

Oligochaetes from brackish and marine waters in The Netherlands (Annelida: Oligochaeta)

Oligochaete worms mainly occur in fresh water but some species occur in brackish water and even in the open sea. In marine benthos research, these animals have not traditionally been identified, because they are small and difficult to identify. However, they are not much more difficult than the closely related Polychaeta, which also have very small representatives. This article provides an overview of the 32 species that are now known from salt waters in our country, six of which are presented as new to the Dutch fauna. The discovery of *Heterodrilus subtilis* in the North Sea is very special, because this species is only known from the type material that was collected about a hundred years ago in the Gulf of Naples.

Introduction

In the past, oligochaetes received little attention in marine benthos research, in contrast to polychaetes, mollusks and crustaceans. This has a number of causes. First, marine oligochaetes are rather small and thin. Almost all individuals are thin and easily pass through a sieve with a standard mesh size of 1 mm. Occasionally, some oligochaetes remain on the sieve, often attached to inorganic material. Subsequently, these animals can be difficult to determine due to the many species described and the complicated taxonomy. It also does not help that the marine Oligochaeta in our area are sexually mature for only part of the year (usually spring). That is the only period in which they can be identified to species. The process of determination with the right keys, then follows.

There are two standard works for marine oligochaetes that are usable for the Dutch territory. Brinkhurst (1982) gives an overview of the English species. However, species diversity is much greater there, because the English sea area is much larger and even includes the eastern part of the Atlantic and has much deeper parts than the Dutch. In doing so, it should be noted that the species richness of the Dutch North Sea is poorly known, and that it is therefore no bad thing to consider a wide variety of species. The standard work of Brinkhurst & Jamieson (1971) gives a good overview of all known oligochaetes of the world, but their tables are also very complicated. Both books do not really invite you to get started with the Dutch finds. In addition, there are many papers that deal with a certain genus. But if one does not know to which genus an animal belongs, it often comes down to looking at pictures. In recent years, the author has collected and identified many oligochaetes from fresh and brackish Dutch waters and this resulted in 2013 in a book about the oligochaetes of the Netherlands and Belgium (Van Haaren & Soors 2013). It is only in recent years that the identification of marine Oligochaeta has started. This is only partially incorporated in the aforementioned book. This paper provides an overview of the previously known species of brackish and salty waters in the Netherlands. A number of species were not included in Van Haaren & Soors (2013), because at the time of publication too little was known about them.

This paper gives information about ecology and distribution of all known Dutch species from the brackish and marine environments. Of the species already mentioned in Van Haaren & Soors (2013), no extensive description is given, but more attention is given to new knowledge. Species of reduced and full salinity are discussed in more detail in terms of diagnostic characteristics, ecology and distribution. In addition, a key for identification is presented. For taxa not included in Van Haaren & Soors (2013), for the first time, a Dutch name is given: *groot zanddraadje* (*Grania maricola*), *naakt zanddraadje* (*G. postclitellochaeta*

agg.), *Variabel zanddraadje* (*Grania variochaeta*), *viking zanddraadje* (*G. vikinga*), *valse drietand* (*Heterodrilus subtilis*), *Noorse spitssnuitzandworm* (*Limnodriloides scandinavicus*) and *dwergekustworm* (*Tubificoides brownae*). For four very similar marine species, it was decided not to introduce Dutch names because the differences are subtle, i.e. *Pectinodrilus rectisetosus*, *Pirodrilus minutus*, *Phalodrilus parthenopaeus* and *Thalassodrilus klarae*.

Material

The material examined mostly comes from samples taken by or on behalf of Rijkswaterstaat as part of the monitoring of national waters. Benthos research has been carried out in the following regions: Coastal zone (incl. Voordelta, Vlake van de Raan), Offshore (including Brown bank), Frisian front, (central) Oyster grounds, Dogger Bank, Cleaver Bank, Wadden Sea, Lake Grevelingen, Eastern- and Western Scheldt estuary. Furthermore, on behalf of Water Authority Boards and Rijkswaterstaat, research has also been carried out on macro-invertebrates in various small and large brackish inland waters. As far as is known, benthos research has never been carried out in the North Sea regions of the Gas Fountains and the Borkum Stones. For the location of the various North Sea regions, see Figure 1 or the website of the Anemoon Foundation (Anemoon 2015).

Most of the oligochaete identifications in these samples were carried out by the author as an employee of Grontmij. The analysis results of these samples have mostly appeared in reports, including the Sand engine project, Holland (Wijsman & Verduin 2011), North Sea (Tempelman et al. 2009a, 2009b, Verduin et al. 2011, 2012, Verduin & Leewis 2013) and inland waters such as the Walcheren Channel (Oosterbaan et al. 2003). A large part of the collected material is included in the author's collection (Amsterdam), often as a permanent slide or otherwise in a preservative. One very unique marine species, *Heterodrilus subtilis*, is in the collection of the University of Gothenburg. Part of the studied material has been returned to the client after identification or has been incinerated for the benefit of biomass determinations.

The specified coordinates in the paragraphs on observations are represented as national Amersfoort coordinates (AC), or for the marine locations as the international WGS84 coordinates.

Ecotopes

This paper discusses all species that occur or are expected in Dutch brackish and salty waters (Table 1). These are divided into four groups.

The species of the first two ecotopes (fresh and brackish) are well known and it can be expected that little will be added in the future. In group 3 (reduced salinity) some species can still be expected, especially on the North Sea coast. Only a few species of ecotope 4 (full salinity) are known and many species are still expected.

1) Fresh water

Eight freshwater species are known to tolerate some brackish water (oligohaline). However, the question remains whether they can spend their entire cycle here. *Isochaetides michaelsoni*, *Tubifex blanchardi* and *Paranais frici* are fairly rare species of our rivers, which occur in slightly brackish waters up to the coast. *Potamothrix bavaricus* can be found mainly on the coast, in various small and large inland waters. There, it is found mainly in slightly brackish waters, but also in fresh water. It is therefore more of a coastal species than a brackish water species. *Limnodrilus hoffmeisteri* and *L. claparedianus* are true freshwater species and are only sporadically found in brackish water. The densities are, as with the previous species, always low. Both species are extremely common in fresh water in northwestern Europe and are among the most numerous animal species in the northern hemisphere. There is a high probability of collecting them in fresh water. *Nais elinguis* is a

different story. In terms of biotope, the species resembles *Tubifex tubifex* (Müller, 1774), another common oligochaete. Both live mainly under rather extreme conditions, so in places where there is little competition. In the Netherlands, *N. elinguis* lives in oxygen-rich, cold streams and small rivers or in light to strongly brackish waters on the coast, including mud plains in the tidal zone that are dry at low tide. The species thus seems to have a broad ecological spectrum, but it does not or hardly occurs in water types such as nutrient-rich ditches or drainage waters. This species is only to be expected in the ion-rich biotopes, such as organically polluted or brackish ditches.

2) Brackish water

In inland brackish waters and estuaries (oligo-mesohaline), nine species can be found. *Amphichaeta sannio*, *Baltidrilus costatus*, *Tubificoides benedii* and, to a lesser extent, also *T. heterochaetus* still occur in the polyhaline range (group 3). *A. sannio* especially benefits from the diatom bloom in spring. It is mainly found in spring in the brackish part of the Rhine delta and the Wadden Sea, more dynamic water systems. *Tubificoides benedii* also occurs in these kinds of places, but also in all kinds of small and large stagnant brackish water systems. *Tubificoides heterochaetus* is more a species of estuaries and is, for example, scarce in the North Sea Canal and the eastern part of the Western Scheldt. Also, *Tubificoides benedii* and *T. heterochaetus* have their breeding peak in the spring. *Monopylephorus* species are mainly found in oligohaline environments, but little is known about the ecological preference of *M. limosus* and *M. rubroniveus* in the Netherlands. *Monopylephorus irroratus* is a typical species of the freshwater tidal area (including Hollandse IJssel) and, in terms of ecology, it falls a bit between the first and second group. *Baltidrilus costatus*, *Paranais litoralis*, *T. benedii* and *T. heterochaetus* are true brackish water species and will never be found in fresh or salt water.

3) Inland and coastal waterbodies with reduced salinity

These species can be found in inland waters and the coastal zone (polyhaline). These are (strongly) brackish to saline canals and estuaries (such as Walcheren canal, Nieuwe Waterweg, Western- and Eastern Scheldt, Dollard estuary), the Wadden Sea and the coastal zone to about 20 kilometres offshore (approximately 5-20 meters depth). In this coastal zone (fig. 1) there are obviously deeper places to be designated, even to a depth of -67 m NAP (Western Scheldt near Borssele), but this area is subject to tidal action and variable wave action. From these waters, twelve species are known and at least two are to be expected, with four species also in the oligo-mesohaline range (see group 2). *Tubificoides diazi*, *T. benedii* and *Clitellio arenarius* are the most common species in the Wadden Sea. In addition, *A. sannio* occurs on mudflats, but the densities are unknown, because they are rather small and flush through the standard sieves (of 1 mm). Along the shallow coast, mainly *T. diazi* and *Grania postclitellochaeta* agg. occur. *Grania postclitellochaeta* s. str. is the only *Grania* that can penetrate into brackish water. Furthermore, in this ecotope *Thalassodrilus prostatus*, *Spiridion insigne* and *Aktedrilus monospermathecus* are to be expected. This area is dynamic and subject to tidal movements. The sediment consists mainly of fine and coarse sand in the coastal zone. In the Western- and Eastern Scheldt there are mainly *B. costatus*, *P. litoralis*, *Tubificoides pseudogaster*, *T. diazi* and *T. brownae*.

4) Marine (full salinity)

Some species are known from the open North Sea (euhaline), where there is less water movement and the depth is about 20-50 metres. From this area, the following eleven species were found in the Netherlands: *Grania maricola*, *G. postclitellochaeta* agg., *G. variochaeta*, *G. vikinga*, *Heterodrilus subtilis*, *Limnodriloides scandinavicus*, *Pectinodrilus rectisetosus*, *Phallogrilus parthenopaeus*, *Pirodrilus minutus*, *Thalassodrilus klarae* and scarce *T. diazi*. Furthermore, *A. pusillus* is to be expected here, along with many species yet to be

discovered. The sediment type is quite different, depending on the area (see fig. 1). From the northern part of the Dutch North Sea (Frisian Front, Oyster Grounds, Dogger Bank), virtually no species are known, although oligochaetes are occasionally reported from these areas in benthos reports (for example Daan & Mulder 2005). Only *L. scandinavicus* is known from the Oyster grounds, but more species are to be expected here. Several species from the Cleaver Bank are known, including four species of *Grania*, *L. scandinavicus*, *P. minutus* and *T. klarae*. Offshore in the North Sea, five species are known so far: *G. vikinga*, *H. subtilis*, *P. rectisetosus*, *P. parthenopaues* and *T. diazi*.

Morphology

Oligochaetes versus polychaetes

Oligochaetes and polychaetes are generally easy to separate. Oligochaetes have simple morphology, while most polychaetes have complex, compound chaetae, parapodia, various tentacles, gills and palps and anal papillae. There are also polychaetes without a combination of these characteristics and they resemble oligochaetes, such as Capitellidae, *Ctenodrilus serratus* (Schmidt, 1857) (Ctenodrilidae), *Galathowenia oculata* (Zachs, 1923) (Oweniidae), *Polygordius appendiculatus* Fraipont, 1887. (Polygordiidae), *Micromaldane ornithochaeta* Mesnil, 1897 (Maldanidae) and Protodriloidae. Marine oligochaetes never have gills, tentacles or other threadlike appendages, nor parapodia, compound chaetae or anal cirri. A thread-like extension of the anal segment is known only from a single non-native oligochaete species. The smooth chaetae of oligochaetes consist of a single shaft with distally three teeth at most. The grooved chaetae of polychaetes are either single or composite; however, single chaetae are only present in species with well-developed parapodia. The hairs of polychaetes are also often grooved and usually have a pair of continuous lateral fins. There are also some biological differences. Oligochaetes are hermaphrodites, with both female and male sexual organs in the same individual. Polychaetes have separate sexes and are either male or female, and even, depending on the species, show sexual dimorphism, for example in *Pygospio elegans* Claparède, 1863. In the identification of oligochaetes, and especially in the case of tubificids, the shape of the male sexual organs play an important role. If clear penises (always two) have been developed, the shape and length and the presence of a protective sheath is diagnostic.

Oligochaetes

In general, many species of tubificid oligochaetes and Enchytraeidae can only be identified with certainty if they are sexually mature. These adult animals can be recognized by the presence of a well-developed segment with sexual organs, the clitellum or saddle. Naidid worms can also be identified if they do not show any sexual characteristics. They are then either juvenile or exhibit asexual reproduction. If they reproduce sexually, the clitellum forms in segment VI. In the case of tubificids, the clitellum always forms in segment XI and in Enchytraeidae in segment XII. The clitellum is a thickening of the epidermis that protects the internal genital structures. Because of this thickening, the segment is also less transparent. In this clitellum various structures develop, including a penis, whether or not protected by a sheath, and prostate glands. In the clitellum (naidids) or a segment anterior to the clitellum, the spermatheca develop. In the case of tubificids, this is the segment just anterior to the clitellum (segment X) and in Enchytraeidae (including *Grania*), in segment V. In some species, the ventral chaetae in or near the clitellum have a different form and function. These modified genital chaetae in the clitellum are called penial chaetae, and in the spermathecal segment, spermathecal chaetae (anterior or sometimes posterior to the clitellum). These are located at the place where the spermatheca is located. Within naidid oligochaetes (e.g., *Nais*, *Paranais*), only penial chaetae may be present in segment VI, the place where the clitellum can develop. In tubificid oligochaetes, penial chaetae can develop in segment XI and

spermathecal chaetae in segment IX, X and / or XII. Enchytraeidae (including *Grania*) never form modified genital chaetae. A number of species, and especially the species mentioned in couplets 1-20 of the identification key (see below), can easily be recognized, often on the basis of their unique chaetae and the numbers of chaetae in each bundle. Figure 2 shows a worm with the most important characteristics and in figure 3 different types of chaetae and hairs. Oligochaetes have basically two pairs of dorsal bundles and two pairs of ventral bundles with chaetae. If hairs are present, they are always in the dorsal bundles. Some species of Naididae, including *Nais*, *Paranais*, *Amphichaeta*, and some Enchytraeidae lack one, some or even all dorsal bundles and, depending on the species, more or fewer ventral chaetal bundles. There are even terrestrial Enchytraeidae where all chaetae are missing. Within the Enchytraeidae (incl. *Grania*), the dorsal bundles have shifted to a lateral position, so that you should actually speak of lateral bundles. For convenience, dorsal bundles are used here as well. To determine whether you are looking at dorsal bundles or ventral bundles, you can use the mouth opening for orientation, because it is always ventral in position.

key

All oligochaetes from Table 1 are included in this key. Species marked with a * have not yet been established with certainty for the Netherlands, but are expected.

- | | | |
|---|--|------------------------------------|
| 1 | Hairs present in the dorsal bundles | 2 |
| - | Hairs absent in the dorsal bundles | 6 |
| 2 | Dorsal bundles present from segment VI; in these bundles, often 2-3 hairs and 2-3 thin needles with two long thin tips. Often with eye pigment (fig. 5) | <i>Nais elinguis</i> |
| - | Dorsal bundles start, just like the ventral, in segment II. Dorsal chaetae, at least the anterior, sigmoid with distinct teeth. Never with eye pigment | 3 |
| 3 | Body heavily papillated. The animal is very dark in colour, usually dark brown to almost black (fig. 8, 51) | <i>Tubificoides insularis</i> * |
| - | Body not papillated. The animal is not so dark in colour, usually pink-red (like fig. 32) .. | 4 |
| 4 | Hairs spirally twisted distally | <i>Monopylephorus irroratus</i> |
| - | Hairs straight | 5 |
| 5 | Dorsal chaetae in posterior segments simple pointed, bifid in anterior segments. Sexually mature specimens without spermathecal chaetae | <i>Tubificoides parapectinatus</i> |
| - | Dorsal chaetae in posterior segments bifid, pectinate in anterior segments. Sexually mature specimens with spear-shaped spermathecal chaetae (in segment X) <i>Potamothrix bavaricus</i> | |
| 6 | Body with distinct papillae, at least on the tail | 7 |
| - | Body without papillae | 8 |
| 7 | Body, with the exception of the head and tail tip, covered with (blunt) papillae, often with brown encrustations (figs. 8, 51). Body not conspicuously narrowed behind the clitellum (segment XI). Chaetae two per bundle with short distal tooth or single-pointed | <i>Tubificoides benedii</i> |
| - | Usually only the tail with fine, pointed papillae, usually barely visible at low magnification (fig. 50). Body strongly narrowed just after the clitellum (or segment XI) (as <i>T. brownae</i> : fig. 45). In anterior segments, (2-)3-6 bifid chaetae with approximately equal teeth; in posterior segments, 1-2 chaetae with such a reduced proximal tooth that the chaetae appear single-pointed | <i>Tubificoides heterochaetus</i> |
| 8 | All chaetae (dorsal and ventral) simple pointed, never with indication of reduced distal teeth | 9 |
| - | At least the ventral chaetae are bifid, the distal tooth can be more or less reduced. Some species with simple pointed chaetae in tail segments | 13 |

- 9 Animals long and thin, almost nematode-like. In anterior segments, 0-2 ventral chaetae; in the posterior, 2 ventral and 0-2 dorsal chaetae. Chaetae in shape of a hockey stick, basically broad, then tapered towards the end (*Grania*)10
- Animals not filiform, often short and relatively thick, not nematode-like. Usually more than two chaetae per bundle, always straight or sigmoid, never in the form of a hockey stick. One or more dorsal chaetae in anterior segments may be missing, but never all ...
.....Other Enchytraeidae
- 10 All dorsal chaetae and anterior ventral chaetae are missing. So only 2 ventral chaetae in the tail segments *Grania postclitellochaeta* agg.
- Dorsal chaetae at least present in the tail; ventral chaetae may be present in anterior segments. So 4 chaetae in at least the last 8 tail segments..... 11
- 11 Large species: diameter >0.2 mm, length >8 mm. Ventral chaetae present from segment VI, dorsal chaetae from segment 23-24. Posterior chaetae >100 µm long *Grania maricola*
- Smaller species: diameter <0.2 mm, length <8 mm. Presence and position of dorsal and ventral chaetae otherwise. Posterior chaetae <80 µm long..... 12
- 12 Ventral chaetae usually absent in anterior segments. Sometimes with a single unpaired ventral chaeta in one or more anterior segments from segment IV. Dorsal chaetae present in the last 7-16 segments, so only from segment XXXVII or beyond
.....*Grania variochaeta*
- Ventral chaetae always present from segment IV, dorsal chaetae from segment XIX-XX, and cover at least 16 tail segments..... *Grania vikinga*
- 13 Dorsal bundles missing at least from segment II 14
- Dorsal bundles present in all anterior segments 16
- 14 Dorsal bundles only missing in segment II. Segment III is noticeably much longer than the other segments, resulting in a greater distance between the chaetal bundles of segments III and IV. Ventral bundles in segment II approximately parallel to those of segment III (fig. 6). Extremely small species, usually not longer than 2 mm
.....*Amphichaeta sannio*
- Dorsal bundles missing in segments II-IV. Segment III is not noticeably longer. Ventral bundles of segment II often pointed forwards (fig. 7). Slightly larger species, often more than 2 mm long (*Paranais*) 15
- 15 All ventral chaetae with distal tooth clearly longer than the proximal. Skin often with brown encrustations and with fine longitudinal stripes. Mainly in fresh water
..... *Paranais frici*
- Only the ventral chaetae of segment II with one clearly longer tooth, the remainder with teeth of approximately equal length. Skin without brown encrustations and without longitudinal stripes. Mainly in brackish water *Paranais litoralis*
- 16 Dorsal bundles of segment (IV-) V-XIII (-XIV) with palm-shaped chaetae (Fig. 11), the remainder bifid *Baltidrilus costatus*
- Chaetae never palm-shaped, always simple pointed or bifid 17
- 17 Ventral chaetae in anterior segments straight, with short teeth (fig. 13)
..... *Heterodrilus subtilis*
- Anterior ventral chaetae sigmoid 18
- 18 Posterior segments with simple pointed dorsal chaetae or with a tiny distal tooth 19
- Posterior segments with bifid dorsal chaetae. Distal tooth clearly developed.....21
- 19 Chaetal bundles in posterior segments with at most 1-2 chaetae per bundle. Longer species, over 7-8 mm. Adult specimens without (highly) modified penial chaetae in segment XI. Atria (in segment XI) poorly or not visible (from external view).....20
- Chaetal bundles in posterior segments with four or more chaetae per bundle. Small species, not much longer than 4 mm. Adult specimens with 10-22 simple pointed penial

	chaetae in segment XI. Highly enlarged atria in segment XI (fig. 43)	
 <i>Thalassodrilus prostatus</i> *	
20	Chaetae in posterior segments thin with a reduced proximal tooth, making the chaetae look simple pointed in most views. Smaller, thin species with clearly narrowed tail after the clitellum (diameter <400 µm)	<i>Tubificoides heterochaetus</i>
-	Chaetae in posterior segments not remarkably thin, sometimes with a small distal tooth. Larger, thick species (diameter >500 µm). Tail not narrowed after the clitellum (fig. 32)	<i>Clitellio arenarius</i>
21	A pair of long chitinous penis sheaths in segment XI, which are often more than 4 times longer than the width and usually longer than 300 µm (Figure 9). Mainly in fresh water	<i>Limnodrilus</i>
	For the distinction between the different species of <i>Limnodrilus</i> , see van Haaren & Soors (2013).	
-	If chitinous penis sheaths present in segment XI, then no more than 4 x as long as wide and less than 200 µm long (Figure 10)	22
22	Modified genital chaetae in one or more segments IX-XII	23
-	No modified genital chaetae in segment X or XI	30
23	Modified genital chaetae in segments IX, X and / or XII. No modified chaetae in segment XI	24
-	Modified genital chaetae at least in segment XI (penial chaetae); in one species, also modified spermathecal chaetae in segment X	25
24	Spermathecal chaetae in segment X in the shape of a thin needle with a longitudinal groove in the distal part and bent proximally (Fig. 36). Head elongated and slightly pointed (Fig. 35). Thin species: 200-300 µm. North Sea	<i>Limnodriloides scandinavicus</i>
-	Spermathecal chaetae in one or more segments of segment IX, X or XII with a long distal tooth and a bifid proximal tooth (fig. 12). Head short and blunt. Large, thick species > 400 µm. Rhine delta	<i>Isochaetides michaelsoni</i>
25	Two types of penial chaetae (in segment XI), including strongly enlarged bifurcated chaetae (Fig. 14)	<i>Adelodrilus pusillus</i> *
-	One type of penial chaetae in segment XI, no strongly enlarged forked chaetae (Fig. 15)	26
26	Two straight, thick (9-13 µm), sword-shaped penial chaetae with a broad base and narrower rounded ends. Spermathecal chaetae (in segment X) modified to thin bifid chaetae Blunt, round head	<i>Phallodrilus parthenopaeus</i>
-	Three or more thinner (1.5-3 µm) penial chaetae, spermathecal chaetae (in segment X) unmodified	27
27	4-6 penial chaetae long (80-90 µm) and straight, only the tip hook-shaped. Reduced salinity	<i>Spiridion insigne</i> *
-	4-15 penial chaetae short (25-55 µm), with straight to hook-shaped tip. In full salinity, North Sea	28
28	(3-) 4-5 chaetae in anterior and posterior segments. 5-7 penial chaetae with slightly curved tips	<i>Thalassodrilus klarae</i>
-	2-3 (-4) chaetae in anterior bundles and 2 chaetae in posterior bundles. Penial chaetae with straight or hook-shaped tips	29
29	(6-) 7-9 (-15) relatively small, short penial chaetae (25-50 µm) with straight tips. Segment XI without bulges	<i>Pectinodrilus rectisetosus</i>
-	4-9 Penial chaetae, distally curved, hook-shaped. Segment XI with a pair of short bulges (fig. 42)	<i>Pirodrilus minutus</i>
30	Penis sheath (in segment XI) present (<i>Tubificoides</i>)	31
-	Penis sheath absent	33

- 31 Posterior segments are relatively long, about 5 times as long as wide, with one chaeta per bundle *Tubificoides brownae*
- Posterior segments short, often no more than twice as long as wide and with two chaetae per bundle.....32
- 32 Penis sheath short and straight, less than about 100 µm (fig. 17) *Tubificoides pseudogaster*
- Penis sheath curved, up to 140 µm long (fig. 18)..... *Tubificoides diazi*
- 33 Chaetae in anterior segments bifid, the distal tooth shorter and thinner.....34
- Chaetae in anterior segments with approximately equal teeth or the distal tooth longer35
- 34 Small species (length <3.5 mm). All chaetae bifid with shorter distal tooth. Spermatheca ends with a single pore dorsally in segment X *Akteredilus monospermathecus* *
- Large species (length >15 mm). Chaetae in segment II simple pointed, bifid in the other segments. Spermatheca ventral in segment X *Monopylephorus limosus*
- 35 Anterior chaetae with a slightly longer distal tooth, posterior chaetae with a shorter distal tooth or simple pointed *Monopylephorus rubroniveus*
- All chaetae normally bifid. Penis not chitinous, but with striking granular thickening *Tubifex blanchardi*

Species description

In particular, the species of reduced and full salinity waters (ecotopes 3 and 4) are discussed in more detail below. For three brackish species (ecotope 2), namely *Monopylephorus irroratus*, *Nais elinguis* and *Paranais litoralis*, recognition, ecology and distribution are briefly discussed. For more information regarding these and other species of ecotope 1 and 2, see Van Haaren & Soors (2013).

Family Enchytraeidae

Genus *Grania* – *zanddraadjes* (=sandthreads)

The genus *Grania* can be easily recognized by the habitus in combination with the unique chaetae. *Grania* looks like a nematode due to the thread-thin appearance (fig. 25), but in contrast to the last group it has segments and also chaetae. Furthermore, nematodes almost always have a pointed, almost thread-like appendage. This is always missing in *Grania*. The chaetae of *Grania* resemble hockey sticks, a strongly curved and sometimes widened base and a thick straight distal part protruding from the body (fig. 23-24). Where in many oligochaetes two or more chaetae per bundle are present, this is reduced in *Grania* to only one chaeta per bundle. Chaetae are missing in many segments. If present, one pair of chaetae is ventrally positioned and one pair laterally. The lateral bundles are called dorsal bundles for convenience here, according to the terminology in the other worm families. The anterior segments lack dorsal chaetae and, depending on the species, sometimes the ventral chaetae. In the posterior segments, ventral chaetae are always present, at least from segment XIX; dorsal chaetae are, depending on the species, present in a variable number of segments. Thus there are 0-4 chaetae per segment. In general, you can already distinguish *Grania* species on the basis of the presence or absence of the ventral and dorsal chaetae in each segment (Fig. 4, 19). Because the septa (inner walls between the segments) in *Grania* are not well developed, the segment number is difficult to determine. However, in Rose Bengal stained individuals (which is customary in benthic research) the pharyngeal glands are stained pink. These pharyngeal glands are always located in segments IV-VI, so that the location of the anterior chaetae can be determined on the basis of these glands (fig. 20-22).

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From northwest Europe the following species are described:

- *G. postclitellochaeta*, *G. ovitheca* and *G. occulta* without dorsal chaetae,
- *G. variochaeta* with dorsal chaetae in the last 7-16 segments and possibly unpaired chaetae in a single anterior segment,
- *G. maricola* with ventral chaetae from VI and dorsal chaetae from XXIII-XXIV,
- *G. pusilla* Erséus, 1974 with ventral chaetae from V-VI and dorsal chaetae from XVIII-XXVI,
- *G. vikinga*, *G. roscoffensis* Lasserre, 1967 and *G. mira* Locke & Coates, 1998 with ventral chaetae from segment IV and dorsal chaetae starting around segment XIX. For distinguishing these three species see *G. vikinga*. Furthermore, Rota & Erséus (2003) have described a number of species from the Atlantic coast, which are not discussed here.

Of the aforementioned species, only *G. postclitellochaeta* agg., *G. vikinga*, *G. variochaeta* and *G. maricola* are known from the Netherlands.

The genus *Grania* has a typical interstitial way of life and occurs all over the world in the sand of the seabed (De Wit 2010). Only a few species can also be found in silty conditions, including *G. pusilla* in western Sweden.

Grania maricola – Groot zanddraadje

New for the Netherlands

Cleaver bank N54°15'18 "E3°14'57", 4.vii.2015, n = 1; N54°12'43 "E3°3'29", 3.vii.2015, n = 1.

Diagnostics *Grania maricola* is a strikingly large species, which is almost twice as long and thick as most other *Grania* species. It is described as 14-20 mm long and 0.21-0.28 mm thick, while virtually all other species do not become much longer than about 8 mm and thinner than about 0.15 mm. Only material from *G. roscoffensis* (a species also found in Europe) from Hawaii, can become as large as *G. maricola*. Furthermore, the ventral chaetae start in segment VI in *G. maricola* and the dorsal chaetae in segment XXIII-XXIV. According to the description, this species would consist of 61-64 segments, more than any other species. Although *G. vikinga* usually consist of 43-56 segments, this species can also consist of 72 segments. However, the thickness of *G. vikinga* always remains less than 0.14 mm. Both individuals of *G. maricola* from the Cleaver Bank were 14-15 mm long, had a diameter of 0.23-0.25 mm, consisted of 57-61 segments and the dorsal chaetae started in segment XIII. The length of the chaetae are not described, but they are remarkably much longer in the Dutch material than in other species. The posterior chaetae in *G. maricola* are 110-130 µm long, while those of *G. vikinga*, *G. postclitellochaeta* and *G. variochaeta* are about 50 µm long with a maximum of 80 µm.

Ecology The type material of *G. maricola* from Ireland was collected at a depth of 43 meters. The individuals from Cleaver Bank were collected at a depth of 41.5-44.1 m in sediment consisting mainly of coarse sand, but also with some pebbles and large stones. There was hardly any shell material or silt present. The accompanying fauna consisted in part of the oligochaetes *G. postclitellochaeta* agg. and *G. vikinga*, the polychaetes *Aonides paucibranchiata* Southern, 1914, *Notomastus latericeus* Sars, 1851, *Pisione remota* (Southern, 1914), *Syllis cornuta* Rathke, 1843, the mud shrimp *Upogebia deltaura* (Leach, 1815) and the sea urchin *Echinocyamus pusillus* (OF Müller, 1776). Furthermore, the lancet *Branchiostoma lanceolatum* (Pallas, 1774) also appears here. On the Norwegian west coast, it occurs in subtidal coarse sediments and seems to be limited to shell substrata (Erséus 1976).

Distribution *Grania maricola* was originally described by Southern (1913), based on material from Ireland. It was the first *Grania* that was described and thus the description of the genus

is based on this species. *G. maricola* is also known from Sweden (Schr. Med P. de Wit) and from the Tyrrhenian Sea (Bonomi & Erséus 1984). GBIF (2015) provides observations from Sweden, Norway, Ireland, the Shetland Islands and France. From the Netherlands, the species is only known for the time being from the Cleaver Bank (fig 56), but it can be expected that this species is more widely distributed in (coarse) sandy substrata.

Grania postclitellochaeta agg.- *naakt zanddraadje*

Incl. *Grania postclitellochaeta*, *G. ovitheca*, *G. occulta*.

Coastal zone Sand engine: AC 75,69-456,651, 12.x.2010, n = 8; Idem, 29.viii.2012, n = 5; AC 70,075-450,211, 13.x.2010, n = 6; AC 72,124-452,142, 14.x.2010, n = 1; AC 75,253-455,518, viii.2013, n = 1; AC 75,469-456,651, viii.2013, n = 15; AC 75,123-455,630, viii.2013, n = 1; AC 75,179-456,899, viii.2013, n = 2. **Offshore** N53°18'0" E04°42'30", 9.iv.2015, n = 3; N53°22'00" E4°49'59", 9.iv.2015, n = 3. **Cleaver bank** N54°15'54" E3°17'42", 4.vii.2015, n = 13; N54°15'18" E3°14'57", 4.vii.2015, n = 17; N54°9'37" E3°15'0,9", 2.vii.2015, n = 1; N54°7'33" E3°10'47", 2.vii.2015, n = 8; N54°6'13" E3°15'0,1", 2.vii.2015, n = 13; N54°3'48" E3°14'57", 2.vii.2015, n = 1; N54°4'32" E3°10'49", 2.vii.2015, n = 5; N54°0'45" E3°13'32", 3.vii.2015, n = 4; N53°57'28" E3°10'47", 3.vii.2015, n = 7; N54°7'1" E3°9'24", 2.vii.2015, n = 6; N54°7'7" E3°7'9", 2.vii.2015, n = 1; N53°52'52" E2°59'18", 1.vii.2015, n = 4; N53°59'45" E2°56'30", 2.vii.2015, n = 3; N54°2'24" E2°56'5", 2.vii.2015, n = 5; N54°0'52" E3°7'13", 30.vi.2015, n = 3; N54°3'19" E3°9'25", 30.vi.2015, n = 2; N54°5'48" E2°51'13", 3.vii.2015, n = 1; N53°52'53" E3°0'42", 1.vii.2015, n = 13; N54°4'37" E3°9'25", 2.vii.2015, n = 1; N54°5'25" E3°7'7", 2.vii.2015, n = 3; N53°55'7" E3°13'32", 3.vii.2015, n = 11; N54°3'49" E2°57'11", 2.vii.2015, n = 6; N53°58'27" E3°2'10", 30.vi.2015, n = 13; N53°58'42" E3°3'32", 30.vi.2015, n = 7; N53°58'59" E3°4'56", 30.vi.2015, n = 4.

Diagnostics In 1935 Knöllner described *Grania postclitellochaeta* (as *Michaelsena postclitellochaeta*) as a species without dorsal chaetae and only ventral chaetae behind the clitellum. The abdomen therefore always has one thick chaeta per bundle (so two per segment) and only ventrally. It took a long time before two other species were described with the same characteristics, *G. ovitheca* and *G. occulta* from the Skagerrak. On the basis of a few subtle morphological differences and genetic research, it could be established that it was in fact three different species. The last two species can only be genetically separated with certainty (De Wit & Erséus 2010). *G. postclitellochaeta* is distinguishable from *G. ovitheca* / *occulta*, based on the shape of a number of internal glandular structures and subtle differences of the genitals, but this is not useful for routine identification. It is more practical to consider *G. postclitellochaeta*, *G. ovitheca* and *G. occulta* as a complex of species without dorsal chaetae and ventral chaetae only after segment XIII and for this purpose *Grania postclitellochaeta* agg. is introduced. If we mean *Grania postclitellochaeta* as a separate species, we use *Grania postclitellochaeta* s. str. (*sensu stricto*). Which of the three species occur in the Netherlands is not yet known. The morphological differences of the individual species are subtle and require further study. Moreover, no genetic research has yet been done on Dutch material. *Grania postclitellochaeta* agg., like *G. vikinga* and *G. variochaeta*, is a small, thin worm that does not grow thicker than 0.15 mm and usually not much longer than 8 mm (fig. 21). In contrast, *G. postclitellochaeta* agg. chaetae have a thicker hook than both other species, which are more or less L-shaped (figs. 23, 24, 26).

Ecology *Grania postclitellochaeta* s. str. is one of the few euryhaline *Grania* species, with a salinity range of 11-35 ‰ (Rota & Erséus 2003). Other *Grania* species from brackish waters (meso- to polyhalien) are two estuarine species from Tasmania (Rota & Erséus 2000). *Grania postclitellochaeta* s. str. is known from intertidal and subtidal coarse sandy sediments up to a depth of 100 m (Rota & Erséus 2003). *Grania occulta* and *G. ovitheca* are for the time being limited to marine habitats. The type material of *G. occulta* was collected at a depth of 10-25

m in shell sand with some mud. *Grania ovitheca* / *occulta* occurs in sublittoral (shell) sand at a depth of 15-173 m (Rota & Erséus 2003). In the Netherlands, *G. postclitellochaeta* agg. is found in the shallow littoral of the Sand engine and to a depth of 47 m at the Cleaver Bank. In the Sand Engine the species was found with, among others, the polychaetes *Microphthalmus similis* Bobretzky, 1870 and *Spio martinensis* Mesnil, 1896 and the American jackknife clam *Ensis directus* (Conrad, 1843). On the Cleaver Bank, it was found together with the polychaetes *Aonides paucibranchiata*, *Notomastus latericeus*, *Syllis cornuta*, *Chone infundibuliformis* Krøyer, 1856 and *Pholoe baltica* Örsted, 1843, the sea urchin *Echinocyamus pusillus* and the lancet *Branchiostoma lanceolatum*. The oligochaetes *G. vikinga* and *P. minutus* have also been found at a number of sites.

Distribution This species group is known from the Netherlands from the Sand engine, a sand replenishment project off the coast of The Hague, one offshore location just north of Texel and the Cleaver Bank (fig.57). It is not unlikely to suggest that the observations relate to at least two different species. Possibly the observations of the Sand Engine relate to *G. postclitellochaeta* s. str. The observations of the offshore location and the Cleaver Bank can not yet be assigned to a species. *Grania postclitellochaeta* s. str. is further reported from the Atlantic and Mediterranean coasts of France, Iceland, the Baltic Sea, the west coast of Sweden, the North Sea (Belgium) and the Norwegian Sea to almost 70°N (Lasserre 1966, Vandepitte et al. 2010, Rota & Erséus 2003). The reports of *Hemigrania postclitellochaeta* from the US East Coast and the Gulf of Mexico (GBIF 2015, Lasserre 1971) may relate to another *Grania* species. The two other species of this aggregate, *G. ovitheca* and *G. occulta*, are known from the west coast of Sweden. De Wit & Erséus (2010) suggest that *G. occulta* is possibly a more southerly species and that in Scandinavia there is an overlap with *G. ovitheca*. This is a special note since Rota & Erséus (2003) reported that they collected *G. ovitheca* (and *G. postclitellochaeta*) in the southern North Sea off the Belgian coast. It is possible that the Belgian observations of *G. ovitheca* therefore refer to *G. occulta*, a species that was only described in 2010. The type material of *G. occulta* originates from the west coast of Sweden, but possibly the species is more widely distributed. *Grania ovitheca* / *occulta* is known from Sweden, Norway, Belgium, Italy and Morocco (Rota & Erséus 2003, Bonomi & Erséus 1984).

Grania variochaeta - variable sand wire

New for the Netherlands

Cleaver bank N54°9'22 "E3°7'9", 2.vii.2015, n = 1; N53°55'7 "E3°13'32", 3.vii.2015, n = 7.

Diagnostics *Grania variochaeta* can be confused with *G. vikinga* because of the mosaic pattern of the clitellum and the presence of posterior dorsal chaetae. According to the original description of *G. variochaeta*, the last 8-10 tail segments have dorsal chaetae and the anterior segments may contain a variable number of chaetae, often just an unpaired chaeta in one or more segments. In the Dutch material from the Cleaver Bank, the presence of the chaetae was very variable (Table 2). The individuals consisted of 51-57 segments and the dorsal chaetae were present in the last 7-16 segments and here too few chaetae could be missing. The ventral chaetae started posteriorly from segment XIII-XVII with occasionally segments without chaetae. Only in three individuals, were anterior ventral chaetae found in segment IV (unpaired), segments VIII and IX (unpaired) and segment XI (paired). In *Grania vikinga*, the dorsal chaetae start at segment XIX or XX, leaving at least 16 tail segments with dorsal chaetae, and paired ventral chaetae are always present from segment IV. Furthermore, the proximal part of the chaetae in *G. variochaeta* is not strongly thickened and has more or less an L-shape, somewhat similar to that of *G. vikinga*. The posterior chaetae of *G. postclitellochaeta*, however, have a strongly thickened foot.

Ecology Like *G. maricola* and *G. postclitellochaeta*, this species is typical of shell / sand sediments. At both locations of the Cleaver Bank, it was found together with *G. postclitellochaeta* agg. or *G. vikinga* at a depth of 40.8-41.1 m. Also, Erséus (1976) found *G. variochaeta* and *G. postclitellochaeta* agg. together in some deeper, sandy, silty or even clayey sediments, while *G. maricola* was more limited to pure shell sediments. *Grania variochaeta* is known from depths of 8-260 m (Erséus 1976) and occurs in subtidal, heterogeneous sand substrata (Rota & Erséus 2003). At the locations on the Cleaver Bank, the accompanying fauna differs. Here, among others, the polychaetes *Pisione remota*, *Chone infundibuliformis* and the sea urchin *Echinocyamus pusillus* were found.

Distribution *Grania variochaeta* is known from France (Brittany) (De Wit & Erséus 2010), the west coast of Norway and Sweden (Erséus 1976) and the Moroccan coast (Casablanca): (Rota & Erséus 2003). In the Netherlands the species is known only from two locations on the Cleaver Bank (fig.58).

Grania vikinga – vikingzanddraadje

Offshore N53°57'14" E6 °18'35", 17.iii.2010, n = 1 (Verduin et al. 2012). **Cleaver Bank** N54°15'18" E3°14'57", 4.vii.2015, n = 2; N54°9'37" E3°15'0,9", 2.vii.2015, n = 1; N54°7'33" E3°10'47", 2.vii.2015, n = 4; N54°9'22" E3°7'9", 2.vii.2015, n = 6; N53°57'28" E3°10'47", 3.vii.2015, n = 1; N54°7'1" E3°9'24", 2.vii.2015, n = 1; N53°59'45" E2°56'30", 2.vii.2015, n = 1; N54°2'24" E2°56'5", 2.vii.2015, n = 1; N54°3'49" E2°57'11", 2.vii.2015, n = 2; N53°58'59" E3°4'56", 30.vi.2015, n = 3.

Diagnostics *Grania vikinga* is, like *G. postclitellochaeta* agg. and *G. variochaeta*, a fairly small, thin species. It measures 5.1-8.7 mm long, is 85-140 µm in diameter and usually consists of 43-56 segments, but the individual from the single offshore site had 72 segments. The paired ventral chaetae start in segment IV (fig. 22) and the dorsal chaetae generally start in segment XIX-XXI, but they can start sporadically somewhat further (segment XXIX). The ventral chaetae gradually become longer towards the rear, in the anterior segments they are 30-38 µm long and reach up to 52 µm in the posterior segments (Rota & Erséus (2003) report 60 µm as maximum) (fig. 24, 28). *G. vikinga* also has a mosaic pattern of glands on the clitellum (fig. 27). *G. variochaeta* and *G. maricola* also have this to a greater or lesser extent. Unlike *G. postclitellochaeta* agg., *G. vikinga* does have chaetae in the anterior segments. The only species that looks a bit like it is *G. variochaeta*, because this species also has dorsal chaetae in the tail segments. *Grania variochaeta*, however, has no paired anterior ventral chaetae and the anterior chaetae are at most limited to a few unpaired ventral chaetae (Fig. 4). The dorsal chaetae also start much further in this species than in *G. vikinga*. In *G. variochaeta* the dorsal chaetae start from segment XXXVII or beyond, while those in *G. vikinga* usually start around segment XX. *Grania vikinga* is distinguished from *G. roscoffensis* and *G. mira*, among others, because in *G. vikinga* the chaetae gradually become longer towards the rear and the clitellum has a mosaic pattern which is dorsally interrupted.

Ecology The type material from the Skagerrak is from subtidal sand at a depth of 12-18 m. The individuals from the only offshore location were collected at approximately 50 km north of Schiermonnikoog in the German part of the North Sea, at a depth of 31 m, with moderately coarse sand (average grain size 381 µm, silt fraction (<63 µm) 0.7%). On the Cleaver Bank, it was found in coarse sandy and stony substrata without silt at a depth of 36-46 m. The only offshore location where it was found has a low diversity and it was found there together with, among others, *Lanice conchilega* (Pallas, 1766), *Nephtys cirrosa* Ehlers, 1868, *Scoloplos armiger* (Müller, 1776) and Phoronida. On the Cleaver Bank, it is often found together with the polychaetes *Aonides paucibranchiata*, *Syllis cornuta*, *Notomastus latericeus*, *Chone infundibuliformis* and *Pisione remota*, the sea urchin *Echinocyamus pusillus* and the lancelet *Branchiostoma lanceolatum*. At most locations, it also co-occured with *G. postclitellochaeta* agg. and often also with *Pirodrilus minutus*.

Distribution *Grania vikinga* was described by Rota & Erséus (2003) on the basis of material from the Skagerrak on the west coast of Sweden. No other records are not known, so these are the first from the North Sea. The species is known in the Netherlands from the Cleaver Bank and an offshore location in Germany (fig.59).

Familie Naididae

Adelodrilus pusillus

Not known from The Netherlands.

Diagnostics Within the genus, only *A. pusillus* is known from the North Sea. Erséus (1978) mentions one individual of *A. pusillus* in coarse sand, at a depth of about 20 m in the southern bight of the North Sea (N52°13'35 "E2°51'08"). This location is about 110 km west of Noordwijk, about 500 metres outside the Dutch part of the North Sea in English waters. Along the Norwegian and Swedish west coast, *A. cooki* Erséus, 1978 occurs alongside *A. pusillus*. This species is to be expected in the Dutch part of the North Sea (fig. 29). *Adelodrilus pusillus* has, in addition to some 'normal' penial chaetae, only one strongly enlarged chaeta (35-40 µm long) in segment XI (penial chaetae), while *A. cooki* has two giant chaetae: one forked (120-165 µm) and one simple pointed (85-105 µm) (fig. 14). Furthermore, the ventral bundles of segments IX and X in *A. cooki* contain 1-2 simple pointed chaetae and 0-1 normal bifid chaetae, while *A. pusillus* only has bifid chaetae.

Ecology *Adelodrilus pusillus* occurs in sublittoral (shell) sand, 13-30 m deep and *A. cooki* in sublittoral coarse sand, 17-30 m (Erséus 1978, Schmelz 2004).

Distribution Besides the observation of *A. pusillus* in the English part of the North Sea (near the Dutch border) both *Adelodrilus* species are known from the Norwegian and Swedish coasts and *A. pusillus* also from the strait of Messina (Italy) (Bonomi & Erséus 1984 , Erséus 1983).

Aktedrilus monospermathecus – zandkustworm

Reported for the Netherlands, but no evidence.

Diagnostics *Aktedrilus monospermathecus* is a small species with only small bifid chaetae. It is up to 3.5 mm long, has 25-41 segments and the clitellum is 110-230 µm thick. The bifid chaetae are 24-45 µm long; (2) 3-4 (5) chaetae per bundle in anterior segments, (1) 2-3 (4) per bundle in posterior segments. The chaetae are slightly S-shaped, with a shorter and thinner distal tooth. The typical characteristic of this genus can only be seen in sexually mature specimens. There is only one spermatheca, with the opening dorsally in segment X. This opening can also be seen fairly well at low magnification (fig. 30). The head is blunt. For a detailed description see Van Haaren & Soors (2013) and Erséus (1980b). Preserved material of *A. monospermathecus* cannot be distinguished from the closely related *A. sphaeropenis* Erséus & Kossmagk-Stephan, 1982. The latter species is described from the German island of Sylt and co-occurs with *A. monospermathecus* (Erséus & Kossmagk - Stephan 1982).

Ecology From abroad there are reports from intertidal sandy substrata in the area (Knöllner 1935, Erséus 1980b).

Distribution *Aktedrilus monospermathecus* is reported for the Netherlands (Hansson 1998), but there is no evidence or exact location. The animals are extremely small and it is therefore likely that the species is under-sampled. *Aktedrilus monospermathecus* was described from Kiel Bay in the Baltic Sea (Germany) and later redescribed by Erséus (1980b) from material collected in France (Petite-Nice, south of Arcachon) and Scotland (Loch Leven). There are also reports from the Polish coast (Kedra 2010), Hale, Lancashire (England) (Cook 1969) and the Koster area (Sweden) (Hansson 1998). Von Bülow (1957) reports several sites along

the German Baltic coast. There are also observations from Denmark (Helsingør) and Italy (Porto Cesareo) (GBIF 2015, Bonomi & Erséus 1984). Wolff & Dankers (1981) report *A. monospermathecus* from the German Wadden Sea, but this may partly relate to *A. sphaeropenis*. Material and photos of an as yet unidentified *Akteredrilus* species were collected in 2014 in the German river Weser (km 44) (Uwe Haesloop). Hrabě (1960) also reported *A. monospermathecus* from the Weser, but possibly also refers to *A. sphaeropenis*. Probably, *A. monospermathecus* occurs throughout Europe on the Atlantic, Mediterranean, Baltic and North Sea coasts.

Amphichaeta sannio – Brakke kiezelwierhapper

Wadden Sea Balgzand, Raai C, AC 122,400 to 122,649-550,150 to 551,118, 9.ix.2014, n = 1.

Diagnosics *Amphichaeta sannio* is a very small worm (length <2 mm), one of the smallest oligochaetes in the world. The genus *Amphichaeta* can be recognized by the absence of dorsal chaetal bundles in segment II and the large distance between the chaetae of segments III and IV (fig. 6, 31). Furthermore, the hairs in the dorsal bundles are missing in this species. The similar *A. leydigii* Tauber, 1879 occurs in rivers and differs from *A. sannio* in the number of chaetae per bundle (Van Haaren & Soors 2013). *Amphichaeta sannio* has four chaetae per bundle in the dorsal bundles of segment III and the ventral bundles of segment II and three chaetae per bundle in the other segments. In *A. leydigii* the numbers of chaetae per segment are different.

Ecology *Amphichaeta sannio* is probably a common species in the Netherlands in all kinds of brackish situations in estuarine areas. In order to collect this species, a much smaller sieve mesh size is required than usual, for example 200-250 µm. *Amphichaeta* is especially dominant in spring with diatom blooms, their largest food source. At the location in the Wadden Sea, *A. sannio* was found together with *Clitellio arenarius*.

Distribution There is not much known about the occurrence of *A. sannio* in the Netherlands. The species occurs at least in the brackish part of the Rhine delta and the Wadden Sea, but it is probably more widespread in other dynamic situations. Wolff & Dankers (1981) report the species from the German Wadden Sea.

Baltidrilus costatus - Kustpalmborsteltje

= *Heterochaeta costata* Claparède, 1863

Due to the large number of records, a reference list is omitted here.

Diagnosics Easily recognizable by the lack of hairs in the dorsal bundles and the presence of palm-shaped dorsal chaetae in segments IV / V to XIII / XIV (fig. 11). Because of this, this species can also be recognized when not sexually mature. At low magnification, the typical chaetae in the anterior body are not clearly visible and they may resemble *Tubificoides*, for example. Making a slide and studying it at a higher magnification may be necessary. Only the freshwater species *Psammoryctides barbatus* (Grube, 1861) has similar palm-shaped chaetae, but this species has hairs in the dorsal bundles. All other species (including *Tubificoides*) have either bifid or simple pointed chaetae.

Ecology Typical brackish water species of silty sediments in estuaries, strongly brackish inland waters and mud plains in the intertidal. It can be found in ditches, canals, lakes and rivers. It lives mainly in the oligo-mesohaline range, but can withstand large fluctuations in salinity, so that it can also be temporarily found in polyhaline water. Fresh water is not tolerated. In the Western Scheldt, *B. costatus* occurs in a low-dynamic situation in the high littoral.

Distribution This species is very common in all kinds of brackish inland waters along the entire coast, especially in shallow areas. In addition to the observations in Van Haaren &

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Soors (2013), the species was also recently observed in the Dollard and the Western Scheldt. It is already mentioned by Wolff & Dankers (1981) from the Dutch and German Wadden Sea. Other sites are, for example, the Oostvoornse meer, Eastern Scheldt (Paulinaschor) and various brackish inland waters in the provinces Zuid-Holland and Zeeland, the Verenigde Hager and Pettemerpolder and the isle of Texel.

Clitellio arenarius – Kuststekelworm

Due to the large number of records, a reference list is omitted here.

Diagnosics *Clitellio arenarius* is one of the larger marine oligochaetes and can grow to about 7 cm (fig. 32-33). This species usually has simple pointed chaetae, but often also a smaller distal tooth. In the anterior segments there are 3-4 chaetae per bundle, in the posterior segments two chaetae. This species is not papillated and has no hairs.

Ecology Usually in silty and detritus rich sediments. Missing from clean sandy sediments. At the site in the Wadden Sea, *C. arenarius* was found together with *A. sannio*.

Distribution the Eastern Scheldt, Wadden Sea coast of Texel (NIOZ port) (Van Haaren & Soors 2013) and the Balgzand. In Piscaria (2015) there are a few plausible inland observations of the former Waterschap Zeeuwse eilanden from Walcheren and Noord- and Zuid-Beveland. Reported by Wolff & Dankers (1981) from the German Wadden Sea.

Heterodrilus subtilis – Valse drietand

Offshore N52°28'27 "E3°47'02" O, 5.iii.2012, n = 10 (Verduin & Leewis 2013), and 16.iii.2015, n = 4.

Diagnosics *Heterodrilus subtilis* is one of the few representatives of this genus without tridentate chaetae (Sjölin 2007, Erséus 1981). In the anterior segments, this marine species has two straight, bifid chaetae with the distal tooth somewhat shorter than the proximal tooth (Fig. 13). These chaetae grow longer and thicker posteriorly, about 65 µm long in segment III and 85 µm from segment VI. These chaetae are so striking in shape and size that the species is relatively easy to recognize. From segment X, there is a single, straight, simple pointed chaeta with a proximal hook (70-80 µm) in the ventral bundles. A flattened blunt bump is present just before the tip of the chaetae. In dorsal bundles, there is a single, more sigmoid, simple pointed chaeta per bundle (90-100 µm) (fig. 13). No (penial) chaetae are present in segment XI. The species is relatively thin (200-240 µm) and long, making the large thick chaetae stand out fairly clearly (fig. 34). A revision of the genus *Heterodrilus* is given by Sjölin (2007) and Erséus (1981), where the original description of Pierantoni (1917) is repeated for *H. subtilis*.

Ecology Almost nothing is known about the ecology because the species is only known from the type location in the Gulf of Naples (Italy) and the single Dutch offshore location. At this site in the North Sea, it was found at a depth of 31 m in a place with little silt and medium to fine sand (grain size 269 µm, sludge fraction (<63 µm) 0.7%). In 2012, it was found together with the oligochaete *Phalodrilus parthenopaeus* and the polychaetes *Parexogene hebes* (Webster & Benedict, 1884), *Notomastus latericeus*, *Ophelia limacina* (Rathke, 1843), *Nephtys cirrosa* and the amphipod *Bathyporeia elegans* Watkin, 1938. In 2015, *P. parthenopaeus* was not found but mainly again the polychaetes *Parexogene hebes*, *Ophelia limacina*, *Nephtys cirrosa* and *Spiophanes bombyx* (Claparède, 1870) and the amphipod *Bathyporeia elegans*.

Distribution *Heterodrilus subtilis* was described by Pierantoni (1917) as *Clitellio subtilis* from the Gulf of Naples. Since then, the species has not been observed, not even during repeated sampling at the type location (Sjölin & Erséus 2001, pers.comm. C. Erséus). The record from the Tyrrhenian sea (Bonomi & Erséus 1984) appears to relate to *Heterodrilus tripartitus* Sjölin

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& Erséus 2001. Rediscovery of this species about 100 years after its description can therefore be called spectacular. *P. parthenopaeus*, also known from the Gulf of Naples, was also found in the North Sea, together with *H. subtilis* (see fig. 60). The Dutch material of *H. subtilis* is in the collection of the University of Gothenburg and will be described shortly.

Limnodriloides scandinavicus – Noorse spitsnuitworm

Oyster grounds N53°44'40 "E4°54'00" E, 16.III.2010, n = 2 (Verduin et al. 2012); N53°31'30 "E3°18'21", 15.III.2007, n = 4 (Tempelman et al. 2009a); Idem, 12.III.2009, n = 1 (Verduin et al. 2011, van Haaren & Soors 2013); Idem, 15.III.2012, n = 2 (Verduin & Leewis 2013).

Cleaver Bank N54°2'50 "E2°53'16", 2.vii.2015, n = 1; N54°10'4 "E2°51'46" O, 3.vii.2015, n = 5; N54°14'39 "E3°3'30", 3.vii.2015, n = 1; N54°5'48 "E2°51'13", 3.vii.2015, n = 17; N54°5'53 "E2°52'35", 3.vii.2015, n = 2; N53°55'8 "E2°57'56", 1.vii.2015, n = 1; N54°15'23 "E2°52'5", 3.vii.2015, n = 1.

Diagnostics This species can only be recognized with certainty if it is sexually mature. In adults, there are modified spermathecal chaetae in segment X in the form of long, thin needles that are longitudinally grooved in the distal part (fig. 36). This chaetal shape then resembles that of the freshwater species *Potamothrix heuscheri* (Hrabě, 1941). Furthermore, the species only has bifid chaetae (fig. 37), 2-3 chaetae per bundle in the anterior and two in the posterior segments. There are no hairs or papillae present. *Limnodriloides scandinavicus* can also be recognized by the elongated, almost pointed prostomium (fig. 35). Other marine Tubificid species have a rounded blunt head. However, caution should be exercised since similar species may still be found in the future.

Ecology *Limnodriloides scandinavicus* is mentioned by Erséus (1982) from intertidal and subtidal sand, to a depth of at least 45 m. The sediment consists of a mixture of fine sand, mud, shell grit, sometimes with algae or only coarse sand. The species is found along the German North Sea coast on an intertidal sand flat in *Arenicola* burrows. At the Dutch sites on the Oyster grounds, the species was found at a depth of 35-37 m with very fine sand (average grain size 123-184 µm) and a little silt (silt fraction (<63 µm) 2.7-9.9%). The accompanying fauna consisted in the four samples of mudshrimp *Callianassa subterranea* (Montagu, 1808), the heart urchin *Echinocardium cordatum* (Pennant, 1777) and the bivalve *Tellmya ferruginosa* (Montagu, 1808) and partly also with the bivalves *Abra alba* (W. Wood, 1802), *Corbula gibba* (Olivi, 1792) and *Nucula nitidosa* Winckworth, 1930 and Phoronida. At the Cleaver Bank, the species was found in coarse sandy, stony sediment at a depth of 40-49 m. Here, the species is also always found together with *C. subterranea* and with the polychaetes *Pholoe baltica* and *Lumbrineris near cingulata* sensu Oug (2012) and the bivalve *Kurtiella bidentata* (Montagu, 1803). *Arenicola* was not found in any of the samples where *L. scandinavicus* was found. *Callianassa subterranea* has been found at all locations, so there may be a relationship with the burrows of this species. The grain size of the sand does not seem important for this species.

Distribution *Limnodriloides scandinavicus* is a marine species, described on the basis of material collected on the west coast of Norway (Raunefjorden). Furthermore, Erséus (1982) reported the species along the entire Norwegian coast, the west coast of Sweden and the North Sea coast of West Germany. GBIF (2015) also mentions them from England and Ireland. *Limnodriloides scandinavicus* differs from other *Limnodriloides* species in the absence of hairs, the presence of modified spermathecal chaetae and its distribution. Besides *L. scandinavicus*, Erséus (1982, 1989, 1992) treated a number of species of *Limnodriloides* with modified spermathecal chaetae, each with their own geographical distribution: *L. winkelmanni* Michaelsen, 1914 in Southwest Africa, *L. australis* Erséus, 1982 and *L. armatus* Erséus, 1982 in the Great Barrier Reef (Australia), *L. thrushi* Erséus, 1989 in

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New Zealand, *L. barnardi* Cook, 1974 on the Pacific coast of Mexico and the northwest Atlantic coast, *L. victoriensis* Brinkhurst & Baker, 1979 from the Canadian Pacific coast and *L. janstocki* Erséus, 1992 from Tenerife. Furthermore, a multitude of *Limnodriloides* species have been described without modified spermathecal chaetae. In the Netherlands, *L. scandinavicus* is only known from the Cleaver Bank and the outermost edge of the Oyster Grounds (Fig. 61).

Monopylephorus irroratus - spiraalhaarmelkworm

Coastal zone Hollandse IJssel near Moordrecht Oost, AC 106.5-445.1, 31.v.2000, n = 2; Idem, AC 106.5-445.1, 29.v.2002, n = 8 (Van Haaren 2002).

Diagnostics This species is fairly easy to recognize, even if not fully grown. The hairs in the dorsal bundles are spirally twisted distally and thus get a 'corkscrew' shape. This hair shape is unique and can be observed better at low magnification than under a cover glass at higher magnifications. See further Van Haaren & Soors (2013).

Ecology *Monopylephorus irroratus* is a species of estuarine waters, but it is also known from the freshwater tidal area of the Hollandse IJssel. Apparently the species can temporarily tolerate strong fluctuations in salinity.

Distribution The species was observed in the Hollandse IJssel near Moordrecht-Oost (31.v.2000, 29.v.2002). It has also been reported from the Ems-Dollard estuary (Ysebaert et al. 1998). The species is also known almost exclusively from Europe (France, Germany, Belgium, Great Britain, and possibly Denmark) and also from Massachusetts (USA) (Van Haaren 2002, pers.comm. Uwe Haesloop).

Nais elinguis - vorktandzwemwormpje

Due to the large number of records, a reference list is omitted here.

Diagnostics This relatively small species can be recognized by the following combination of characteristics: dorsal bundles missing from segments; 2-3 hairs and 2-3 bifid needles, whose teeth are relatively long, from segment VI; all ventral chaetae (usually 4-5) bifid and with a clearly longer distal tooth. Eye pigment sometimes occurs on the head (fig. 5).

Ecology *Nais elinguis* is found in brackish inland waterbodies such as ditches, shallow lakes, canals and can be expected in intertidal area on mudflats. It also occurs in all kinds of stream systems. It does not occur in the coastal zone or full salinity (North Sea).

Distribution This species is very common in the Netherlands in all kinds of ion-rich situations in the coastal region such as Lake Oostvoorne and various small, brackish, inland waters in Zeeland and Zuid-Holland provinces. The species also occurs in all kinds of streams on Pleistocene sandy sediments. Wolff & Dankers (1981) also report the species from the Dutch and German Wadden Sea.

Paranais litoralis – Glad slikwormpje

Due to the large number of records, a reference list is omitted here.

Diagnostics Dorsal bundles missing from segments II-IV in this relatively small species, and only bifid chaetae are present from segment V (fig. 7). Ventral bundles are present from segment II, with bifid chaetae. The ventral chaetae in the first chaetiger (segment II) are usually pointed forward and contain the most chaetae per bundle (5-6). More posteriorly, the number of chaetae per bundle is gradually reduced, to 2-3 chaetae in posterior segments. In anterior segments, the distal tooth is distinctly longer than the proximal. More to the rear, the teeth are equal.

Ecology Achieves the highest densities in estuaries and strongly brackish inland waters in

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the mesohaline range. It has no particular sediment-type preferences and can be found on both mineral and silt sediments and also on filamentous algae. At the location in the Western Scheldt, it was found in a low energy situation on the upper shore.

Distribution Western- and Eastern Scheldt, Lake Oostvoorne and various small and large brackish inland waters in Zeeland, Zuid-Holland, Noord Holland (including Texel, Noordzeekanaal (Zuiderpolder)), Groningen and Friesland provinces. Further reported from the Eems-Dollard estuary (Ysebaert et al. 1998) and the Dutch and German Wadden Sea (Wolff & Dankers 1981).

Pectinodrilus rectisetosus

New for the Netherlands

Offshore N53°18'0 "E04°42'29", 9.iv.2015, n = 1.

Diagnostics In principle, truly marine oligochaetes can only be properly identified if they are sexually mature. The only Dutch specimen of this species is sexually mature. The anterior segments have three bifid chaetae per bundle; from segment VII or further back, this is reduced to two bifid chaetae per bundle. The distal tooth is thinner and slightly shorter than the proximal tooth in all chaetae. The anterior chaetae are generally thinner than the posterior chaetae (after the clitellum), but they are all equally long (55-62 µm). At the base of the proximal tooth is a kind of thin pleat which connects the proximal tooth to the shaft of the chaetae. This pleat, also known as the subdental ligament (fig. 40), would be typical for all representatives of the *P. rectisetosus* complex (Erséus 1988), but it has also been established in other Dutch species (*P. minutus*, *P. parthenopaeus*, *T. klarae*). From this complex, only *P. rectisetosus* appears in our faunal area. In other marine oligochaetes, either this subdental ligament is absent or limited to the posterior segments (see, e.g. *Phalodrilus parthenopaeus*).

Furthermore, the only Dutch specimen showed a group of five modified penial chaetae on the left side of segment X and a group of six modified penial chaetae on the right side of segment XI. These penial chaetae were small, thin and straight with simple tips. To see this, a magnification of 1000x is necessary. Within this species it is known that there can be 4-15 modified penial chaetae per bundle, but in general there are 7-9. The penial chaetae are relatively short (25-50 µm) and thin (about 1.5 µm), clearly smaller than the normal chaetae (Fig. 15). The Dutch specimen consisted of 20 segments, was 1.8 mm long and the clitellum was 180 µm wide. The species is known to reach a length of 3.2-11.9 mm (Erséus 1988). However, part of the tail was missing from the specimen. The head has a blunt prostomium.

Ecology From abroad it has been found in shallow, (coarse) sandy, intertidal sediments (Erséus 1979b, 1984, 1988). The single Dutch specimen (offshore) was found subtidally at a depth of 28.5 m on coarse sandy sediment with lots of fine shell grit. It was found together with 3 specimens of *G. postclitellochaeta* agg., also a typical species of sandy sediments. The location has low diversity with a few specimens of the polychaetes *A. paucibranchiata*, *L. conchilega*, *N. cirrosa* and *S. bombyx* and the razor clams *Ensis directus* and *E. magnus* Schumacher, 1817.

Distribution *Pectinodrilus rectisetosus* is known from Italy (Ischia), the Atlantic coast of France (Arcachon), the Arabian Gulf (Saudi Arabia) and Hawaii. From the Netherlands, the species is currently known only from one offshore location off the coast of Texel (fig.62).

Phalodrilus parthenopaeus

Offshore N52°28'27 "E3°47'02", 5.iii.2012, n = 22 (Verduin & Leewis 2013).

Diagnostics This species has 3-5 thin bifid chaetae in the anterior and 2 (-3) in posterior segments. The posterior chaetae have a thinner distal tooth and a thick, downwardly bent

proximal tooth. There is a thin connection between the proximal tooth and the main shaft, the subdental ligament (Fig. 40). However, all chaetae are very small and therefore difficult to study, even at a magnification of 400x. This subdental ligament is also present in *P. rectisetosus*, *P. minutus* and *T. klarae*. The worms have a blunt, rounded head (fig. 38). In sexually mature specimens, there are two thick (9-13 µm), blunt, simple pointed penial chaetae in segment XI, 70-80 µm long, which are wider at the base than at the tip (fig. 39) and two pairs of modified spermathecal chaetae in X (small and with hooked bifid tips). The animals are, like many other marine oligochaetes, quite small: 3-12 mm long and 200-250 µm thick.

Ecology Little is known about the ecology of this marine species other than that it has a preference for sandy sediments. At the Dutch site, it was found at a depth of 31 m on a fine, sandy sediment with little silt (average grain size 269 µm, silt fraction (<63 µm) 0.7%). The Erséus material (1987, see below) is from coarse sand (Punta li Canneddi) and sand with a little silt (Molo Caronte). *H. subtilis* was found with this species at the same place in the North Sea. This is remarkable as these species have also been found together in the Gulf of Naples. Other accompanying fauna of this offshore location include the polychaetes *P. hebes*, *N. latericeus*, *N. cirrosa* and *O. limacina*.

Distribution *Phalldrilus parthenopaeus* has been described by Pierantoni (1902) on the basis of material collected in the Gulf of Naples at the beginning of the 20th century. The exact location and date of the type material is not known. The species has been re-described by Erséus (1980a) and Erséus (1987) mentions material of the red algae *Corallina* on the Isle of Lewis in the Hebrides (Scotland), two observations in Italy (bay at Punta li Canneddi, Northern Sardinia, 1 m deep; Molo Caronte, Sicily, 40 m from the coast, 4 m deep) and one in Ireland (Sherkin Island) (fig.41). No other observations are known, even outside Europe. In the Netherlands the species is known only from one offshore location (fig.60).

Pirodrilus minutus

New to the Netherlands

Cleaver bank N54°10'15 "E3°10'49", 2.vii.2015, n = 8; N54°9'37 "E3°15'0.9", 2.vii.2015, n = 3; N54°9'22 "E3°7'10", 2.vii.2015, n = 2; N54°7'1 "E3°9'24", 2.vii.2015, n = 1; N54°7'7 "E3°7'9" D, 2.vii.2015, n = 1; N54°3'49 "E2°57'11", 2.vii.2015, n = 2; N53°58'42 "E3°3'32" O, 30.vi.2015, n = 2; N53°58'59 "E3°4'56", 30.10.2015, n = 1; N54°12'43 "E3°3'29", 3.vii.2015, n = 2.

Diagnostics *Pirodrilus minutus* resembles many other marine oligochaetes in general appearance but differs in a number of details. It can only be recognized with certainty if it is sexually mature. In segment XI, there are two ventral, externally visible, round protrusions, the so-called pseudopenes. Between them, there are (4-) 6-9 modified penial chaetae, which are simple pointed with hooked tips (fig. 15). These penial chaetae are 45-55 µm long and 1.5-2 µm thick. The normal chaetae are bifid, with the distal tooth slightly shorter and thinner than the proximal tooth, with a subdental ligament visible at the base of the latter. In the anterior segments III-X, there are three chaetae per bundle; in the posterior segments and usually also in segment II, there are two chaetae per bundle. There are no modified spermathecal chaetae in segment X. The prostomium has approximately the same shape as in *P. parthenopaeus*. As the head is rounded so bluntly and symmetrically, the actual mouth opening is difficult to determine.

Ecology The species was described by Hrabě (1973) as *Phalldrilus minutus* from the Black Sea at a depth of 100-120 m. Subsequently it was discovered by Erséus & Kossmagk-Stephan (1983) on sandy intertidal sites on the island of Sylt and in sand from a drainage channel from a marine aquarium in Helgoland. These places apparently do not resemble

those of the Cleaver Bank, where the species occurs at subtidal (37-46 m deep), coarse sandy locations. The accompanying fauna on the Cleaver Bank consisted in all cases of mud shrimp *Upogebia deltaura*, the polychaete *N. latericeus* and the sea urchin *E. pusillus* and sometimes with the polychaetes *A. paucibranchiata*, *C. infundibuliformis* and *P. remota* and the lancet *B. lanceolatum*.

Distribution In the Netherlands, *Pirodrilus minutus* is only known from the Cleaver Bank (fig.63). Because the species is fairly common and apparently not widely distributed, it seems to be a typical species of this area. Of course it is difficult to predict its actual distribution in our region. The species probably has a similar distribution to *T. klarae*: coarse sandy subtidal sediment. Similar areas include the Borkum Stones and possibly also the area directly to the west of the Rhine-Meuse delta. The species is further known only from the Black Sea (Romania) (Hrabě 1973) and the German North Sea (Erséus & Kossmagk-Stephan 1983).

Spiridion insigne

Not known from the Netherlands.

Diagnosics Description taken from Cook (1969) and Erséus (1979a). Length 3.7 to 10 mm, diameter segment XI: 0.34 mm, anterior segments: 0.13 mm. Chaetae bifid, with distal tooth shorter and thinner than the proximal tooth, 35-45 µm long; 3-5 chaetae in anterior segments; 1-2 (sometimes 3) in posterior segments. 4-6 simple pointed, hook-shaped penial chaetae (in segment XI), 77-90 µm long. Ventral chaetae absent from segment X. Can be confused with *T. prostates*, but this species has simple pointed chaetae in the posterior segments and many more chaetae per bundle (4-7). Furthermore, *T. prostates* has a strongly thickened atrium and the (10-22) penial chaetae are difficult to see in a cavity behind the atria. In contrast, *S. insigne* does not have strongly muscular atria and the (4-6) penial chaetae are easily visible and longer (Fig. 15).

Ecology At the type locality in the Kiel Bay, it occurs in the groundwater on the beach, 50-60 cm deep in the sand. Here, it was also found together with *T. prostates* (Knöllner 1935). The species seems to show a preference for habitats with lower salinity (Erséus 1979a).

Distribution *Spiridion insigne* has been described using material from the Schilkseebucht in Kiel Bay in the German Baltic Sea. See Van Haaren & Soors (2013) for more information. The species is not yet known from the Dutch part but could be expected in large estuaries such as the Western- and Eastern Scheldt. Erséus (1979a) reports the species from the marine littoral and brackish water in Germany (Baltic, North Sea, Weser), France (Brittany) and the west coast of Scotland.

Thalassodrillus klarae

New for the Netherlands

Cleaver bank N54°2'24 "E2°56'5", 2.vii.2015, n = 1.

Diagnosics This is, like *T. prostates*, a relatively small species with a length of up to about 4 mm and at most 48 segments. There are (3-) 4-5 chaetae per bundle in both the anterior and posterior segments. Here the upper tooth (distal) is shorter than the lower one. More to the rear, the difference becomes more marked: the distal tooth becomes progressively shorter posteriorly. In sexually mature specimens, there are 5-7 modified penial chaetae per bundle (in segment XI), 45-55 µm long and approx. 3 µm thick. These are simple pointed, straight or slightly curved at the end. These penial chaetae are slightly thicker than the normal chaetae. Less well visible is the spermathecal pore, which is (as with *T. prostates*) lateroventral, between the ventral and dorsal chaetal bundles. The species also differs from many similar species because there are also 4-5 chaetae per bundle in the posterior segments. In most others, this is often reduced to one or two.

Ecology The type material from Belgium (Kwintebank) was found in the sublittoral at a depth of 15 m. The Belgian Kwintebank is an approximately 15 kilometre long sandbank with mainly medium to coarse sand and, in terms of sediment, is much like the Cleaver Bank. The single specimen from the Cleaver Bank was found at a depth of 45 m in coarse sandy sediment. The accompanying fauna at this location consisted of the oligochaetes *G. postclitellochaeta* agg., *G. vikinga*, the sea urchin *E. pusillus* and a high species diversity (24 species!) of polychaetes, including *S. cornuta*, *Glycera lapidum* Quatrefages, 1866, *A. paucibranchiata*, *Sphaerosyllis bulbosa* Southern, 1914, *Hydroides norvegica* Gunnerus, 1768, *Goniadella bobrezkii* (Annenkova, 1929) and *P. remota*, but all in low numbers. The lancelet *B. lanceolatum* has not been found here.

Distribution This species was described by Erséus as *Phalodrilus klarae* from the southern bight of the North Sea on the Belgian Kwintebank (Erséus 1987). Other observations, besides those of the Cleaver Bank (fig.64), are not known. Given its possible preference for coarse sandy sediments, the species may be limited in its distribution in the Dutch North Sea to the Cleaver Bank, the Borkum Stones and possibly also the area closest to the Rhine-Meuse delta.

Thalassodrilus prostatus

Reported for the Netherlands, but no evidence.

Diagnostics This species has (3-) 4-7 bifid chaetae in anterior and posterior segments, with the distal tooth distinctly shorter. Further back, the distal tooth becomes progressively smaller and the chaetae eventually become simple pointed. In sexually mature specimens, there are 10-22 modified penial chaetae per bundle in segment XI (fig. 44). These are straight and simple pointed, with a slightly curved tip. The penial chaetae are located in a large cavity formed by two large, strongly muscular atria (fig. 43). The modified penial chaetae lie just in front of this large cavity, so that they are poorly visible from the outside. To see this, the body must be cleared.

Ecology The species occurs from brackish to the marine littoral (meso- to polyhaline). The type material, from the Kiel Bay, was collected in beach groundwater, 45-50 cm deep in the sand (Knöllner 1935).

Distribution This species is reported from Finland (Tvärminne), the west coast of Sweden (Göteborg, Koster area), the Netherlands (without source or location) (Hansson 1998), Ireland, Norway (GBIF 2015) and Germany (Knöllner 1935 and river the Weser (2014): pers.comm. Uwe Haesloop). Wolff & Dankers (1981) report the species of the German Wadden Sea.

Tubificoides benedii – Grote kustknobbelworm

Due to the large number of records, a reference list is omitted here.

Diagnostics The body is heavily papillated, with the exception of a few head segments and the tip of the tail. The chaetae are simple pointed or have a small distal tooth and there are usually only (1) 2 chaetae per bundle. Furthermore, this species has no hairs, which separates them from *T. insularis*. *Tubificoides benedii* is the only heavily papillated oligochaete without hair chaetae.

Ecology It can be found under a large number of conditions, but reaches its highest densities in silty sediments under mesohaline conditions; see Van Haaren & Soors (2013).

Distribution Very common in all kinds of strongly brackish, small to large inland waters and also in Lake Grevelingen, Lake Veere, Western- and Eastern Scheldt, Nieuwe Waterweg, Canal through Walcheren, North Sea Canal (from km11 to Inner-IJ), Wadden Sea and Dollard estuary. Previously reported from the Western Scheldt and the Eems-Dollard estuary (Ysebaert et al. 1998). Wolff & Dankers (1981) reports the species from the Dutch and

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German Wadden Sea. Furthermore, it has recently been observed subtidally in the Voordelta, but this is probably not the ideal biotope for this species.

Tubificoides brownae - dwergkustworm

New to The Netherlands

Coastal zone Nieuwe waterweg km 1028 nabij Hoek van Holland, AC 69,379-442,281, 6.x.2014, n = 9; Veerse meer, AC 37,689-395,289, 26.viii.2013, n = 4. **Western Scheldt** AC 36,014-379,866, 24.ix.2013, n = 4; AC 56,330-385,813, 19.viii.2014, n = 3; AC 56,011-386,107, 19.viii.2014, n = 16; AC 58,023-385,145, 19.viii.2014, n = 5; AC 38,894-375,508, 17.ix.2014, n = 7; AC 39,331-376,147, 17.ix.2014, n = 5; AC 53,515-385,632, 4.ix.2014, n = 2. **Eastern Scheldt** AC 48,731-408,805, 16.ix.2014, n = 1; AC 65,626-407,167, 16.ix.2014, n = 22; AC 64,354-405,989, 16.ix.2014, n = 3; AC 66,666-393,028, 16.ix.2014, n = 1; AC 68,235-392,583, 15.ix.2014, n = 1.

Diagnostics This species can usually be easily recognized by the habitus and the chaetae, especially those on the tail. The anterior part is usually heavily swollen but narrowed just after the genital segments (XIII-XIV). As a result, the tail is extremely narrow and threadlike, with elongated segments that are approximately 5 times longer than wide (fig. 45-46). Especially in immature specimens, the anterior part is sometimes less swollen, so they can be confused with other *Tubificoides* species. In the tail segments, there is one bifid chaeta per bundle (so four per segment), with the lower (proximal) tooth clearly thicker and slightly bent back (fig. 53). In the anterior segments, there are 3-5 chaetae per bundle, which often have a slightly shorter distal tip. This species has no papillae or hairs. This combination of characteristics distinguishes it from other *Tubificoides* species. The tail segments of other *Tubificoides* species are shorter, usually only about twice as long as wide and have two chaetae per bundle. In sexually mature specimens of *T. brownae*, the penis sheath is short and tubular (approximately 50 µm long), which, by the way, tend to shrink when cleared (in levulose). *Tubificoides brownae* is relatively small compared to other *Tubificoides* species (hence its vernacular name) with which it can be found.

Ecology *Tubificoides brownae* occurs in brackish water in estuaries and can withstand organic loads. In North America the species occurs in the shallow (up to 25 m) subtidal on silty and sandy sediments. In North American tidal flats, the species showed a strong increase in periods with a high benthic chlorophyll content. The species is also susceptible to hypoxia (Gillett et al. 2007). In the Netherlands it has only been found in the autumn (Aug.-Oct.). However, observations from April-July are also known from North America. The species was found in many locations in the Netherlands together with *Streblospio benedicti* Webster, 1879.

Distribution *Tubificoides brownae* was described from material from the Indian River Bay (Coast Guard Harbor), Delaware, USA (Milligan (1996). Brinkhurst (1985) provides additional sites for this species: North America (Pacific coast: British Columbia to California, Atlantic coast, from Massachusetts to Florida, including the Gulf of Mexico), Saudi Arabia, England (Kent, Severn estuary) and the southern bight of the North Sea. Kvist et al. (2010) also gives observations from Wales (near Newport). Recently it has been established that the species also occurs in the IJzer estuary in Belgium (Van Haaren & Soors 2013) and in the Nieuwe Waterweg, Lake Veere and the Western- and Eastern Scheldt (fig.65).

Tubificoides diazi - Kromschedekustworm

Coastal zone Nieuwe waterweg at Hook of Holland km1028, AC 69,379-442,281, 24.ix.2012, n = 2; Voordelta: N51°34'00 "E3°18'59", 13.iv.2015, n = 5; Vlak van de Raan: N51°25'59 "E3°19'59", 11.v.2015, n = 16; N53°32'31 "E5°59'48", 4.iii.2009, n = 1; N52°15'36

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"E4°24'20" O, 16.iii.2015, n = 6, N51°47'26 "E3°48'47", 18.iv.2007, n = 1 (Tempelman et al 2009a), Idem 17.iv.2008, n = 8, Idem 16.iv.2009, n = 8, Idem 8.iv.2010, n = 47, Idem 24.iv.2012, n = 3, Idem 27 .v.2015, n = 17; Sand Engine: AC 67.834-448.180, 20.viii.2012, n = 5; AC 72.450-453.970, 28.viii.2012, n = 1; AC 75.179-456.899, viii. 2013, n = 2, AC 74.349-456.294, viii 2013, n = 3, AC 73.545-454.38, viii 2013, n = 1, AC 73.138-454.697, viii, 2013, n = 2, AC 70.075-450.211, viii. 2013, n = 1, AC 68,980-448,515, 26.xi.2013, n = 1, AC 67,834-448,154, viii.2013, n = 1. Veerse Meer: AC 48,892-396,099, 1.x.2013, n = 2, AC 47.486-396.621, 1.x.2013, n = 1, AC 46.202-397.226, 1.x.2013, n = 1, AC 36.494-396.631, 26.viii.2013, n = 1. **Offshore** N53°51'27 "E5°58'55", 23.iii.2015, n = 1; N53°37'29 "E6°06'24", 17.iii.2010, n = 1; N53°36'37 " E5°49'32 ", 8.iv.2015, n = 2. **Eastern Scheldt** AC 54.461-395.933, 16.ix.2014, n = 2, AC 56.139-403.271, 16.ix .2014, n = 4, **Wadden Sea** Balg Sand Raai J, AC 121,985 to 122,522-554,523 to 555,343, 10.ix.2014, n = 1; Javarugging Raai S1, AC 138.007 to 139.498-558.932 to 559.114, 25.viii.2014, n = 20.

Diagnostics This species can only be recognized when sexually mature. The penis sheath (in segment XI) is long (up to 140 µm) and curved, which is unique within this genus (fig. 48). At the base of the sheath is a small protuberance, which is usually difficult to see. The tail is not conspicuously narrowed (compare *T. brownae* and *T. heterochaetus*), has relatively short tail segments (fig. 49) and almost always has two chaetae per bundle. In the anterior part, the partition walls (septa) between the segments are well developed (fig. 47). This can be used as a characteristic, but the distinction from other *Tubificoides* species (especially *T. pseudogaster*) is rather subtle. Only *I. michaelsoni* also has clearly developed septa, but it lives in fresh water, has no penis sheath and is significantly larger. *Tubificoides diazi* differs from other *Tubificoides* species mainly in the absence of hairs, the strongly developed septa in anterior segments and the shape and length of the penis sheath. For separation from *T. pseudogaster*, see under that species. Staining with Bengal pink does not produce a pattern on the genital segment, as depicted for *T. pseudogaster* (Fig. 52).

Ecology Little is known about the ecology of *T. diazi*. In the Netherlands and Belgium it is not a true marine species, but it occurs in the intertidal area and the coastal zone. In the Netherlands the species occurs from the high littoral to the sublittoral (1-31 m). It occurs in fine and coarse sand and can tolerate some silt.

Distribution *Tubificoides diazi* was described from material collected along the coast of New Jersey (USA), on a silt-clay sediment, at a depth of 34 m (Brinkhurst & Baker 1979). In yet another paper on this genus, Brinkhurst (1986) reports other sites from North America and Canada, but also from France (Arcachon), Australia (Victoria) and Scotland (Kinneil). Kvist et al. (2010) reports the species from Wales (Oxwich, southwest coast) and the French Atlantic coast (Pouldohan Bay). Recently the species was established in the subtidal part of the estuarine estuary of the IJzer (Belgium) (pers.comm. Jan Soors). Because of this, it was a matter of time that the species would also be found in the Netherlands. It is probably not a recent introduction but is likely to have been in the Netherlands for some time. Also, there is no indication that it is a non-indigenous species. For the time being, we assume a natural spread on both sides of the Atlantic (amphi-Atlantic). The species is known with certainty from the Netherlands along virtually the entire coastal zone, both inland (Veerse Meer, Nieuwe Waterweg, Eastern Scheldt) and offshore (including Voordelta, Sand Engine, Wadden Sea area) (fig.66). Juveniles of this species have been found at a number of locations in the Western and Eastern Scheldt, with the rather characteristic clear septa in the anterior segments. It is known with certainty from the Eastern Scheldt, but is probably common in both estuaries. *Tubificoides diazi* is often found in the Netherlands together with the polychaetes *Capitella capitata* (Fabricius, 1780), *L. conchilega*, *Nephtys hombergii* Savigny in Lamarck, 1818, *N. latericeus*, *S. armiger* and *S. bombyx*.

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Tubificoides heterochaetus - langstaartkustworm

Coastal zone Nieuwe waterweg km 1028 nabij Hoek van Holland, AC 69,379-442,281, 27.x.2014, n = 4; Nieuwe waterweg km 1017 nabij Maasluis, AC 77,978-436,090, 6.x.2014, n = 10; Flakkee, Noordzijde van de Havelose weg, AC 64,902-417,538, 8.v.2006, n = 11; Idem, 2.iv.2009, n = 7 (zie ook Kvist et al. 2010); Goeree, voor Gemaal Wittebrug, AC 56,973-426,076, 1.v.2006, n = 17; Goeree, kruising Hoofdwatergang Boutweg, AC 51,289-424,856, 28.ix.2005, n = 1; Idem, 5.ix.2006, n = 2; Noordzeekanaal: km6, AC 106,573-496,483, 17.iv.2001, n = 1; km6, AC 106,579-496,505, 17.iv.2001, n = 2; km11, AC 110,768-493,83, 19.ix.2000, n = 1; Idem, 17.iv.2001, n = 7; km11, AC 110,768-493,912, 17.iv.2001, n = 1; km14, AC 113,703-493,182, 19.ix.2000, n = 2; km14, AC 113,686-493,195, 17.iv.2001, n = 2; km18, AC 117,576-492,33, 19.ix.2000, n = 1; km18, AC 117,587-492,418, 17.iv.2001, n = 1; km20, AC 119,46-491,721, 20.ix.2000, n = 2; Idem, 18.iv.2001, n = 1; km20, AC 119,459-491,748, 20.ix.2000, n = 8; Idem, 18.iv.2001, n = 1; Afrikahaven, AC 111,300-493,340, 13.ix.2002, n = 1; nvo Spaarnwoude, AC 108,800-494,500, 17.vi.2003, n = 57; Idem, 1.x.2003, n = 2; Zuiderpolder, AC 109,445-494,504, 21.ix.2004, n = 1; Oude Maas: AC 82,221-431,472, 15.iii.2001, n = 1; AC 81,612-434,011, 16.iii.2001, n = 3; AC 81,743-433,491, 16.iii.2001, n = 88; AC 82,087-432,855, 16.iii.2001, n = 190; AC 83,39-430,034, 15.iii.2001, n = 2; **Western Scheldt** Bij Bath, AC 73,484-379.164, 8.ix.2015, n = 18; AC 73,238-379.311, 8.ix.2015, n = 1; AC 73,238-379.311, 8.ix.2015, n = 4.

Diagnostics This species is very similar to *T. brownae* in habitus due to the somewhat swollen anterior and the strongly narrowed tail. However, *T. heterochaetus* has 1-2 (apparently) single-pointed, needle-shaped chaetae (fig. 50) in the tail segments, which is unique in the genus *Tubificoides*. The posterior chaetae have a small, thin proximal tooth, which makes the chaetae appear single pointed in most views. You see this proximal tooth well with chaetae that lie exactly laterally. Often these (seemingly) simple pointed tail chaetae are already clearly visible at low magnification, but sometimes a high magnification, on a slide, is necessary. In the anterior segments there are (2-) 3-6 bifid chaetae with approximately equal teeth and there are no hairs in the dorsal bundles. Juveniles have small pointed papillae almost over the entire body, which in the adults are limited to the tail. In some cases all papillae are missing. At low magnification, the papillae appear absent, but at higher magnification they are clearly present.

Ecology The species is found mainly in oligo-mesohaline parts of estuaries and inland waters, but the species can handle large fluctuations in salinity. It has been found in the Netherlands to a depth of 15.5 m.

Distribution *Tubificoides heterochaetus* was described by Michaelsen (1926) (as *Limnodrilus heterochaetus*) on the basis of material collected in northern Germany (Greifswald). Baker (1981) redescribed the species on the basis of Michaelsen's lectotypes and material from North Carolina (USA). It occurs along the German, Dutch and Belgian coastal zone (Van Haaren & Soors 2013) and along the Atlantic coast of North America, including the Gulf of Mexico (Brinkhurst & Baker 1979). So it is a typical amphi-Atlantic species, but there are also reports from the Danube delta (Milligan 1996). In the Netherlands, the species is known from the North Sea Canal (km 6 - km 20) (AquaSense 2002), Oude Maas (Van Haaren & Soors 2013), the Nieuwe Waterweg, the eastern part of the Western Scheldt and some brackish inland waters on Goeree-Overflakkee (fig.67). It occurs here from the shallow littoral to a depth of 16 m. The observations from the Ghent-Terneuzen canal from Haaren & Soors (2013) are based on a mistake. In Belgium the species is collected in the Zeeschelde (Seys et al. 1999). There are also historical observations from the former Zuiderzee (Wolff 2005, De Vos 1936), but the conditions have changed since the closure so that the IJssel and Markermeer no longer forms an appropriate biotope for this species.

Tubificoides insularis – verborgen kustknobbelworm

Not known from the Netherlands.

Diagnostics This species is very similar to the indigenous *T. benedii* but is distinguished by the presence of hairs in the dorsal bundles. Furthermore, like *T. benedii*, the species is heavily papillated with the exception of a few head and tail tip segments. In *T. insularis*, the anterior ventral bundles usually have 3-4 chaetae per bundle, while *T. benedii* usually only has two.

Ecology In England, the species is mainly found in somewhat salter conditions than the other *Tubificoides* species. It occurs here in silty sediments of estuaries and the intertidal area.

Distribution *Tubificoides insularis* is currently only known from the British North Sea coast but is probably widespread. Kvist et al. (2010) provide observations from Wales and Scotland.

Tubificoides parapectinatus - Zeeuwse kustworm

Coastal zone Grevelingen AC 51,517-419,533, 25.ix.2013, n = 5. Veerse Meer: AC 36,519-396,630, 4.iv.2013, n = 1; Idem, 26.viii.2013, n = 6; AC 35,672-397,360, 4.iv.2013, n = 1; Idem, 26.viii.2013, n = 1; AC 34,277-400,463, 24.ix.2013, n = 2; AC 33,715-399,796, 24.ix.2013, n = 1; AC 46,055-396,869, 27.viii.2013, n = 3; Kanaal door Walcheren: AC 30,173-387,059, 20.v.2003, n = 6; AC 30,251-387,348, 20.v.2003, n = 2; AC 30,934-389,200, 20.v.2003, n = 2; AC 31,186-389,914, 20.v.2003, n = 1; AC 31,389-390,427, 20.v.2003, n = 3; AC 33,387-391,859, 20.v.2003, n = 28; AC 34,208-391,758, 20.v.2003, n = 68; AC 31,817-390,952, 2.xi.2008, n = 3 (zie ook Kvist et al. 2010); AC 35,771-396,377, 20.v.2003, n = 3; AC 35,919-396,737, 20.v.2003, n = 5; AC 29,801-385,969, 20.v.2003, n = 23; AC 29,182-385,549, 21.v.2003, n = 15; **Eastern Scheldt**: AC 47,867-408,248, 17.ix.2013, n = 2.

Diagnostics *Tubificoides parapectinatus* falls within a complex of species that may only be recognizable with certainty genetically. In this group of species there are both hairs and simple pointed chaetae in the posterior dorsal bundles. In addition to *T. parapectinatus*, this is also known in Europe for *T. amplivasatus* (Erséus, 1975), *T. scoticus* Brinkhurst, 1985, *T. swirencoides* Brinkhurst, 1985 and *T. swirencowi* Jaroshenko, 1948. *Tubificoides parapectinatus* differs morphologically from the others in that the simple pointed chaetae start from segment XII / XIII, the anterior ventral bundles have on average more chaetae (usually 3-4) and the posterior ventral bundles usually have only one chaeta. The specimens from Lake Veere had two chaetae in the posterior segments, but there were no indications that it was a different species. *T. scoticus*, *T. swirencoides* and *T. swirencowi* also have papillae on the tail which are missing from *T. parapectinatus* and *T. amplivasatus*. Sometimes, however, *T. scoticus* can also be unpapillated. *Tubificoides parapectinatus* has (1-)2-5 bifid chaetae in the anterior dorsal bundles with slightly longer distal teeth and (1-) 2-3 (-4) hairs. The posterior dorsal bundles have 1-3 simple pointed chaetae and (1-) 2-3 hairs.

Ecology occurs in shallow areas of strongly brackish waters and estuaries. The Dutch sites have depths varying from 1.3 to 8.7 m. The accompanying fauna consists in most cases of the polychaets *Aphelocheata marioni* (Saint-Joseph, 1894), *Heteromastus filiformis* (Claparède, 1864), *Hediste diversicolor* (Müller, 1776), *Alitta succinea* (Leuckart, 1874), *Polydora cornuta* Bosc, 1802, *S. benedicti* and the oligochaetes *Tubificoides benedii* and *T. pseudogaster*. Furthermore, the lagoon cockle *Cerastoderma glaucum* (Bruguère, 1798) and the isopod *Cyathura carinata* (Krøyer, 1874) were common.

Distribution The species is originally known from the Pacific and Atlantic coasts of North America. In the Netherlands the species is known from Lake Grevelingen, Lake Veere

Eastern Scheldt and the Kanaal at Walcheren (fig.68). There is no indication that the species must be considered non-indigenous, but neither can this be excluded.

Tubificoides pseudogaster – gewone kustworm

Due to the large number of records, a reference list is omitted here.

Diagnosics This species has no hair chaetae or papillae and only bifid chaetae. The tail is not very narrowed behind the clitellum, in contrast to e.g. *T. brownae* and *T. heterochaetus*. *Tubificoides pseudogaster*, like *T. diazi*, has 3-5 (6) chaetae in the anterior segments and two chaetae per bundle in the posterior segments. Only sexually mature specimens can easily be distinguished from *T. diazi*, based on the penis sheath. It is short (up to 100 µm), straight and tubular, while that of *T. diazi* is longer and curved. Another difference becomes clear when stained with Rose Bengal; in *T. pseudogaster* a typical colour pattern becomes visible: the underside of the clitellum (segment XI) and the paired ventral spermathecal pores in the segment before it are strongly coloured pink and the clitellum is flattened on the underside (Fig. 52). In sexually mature *T. diazi* there is no noticeable staining visible and the clitellum is rather round in diameter. The septa (walls between segments) in the anterior segments are less clearly developed than in *T. diazi*, but this difference is rather subtle. Generally, *T. pseudogaster*, *T. diazi* and *T. brownae* are also distinguishable on the basis of the chaetae in the posterior segments (Fig. 53), but this requires some experience. The differences are listed below.

T. brownae: one chaeta per bundle, thick proximal tooth that is rather strongly bent downwards and a thin distal tooth; nodulus (bulge) in the middle of the chaetae.

T. diazi: two chaetae per bundle, distal tooth thinner and often also slightly shorter than the proximal tooth; nodulus in the middle. Chaetae on average smaller, to about 40 µm long.

T. pseudogaster: 2 (-3) chaetae per bundle, teeth of approximately the same thickness and length, sometimes distal tooth a little longer; nodulus in distal third part. Chaetae slightly larger, up to about 50 µm long.

Ecology This species mainly occurs in silty substrata in estuaries (mesohaline). In the Netherlands, the species has been found at depths ranging from 0.35-15.9 m.

pseudogaster is often found in the Netherlands together with the oligochaete *T. benedii* and the polychaetes *C. capitata*, *P. cornuta*, *S. benedicti*, *Arenicola*, *Heteromastus filiformis* and *S. armiger*.

Distribution *Tubificoides pseudogaster* is fairly common in the Netherlands, but there is a chance that old reports may relate to other *Tubificoides* species. As a result, the precise distribution in the Netherlands is not well known. *Tubificoides pseudogaster* occurs at least in the Eastern Scheldt, Kanaal at Walcheren, Noordzeekanaal (km14 and Zuiderpolder) (Van Haaren & Soors 2013), Wadden Sea, lake Grevelingen and Veere (fig.69). The species is not yet known from the Western Scheldt. The observation from the Ghent-Terneuzen canal from Haaren & Soors (2013) is based on a mistake.

Discussion

In the Netherlands, 32 species are now known from oligohaline to euhaline waters. The oligochaete records almost all relate to observations made by the author. With increasing research effort on oligochaetes, both the number of records and the number of species will increase. Particularly in euhaline waters, many more species can still be expected. This article does not pretend to be complete, but hopefully it will encourage further research.

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Summary

Oligochaete worms of brackish and marine waters in the Netherlands (Annelida: Oligochaeta).

About 32 species of oligochaete worms are known from Dutch saline waterbodies. Eight species are primarily freshwater species with a tolerance for low salinity. In oligo- to mesohaline waterbodies nine species are reported mainly from estuarine habitats. Some of them are quite rare, like three species of *Monopylephorus*. Polyhaline waterbodies are the most diverse with at least twelve species, six of them belong to the genus *Tubificoides*. Eleven species are reported from the euhaline part of the North Sea, but more studies will probably result in a longer list. A key is presented for all the treated species and a summary is given on the ecology and distribution, except for the species which are treated by van Haaren & Soors (2013). Six species are reported for the first time for the Netherlands: *Grania maricola*, *G. variochaeta*, *Pectinodrilus rectisetosus*, *Pirodrilus minutus*, *Thalassodrilus klarae* and *Tubificoides brownae*. Yet another species, *L. scandinavicus*, was already reported from Dutch Oystergrounds by van Haaren & Soors (2013), but the species appears to common at Cleaverbank as well. The very rare oligochaete species *Heterodrilus subtilis* occurs in one offshore location and is globally only known from its type-locality. A few expected species are included in this paper, as they have been reported from the Belgian, German or British North Sea: *Adelodrilus pusillus*, *Aktedrilus monospermathecus*, *Spiridion insigne* and *Tubificoides insularis*. A species-complex *Grania postclitellochaeta* aggregate (agg.) is newly introduced in order to accommodate three closely related species: *G. postclitellochaeta*, *G. occulta* and *G. ovitheca*.

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