1997, Rosenberg 1977, Saiz Salinas &Urdangarin 1994, Warwick et al. 1991).

The ITI feeding habit classification of the endofaunal species was added based on Holtmann (2000).

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**SAMENVATTING**

**Gevoeligheden van mariene macrozoöbenthos-soorten voor omgevingsfactoren**
In de huidige studie zijn 309 in Nederland algemeen voorkomende mariene macrobenthos-soorten bestudeerd. Hierbij is uitgezocht hoe gevoelig deze soorten zijn voor sedimentatie, visserij en eutrofiëring/organische belasting. Deze studie vormde een onderdeel van het ontwerp en de kalibratie van de Benthic Ecosystem Quality Index 2 (BEQI-2), een maatlat voor marien benthos die door Rijkswaterstaat is ontwikkeld om te voldoen aan de verplichtingen van de Europese Kader Richtlijn Water. De soorten op de lijst die hier wordt behandeld zijn geselecteerd vanwege hun relatief hoge abundantie en/of hoge biomassa in Nederlandse wateren zoals dit geregistreerd is in de MWTL-benthosdataset vanaf 1990 tot heden. In aanvulling op deze MWTL-dataset waarin vooral endofauna soorten staan opgenomen, is een selectie van epifaunasoorten toegevoegd gebruik makend van het op duikerswaarnemingen MOO-project van Stichting ANEMOON en het SETL-project (soortenaangroei op PVC plaatjes). Vervolgens is voor de 309 geselecteerde soorten een literatuurstudie uitgevoerd om classificaties te bepalen voor de AMBI; de nieuw ontworpen Sedimentation Biotic Index (SEBI) en Fisheries Biotic Index (FIBI) en de Infaunal Trophic Index (ITI). Deze soortenclassificaties zijn gebaseerd op het expertoordeel van drie onafhankelijke onderzoekers van marien benthos. De nieuw ontwikkelde indices, de SEBI (Sedimentation Marine Biotic Index) en de FIBI (Fisheries Marine Biotic Index), zijn specifiek ontworpen voor respectievelijk de gevoeligheid voor sedimentatie en bodemberoerende visserij.

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Table 2. Occurrence of 309 common, marine, benthic animal species in the Netherlands. The distribution of the species in the Delta area, the North Sea and the Wadden Sea is added based on the MWTL benthos data. For the samples in which a specific species was present, the average densities and biomasses were calculated and are presented in the classes 1 (0-9), 2 (10-99), 3 (100-999), 4 (1000-9999) and 5 (> 9999), specimens/m² for the densities and mg/m² for the biomass values. Species for which no abundance measure is given in all three regions, are probably missed or not identified down to the species level in the MWTL monitoring programs. They are considered common Dutch species on the basis of the monitoring programs MOO and/or SETL.

Tabel 2. Het voorkomen van 309 algemene mariene, benthos-diersoorten in Nederland in het Delta gebied, de Noordzee en de Waddenzee gebaseerd op de MWTL benthos dataset. Waar mogelijk zijn de gemiddelde dichtheden en biomassa van deze soorten weergegeven in de klassen 1 (0-9), 2 (10-99), 3 (100-999), 4 (1000-9999) en 5 (> 9999), in individuen/m² voor de dichtheden en mg/m² voor de biomassa. Soorten waarvoor geen abundantiegegevens staan aangegeven voor de drie gebieden, betreffen hoogstwaarschijnlijk soorten die gemist worden of niet tot op het soortniveau gedetermineerd worden binnen de MWTL-monitoring. Zij worden in Nederland algemeen geacht, vanwege hun voorkomen in de monitoringsprogramma's MOO en/of SETL.

| | **Density (specimens/m²)** | | | **Biomass (mg/m²)** | | |
|---|---|---|---|---|---|---|
| **Naam** | **Delta area** | **North Sea** | **Wadden Sea** | **Delta area** | **North Sea** | **Wadden Sea** |
| **Annelida - worms - wormen** | | | | | | |
| *Alitta succinea* | 3 | 3 | 2 | 3 | 3 | 3 |
| *Alitta virens* | 2 | 2 | 1 | 5 | 4 | 3 |
| *Ampharete acutifrons* | 3 | 2 | - | 2 | 1 | - |
| *Aonides paucibranchiata* | - | 2 | - | - | 2 | - |
| *Aphelochaeta marioni* | 4 | 2 | 3 | 3 | 2 | 2 |
| *Aphrodita aculeata* | 2 | 2 | - | 1 | 4 | - |
| *Arenicola defodiens* | 4 | - | - | 5 | - | 3 |
| *Arenicola marina* | 2 | 2 | 2 | 4 | 4 | 4 |
| *Aricidea minuta* | 3 | 2 | 1 | 2 | 2 | 1 |
| *Atherospio disticha* | - | 3 | - | - | 2 | - |
| *Atherospio guillei* | - | 2 | - | - | 2 | - |
| *Bylgides sarsi* | 2 | 1 | 1 | 3 | 1 | 2 |
| *Capitella capitata* | 3 | 3 | 2 | 3 | 2 | 2 |
| *Chaetopterus variopedatus* | - | 2 | - | - | 4 | - |
| *Dipolydora coeca* | 3 | 2 | 2 | 2 | 1 | 1 |
| *Eteone flava* | 3 | 2 | - | 2 | 2 | - |
| *Eteone longa* | 2 | 2 | 2 | 3 | 2 | 2 |
| *Euclymene droebachiensis* | - | 2 | - | - | 3 | - |
| *Eulalia viridis* | 3 | 2 | - | 2 | 4 | - |
| *Eumida sanguinea* | 3 | 3 | 2 | 3 | 2 | 2 |
| *Eunereis longissima* | 2 | 2 | 1 | 4 | 4 | 3 |
| *Eunoe nodosa* | - | 3 | - | - | - | - |
| *Exogone naidina* | 3 | 2 | - | 1 | 1 | - |
| *Ficopomatus enigmaticus* | 3 | - | - | 3 | - | - |
| *Galathowenia oculata* | - | 2 | - | - | 2 | - |
| *Gattyana amondseni* | - | 3 | - | - | - | - |
| *Gattyana cirrhosa* | 3 | 2 | - | 4 | 2 | - |

Table 2. Continued

| Naam | Density (specimens/m²) | | | Biomass (mg/m²) | | |
|---|---|---|---|---|---|---|
| | Delta area | North Sea | Wadden Sea | Delta area | North Sea | Wadden Sea |
| *Glycera alba* | 2 | 2 | 1 | 3 | 2 | 1 |
| *Glycera lapidum* | - | 2 | - | - | 2 | - |
| *Goniadella bobretzkii* | - | 3 | - | - | 2 | - |
| *Harmothoe imbricata* | 3 | 2 | 1 | 3 | 3 | 2 |
| *Harmothoe impar* | 3 | 2 | 1 | 3 | 2 | 2 |
| *Hediste diversicolor* | 3 | 2 | 3 | 4 | 4 | 4 |
| *Hesionura elongata* | - | 2 | - | - | - | - |
| *Heteromastus filiformis* | 4 | 2 | 3 | 4 | 3 | 4 |
| *Lanice conchilega* | 3 | 3 | 3 | 4 | 4 | 4 |
| *Lumbrineris latreilli* | 2 | 2 | - | 2 | 3 | - |
| *Magelona filiformis* | - | 3 | - | - | 2 | - |
| *Magelona johnstoni* | - | 3 | - | - | 3 | 1 |
| *Magelona papillicornis* | 3 | 3 | - | 3 | 3 | - |
| *Malmgreniella ljungmani* | - | 2 | - | - | 2 | - |
| *Marenzelleria viridis* | 3 | - | 4 | 3 | - | 4 |
| *Mediomastus fragilis* | - | - | - | - | - | - |
| *Microphthalmus fragilis* | 3 | - | - | 1 | - | - |
| *Microphthalmus sczelkowii* | 3 | 2 | - | 1 | 1 | - |
| *Microphthalmus similis* | 3 | 3 | 1 | 1 | 1 | 1 |
| *Myrianida langerhansi* | 3 | 2 | - | 1 | 1 | - |
| *Myriochele danielsseni* | - | 3 | - | - | 2 | - |
| *Neoamphitrite figulus* | 3 | - | 1 | 4 | - | 1 |
| *Neodexiospira brasiliensis* | - | - | - | - | - | - |
| *Nephtys caeca* | 2 | 2 | 1 | 4 | 4 | 3 |
| *Nephtys cirrosa* | 2 | 2 | - | 3 | 3 | 2 |
| *Nephtys hombergii* | 2 | 2 | 2 | 3 | 4 | 3 |
| *Nephtys longosetosa* | 2 | 2 | 1 | 4 | 3 | 2 |
| *Notomastus latericeus* | 1 | 2 | - | 4 | 4 | - |
| *Ophelia rathkei* | 3 | 2 | - | 2 | 2 | - |
| *Owenia fusiformis* | 3 | 2 | - | 4 | 3 | - |
| *Paradoneis fulgens* | 3 | - | - | 2 | - | - |
| *Pectinaria koreni* | 3 | 3 | 1 | 4 | 3 | 2 |
| *Pherusa flabellata* | 3 | - | - | 2 | - | - |
| *Pholoe minuta* | 1 | 2 | 1 | 2 | 2 | 1 |
| *Phyllodoce groenlandica* | - | 2 | - | - | 3 | - |
| *Phyllodoce laminosa* | - | 3 | - | - | 3 | - |
| *Phyllodoce lineata* | - | 2 | - | - | 2 | - |
| *Phyllodoce maculata* | 3 | 3 | - | 3 | 2 | - |
| *Phyllodoce mucosa* | 3 | 3 | 2 | 3 | 3 | 2 |
| *Pisione remota* | - | 3 | - | - | 2 | - |
| *Polycirrus medusa* | 3 | 2 | - | 3 | 2 | - |

Table 2. Continued

| Naam | Density (specimens/$m^2$) | | | Biomass ($mg/m^2$) | | |
|---|---|---|---|---|---|---|
| | Delta area | North Sea | Wadden Sea | Delta area | North Sea | Wadden Sea |
| *Polydora ciliata* | 3 | 3 | - | 2 | 2 | - |
| *Polydora cornuta* | 3 | 2 | 2 | 3 | 1 | 2 |
| *Pomatoceros triqueter* | - | 2 | - | - | 1 | - |
| *Pseudopolydora pulchra* | 3 | 2 | - | 2 | 2 | - |
| *Pseudopotamilla reniformis* | 3 | - | - | 4 | - | - |
| *Pygospio elegans* | 4 | 3 | 3 | 3 | 2 | 2 |
| *Sabella pavonina* | - | - | - | - | - | - |
| *Scalibregma inflatum* | 3 | 2 | - | 3 | 2 | - |
| *Scolelepis foliosa* | 2 | 2 | 1 | 4 | 3 | 3 |
| *Scolelepis squamata* | - | - | - | - | - | - |
| *Scoloplos armiger* | 3 | 3 | 3 | 3 | 3 | 3 |
| *Spio filicornis* | 3 | 3 | - | 2 | 2 | - |
| *Spio martinensis* | 3 | 2 | 2 | 2 | 2 | 2 |
| *Spiophanes bombyx* | 3 | 3 | 1 | 3 | 3 | 1 |
| *Spirorbis tridentatus* | 3 | - | - | 2 | - | - |
| *Streblospio shrubsolii* | 3 | 1 | 1 | 2 | - | 1 |
| **Ascidiacea - sea Squirts - zakpijpen** | | | | | | |
| *Aplidium glabrum* | - | - | - | - | - | - |
| *Ascidiella aspersa* | 3 | - | - | 5 | - | - |
| *Botrylloides violaceus* | - | - | - | - | - | - |
| *Botryllus schlosseri* | 2 | - | - | 4 | - | - |
| *Ciona intestinalis* | 3 | - | - | 5 | - | - |
| *Didemnum vexillum* | - | - | - | - | - | - |
| *Diplosoma listerianum* | - | - | - | - | - | - |
| *Molgula manhattensis* | 3 | - | 1 | 3 | - | 3 |
| *Molgula socialis* | - | - | - | - | - | - |
| *Pelonaia corrugata* | - | 2 | - | - | 5 | - |
| *Styela clava* | 3 | - | - | 5 | - | - |
| **Bryozoa - bryozoans - mosdiertjes** | | | | | | |
| *Bugula plumosa* | - | - | - | - | - | - |
| *Bugula simplex* | - | - | - | - | - | - |
| *Bugula stolonifera* | - | - | - | - | - | - |
| *Conopeum reticulum* | - | - | 1 | - | - | 1 |
| *Cryptosula pallasiana* | - | - | - | - | - | - |
| *Electra pilosa* | - | - | - | - | - | - |
| *Membranipora membranacea* | - | - | - | - | - | - |
| *Scrupocellaria scruposa* | - | - | - | - | - | - |
| *Tricellaria inopinata* | - | - | - | - | - | - |
| **Cnidaria - cnidarians - neteldieren** | | | | | | |
| *Actinia equina* | - | - | - | - | - | - |
| *Alcyonium digitatum* | - | - | - | - | - | - |

Table 2. Continued

| Naam | Density (specimens/m²) | | | Biomass (mg/m²) | | |
|---|---|---|---|---|---|---|
| | Delta area | North Sea | Wadden Sea | Delta area | North Sea | Wadden Sea |
| *Cerianthus lloydii* | 2 | 2 | - | 5 | 4 | - |
| *Diadumene cincta* | - | - | - | - | - | - |
| *Ectopleura larynx* | - | - | - | - | - | - |
| *Eudendrium album* | - | - | - | - | - | - |
| *Gonionemus vertens* | - | - | - | - | - | - |
| *Halecium halecinum* | - | - | - | - | - | - |
| *Hydractinia echinata* | - | - | - | - | - | - |
| *Metridium senile* | - | - | 1 | - | - | 3 |
| *Obelia bidentata* | 2 | 2 | - | 2 | 3 | - |
| *Obelia dichotoma* | - | - | - | - | - | - |
| *Obelia geniculata* | - | - | - | - | - | - |
| *Obelia longissima* | - | - | 1 | - | - | 2 |
| *Sagartia elegans* | - | - | - | - | - | - |
| *Sagartia troglodytes* | - | 2 | 1 | - | 5 | 3 |
| *Sagartiogeton undatus* | 3 | - | - | 5 | - | - |
| *Tubularia indivisa* | - | - | - | - | - | - |
| *Urticina felina* | - | - | - | - | - | - |
| **Crustacea - crustaceans - kreeftachtigen** | | | | | | |
| *Abludomelita obtusata* | 3 | 2 | - | 2 | 2 | - |
| *Ampelisca brevicornis* | 3 | 2 | - | 2 | 2 | - |
| *Aora gracilis* | - | 2 | - | - | 2 | - |
| *Athanas nitescens* | 2 | - | - | 3 | - | - |
| *Balanus crenatus* | 4 | 3 | 3 | - | - | - |
| *Balanus improvisus* | 4 | 3 | - | - | - | - |
| *Bathyporeia elegans* | 3 | 3 | - | 3 | 2 | - |
| *Bathyporeia guilliamsoniana* | - | - | - | - | - | - |
| *Bathyporeia pilosa* | 3 | 2 | 2 | 3 | 1 | 1 |
| *Bathyporeia sarsi* | 3 | 2 | 1 | 2 | 1 | 1 |
| *Bathyporeia tenuipes* | - | 2 | - | - | 2 | - |
| *Bembidion laterale* | 3 | - | - | 2 | - | - |
| *Bodotria scorpioides* | 3 | 2 | 1 | 2 | 1 | 1 |
| *Callianassa subterranea* | - | 2 | - | - | 4 | - |
| *Callinectes sapidus* | - | - | - | - | - | - |
| *Cancer pagurus* | 2 | 2 | - | 5 | - | - |
| *Caprella mutica* | - | - | - | - | - | - |
| *Carcinus maenas* | 2 | 2 | 1 | 5 | 4 | 3 |
| *Corophium multisetosum* | 3 | - | - | 2 | - | - |
| *Corophium volutator* | 4 | 4 | 4 | 3 | 4 | 4 |
| *Corystes cassivelaunus* | - | 2 | - | - | 4 | - |
| *Crangon crangon* | 2 | 2 | 2 | 3 | 3 | 3 |
| *Cumopsis goodsir* | 2 | 1 | 1 | 1 | 1 | 1 |

Table 2. Continued

| Naam | Density (specimens/m²) | | | Biomass (mg/m²) | | |
|---|---|---|---|---|---|---|
| | Delta area | North Sea | Wadden Sea | Delta area | North Sea | Wadden Sea |
| *Diastylis bradyi* | 2 | 2 | 1 | 2 | 2 | 1 |
| *Diastylis lucifera* | 2 | 2 | - | 2 | - | - |
| *Elminius modestus* | - | - | 2 | - | - | 3 |
| *Eualus cranchii* | - | - | - | - | - | - |
| *Galathea squamifera* | - | - | - | - | - | - |
| *Gammarus locusta* | 3 | 2 | 2 | 3 | 1 | 2 |
| *Gammarus zaddachi* | 3 | - | - | 3 | - | - |
| *Harpinia antennaria* | - | 2 | - | - | 2 | - |
| *Haustorius arenarius* | 3 | 2 | - | 3 | 2 | - |
| *Hemigrapsus sanguineus* | - | - | - | - | - | - |
| *Hemigrapsus takanoi* | - | - | 1 | - | - | 3 |
| *Hemimysis lamornae* | - | - | - | - | - | - |
| *Hippolyte varians* | 2 | 2 | - | 3 | - | - |
| *Homarus gammarus* | - | - | - | - | - | - |
| *Hyas araneus* | - | - | - | - | - | - |
| *Hyas coarctatus* | - | - | - | - | - | - |
| *Idotea linearis* | 2 | 1 | 1 | 2 | 2 | - |
| *Inachus phalangium* | - | - | - | - | - | - |
| *Jassa falcata* | 2 | 2 | - | 2 | - | - |
| *Jassa marmorata* | - | 2 | - | - | 1 | - |
| *Leptomysis lingvura* | - | - | - | - | - | - |
| *Liocarcinus depurator* | 3 | - | - | 5 | - | - |
| *Liocarcinus holsatus* | 2 | 2 | - | 5 | 4 | - |
| *Liocarcinus marmoreus* | - | 2 | - | - | 4 | - |
| *Liocarcinus navigator* | - | - | - | - | - | - |
| *Macropodia rostrata* | - | - | - | - | - | - |
| *Metopa alderi* | - | 3 | - | - | 5 | - |
| *Microprotopus maculatus* | 3 | 2 | - | 1 | 1 | - |
| *Necora puber* | - | - | - | - | - | - |
| *Neomysis integer* | 3 | - | 1 | 3 | - | 1 |
| *Nephrops norvegicus* | - | 2 | - | - | 5 | - |
| *Orchomenella nana* | - | 4 | - | - | 2 | - |
| *Pagurus bernhardus* | 2 | 2 | 1 | 4 | 4 | 3 |
| *Palaemon adspersus* | 2 | - | - | 4 | - | - |
| *Palaemon elegans* | 2 | - | - | 4 | - | - |
| *Palaemon macrodactylus* | - | - | - | - | - | - |
| *Palaemon serratus* | - | - | - | - | - | - |
| *Pandalus montagui* | - | - | - | - | - | - |
| *Pariambus typicus* | - | 2 | - | - | 1 | - |
| *Perioculodes longimanus* | - | 2 | - | - | 1 | - |
| *Photis longicaudata* | - | 2 | - | - | 2 | - |

Table 2. Continued

| Naam | Density (specimens/m²) | | | Biomass (mg/m²) | | |
|---|---|---|---|---|---|---|
| | Delta area | North Sea | Wadden Sea | Delta area | North Sea | Wadden Sea |
| *Phoxichilidium femoratum* | 2 | 2 | 1 | 2 | 1 | - |
| *Pilumnus hirtellus* | - | - | - | - | - | - |
| *Pinnotheres pisum* | 3 | - | - | 3 | - | - |
| *Pisidia longicornis* | 2 | 2 | - | 3 | - | - |
| *Praunus flexuosus* | 3 | - | 1 | 3 | - | 1 |
| *Pycnogonum litorale* | 3 | - | - | 4 | - | - |
| *Schistomysis kervillei* | 2 | 2 | 1 | 2 | 2 | 1 |
| *Scopelocheirus hopei* | - | 2 | - | - | 2 | - |
| *Stenothoe marina* | 3 | 2 | - | 2 | 1 | - |
| *Tryphosella sarsi* | - | 3 | - | - | 2 | - |
| *Tryphosites longipes* | - | 2 | - | - | 2 | - |
| *Upogebia deltaura* | - | 2 | - | - | 4 | - |
| *Urothoe brevicornis* | 3 | 2 | - | 2 | 2 | - |
| *Urothoe poseidonis* | 3 | 3 | 3 | 3 | 2 | 3 |
| **Echinodermata - echinoderms - stekelhuidigen** | | | | | | |
| *Acrocnida brachiata* | - | 2 | - | - | 4 | - |
| *Amphiura chiajei* | - | 3 | - | - | 3 | - |
| *Amphiura filiformis* | - | 3 | - | - | 4 | - |
| *Asterias rubens* | 2 | 2 | 1 | 5 | 4 | 4 |
| *Brissopsis lyrifera* | - | 2 | - | - | 4 | - |
| *Echinocardium cordatum* | 2 | 2 | 1 | 5 | - | 2 |
| *Echinocyamus pusillus* | - | 2 | - | - | 2 | - |
| *Ophiothrix fragilis* | 3 | - | - | 4 | - | - |
| *Ophiura albida* | 2 | 2 | 1 | 4 | 3 | 2 |
| *Ophiura ophiura* | - | 3 | - | - | 3 | 2 |
| *Psammechinus miliaris* | 2 | 2 | - | 5 | 4 | - |
| **Echiura - spoon worms - zandwormen** | | | | | | |
| *Echiurus echiurus* | - | 3 | - | - | 3 | - |
| **Mollusca - molluscs - weekdieren** | | | | | | |
| *Abra alba* | 3 | 3 | 1 | 3 | 4 | 2 |
| *Acanthocardia echinata* | 2 | 2 | - | 5 | 4 | - |
| *Acanthocardia paucicostata* | 3 | - | - | 3 | - | - |
| *Acanthodoris pilosa* | - | - | - | - | - | - |
| *Aeolidia papillosa* | - | - | - | - | - | - |
| *Aeolidiella glauca* | - | - | - | - | - | - |
| *Aequipecten opercularis* | - | - | - | - | - | - |
| *Alvania lactea* | - | 3 | - | - | 3 | - |
| *Arctica islandica* | - | 2 | - | - | 4 | - |
| *Astarte montagui* | - | 2 | - | - | 3 | - |
| *Buccinum undatum* | - | 2 | - | - | 5 | - |
| *Cerastoderma edule* | 2 | 3 | 2 | 4 | 5 | 4 |

Table 2. Continued

| Naam | Density (specimens/m$^2$) | | | Biomass (mg/m$^2$) | | |
|---|---|---|---|---|---|---|
| | Delta area | North Sea | Wadden Sea | Delta area | North Sea | Wadden Sea |
| *Cerastoderma glaucum* | 3 | - | - | 4 | - | - |
| *Corbula gibba* | 3 | 3 | - | 3 | 3 | - |
| *Coryphella gracilis* | - | - | - | - | - | - |
| *Crassostrea gigas* | - | - | 1 | - | - | 4 |
| *Crepidula fornicata* | 3 | - | 1 | 4 | - | 1 |
| *Cuthona amoena* | - | - | - | - | - | - |
| *Cuthona concinna* | - | - | - | - | - | - |
| *Cuthona foliata* | - | - | - | - | - | - |
| *Cuthona gymnota* | - | - | - | - | - | - |
| *Cuthona nana* | - | - | - | - | - | - |
| *Dendronotus frondosus* | - | - | - | - | - | - |
| *Donax vittatus* | - | 2 | 1 | - | 4 | 1 |
| *Doris pseudoargus* | - | - | - | - | - | - |
| *Doto fragilis* | - | - | - | - | - | - |
| *Elysia viridis* | 3 | - | - | 4 | - | - |
| *Ennucula tenuis* | - | 2 | - | - | - | - |
| *Ensis directus* | 3 | 3 | - | 5 | 5 | - |
| *Ensis ensis* | 2 | 2 | - | 4 | 4 | - |
| *Ensis magnus* | 2 | 2 | - | 5 | 5 | - |
| *Ensis minor* | - | 2 | - | - | 5 | - |
| *Ensis siliqua* | - | 2 | - | - | 5 | - |
| *Epitonium clathratulum* | 2 | - | - | 2 | - | - |
| *Epitonium clathrus* | 2 | - | - | 4 | - | - |
| *Eubranchus exiguus* | - | - | - | - | - | - |
| *Eubranchus pallidus* | - | - | - | - | - | - |
| *Euspira catena* | - | 2 | - | - | - | - |
| *Facelina bostoniensis* | - | - | - | - | - | - |
| *Flabellina gracilis* | - | - | - | - | - | - |
| *Geitodoris planata* | - | - | - | - | - | - |
| *Goniodoris castanea* | - | - | - | - | - | - |
| *Goodallia triangularis* | - | 2 | - | - | 2 | - |
| *Hermaea bifida* | - | - | - | - | - | - |
| *Hyala vitrea* | - | 2 | - | - | 2 | - |
| *Hydrobia ulvae* | 4 | 2 | 5 | 4 | 1 | 5 |
| *Janolus cristatus* | - | - | - | - | - | - |
| *Janolus hyalinus* | - | - | - | - | - | - |
| *Jorunna tomentosa* | - | - | - | - | - | - |
| *Kurtiella bidentata* | 3 | 3 | 1 | 2 | 2 | 1 |
| *Lepidochitona cinerea* | 2 | - | 1 | 3 | - | 2 |
| *Littorina littorea* | 2 | - | 2 | 4 | - | 4 |
| *Lutraria lutraria* | - | 2 | - | - | 5 | - |

Table 2. Continued

| | Density (specimens/m²) | | | Biomass (mg/m²) | | |
|---|---|---|---|---|---|---|
| **Naam** | **Delta area** | **North Sea** | **Wadden Sea** | **Delta area** | **North Sea** | **Wadden Sea** |
| *Macoma balthica* | 2 | 3 | 2 | 3 | 4 | 3 |
| *Mactra stultorum* | - | 2 | - | - | 3 | - |
| *Mya arenaria* | 2 | 2 | 2 | 4 | 4 | 5 |
| *Mya truncata* | - | 2 | - | - | 4 | - |
| *Mytilus edulis* | 3 | 3 | 3 | 5 | 2 | 4 |
| *Nassarius reticulatus* | 2 | 2 | - | 4 | 4 | - |
| *Nucella lapillus* | - | - | - | - | - | - |
| *Nucula nitidosa* | - | 2 | - | - | 3 | - |
| *Onchidoris bilamellata* | - | - | 1 | - | - | 1 |
| *Onchidoris muricata* | - | - | - | - | - | - |
| *Ostrea edulis* | 3 | - | - | 5 | - | - |
| *Patella vulgata* | - | - | - | - | - | - |
| *Petricola pholadiformis* | 3 | 3 | 1 | 4 | 5 | 3 |
| *Propebela turricula* | - | - | - | - | - | - |
| *Retusa obtusa* | 3 | - | 2 | 2 | - | 2 |
| *Saxicavella jeffreysi* | - | 2 | - | - | 2 | - |
| *Scrobicularia plana* | 2 | 2 | 1 | 4 | - | 3 |
| *Spisula subtruncata* | 3 | 4 | 1 | 4 | - | 1 |
| *Tellimya ferruginosa* | 3 | 2 | - | - | 2 | - |
| *Tellina fabula* | 2 | 2 | 1 | 3 | 4 | 2 |
| *Tellina pygmaea* | - | 2 | - | - | 2 | - |
| *Tellina tenuis* | 2 | 2 | 1 | 3 | 3 | 3 |
| *Tergipes tergipes* | - | - | 1 | - | - | - |
| *Thecacera pennigera* | - | - | - | - | - | - |
| *Thyasira flexuosa* | - | 2 | - | - | - | - |
| *Trivia arctica* | - | - | - | - | - | - |
| *Venerupis senegalensis* | 2 | - | - | 5 | - | - |
| **Phoronida - phoronids - hoefijzerwormen** | | | | | | |
| *Phoronis hippocrepia* | - | - | - | - | - | - |
| **Platyhelminthes - flatworms - platwormen** | | | | | | |
| *Cephalothrix rufifrons* | - | - | - | - | - | - |
| *Emplectonema echinoderma* | - | - | - | - | - | - |
| **Porifera - sponges - sponzen** | | | | | | |
| *Cliona celata* | - | - | - | - | - | - |
| *Halichondria bowerbanki* | - | - | - | - | - | - |
| *Halichondria panicea* | - | - | - | - | - | - |
| *Haliclona oculata* | - | - | - | - | - | - |
| *Haliclona xena* | - | - | - | - | - | - |
| *Hymeniacidon perlevis* | - | - | - | - | - | - |
| *Leucosolenia variabilis* | - | - | - | - | - | - |
| *Mycale micracanthoxea* | - | - | - | - | - | - |

Table 2. Continued

| Naam | Density (specimens/m²) | | | Biomass (mg/m²) | | |
|---|---|---|---|---|---|---|
| | Delta area | North Sea | Wadden Sea | Delta area | North Sea | Wadden Sea |
| *Protosuberites denhartogi* | - | - | - | - | - | - |
| *Suberites massa* | - | - | - | - | - | - |
| *Sycon ciliatum* | - | - | - | - | - | - |
| *Sycon scaldiense* | - | - | - | - | - | - |
| **Sipuncula - peanut worms - pindawormen** | | | | | | |
| *Golfingia vulgaris vulgaris* | - | 2 | - | - | 3 | - |

Table 3. The list of common marine macro-fauna of the Netherlands, with their AMBI, SEBI and FIBI scores, and where applicable, the ITI-V.
Tabel 3. De geselecteerde 309 algemene mariene, Nederlandse benthos-diersoorten, hun AMBI, SEBI, FIBI en ITI-V classificaties.

| Naam | AMBI Borja | AMBI review | SEBI | FIBI | ITI-V |
|---|---|---|---|---|---|
| **Annelida - worms - wormen** | | | | | |
| *Alitta succinea* | III | III | III | III | III |
| *Alitta virens* | III | III | III | III | III |
| *Ampharete acutifrons* | II | II | III | III | III |
| *Aonides paucibranchiata* | III | III | III | III | III |
| *Aphelochaeta marioni* | IV | IV | IV | III | III |
| *Aphrodita aculeata* | I | II | II | II | III |
| *Arenicola defodiens* | I | I | III | III | III |
| *Arenicola marina* | III | III | III | III | III |
| *Aricidea minuta* | I | I | IV | IV | II |
| *Atherospio disticha* | | IV | III | III | III |
| *Atherospio guillei* | IV | IV | III | III | III |
| *Bylgides sarsi* | I | I | III | III | III |
| *Capitella capitata* | V | V | IV | IV | IV |
| *Chaetopterus variopedatus* | I | I | III | II | I |
| *Dipolydora coeca* | IV | IV | III | III | II |
| *Eteone flava* | III | III | II | III | III |
| *Eteone longa* | III | III | III | III | III |
| *Euclymene droebachiensis* | III | III | III | III | IV |
| *Eulalia viridis* | II | II | II | III | V |
| *Eumida sanguinea* | II | II | III | III | V |
| *Eunereis longissima* | III | III | III | III | III |
| *Eunoe nodosa* | II | II | III | III | III |
| *Exogone naidina* | II | II | III | III | III |
| *Ficopomatus enigmaticus* | III | III | II | II | I |
| *Galathowenia oculata* | III | II | IV | III | II |
| *Gattyana amondseni* | III | III | III | III | III |

Table 3. Continued

| Naam | AMBI Borja | AMBI review | SEBI | FIBI | ITI-V |
|---|---|---|---|---|---|
| *Gattyana cirrhosa* | III | III | III | III | III |
| *Glycera alba* | IV | III | II | III | III |
| *Glycera lapidum* | II | II | II | III | III |
| *Goniadella bobretzkii* | II | II | II | III | III |
| *Harmothoe imbricata* | II | II | II | III | III |
| *Harmothoe impar* | II | II | III | III | III |
| *Hediste diversicolor* | III | III | III | II | III |
| *Hesionura elongata* | II | II | IV | III | III |
| *Heteromastus filiformis* | IV | IV | IV | IV | IV |
| *Lanice conchilega* | IV | III | IV | II | II |
| *Lumbrineris latreilli* | II | III | IV | IV | II |
| *Magelona filiformis* | II | II | III | III | III |
| *Magelona johnstoni* | I | I | IV | II | III |
| *Magelona papillicornis* | I | I | IV | II | III |
| *Malmgreniella ljungmani* | I | I | IV | II | III |
| *Marenzelleria viridis* | II | II | III | III | III |
| *Mediomastus fragilis* | II | II | III | III | II |
| *Microphthalmus fragilis* | III | III | IV | IV | III |
| *Microphthalmus sczelkowii* | II | II | II | II | IV |
| *Microphthalmus similis* | II | II | II | II | IV |
| *Myrianida langerhansi* | II | II | III | III | IV |
| *Myriochele danielsseni* | II | II | III | III | III |
| *Neoamphitrite figulus* | III | III | IV | III | III |
| *Neodexiospira brasiliensis* | I | II | IV | III | III |
| *Nephtys caeca* | | II | II | II | I |
| *Nephtys cirrosa* | II | II | III | II | V |
| *Nephtys hombergii* | II | II | IV | II | V |
| *Nephtys longosetosa* | II | II | II | II | V |
| *Notomastus latericeus* | II | II | III | II | IV |
| *Ophelia rathkei* | III | III | II | II | IV |
| *Owenia fusiformis* | I | I | II | II | IV |
| *Paradoneis fulgens* | II | II | III | II | II |
| *Pectinaria koreni* | III | III | II | II | III |
| *Pherusa flabellata* | I | I | IV | III | II |
| *Pholoe minuta* | II | II | II | III | III |
| *Phyllodoce groenlandica* | IV | III | IV | II | III |
| *Phyllodoce laminosa* | II | II | IV | II | III |
| *Phyllodoce lineata* | II | II | IV | II | III |
| *Phyllodoce maculata* | II | II | IV | II | III |
| *Phyllodoce mucosa* | III | III | IV | II | III |
| *Pisione remota* | I | II | III | III | IV |
| *Polycirrus medusa* | IV | IV | IV | III | III |

Table 3. Continued

| Naam | AMBI Borja | AMBI review | SEBI | FIBI | ITI-V |
|---|---|---|---|---|---|
| *Polydora ciliata* | IV | IV | III | III | III |
| *Polydora cornuta* | IV | IV | III | IV | III |
| *Pomatoceros triqueter* | II | II | II | II | I |
| *Pseudopolydora pulchra* | IV | IV | III | II | II |
| *Pseudopotamilla reniformis* | II | II | III | II | I |
| *Pygospio elegans* | III | III | III | IV | II |
| *Sabella pavonina* | I | II | III | II | I |
| *Scalibregma inflatum* | III | III | IV | IV | IV |
| *Scolelepis foliosa* | III | II | III | III | II |
| *Scolelepis squamata* | III | II | II | III | II |
| *Scoloplos armiger* | III | II | IV | II | IV |
| *Spio filicornis* | III | III | IV | IV | III |
| *Spio martinensis* | III | III | IV | IV | III |
| *Spiophanes bombyx* | III | III | IV | IV | II |
| *Spirorbis tridentatus* | | II | III | II | I |
| *Streblospio shrubsolii* | III | III | III | II | III |
| **Ascidiacea - sea squirts - zakpijpen** | | | | | |
| *Aplidium glabrum* | | II | I | II | I |
| *Ascidiella aspersa* | III | III | II | I | I |
| *Botrylloides violaceus* | | III | I | II | I |
| *Botryllus schlosseri* | I | II | I | II | I |
| *Ciona intestinalis* | III | III | II | I | I |
| *Didemnum vexillum* | | III | I | II | I |
| *Diplosoma listerianum* | | III | II | II | I |
| *Molgula manhattensis* | I | III | III | I | I |
| *Molgula socialis* | | III | III | I | I |
| *Pelonaia corrugata* | | II | II | II | I |
| *Styela clava* | II | II | II | II | I |
| **Bryozoa - bryozoans - mosdiertjes** | | | | | |
| *Bugula plumosa* | | III | II | II | I |
| *Bugula simplex* | | III | II | II | I |
| *Bugula stolonifera* | | III | II | II | I |
| *Conopeum reticulum* | II | II | I | II | I |
| *Cryptosula pallasiana* | II | II | I | II | I |
| *Electra pilosa* | II | II | I | II | I |
| *Membranipora membranacea* | I | II | I | II | I |
| *Scrupocellaria scruposa* | I | II | II | II | I |
| *Tricellaria inopinata* | | III | II | II | I |
| **Cnidaria - cnidarians - neteldieren** | | | | | |
| *Actinia equina* | I | II | II | II | I |
| *Alcyonium digitatum* | | I | II | II | I |
| *Cerianthus lloydii* | I | I | II | II | |

Table 3. Continued

| Naam | AMBI Borja | AMBI review | SEBI | FIBI | ITI-V |
|---|---|---|---|---|---|
| *Diadumene cincta* | | II | II | II | I |
| *Ectopleura larynx* | I | II | II | II | I |
| *Eudendrium album* | | II | II | II | I |
| *Gonionemus vertens* | | II | I | II | I |
| *Halecium halecinum* | | II | II | II | I |
| *Hydractinia echinata* | | II | I | II | I |
| *Metridium senile* | | II | II | II | I |
| *Obelia bidentata* | II | II | II | II | I |
| *Obelia dichotoma* | II | II | II | II | I |
| *Obelia geniculata* | II | I | II | II | I |
| *Obelia longissima* | II | II | II | II | I |
| *Sagartia elegans* | | II | I | II | I |
| *Sagartia troglodytes* | I | II | II | II | I |
| *Sagartiogeton undatus* | | II | III | II | I |
| *Tubularia indivisa* | | II | II | II | I |
| *Urticina felina* | | II | II | II | I |
| **Crustacea - crustaceans - kreeftachtigen** | | | | | |
| *Abludomelita obtusata* | III | II | III | III | III |
| *Ampelisca brevicornis* | I | II | II | I | III |
| *Aora gracilis* | I | II | II | II | III |
| *Athanas nitescens* | I | II | II | II | |
| *Balanus crenatus* | | II | II | II | I |
| *Balanus improvisus* | | III | II | II | I |
| *Bathyporeia elegans* | I | II | III | II | IV |
| *Bathyporeia guilliamsoniana* | I | II | II | | IV |
| *Bathyporeia pilosa* | I | II | III | II | IV |
| *Bathyporeia sarsi* | I | II | III | II | IV |
| *Bathyporeia tenuipes* | I | I | III | II | IV |
| *Bembidion laterale* | | III | III | III | |
| *Bodotria scorpioides* | II | II | III | III | I |
| *Callianassa subterranea* | III | III | III | II | IV |
| *Callinectes sapidus* | I | II | III | IV | V |
| *Cancer pagurus* | III | II | II | II | V |
| *Caprella mutica* | | II | II | II | II |
| *Carcinus maenas* | III | III | III | IV | V |
| *Corophium multisetosum* | III | III | III | II | III |
| *Corophium volutator* | III | III | III | II | III |
| *Corystes cassivelaunus* | I | I | II | IV | V |
| *Crangon crangon* | I | II | II | IV | V |
| *Cumopsis goodsir* | II | II | III | III | |
| *Diastylis bradyi* | II | II | III | III | III |
| *Diastylis lucifera* | III | II | III | III | III |

Table 3. Continued

| Naam | AMBI Borja | AMBI review | SEBI | FIBI | ITI-V |
|---|---|---|---|---|---|
| *Elminius modestus* | II | II | II | II | I |
| *Eualus cranchii* | | II | II | II | |
| *Galathea squamifera* | I | I | II | II | V |
| *Gammarus locusta* | I | II | II | II | II |
| *Gammarus zaddachi* | III | III | III | II | II |
| *Harpinia antennaria* | I | II | III | II | IV |
| *Haustorius arenarius* | I | II | II | II | II |
| *Hemigrapsus sanguineus* | | II | II | IV | V |
| *Hemigrapsus takanoi* | | II | II | IV | V |
| *Hemimysis lamornae* | | II | II | II | |
| *Hippolyte varians* | I | I | II | II | |
| *Homarus gammarus* | | I | II | II | V |
| *Hyas araneus* | I | II | IV | II | V |
| *Hyas coarctatus* | I | II | IV | II | V |
| *Idotea linearis* | II | II | II | II | V |
| *Inachus phalangium* | | I | II | IV | III |
| *Jassa falcata* | V | V | I | III | II |
| *Jassa marmorata* | V | V | III | III | II |
| *Leptomysis lingvura* | | II | II | II | |
| *Liocarcinus depurator* | I | II | III | I | V |
| *Liocarcinus holsatus* | I | II | III | IV | V |
| *Liocarcinus marmoreus* | I | II | II | II | V |
| *Liocarcinus navigator* | I | II | II | II | V |
| *Macropodia rostrata* | I | II | II | IV | V |
| *Metopa alderi* | II | II | II | III | III |
| *Microprotopus maculatus* | I | II | III | III | V |
| *Necora puber* | I | II | II | IV | V |
| *Neomysis integer* | II | III | II | II | V |
| *Nephrops norvegicus* | I | I | II | II | V |
| *Orchomenella nana* | II | II | III | IV | V |
| *Pagurus bernhardus* | II | II | II | IV | V |
| *Palaemon adspersus* | | II | II | II | V |
| *Palaemon elegans* | I | I | II | II | V |
| *Palaemon macrodactylus* | | II | II | II | V |
| *Palaemon serratus* | I | I | II | II | V |
| *Pandalus montagui* | II | II | II | II | V |
| *Pariambus typicus* | III | III | II | II | V |
| *Perioculodes longimanus* | II | II | III | III | III |
| *Photis longicaudata* | I | I | III | II | III |
| *Phoxichilidium femoratum* | I | I | II | II | V |
| *Pilumnus hirtellus* | I | II | II | III | V |
| *Pinnotheres pisum* | | II | II | II | V |

Table 3. Continued

| Naam | AMBI Borja | AMBI review | SEBI | FIBI | ITI-V |
|---|---|---|---|---|---|
| *Pisidia longicornis* | I | I | II | I | V |
| *Praunus flexuosus* | I | II | II | II | V |
| *Pycnogonum litorale* | II | II | II | III | III |
| *Schistomysis kervillei* | II | III | II | II | I |
| *Scopelocheirus hopei* | | II | III | III | III |
| *Stenothoe marina* | II | II | II | II | I |
| *Tryphosella sarsi* | I | II | III | III | III |
| *Tryphosites longipes* | I | II | III | III | IV |
| *Upogebia deltaura* | I | II | III | II | I |
| *Urothoe brevicornis* | I | I | II | IV | IV |
| *Urothoe poseidonis* | I | II | II | IV | IV |
| **Echinodermata - echinoderms - stekelhuidigen** | | | | | |
| *Acrocnida brachiata* | I | II | II | II | I |
| *Amphiura chiajei* | II | II | II | I | I |
| *Amphiura filiformis* | II | II | III | I | I |
| *Asterias rubens* | III | III | II | IV | V |
| *Brissopsis lyrifera* | I | I | II | II | III |
| *Echinocardium cordatum* | I | II | II | IV | IV |
| *Echinocyamus pusillus* | I | I | II | II | III |
| *Ophiothrix fragilis* | I | II | II | II | I |
| *Ophiura albida* | II | II | IV | IV | III |
| *Ophiura ophiura* | II | II | IV | II | III |
| *Psammechinus miliaris* | I | II | II | IV | III |
| **Echiura - spoon worms - zandwormen** | | | | | |
| *Echiurus echiurus* | II | II | | | III |
| **Mollusca - molluscs - weekdieren** | | | | | |
| *Abra alba* | III | III | IV | I | III |
| *Acanthocardia echinata* | I | I | II | II | I |
| *Acanthocardia paucicostata* | I | II | II | II | I |
| *Acanthodoris pilosa* | | II | II | II | V |
| *Aeolidia papillosa* | I | II | I | I | V |
| *Aeolidiella glauca* | | II | III | I | V |
| *Aequipecten opercularis* | I | I | I | I | I |
| *Alvania lactea* | | I | II | III | |
| *Arctica islandica* | III | II | III | II | I |
| *Astarte montagui* | I | I | II | II | I |
| *Buccinum undatum* | II | II | II | II | V |
| *Cerastoderma edule* | III | III | II | IV | III |
| *Cerastoderma glaucum* | III | III | II | IV | III |
| *Corbula gibba* | IV | IV | II | II | I |
| *Coryphella gracilis* | | II | II | II | V |
| *Crassostrea gigas* | III | III | II | II | I |

Table 3. Continued

| Naam | AMBI Borja | AMBI review | SEBI | FIBI | ITI-V |
|---|---|---|---|---|---|
| *Crepidula fornicata* | III | III | II | III | V |
| *Cuthona amoena* | | II | II | II | V |
| *Cuthona concinna* | | II | II | II | V |
| *Cuthona foliata* | | II | II | II | V |
| *Cuthona gymnota* | | II | II | II | V |
| *Cuthona nana* | | II | II | II | V |
| *Dendronotus frondosus* | | II | II | II | V |
| *Donax vittatus* | I | I | II | II | III |
| *Doris pseudoargus* | | II | II | II | V |
| *Doto fragilis* | | II | II | II | V |
| *Elysia viridis* | | II | II | II | V |
| *Ennucula tenuis* | II | II | II | II | II |
| *Ensis directus* | I | II | II | II | I |
| *Ensis ensis* | I | II | II | I | I |
| *Ensis magnus* | | II | II | II | I |
| *Ensis minor* | I | II | II | II | I |
| *Ensis siliqua* | I | II | II | I | I |
| *Epitonium clathratulum* | I | I | II | III | V |
| *Epitonium clathrus* | I | I | II | III | V |
| *Eubranchus exiguus* | | II | II | II | V |
| *Eubranchus pallidus* | | II | II | II | V |
| *Euspira catena* | II | II | II | II | |
| *Facelina bostoniensis* | | II | II | II | V |
| *Flabellina gracilis* | | II | II | II | V |
| *Geitodoris planata* | | II | II | II | V |
| *Goniodoris castanea* | | II | II | II | V |
| *Goodallia triangularis* | II | II | II | II | I |
| *Hermaea bifida* | | II | II | II | V |
| *Hyala vitrea* | I | I | III | II | III |
| *Hydrobia ulvae* | III | III | III | II | III |
| *Janolus cristatus* | | II | II | II | V |
| *Janolus hyalinus* | | II | II | II | V |
| *Jorunna tomentosa* | | II | II | II | |
| *Kurtiella bidentata* | III | III | II | II | II |
| *Lepidochitona cinerea* | II | II | II | III | III |
| *Littorina littorea* | II | II | II | III | |
| *Lutraria lutraria* | I | I | II | II | |
| *Macoma balthica* | III | III | II | II | III |
| *Mactra stultorum* | | II | II | II | I |
| *Mya arenaria* | II | II | II | II | I |
| *Mya truncata* | II | II | II | II | I |
| *Mytilus edulis* | III | III | II | II | I |

Table 3. Continued

| Naam | AMBI Borja | AMBI review | SEBI | FIBI | ITI-V |
|---|---|---|---|---|---|
| *Nassarius reticulatus* | II | II | III | IV | V |
| *Nucella lapillus* | | I | II | II | V |
| *Nucula nitidosa* | I | I | IV | II | III |
| *Onchidoris bilamellata* | | II | II | II | V |
| *Onchidoris muricata* | I | I | II | II | V |
| *Ostrea edulis* | I | II | I | I | I |
| *Patella vulgata* | | II | I | III | |
| *Petricola pholadiformis* | I | II | I | II | I |
| *Propebela turricula* | | II | II | III | II |
| *Retusa obtusa* | II | II | III | III | II |
| *Saxicavella jeffreysi* | I | I | II | II | I |
| *Scrobicularia plana* | III | III | II | III | II |
| *Spisula subtruncata* | I | II | IV | IV | I |
| *Tellimya ferruginosa* | II | II | II | II | II |
| *Tellina fabula* | I | I | II | II | III |
| *Tellina pygmaea* | I | I | IV | II | III |
| *Tellina tenuis* | I | I | II | II | III |
| *Tergipes tergipes* | | II | II | II | V |
| *Thecacera pennigera* | | II | II | II | V |
| *Thyasira flexuosa* | III | III | II | II | I |
| *Trivia arctica* | I | I | II | III | V |
| *Venerupis senegalensis* | I | II | II | II | I |
| **Phoronida - phoronids - hoefijzerwormen** | | | | | |
| *Phoronis hippocrepia* | II | II | III | II | I |
| **Platyhelminthes - flatworms - platwormen** | | | | | |
| *Cephalothrix rufifrons* | | II | II | II | III |
| *Emplectonema echinoderma* | | III | II | II | III |
| **Porifera - sponges - sponzen** | | | | | |
| *Cliona celata* | | III | II | III | I |
| *Halichondria bowerbanki* | II | II | II | I | |
| *Halichondria panicea* | I | II | I | II | I |
| *Haliclona oculata* | | II | II | II | I |
| *Haliclona xena* | | II | II | II | I |
| *Hymeniacidon perlevis* | | II | II | II | I |
| *Leucosolenia variabilis* | | II | II | II | I |
| *Mycale micracanthoxea* | | II | II | II | I |
| *Protosuberites denhartogi* | | II | II | II | I |
| *Suberites massa* | | II | II | II | I |
| *Sycon ciliatum* | | I | II | II | I |
| *Sycon scaldiense* | | I | II | II | I |
| **Sipuncula - peanut worms - pindawormen** | | | | | |
| *Golfingia vulgaris vulgaris* | I | II | II | II | III |

## AANWIJZINGEN VOOR AUTEURS

De Nederlandse Faunistische Mededelingen publiceert artikelen en korte mededelingen over ongewervelde dieren in Nederland. Het tijdschrift is het publicatiemedium voor de werkgroepleden van EIS-Nederland en andere onderzoekers, met als doel het leveren van een bijdrage aan de kennis van de Nederlandse biodiversiteit.

De volgende onderwerpen komen in aanmerking voor opname: faunistiek en ecologie van een soort of soortgroep, naamlijsten, korte monografieën, determinatietabellen etc. Uitgebreide sleutels kunnen ook worden gepubliceerd in Entomologische Tabellen. Naast korte stukken kunnen ook grotere artikelen (eventueel als extra nummer) worden gepubliceerd. Ook kan een geografische ingang gekozen worden (bespreking van de fauna van een gebied), mits de gegevens in een landelijke context worden geplaatst. De voorkeur gaat uit naar rijk geïllustreerde artikelen waarin verschillende aspecten naar voren komen: bijvoorbeeld verspreiding, biologie, ecologie en/of bescherming.
Het gepresenteerde moet nieuwe gegevens bevatten, of op een nieuwe manier gebundeld zijn.
In de rubriek 'Waarnemingen en Mededelingen' is ook plaats voor overzichten en elders gepubliceerde gegevens.

Manuscripten worden digitaal (met alle illustraties en tabellen) aangeleverd. Hierbij dient bij voorkeur gebruik gemaakt te worden van WORD.
De teksten worden met een minimum aan opmaak aangeleverd. Alleen wetenschappelijke soort- en genusnamen dienen gecursiveerd te worden. Gebruik één lettertype in één lettergrootte; laat de tekst links uitlijnen, zonder afbreken, inspringen, centreren, etc.; gebruik zeker geen automatisch genummerde lijsten, noten e.d. Mannetjes- en vrouwtjestekens dienen weergegeven te worden als respectievelijk $ en #.

Diagrammen, tabellen en digitale figuren worden in aparte bestanden aangeleverd. Tabellen dienen zonder opmaak aangeleverd te worden, de kolommen slechts gescheiden door één tab (zeker geen spaties gebruiken!). Illustraties bij voorkeur als orgineel aanleveren. Digitale illustraties bij voorkeur in TIFF-formaat (zeker niet in een WORD-document ingevoegd) met een hoge resolutie en ongecomprimeerd.

Voor de opbouw van artikelen zie een recent nummer (vanaf nummer 18). De artikelen zijn gesteld in het Nederlands (nieuwe spelling), bij een duidelijke internationale context in het Engels. Elk artikel wordt vooraf gegaan door een leader waarin de inhoud kort wordt samengevat en afgesloten met een Engelstalige samenvatting. Bijschriften van figuren en tabellen worden in het Nederlands en het Engels gesteld.

Soortnamen van ongewervelde dieren dienen tenminste éénmaal volledig met auteur en jaartal weergegeven te worden. Bij hogere planten wordt de spelling uit de meest recente versie van de Heukel's Flora van Nederland (Van der Meijden) gevolgd en kan de auteursnaam worden weggelaten. Bij andere soortgroepen (zoals gewervelde dieren, mossen, korstmossen) kan de auteursnaam weggelaten worden. Nederlandse namen beginnen met een kleine letter.

Referenties zijn conform de volgende voorbeelden opgebouwd. Let op het ontbreken van de komma tussen auteur en jaartal en de volledig uitgeschreven naam van het tijdschrift.

Stuivenberg, F. van 1997. Tabel en verspreidingsatlas van de Nederlandse Steninae (Coleoptera: Staphylinidae). – Nederlandse Faunistische Mededelingen 6: 1-60. [*artikel in tijdschrift*]

Ragge, D.R. 1965. Grasshoppers, crickets and cockroaches of the British Isles. – Warne, Londen. [*boek*]

Blackith, R.E. 1987. Primitive Orthoptera and primitive plants. – In: Baccetti, B.M. (red.), Evolutionary biology of orthopteroid insects. Ellis Horwood Limites, Chichester: 124-126. [*hoofdstuk in book*]