

## Introduction to Oligochaetes

### Tim Worsfold (Unicomarine Ltd.), NMBAQC Workshop 2003

#### Oligochaetes in benthic samples

Oligochaetes are very common in benthic samples. They are found in all sediments, from terrestrial to intertidal and subtidal, marine and freshwater. It is often difficult to classify them by their habitat as they are most common in transitional environments (*e.g.* upper shore low salinity shores). A list of marine oligochaetes will, therefore, always be ambiguous. The Species Directory lists many species, including some salt tolerant freshwater taxa, but it is often best to check lists of freshwater species as well for estuarine samples. Some terrestrial earthworms are also found in damp riverbanks and may be found in upper shore cores from the upper reaches of estuaries. Oligochaetes are most common in estuarine mud, where they often dominate the fauna. A good account of oligochaete ecology is given by Giere & Pfannkuche (1982).

#### *Oligochaete identification policy*

Records of oligochaetes are important to distinguish between different depth and, especially, salinity, regimes, particularly in estuarine waters. Physical conditions can often be estimated from oligochaete species only and they are often important indicator species. There have been studies on the importance of oligochaetes in environmental quality in fresh waters (Lafont *et al.*, 1991; Milbrink, 1983; Verdonschot, 1989).

Oligochaete identification can be troublesome and there is much variation between laboratories in the degree of accuracy to which oligochaetes are identified. Many identify to species where possible while there are those who simply state "Oligochaeta indet." (often having tendered for the same project specifications!). The recent sorting methods and oligochaete questionnaires, distributed to NMBAQC Scheme participants highlighted such discrepancies. Unfortunately, any co-ordinated policy is still a long way off and in the meantime we can only develop an in-house procedure. We realise that the situation is not ideal and would welcome any discussion through the NMBAQC Committee that would arrive at a common policy. We welcome work by participants towards greater accuracy and look forward to hearing of any developments that are made towards rapid identification methods or co-ordination of NMBAQC policy. Our current recommendation is summarised below.

Identification of oligochaete families is fairly easy, with experience. Naid s can be identified to genus and a few of the more distinctive species separated. Enchytraeids (a large family) are generally left at the family level, with some of the more distinctive genera (*e.g.* *Grania*) distinguished. Tubificids are identified to species where possible but species level identification is restricted to the relatively small proportion of the fauna that is regularly found in estuarine samples (and included in our identification table). Obscure taxa are generally left at the family or genus level. In addition, all *Tubificoides* spp. that lack papillations and have only bifid chaetae are recorded as *Tubificoides pseudogaster* agg. That would include the following spp.: *T. brownae*, *T. crenacoleus*, *T. diazi* and *T. pseudogaster*. In the NMBAQC Scheme, any identifications we receive of any of the species in the complex will be given

*Tubificoides pseudogaster* agg. as the Unicomarine identification, with the benefit of doubt given as regards scoring.

## Morphology

This guide is concerned mainly with the practical identification of commonly occurring oligochaetes from benthic samples, with an emphasis on gross morphology. The simple external form of oligochaetes makes recognition of features relatively easy but means that there is little to distinguish species and subtle differences must often be employed. Nonetheless, it is possible to recognise most of the common taxa under a stereo-microscope, with confirmation of a proportion of specimens through examination of the chaetae under a compound microscope. No discussion of dissection or clearing is given here. Standard published texts must be consulted for a full understanding of anatomy. It is likely that certain taxa would be missed by using external features alone but a large amount of environmental information can be obtained from following the identification levels given here. It is important to bear in mind the limitations of such an approach, however, and to check the chaetae of a significant proportion of the worms.

## Body form

Oligochaetes can be partially separated into recognisable types in the dish on general features before any attempt is made at identification. Some useful features are listed below. It is often useful to look at the worms with both direct lighting and “back-light”.

- **The size and shape of the worm:** Useful features include the overall width of the worm, the length relative to the width and whether it is particularly fat anteriorly and slender posteriorly.
- **Prostomium shape:** Important head features include the size relative to the main body, whether the tip of the prostomium is pointed or rounded and whether a constriction separates the head from the main body. It is often useful to examine the head from both lateral and dorsal views. There may be some variation within species, however, especially between localities.
- **Papillations:** Small cuticular papillae are found on the body wall of some species, giving the worm a matt appearance under low power. With experience, papillations are easy to discern with a dissecting microscope. The size, density and shape of papillations are useful features and some species have them starting at a particular segment, behind a naked anterior. However, there may be variation in the degree of papillation between tubificids of the same species.
- **Other body wall features:** Useful additional features include colour, texture and degree of transparency. Some species have secondary annulation to each segment. Others have sub-dermal particles, giving a striped appearance, which could be confused with papillations.

## Chaetal Morphology

Chaetae (or setae) can be easily seen using a compound microscope and certain types can be seen under a stereomicroscope at high power with “back light”. Temporary mounts of uncleared worms in alcohol are usually effective and need not damage the specimens. Several worms can be mounted on the same slide. Note must be made of the orientation of the front of each worm, for which the position of the mouth can be

used. In the posterior, the presence of modified chaetae (other than bifids or simple pointed) often characterises dorsal bundles. In most tubificids and naids all ventral chaetae are bifid. The first segment with chaetae is usually segment II.

Typically, each segment has four chaetal bundles: two dorsal and two ventral. The dorsal bundles are usually further apart than the ventrals so that they appear lateral (Figure 1) and certain bundles may be missing from some segments in some taxa, providing an identification feature. Oligochaete chaetae can be classified into several standard types, summarised below. Chaetal arrangement and types vary little within species, while providing a useful identification feature. It is important to note the chaetal types present, the details of their structure, the number of chaetae per bundle and the positions of the chaetae on the worm (whether they are in the dorsal or ventral bundles and which segments).

- **Bifid chaetae:** Nearly all tubificids and naids have some bifid chaetae. They are typically slightly curved with two terminal teeth, the relative length and thickness of which can be significant. The angle at which a chaeta is laying on the slide can effect the apparent relative sizes of the teeth, however, and some bifid chaetae may have a reduced lower tooth, giving the appearance of a simple pointed chaeta.
- **Tridentate chaetae:** A few tubificid species have chaetae with three terminal teeth. Few have been recorded from British waters.
- **Pectinate chaetae:** Some tubificids, mainly freshwater species, have bifid setae with a series of fine intermediate teeth between the main teeth. They are generally found in the dorsal bundles only and often only anteriorly. They may be difficult to distinguish from bifids at low power.
- **Palmate chaetae:** Palmate chaetae can be regarded as extreme pectinate chaetae and are similarly mainly found in the anterior dorsal bundles of fresh and brackish water oligochaetes. The intermediate teeth are the same size as the outer ones, giving the hand-shaped (palmate) shape.
- **Simple pointed chaetae:** Enchytraeids usually have bundles of stout, curved simple pointed chaetae. Some tubificids have longer simple pointed chaetae in posterior dorsal bundles, associated with hair chaetae. Bifid chaetae with reduced lower teeth, found in some tubificids, can appear simple pointed.
- **Genital chaetae:** Some tubificid species have specialised chaetae in some ventral bundles when mature. Spermathecal chaetae are usually found in segment X, penial chaetae in XI. The number of segments with genital chaetae can often be used to characterise genera.
- **Hair chaetae:** Many tubificids and naids have elongate slender setae terminating in an acute point, which are only found in dorsal bundles. They are superficially similar to the capillary chaetae of polychaetes but generally thinner and not hollow. Some or all of the hair chaetae may be lost or broken in damaged specimens. They can be seen most easily with back-light.

### *Internal Morphology*

Internal morphology, especially that of the male reproductive organs, is important in oligochaete taxonomy. Unfortunately, specialised techniques are often necessary to see internal organs. These techniques are generally time-consuming, require much practice and result in damage to the specimens such that they cannot be used for comparative reference of gross morphology or biomass. Effective identification using

internal anatomy also requires mature worms; on average only 30% of worms will be sexually mature in a sample. Accounts of anatomical methods and features can be found in standard works but are only briefly considered here.

The positions of reproductive structures can sometimes be seen through the body wall or inferred from the position of the most swollen part of the worm, especially in tubificids. One of the most commonly used features in oligochaete taxonomy is the shape of the penis sheath, found in some tubificids. The paired penis sheaths can be seen everted in occasional specimens.

### *Taxonomy*

The Oligochaeta are divided into several families, of which most are mainly freshwater in distribution. They are summarised in Table 1. The following notes are not true taxonomic definitions of families or species and do not include all taxa that may be found; they are intended only as a ballpark guide to the more commonly found marine and brackish water taxa. Standard references should be consulted for detailed descriptions and keys. A summary of features for the commonly recorded taxa is given in Table 2 and the same taxa are described in the appendix, with space for additional taxa drawings.

### *Tubificidae.*

The Tubificidae are probably the most diverse family of aquatic oligochaetes. They are found in most habitats but are most common in estuarine mud, where they are often the dominant macrofauna. There are several genera distinguished on internal characteristics but the most common species can be recognised on chaetal and other external features.

The general appearance of a tubificid is usually a fairly featureless worm with a long thin tail. The first ten to twelve segments are generally noticeably thicker than those of the tail. Tail segments are also longer than anterior segments. Complete specimens are rare in samples but the tip of the tail is made up of segments similar to those preceding.

There is a large range of chaetal types but most species have at least some bifid chaetae. Ventral chaetae are nearly always bifid. The bifid chaetae are generally shorter, stouter and with shorter teeth than in the Naididae. Tubificids have male pores (from which the penes emerge) in the ovarian segment, usually XI and spermathecae in X.

### *Naididae*

Naids are often common in freshwater or upper shore habitats. A small number of recognisable taxa are regularly found.

Naids are stated in many keys to form chains of zooids for asexual reproduction. In practice, few chained individuals are found but the tip of the tail is distinctive. The worms are generally shorter than tubificids with a wide front end and a narrower tail of about the same length. The segments towards the end of the tail are short and “bunched up” with a blunt end to the tail. Chaetae are often lacking from the final segments. Some species have eyespots.

Most naids have long, narrow bifid chaetae with long, well-developed teeth, the arrangement of which is variable; they are often missing from the anterior dorsal bundles. Hair chaetae are present in some taxa. There are male pores in the ovarian segments between V and VII.

The genus *Paranais* is the only truly marine member in UK waters; it is found intertidally in estuaries and on coasts and can be recognised by its short stubby appearance, and long bifid setae with equal teeth. Ventral setae start on II, which can give them a bearded appearance.

### *Enchytraeidae*

The third most commonly found family of aquatic oligochaetes is the Enchytraeidae. They are most common on the upper shore and strandline zones, where they may be the dominant macrofauna. They are also common around the water margins of freshwater habitats and amongst algae on pilings. There are also terrestrial and subtidal marine enchytraeids.

The worms are sometimes readily recognised by their general appearance. They are generally similar in width and segment structure along their entire length and often have secondary annulation to the segments. Upper shore forms are usually coiled or bent in a C-shape in samples and can be described as small and neat. The most common subtidal genus, *Grania*, is smooth and almost nematode-like in appearance.

Most enchytraeids have short, stout, simple pointed sigmoid chaetae. In many genera the chaetae are numerous, with many per bundle. In others, there is chaetal reduction, with absence of chaetae in certain bundles and reduction to one or two per bundles in others.

### *Lumbriculidae*

Lumbriculids are found in freshwater and may extend into the upper reaches of estuaries. They are rarely common.

They are more robust in appearance than worms of the preceding families but would still be described as small, with some species having a greenish appearance.

The chaetae are short and simple pointed, with only two per bundle. Lumbriculids can be described as small versions of the larger worms considered below.

### *Glossoscolecidae*

One species, *Sparganophilus tamesis*, of this family is occasionally found in freshwater or upper estuarine samples. It is large and earthworm-like in appearance, often with a pinkish colouring, greenish iridescence and two short, simple chaetae per bundle.

### *Lumbricidae*

Lumbricids include the typical terrestrial earthworms, of which some damp-loving species may be found on the upper shore of the upper reaches of estuaries. The most aquatic species is *Eiseniella tetraedra*, which has a square cross section to its tail.

Other lumbricids can be recognised as such by their less pronounced square section to the tail. As in the two preceding families, there are two short, simple chaetae per bundle.

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### Contacts

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Table 1: Oligochaete Family Features

<b>Family</b>	<b>General features</b>	<b>Habitat</b>
Tubificidae	Small, elongated worms with variable chaetae	Aquatic: freshwater and marine
Naididae	Small, short worms with asexual reproduction; bifid or hair chaetae	Mainly freshwater, some brackish
Enchytraeidae	Small, short worms with variable numbers of simple pointed chaetae	Marine to terrestrial
Haplotaxidae	Very long, thread-like worms; single chaeta per bundle	Mainly freshwater
Lumbriculidae	Small, stout worms; 2 simple chaetae per bundle	Mainly freshwater
Dorydrilidae	Small, stout worms; 2 simple chaetae per bundle	Mainly freshwater
Glossoscolecidae	Large worms with 2 simple chaetae per bundle	Mainly freshwater
Lumbricidae	Earthworms; large, with 2 simple chaetae per bundle; square in section posteriorly	Mainly terrestrial, some freshwater
Branchiobdellidae	Ectoparasitic on crayfish; no chaetae	Freshwater
Aeolosomatidae	Small with hair chaetae and oil droplets; no longer considered to be oligochaetes	Freshwater and brackish



Table 2: Oligochaete Features Table

	Body wall	Dorsal hair chaetae	Anterior dorsal other chaetae	Posterior dorsal other chaetae	Anterior ventral other chaetae	Posterior ventral other chaetae	Male reproductive organs	Other
<b>Tubificidae</b>	<b>Variable</b>	<b>Present or absent</b>	<b>Variable</b>	<b>Variable</b>	<b>Bifid</b>	<b>Bifid</b>	<b>Male pores in ovarian segment, usually XI. Spermathecae in X</b>	<b>Elongated body form, widest at clitellum. No budding</b>
<i>Tubificoides benedii</i>	Densely papillate from II or at least from VI (usually)	No	Reduced or rudimentary UT 2-3 II-III 2 IV-XI	1 from XII	As dorsal	As dorsal	Sheath slightly conical with inflated distal end	Naked animals may be confused with <i>Clitellio arenarius</i>
<i>Tubificoides brownae</i>	Naked	No	3-5 UT shorter, thinner than LT	1 UT thinner, same length as LT, teeth divergent	3-5 UT shorter, thinner than LT	As dorsal	Sheath thin, conical, often crumpled in whole mounts	
<i>Tubificoides crenacoleus</i>	Naked	No	3-5(6) UT thinner, as long or longer than LT	2-3 UT thinner, as long or longer than LT	As dorsal	As dorsal Absent in X	Sheath cone shaped	Sharply conical prostomium
<i>Tubificoides diazi</i>	Naked	No	(2)3-5(6) most in II&III UT thinner, shorter than LT	(1)2(3) LT broad same length as UT	Reduced to 1 or 2 from XII	2-3 per bundle by VIII	Sheath 4-5 times as long as broad with large projection pointing towards base of penes	Long thin posterior
<i>Tubificoides heterochaetus</i>	Slightly papillate posteriorly	No	UT as long and thick as LT	2(3) with 1 simple pointed and est with rudimentary LT	As dorsal	Simple pointed	Sheath thick, small slightly cone shaped	
<i>Tubificoides pseudogaster</i>	Naked	No	3-5(6) UT longer than LT	(1)2(3) UT thinner, longer than LT	As dorsal	As dorsal	Sheath simple cylinder. Always parallel sided	Often used as a label for non-papillated spp. with bifids only. Call them "Tub pse agg."
<i>Tubificoides amplivasatus</i>	Sub dermal particles may be present posteriorly	2-3(4)	Widely separated teeth	Bifids reduced to simple pointed before clitellum	UT thinner, same length as LT	UT thinner, same length as LT	Sheath squat, thimble shaped	
<i>Tubificoides scoticus</i>	Naked or coated in foreign matter. May be slightly papillated posteriorly	2-3(4)	2-3(4) broad lance shaped bifids; UT shorter than LT	Simple pointed from VII	2-5 bifid	3-4 bifid	Sheath long cylinder	
<i>Tubificoides cf. galiciensis</i>	Papillate from XII-XVI	2-3 anteriorly; 1-2 posteriorly	2-3 widely separated bifids UT slightly shorter than LT	1-2 bifids similar to anterior	3-5 similar to dorsal	1 similar to dorsal	Long thin parallel sided penis sheath with rounded end, slightly bent	Found in NE England estuaries
<i>Tubificoides insularis</i>	Papillate from III-VI	1-3(4) short bent anteriorly; 1 post clitellum	1-3(4) UT shorter, thinner than LT	1 bifid post clitellum	3-4 bifid UT shorter, thinner than LT	1 post clitellum bifid very thin UT	Sheath sharply conical with distended end	Resembles <i>T. benedii</i> with hairs

Table 2: Oligochaete Features Table

	Body wall	Dorsal hair chaetae	Anterior dorsal other chaetae	Posterior dorsal other chaetae	Anterior ventral other chaetae	Posterior ventral other chaetae	Male reproductive organs	Other
<i>Tubificoides swirencoides</i>	Papillate from VII or at least from behind clitellum	(1)2-3(4) anteriorly; 1-2 from X	(1)2-3(3). Closely applied short teeth V-VII; possibly extra teeth above UT	Simple pointed after X	2-3 short broad UT, slightly larger LT	1-2. UT thinner, only slightly longer than LT	Sheath cylindrical. 2X as long as broad	
<i>Monopylephorus rubroniveus</i>	Naked	No	2-6 bifids; teeth of variable proportions	Fewer	As dorsal	Usually fewer	Non-ciliated pseudopenes	
<i>Monopylephorus parvus</i>	Naked	No	3-4(5); UT as thick; LT variable	As anterior ?	2? 1 or both simple pointed	As anterior ?	Upright protusible pseudopenes	Descriptions unclear
<i>Monopylephorus irroratus</i>	Naked	1-2 thin spirally twisted, easily broken	2-4 bifids	2-4 bifids	As dorsal	As dorsal	Tall eversible non-ciliated pseudopenes	
<i>Limnodriloides scandinavicus</i>	Naked	No	2-3; UT thinner and shorter than LT	1-2 post clitellum; UT thinner and shorter than LT	As dorsal	As dorsal. Genital chaetae on X or absent; no genital chaetae on XI	Penes eversible; no sheath	
<i>Heterochaeta costata</i>	Naked	No	Pectinate about II-IV. Palmate about V-XIV	Bifid	UT longer than LT	As dorsal	Sheath tub-shaped	Secondary annulation to segments. Pointed prostomium
<i>Tubifex tubifex</i>	Naked	1 - 4	3-5 pectinate	Bifid	4-6 bifids, UT thinner same length as LT	Bifid	Sheath short and tub-like	Often with <i>L.hoffmeisteri</i> , especially in organically polluted waters. Low salinities.
<i>Clitellio arenarius</i>	Naked	No	2-3; reduced or rudimentary UT	2-3; reduced or rudimentary UT	Fewer than anteriorly	Fewer than anteriorly	No cuticular penis sheaths	
<i>Limnodrilus</i>	Naked	No	Bifid (several)	Bifid (several)	Bifid (several)	Bifid (several)	Sheath very elongated in <i>L. hoffmeisteri</i>	In reduced salinity
<i>Psammoryctides barbatus</i>	Naked	Numerous	7-8 palmate	Pectinate ?	strongly bifid	strongly bifid. Spermathecal chaetae thin, straight, hollow ended		In reduced salinity

Naididae	Usually naked	Present or absent	Bifid or simple pointed	Bifid or simple pointed	Bifid	Bifid	Spermathecae in testicular segment, immediately in front of male pores (between V and	Short body. Evidence of budding at posterior
<i>Paranais litoralis</i>	Naked	No	Slightly thinner than ventrals; from V	As anterior ?	5-7 on II, slightly longer than rest. UT longer than LT. Others as posterior	2-3; UT as long as or only slightly longer than LT		

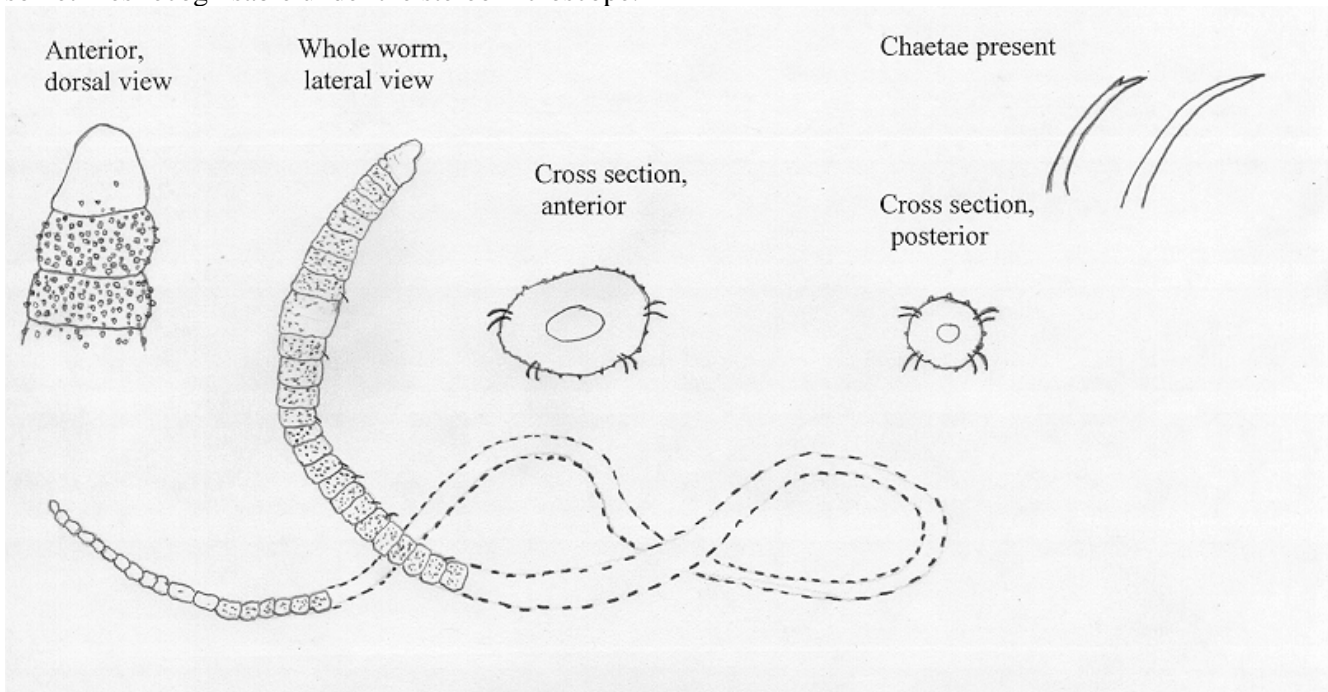
Table 2: Oligochaete Features Table

	<b>Body wall</b>	<b>Dorsal hair chaetae</b>	<b>Anterior dorsal other chaetae</b>	<b>Posterior dorsal other chaetae</b>	<b>Anterior ventral other chaetae</b>	<b>Posterior ventral other chaetae</b>	<b>Male reproductive organs</b>	<b>Other</b>
<i>Nais elinguis</i>	Naked	1-3 ?	Long, almost parallel teeth	Long, almost parallel teeth	UT twice as long as LT	UT twice as long as LT		Distinct eyes
<b>Enchytraeidae</b>	<b>Naked</b>	<b>No</b>	<b>Simple pointed or absent</b>	<b>Simple pointed or absent</b>	<b>Simple pointed or absent</b>	<b>Simple pointed or absent</b>	<b>Spermathecae in V. Testes in XI. Male pores in XII</b>	<b>Short body. Usually similar along length. Often coiled in a "C".</b>
<i>Grania</i>	Naked	No	1 simple pointed; absent from more anterior than posterior bundles	1 simple pointed	1 simple pointed; absent from more anterior than posterior bundles	1 simple pointed		

Appendix: species characteristics

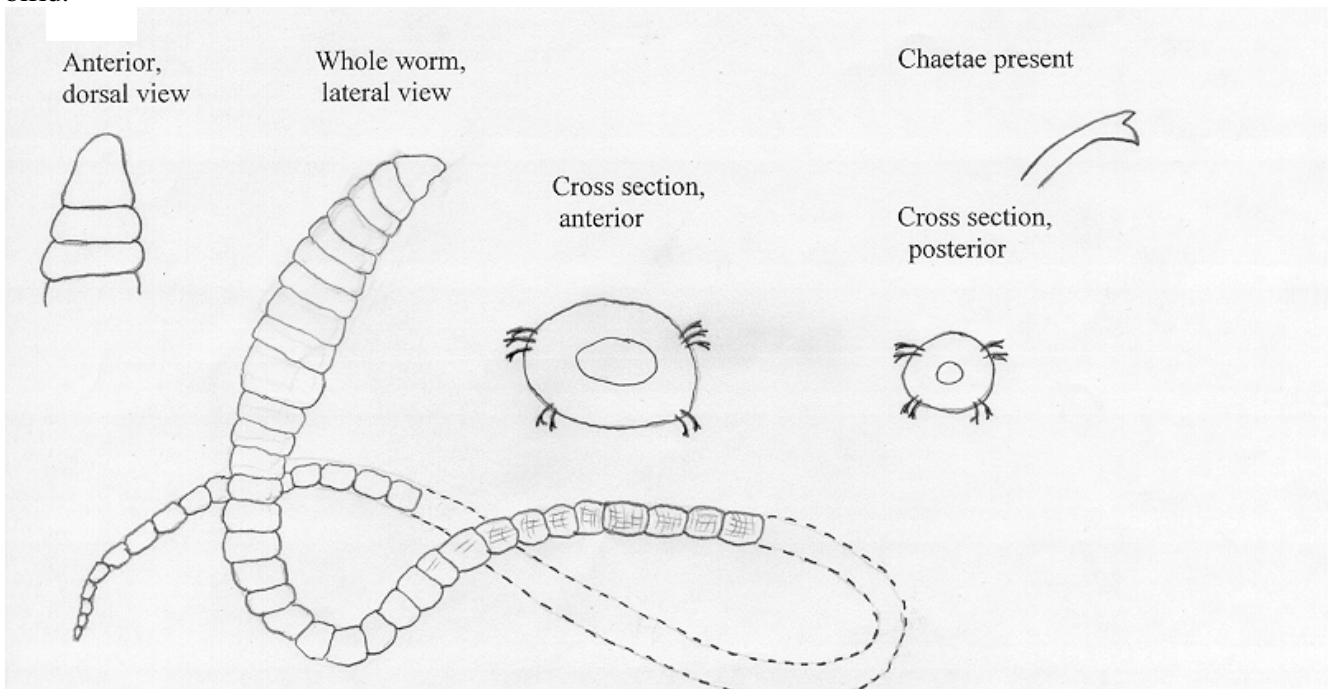
***Tubificoides benedii***

*T. benedii* is one of the most common and easily recognisable oligochaetes on estuarine mudflats. The body is usually densely and coarsely papillated over the whole surface, with a brownish deposit on the skin. Chaetae must be examined in the occasional specimens lacking the papillations and deposit. The chaetae are long and sickle shaped bifids with a reduced lower tooth, sometimes appearing simple pointed. They are sometimes recognisable under the stereomicroscope.



***Tubificoides pseudogaster* agg.**

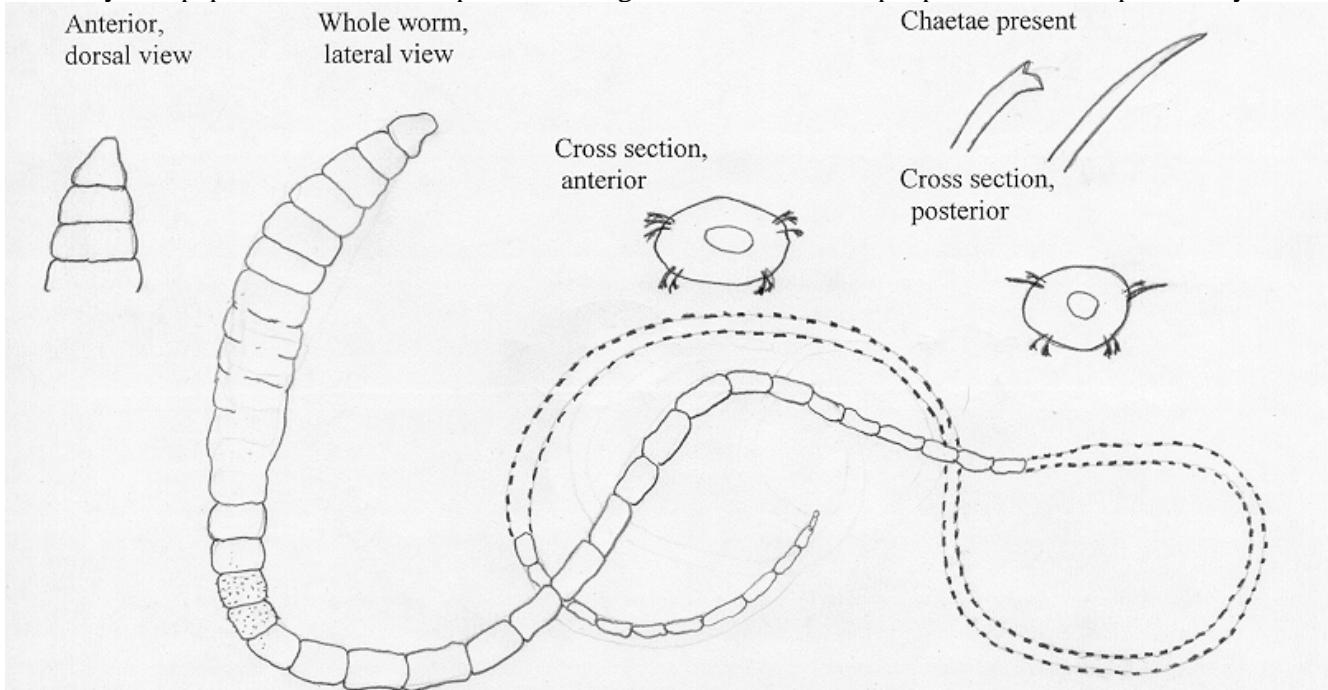
Members of the *T. pseudogaster* complex are found on mudflats and range into low salinity and subtidally. They are often found with *T. benedii* and may be abundant. The body lacks papillations and all chaetae are bifid.



Appendix: species characteristics

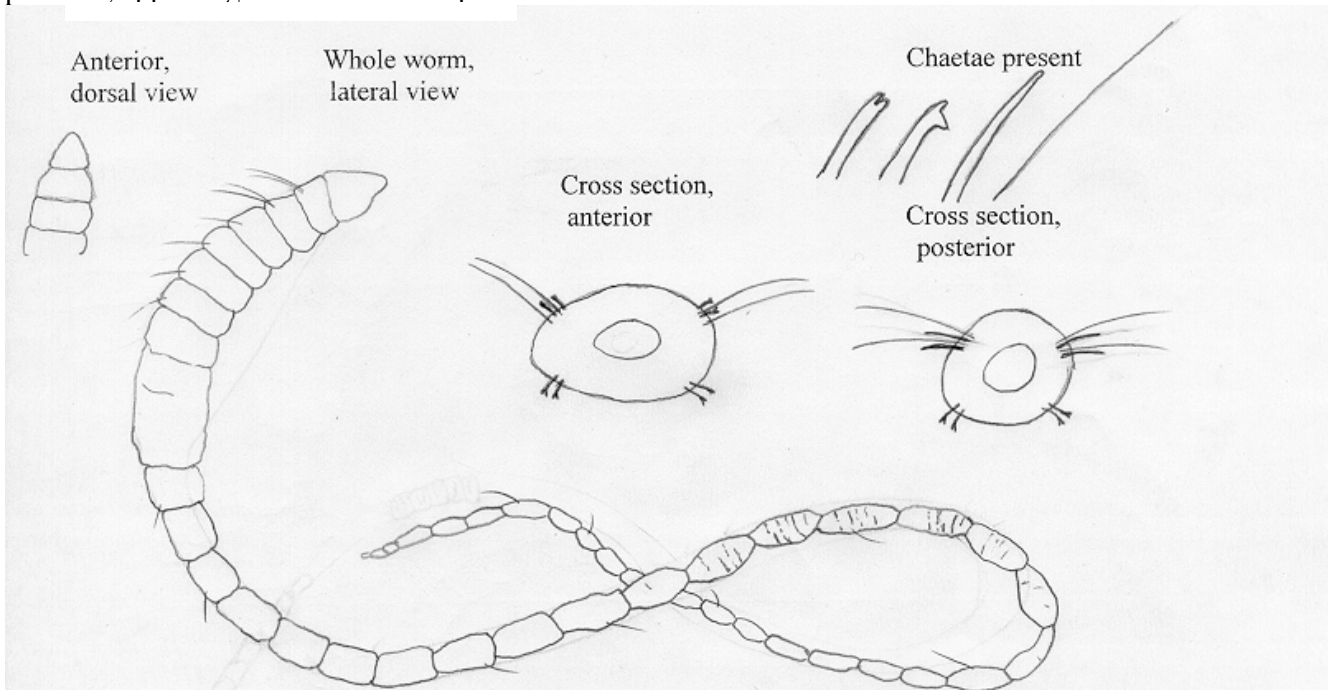
***Tubificoides heterochaetus***

*T. heterochaetus* is often the dominant species in low salinity reaches of estuaries from the lower shore to the shallow subtidal and is particularly common in some parts the Thames. The worms are small and delicate with very fine papillations near the reproductive segments and some simple pointed chaetae posteriorly.



***Tubificoides amplivasatus***

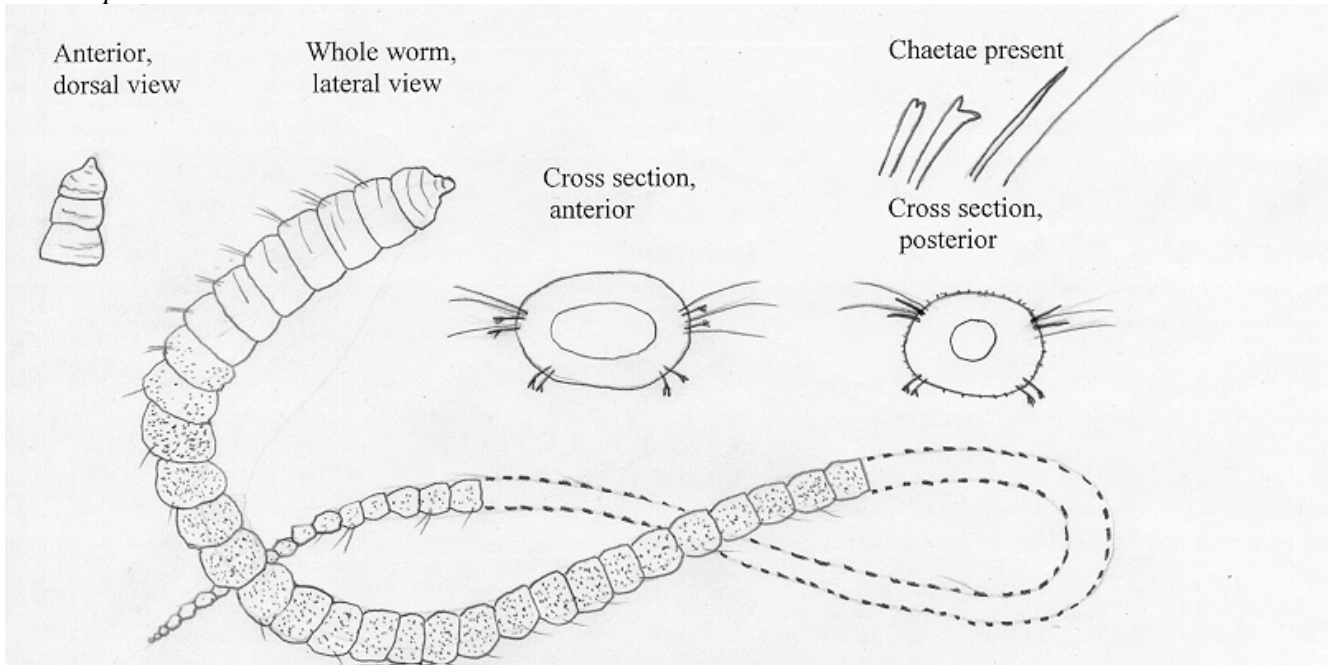
Tubificids from marine subtidal mud are often *T. amplivasatus*. The worms are small and fine with dorsal hair chaetae. The tails have simple pointed chaetae associated with the hair chaetae and often have subdermal particles, appearing as fine brown stripes.



Appendix: species characteristics

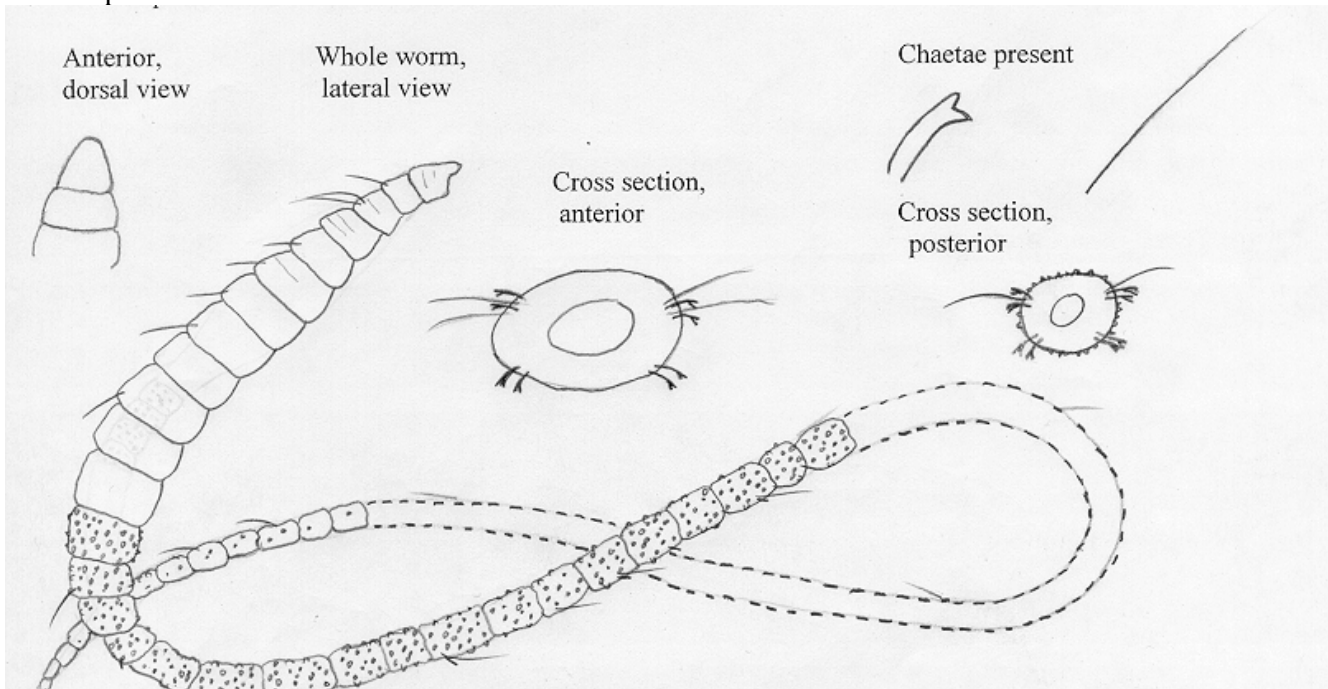
***Tubificoides swirencoides***

*T. swirencoides* is found on the lower shore and shallow subtidal areas of some marine estuaries. The bodies are finely papillated from segment VII and have a pointed prostomium. The chaetae are bifid ventrally, with hair chaetae in the dorsal bundles associated with bifids at the front and simple pointed chaetae at the back, as in *T. amplivasatus*.



***Tubificoides c.f. galiciensis***

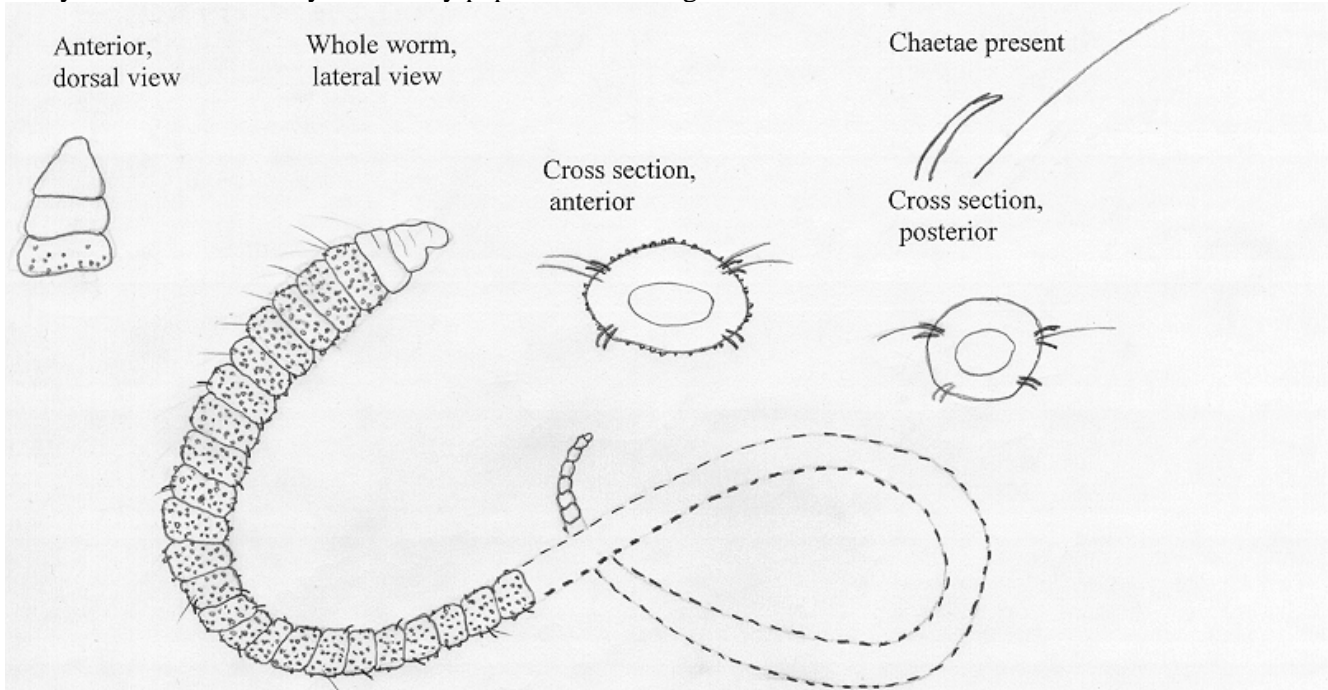
This species is often found with *T. swirencoides* and is similar in many ways. It is distinctive but, as yet, of uncertain identity. The body is papillated from segment XII or XVI. The papillations are usually coarser than in *T. swirencoides* but finer than in *T. benedii*. The prostomium is usually blunt. All chaetae are bifid, with the exception of the dorsal hair chaetae.



Appendix: species characteristics

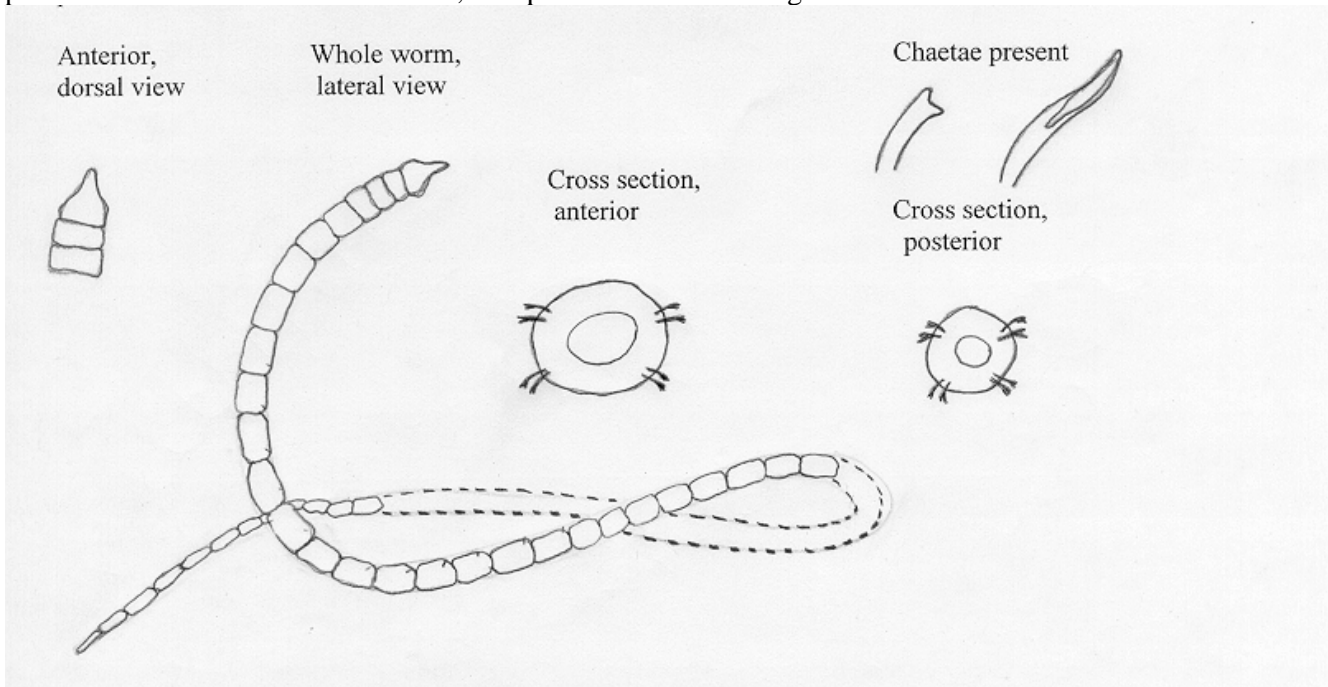
***Tubificoides insularis***

*T. insularis* is usually found in marine conditions in cleaner sediment than the other *Tubificoides* spp. It is rarely abundant. The body is coarsely papillated from segment III or VI and has dorsal hair chaetae.



***Limnodriloides* sp.**

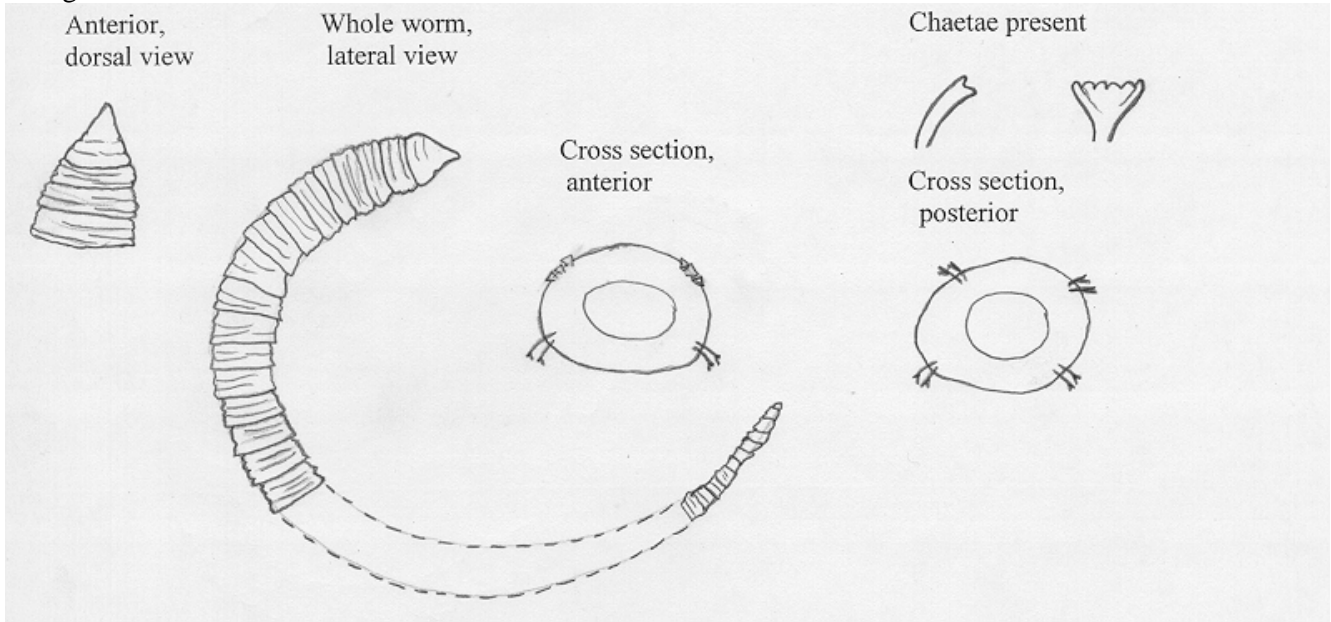
Tubificids found in fully marine conditions in small numbers are often *Limnodriloides*. They resemble *T. pseudogaster* agg. in appearance but are often finer with a more evenly cylindrical body and a more pointed prostomium. The chaetae are all bifid, except for some modified genital chaetae in adults.



Appendix: species characteristics

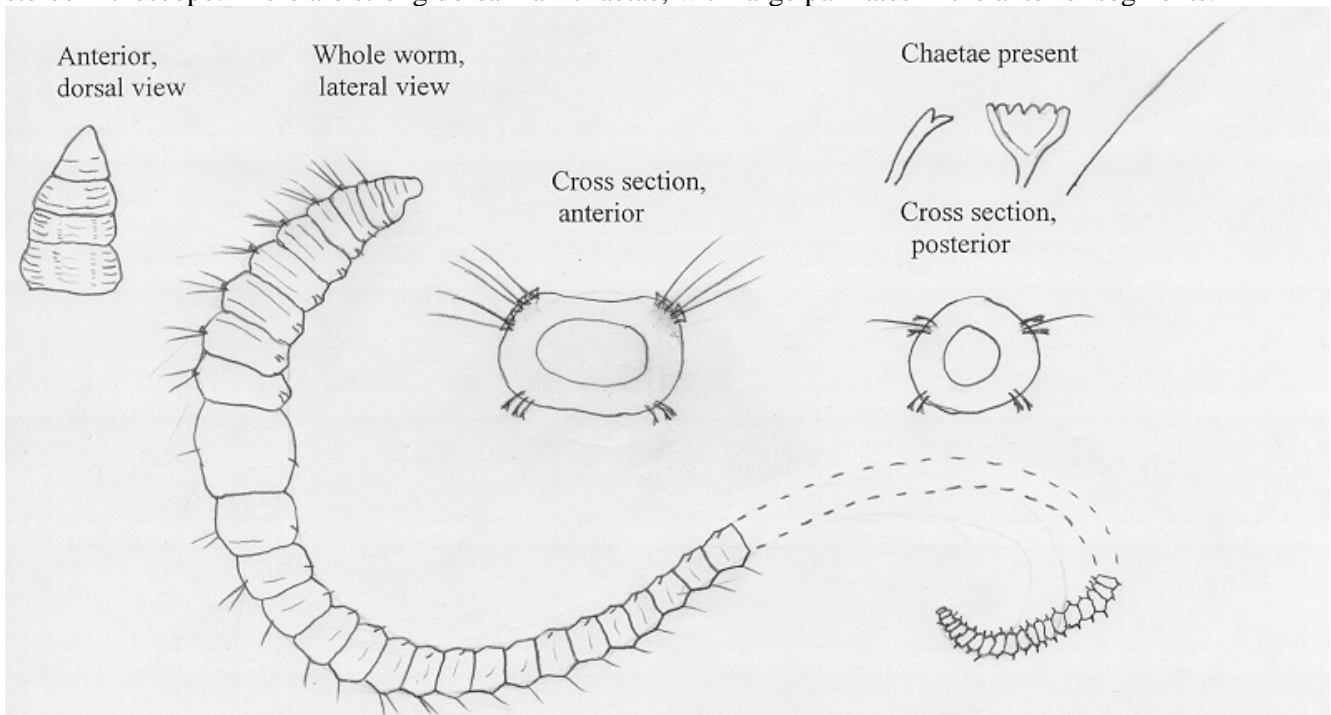
***Heterochaeta costata***

*H. costata* occupies a distinct niche in mid-range salinities in the intertidal but is not particular about sediment type. The body form is often distinctive, with a pointed prostomium and a stout, opaque body with secondary annulation. In populations with less distinct body shapes, the palmate chaetae in the dorsal bundles of segments V to XIV are distinctive.



***Psammoryctides barbatus***

The subtidal sediments of rivers exposed to minimal salt input may be dominated by *P. barbatus*. The worms are rather large and broad but translucent. The chaetae are distinctive and often visible under the stereomicroscope. There are strong dorsal hair chaetae, with large palmates in the anterior segments.

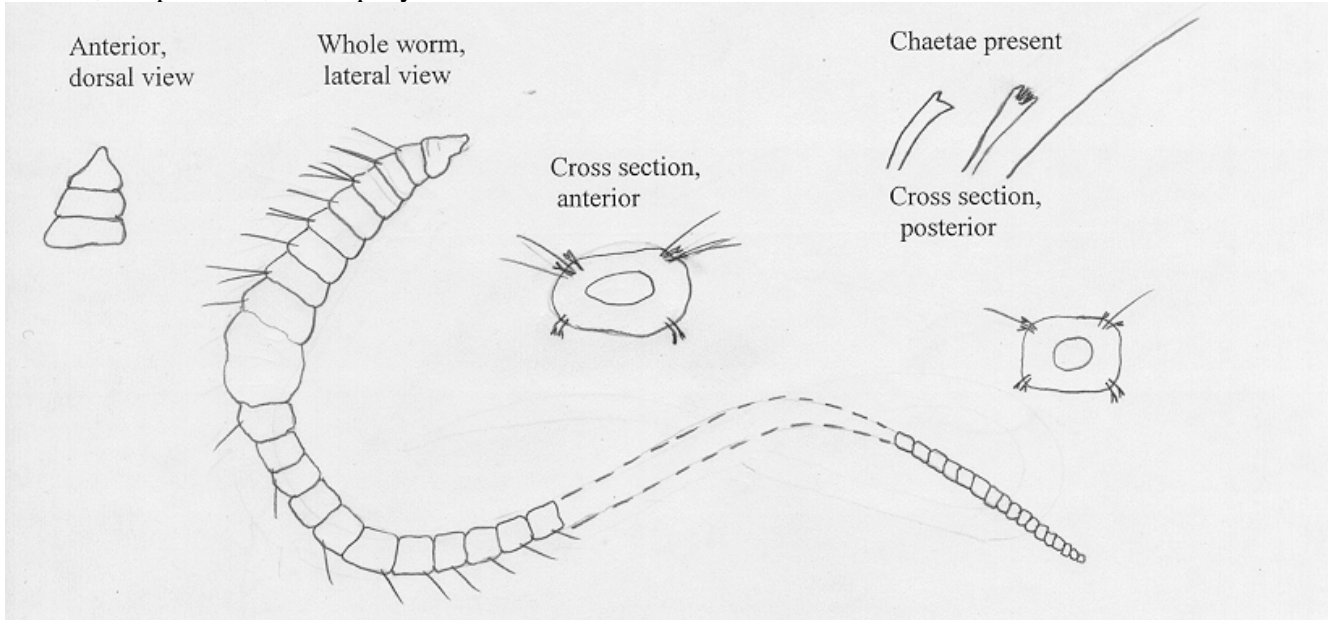




Appendix: species characteristics

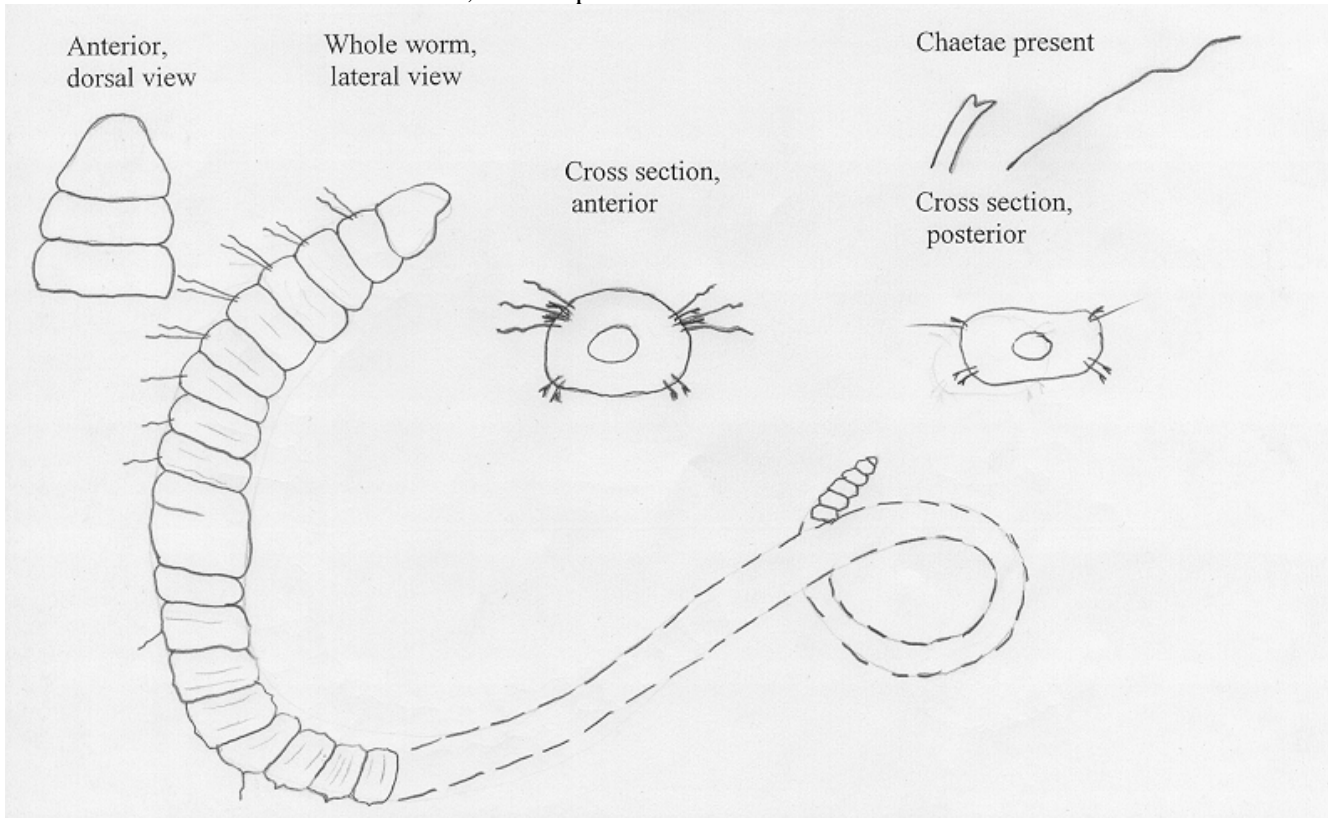
***Tubifex tubifex***

*T. tubifex* is found in low salinity, overlapping the distributions of *P. barbatus* and *Limnodrilus* spp. The worms are very similar to the preceding species in general appearance but often slightly smaller. Pectinate chaetae, not palmates, accompany the hair chaetae in the anterior dorsal bundles.



***Monopylephorus irroratus***

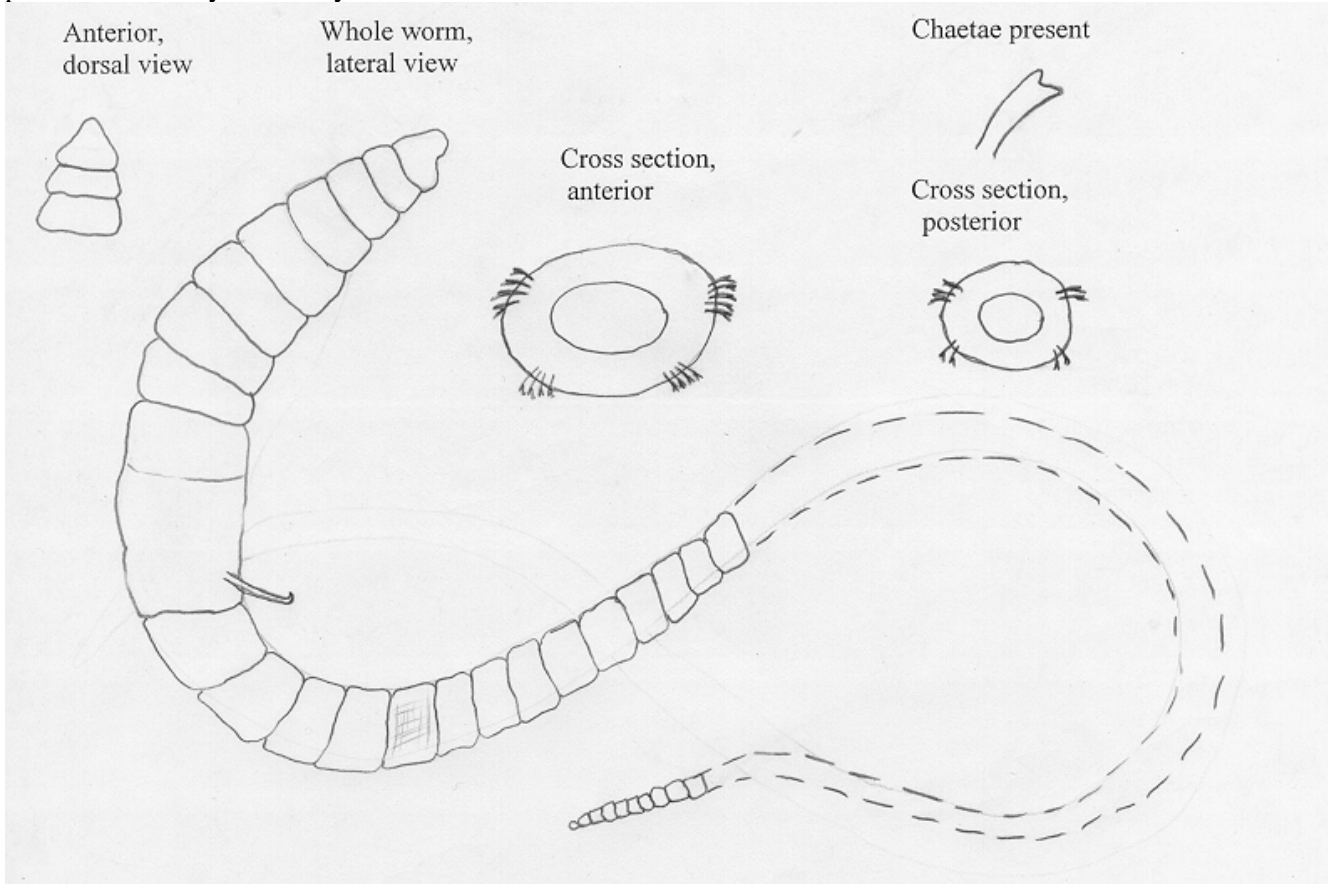
This species is occasionally found in low salinity on the lower shore. The worms are often stout and blunt nosed. The hair chaetae are distinctive, with a spiral twist to the ends.



Appendix: species characteristics

***Limnodrilus hoffmeisteri***

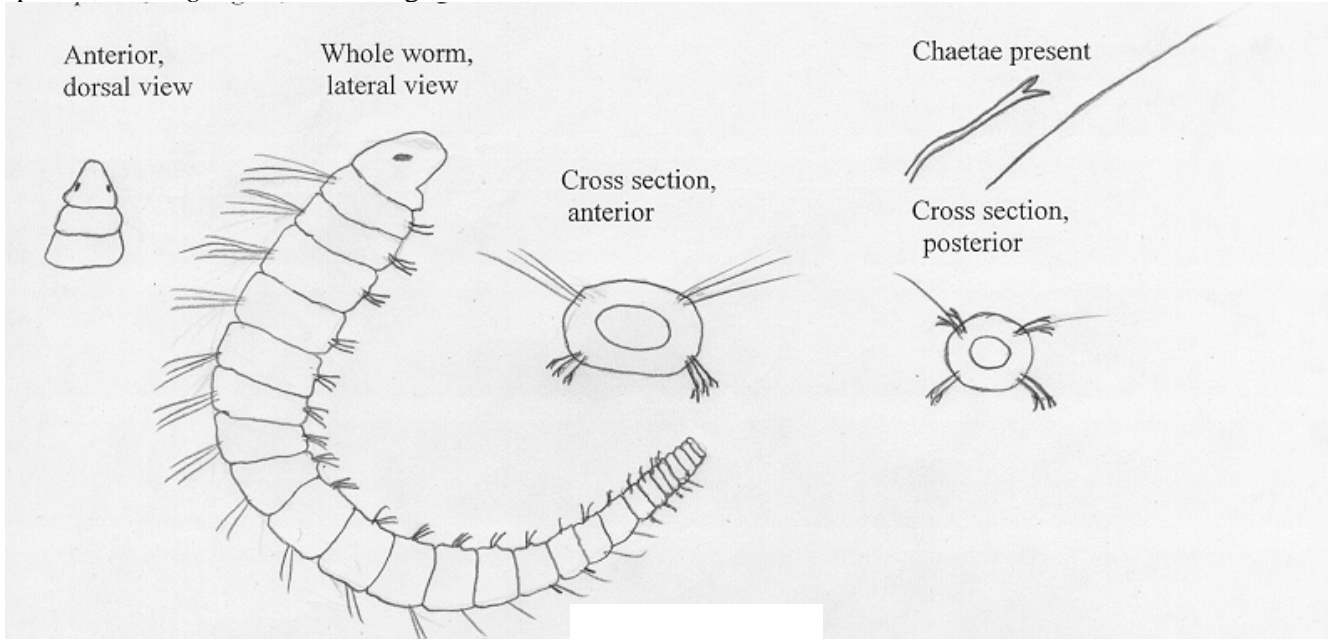
Several species of *Limnodrilus* are found in fresh water. *L. hoffmeisteri* is one of the commonest and most salt tolerant. It is often dominant on the mud banks of tidal rivers and can also be found subtidally. The body is usually robust and smooth. All chaetae are bifid. The most practical distinctions from *T. pseudogaster* agg. are the larger size and the larger numbers of chaetae per bundle. In mature *L. hoffmeisteri*, the long, hooked penis sheaths may be clearly visible.



Appendix: species characteristics

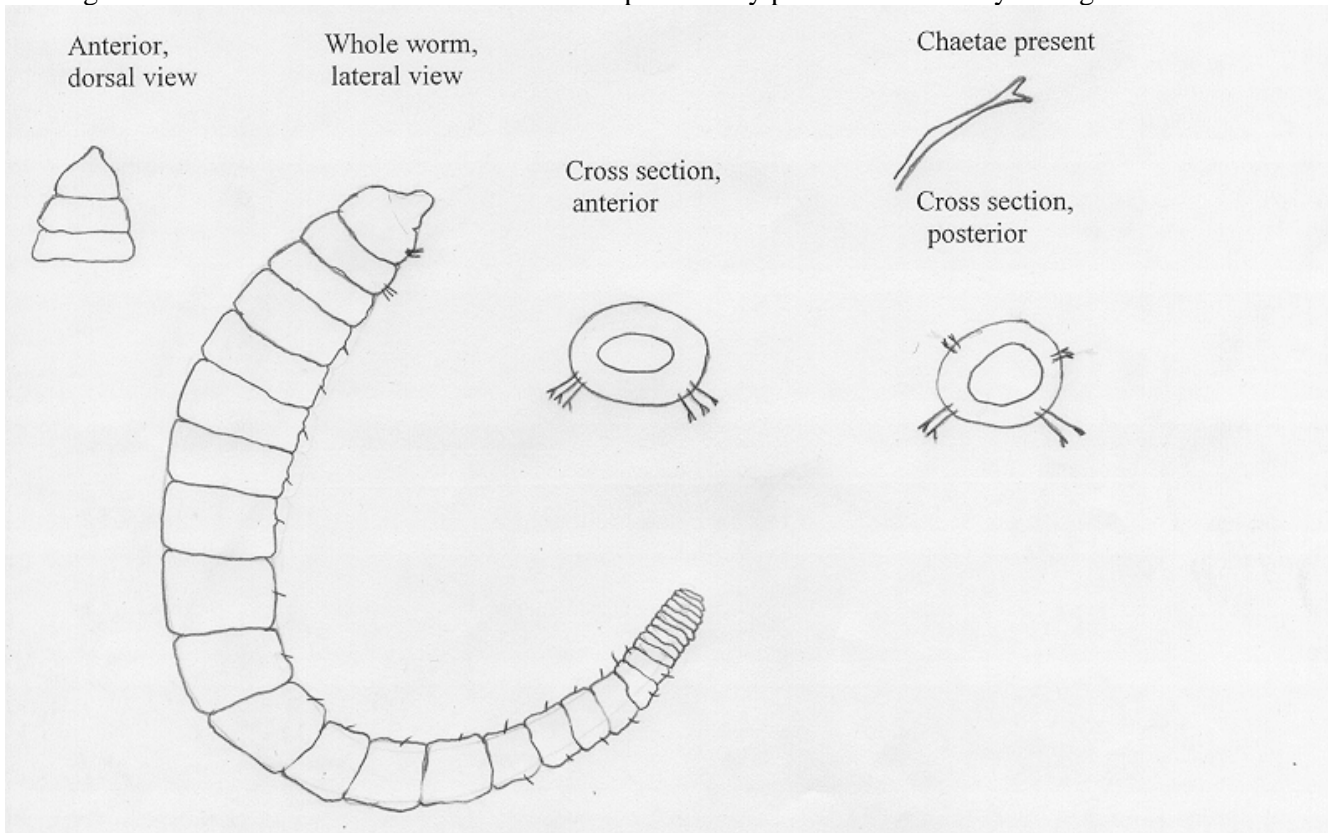
*Nais elinguis*

Members of the genus *Nais* are usually found submerged in low salinity or fresh water, often with *T. tubifex* and *P. barbatus*. They are short with hair chaetae, long bifids and distinctive eyespots. The commonest species, *N. elinguis*, can be distinguished on chaetal details.



*Paranais litoralis*

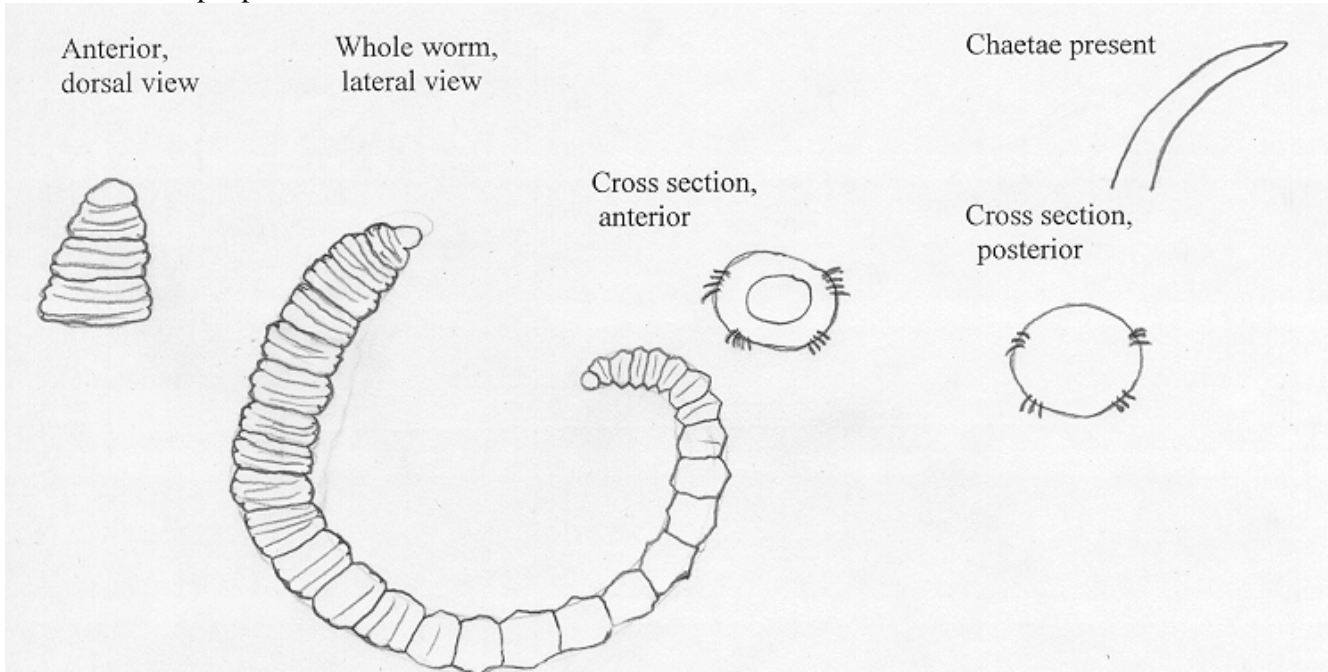
*P. litoralis* is the most salt tolerant British naid and is often found on the upper to mid shore of mid to low salinity mud flats. The body is small and short with compressed tail segments. The chaetae are long bifids, missing from a number of front dorsal bundles and particularly prominent ventrally on segment II.



Appendix: species characteristics

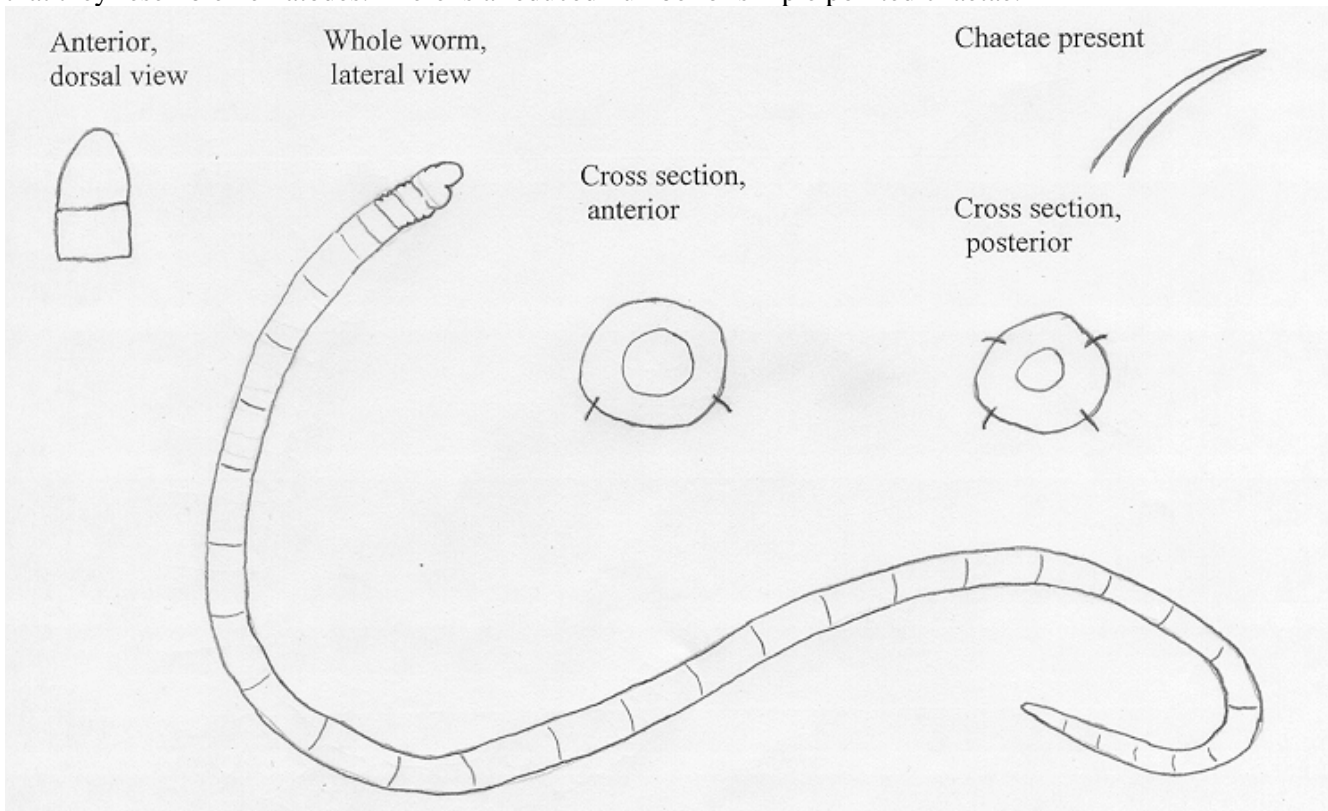
**Enchytraeidae**

Enchytraeids are common on the upper shore in both marine and freshwater systems. Most are short, white and opaque with a blunt prostomium. The segments are usually all similar, with secondary annulation. Chaetae are simple pointed or absent.



**Grania**

The most common oligochaetes in subtidal fully marine samples are often species of *Grania*. They often live in fairly clean sediments alongside interstitial polychaetes. The bodies are smooth, with indistinct septa so that they resemble nematodes. There is a reduced number of simple pointed chaetae.



## Appendix: species characteristics

Appendix: species characteristics

Anterior,  
dorsal view

Whole worm,  
lateral view

Chaetae present

Cross section,  
anterior

Cross section,  
posterior

Anterior,  
dorsal view

Whole worm,  
lateral view

Chaetae present

Cross section,  
anterior

Cross section,  
posterior