A tubeworm (*Serpula vermicularis*)

MarLIN – Marine Life Information Network
Biology and Sensitivity Key Information Review

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2006-11-30

A report from:
The Marine Life Information Network, Marine Biological Association of the United Kingdom.

Please note. This MarESA report is a dated version of the online review. Please refer to the website for the most up-to-date version [https://www.marlin.ac.uk/species/detail/1546]. All terms and the MarESA methodology are outlined on the website (https://www.marlin.ac.uk)

This review can be cited as:
Hill, J.M. 2006. *Serpula vermicularis* A tubeworm. In Tyler-Walters H. and Hiscock K. (eds) *Marine Life Information Network: Biology and Sensitivity Key Information Reviews*, [on-line]. Plymouth: Marine Biological Association of the United Kingdom. DOI https://dx.doi.org/10.17031/marlinsp.1546.1

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A tube worm *Serpula vermicularis*.
Photographer: Paul Naylor
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See online review for distribution map

Distribution data supplied by the Ocean Biogeographic Information System (OBIS). To interrogate UK data visit the NBN Atlas.

Researched by	Jacqueline Hill	**Refereed by**	Dr Elvira Poloczanska
Authority	Linnaeus, 1767		
Other common names	-	**Synonyms**	-

Summary

Description

Serpula vermicularis is a slender, tube-dwelling polychaete between 5 and 7 cm in length with about 200 segments. The tubes are cylindrical with occasional rings and irregular lengthwise ridges cut into blunt teeth. The operculum is calcareous and funnel shaped with radial grooves and a serrated circumference. The colour of the body of the worm varies from pale yellow to brick red. The tube is pinkish-white and the operculum is patterned with red and white rays.

Recorded distribution in Britain and Ireland

Distributed mainly around the north-west coast of Scotland. Also present on the north-east coast of England and the north-west coast of Ireland with scattered records around much of the coast of Britain and Ireland.

Global distribution

Thought to be distributed in the north east Atlantic and the Mediterranean.

Habitat

The calcareous tubes of *Serpula vermicularis* can be found attached to hard substrata such as rocks, stones, bivalve shells and ship hull's from low water to the sublittoral in depths up to 250 m. In

some very sheltered areas the tubes aggregate together to form small reefs.

Depth range

0 - 250m

Identifying features

- Head bears crown of pinnate projections called radioles which project from the tube when feeding. Palps are absent.
- Head with two lobes, each with 30-40 radioles united at the base.
- Single, funnel like operculum (a plug to close the tube when the crown is withdrawn) about 4mm across with serrated circumference and red and white rays.
- Crown is red, white, orange or yellow and may be solid coloured or banded.

Additional information

The tube is attached to hard substrata at the base but in reef aggregations is often free for much of its length.

Listed by

Further information sources

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Biology review

Taxonomy

Phylum	Annelida	Segmented worms e.g. ragworms, tubeworms, fanworms and spoon worms
Class	Polychaeta	Bristleworms, e.g. ragworms, scaleworms, paddleworms, fanworms, tubeworms and spoon worms
Order	Sabellida	
Family	Serpulidae	
Genus	Serpula	
Authority	Linnaeus, 1767	
Recent Synonyms	-	

Biology

Typical abundance	
Male size range	Body length up to 7cm
Male size at maturity	
Female size range	Small-medium(3-10cm)
Female size at maturity	
Growth form	Vermiform segmented
Growth rate	
Body flexibility	No information
Mobility	
Characteristic feeding method	Active suspension feeder
Diet/food source	
Typically feeds on	Detritus
Sociability	
Environmental position	Epifaunal
Dependency	Independent.
Supports	None
Is the species harmful?	

Biology information

Sociability
Dense aggregations of *Serpula vermicularis* tubes occur in enclosed and sheltered locations. These dense settlements of larvae on adult tubes may indicate larval gregarity but Bosence (1979(b)) suggests that aggregations only occur in locations with larval retention and few other hard substrates available for larval settlement. In the open marine environment *Serpula vermicularis* is not normally gregarious.

Feeding
Serpula vermicularis is a suspension feeder that can actively create its own feeding current and so can inhabit areas with little water movement.

Habitat preferences

Physiographic preferences	Open coast, Offshore seabed, Strait / sound, Sea loch / Sea lough, Estuary
Biological zone preferences	Circalittoral offshore, Lower circalittoral, Lower infralittoral, Sublittoral fringe, Upper circalittoral, Upper infralittoral
Substratum / habitat preferences	Artificial (man-made), Bedrock, Biogenic reef, Cobbles, Large to very large boulders, Other species, Pebbles, Small boulders
Tidal strength preferences	Weak < 1 knot (<0.5 m/sec.)
Wave exposure preferences	Moderately exposed, Sheltered, Very sheltered
Salinity preferences	Full (30-40 psu)
Depth range	0 - 250m
Other preferences	No text entered
Migration Pattern	Non-migratory / resident

Habitat Information

Global distribution
Although it is reported that *Serpula vermicularis* has a world-wide distribution, there is a great deal of taxonomic confusion and it is currently thought that the species is limited to the north east Atlantic and the Mediterranean (Holt *et al.*, 1997). There is also the possibility that within the Mediterranean it is actually part of a complex of two or three species (ten Hove pers. comm. cited in Holt *et al.*, 1997).

Life history

Adult characteristics

Reproductive type	Gonochoristic (dioecious)
Reproductive frequency	Annual episodic
Fecundity (number of eggs)	No information
Generation time	
Age at maturity	1 year
Season	See additional text
Life span	2-5 years

Larval characteristics

Larval/propagule type	-
Larval/juvenile development	Planktotrophic
Duration of larval stage	See additional information
Larval dispersal potential	-
Larval settlement period	See additional text

Life history information

Age at maturity and lifespan

Orton (1914) observed that ten month old individuals of *Serpula vermicularis* in the south west of England could successfully reproduce.

Larval settling time

The length of the planktonic stage is unknown but comparison with other serpulid species suggests it may be between six days and two months (Holt *et al*., 1997).

Spawning season

Spawning seems to occur in the summer. In the Clyde area Elmhirst (1922) observed spawning to occur in June to August and in Plymouth ripe individuals were seen in August and September (Allen, 1915).

Sensitivity review

This MarLIN sensitivity assessment has been superseded by the MarESA approach to sensitivity assessment. MarLIN assessments used an approach that has now been modified to reflect the most recent conservation imperatives and terminology and are due to be updated by 2016/17.

Physical Pressures

	Intolerance	Recoverability	Sensitivity	Confidence
Substratum Loss	High	High	Moderate	Low

Serpula vermicularis tubes are permanently attached to the substratum and so will be lost if substratum is removed. Intolerance is therefore, high. Recovery is high but only in relation to individual recruitment. Recovery of *Serpula* reefs may not be possible. See additional information below for full rationale.

Smothering	High	High	Moderate	Very low

Serpula vermicularis is permanently attached to the substratum by a calcareous tube which may be encrusting or in aggregating individuals may extend above the substratum and avoid smothering material. Thus, encrusting individuals are not likely to survive smothering by 5cm of sediment. It is also likely that too much sediment on the surface of rocks or shells would prevent settlement of larvae (Holt *et al*., 1998) and impair the long term survival of populations. Intolerance is therefore reported to be high. *Serpula vermicularis* reefs may be less intolerant as animals in the highest points may be clear of smothering material.

Increase in suspended sediment	Low	High	Low	Low

Bosence (1979b) concluded from observations and from transplant experiments that the lower depth limit of *Serpula vermicularis* was probably determined by suspended sediment and de-oxygenation. However, Moore *et al*. (1998) found no horizontal layers of suspended mud in Loch Creran in Scotland to explain distribution of reefs, although the authors do not rule out the possibility that storm-generated, suspended mud may inhibit reef development (but the lower limit could also be due to inadequate current velocities for suspension feeding). The species is recorded in areas where suspended sediment levels can be high, for instance in the Tamar estuary. A supply of suspended sediment will probably be important to *Serpula vermicularis* because the species requires a supply of particulate matter for suspension feeding. At the benchmark level of an increase of 100mg/l for one month, the likely impact would be an increase in cleaning costs. Thus, the species is not likely to be significantly affected and an intolerance of low is reported. Recovery will be immediate as normal feeding returns on the resumption of pre-impact conditions.

Decrease in suspended sediment	Low	High	Low	Low

A supply of suspended sediment will be important to *Serpula vermicularis* because the species requires a supply of particulate matter for suspension feeding. However, the species is an active suspension feeder creating its own feeding currents so is not likely to be highly intolerant of changes in suspended sediment. Therefore, an intolerance of low is reported.

Dessication	Intermediate	High	Low	Low

Serpula vermicularis is a predominantly subtidal species but does occur in the lower intertidal as scattered specimens and so will have some tolerance to desiccating conditions. Reef specimens have been recorded as being exposed at low tide (Anderson-Smith, 1887). The

species probably survives exposure to air by closing the operculum of the tube to retain water and inhabiting damp areas such as small cracks and crevices in the rock. However, feeding opportunities will be lost during this time which may affect growth and fecundity of individuals compared to those in the subtidal. An increase in desiccation at the level of the benchmark, where the species is continuously exposed to air and sunshine for one hour in each tidal cycle, may be tolerated by some individuals. However, it is expected that some would not survive, either from the direct effects of desiccation or from the longer term impact of reduced growth and fecundity, and so intolerance is reported to be intermediate.

Increase in emergence regime	Intermediate	High	Low	Low

The species is predominantly subtidal, with scattered specimens in the low intertidal. An increase in emergence will increase the time the lower shore species are exposed to air and may result in the death of some individuals. Intolerance is reported to be intermediate.

Decrease in emergence regime	Tolerant*	Not relevant	Not sensitive*	Moderate

The species is predominantly subtidal, with scattered specimens in the low intertidal so a decrease in emergence will have a favourable effect on those normally exposed at very low tides.

Increase in water flow rate	High	High	Moderate	Low

An increase in water flow rate, by two categories (see glossary) for a period of a year, is likely to prevent feeding for significant lengths of time and may result in the death of *Serpula vermicularis* and so intolerance is reported to be high. On return to normal conditions recovery is likely to be high - see additional information.

Decrease in water flow rate	Low	Very high	Very Low	Moderate

Although a reduction in water flow is likely to reduce food supply this will probably not have a huge impact on the suspension feeding *Serpula vermicularis* because the species can generate it's own feeding currents. However, it may allow the deposition of silt which may provide unfavourable conditions for the settlement of larvae. In some sheltered areas where there is little water movement and larvae are prevented from being dispersed aggregations of *Serpula vermicularis* tubes can occur creating large reefs (see biotope CMS.Ser). Therefore, since populations can survive in low water flow environments intolerance is reported to be low.

Increase in temperature	Low	High	Low	Low

There was no information found on the temperature tolerance of *Serpula vermicularis*. However, the species is distributed to the north and south of British waters which suggests that it is unlikely to be very intolerant of a long term change of 2°C. *Serpula vermicularis* is also found in large aggregations in shallow waters (0-14m) of enclosed and sheltered sea lochs where temperatures are likely to vary widely over a period of a year. The species may be more intolerant of a short term increase.

Decrease in temperature	Low	High	Low	Low

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Increase in turbidity	Low	Very high	Very Low	Moderate

An increase in turbidity, reducing light availability may reduce primary production by phytoplankton in the water column which could reduce food availability. However, the species is likely to feed on a variety of particulate matter so effects at the level of the benchmark are likely to be minimal and an intolerance of low is reported.

Decrease in turbidity Low Very high Very Low Moderate

A decrease in turbidity, increasing light availability may increase primary production by phytoplankton in the water column which could improve food availability. However, the species is likely to feed on a variety of particulate matter so effects at the level of the benchmark are likely to be minimal and an intolerance of low is reported. However, the larvae of *Serpula vermicularis* may be intolerant of increased light. Bosence (1979(b)) and other workers found that *Serpula vermicularis* settles on the underside of experimental plates in preference to brightly lit areas. Although this may be due to phototropism, other factors such as temperature, siltation and algal growth, may be important.

Increase in wave exposure Intermediate High Low Moderate

The species probably does not tolerate high levels of wave exposure because it will interfere with feeding. However, *Serpula vermicularis* is capable of retreating into its tube when strong wave action occurs. Intolerance is therefore, set to intermediate. In sheltered areas such as sea lochs, where *Serpula vermicularis* aggregates to create reefs, the species is likely to be more intolerant of wave exposure because the tubes grow upwards and outwards rather than the encrusting form in the open ocean. Moore *et al.* (1998) suggest that the upper limit of reef distribution in Loch Creran may be influenced by wave action. See additional information for recovery.

Decrease in wave exposure Tolerant Not relevant Not sensitive Moderate

Serpula vermicularis occurs in very sheltered sea lochs were wave exposure is minimal so the species is likely to tolerate a decrease.

Noise Tolerant Not relevant Not sensitive Not relevant

At the level of the benchmark *Serpula vermicularis* is not likely to be sensitive to noise but may respond to vibrations associated with noise as a predator avoidance mechanism.

Visual Presence Tolerant Not relevant Not sensitive Not relevant

The species has been observed to react to the visual presence of moving objects not naturally found in the marine environment (e.g., boats, machinery, and humans). It is sensitive to a sudden decrease in light levels as a predator avoidance mechanisms (Poloczanska *et al.*, 2004). However, at the level of the benchmark it is unlikely that this will have an adverse effect on the animal and tolerant has been suggested.

Abrasion & physical disturbance High High Moderate High

The calcareous tubes of *Serpula vermicularis* are likely to be damaged by physical disturbance For example, in Loch Creran *Serpula vermicularis* reefs have been severely damaged by the movement of mooring blocks and chains (Holt *et al.*, 1998). Although the effects were localized, in one instance, mooring had reduced colonies to rubble within a radius of 10 m, and extensive damage was reported within 50 m of salmon cages (Holt *et al.*, 1998). Holt *et al.* (1998) suggested that fishing activity could be very damaging but that no evidence of damage had yet been observed. A passing scallop dredge is likely to result in greater damage. Therefore, intolerance is reported to be high. See additional information below for recovery. For information on the intolerance of *Serpula vermicularis* reefs see CMS.Ser.

Displacement High High Moderate Low

The species lives in a calcareous tube that is permanently attached to the substratum. It is unlikely that the worm is able to reattach the tube if displaced and so would probably die. Intolerance is therefore, reported to be high. See additional information for recovery.

Chemical Pressures

	Intolerance	Recoverability	Sensitivity	Confidence
Synthetic compound contamination				Not relevant

Insufficient information.

Heavy metal contamination	Low	Very high	Very Low	Low

Serpula vermicularis was found at Garrick Roads, close to Restronguet Creek in the Fal estuary, that is contaminated with high levels of metals, in particular copper, zinc and arsenic (Bryan & Gibbs, 1983). Therefore, it appears that the species can tolerate some enhanced heavy metal concentrations and so intolerance is reported to be low.

Hydrocarbon contamination				Not relevant

Insufficient information.

Radionuclide contamination				Not relevant

Insufficient information.

Changes in nutrient levels	Intermediate	High	Low	Very low

In Loch Creran in Scotland, where *Serpula vermicularis* forms extensive reefs, organic effluent from an alginate factory appeared to have been responsible for eliminating reefs for a distance of about 1km and may have reduced reef development at greater distances (Moore *et al.*, 1998). Intolerance is set to intermediate with a very low confidence.

Increase in salinity	Intermediate	High	Low	Low

Serpula vermicularis is not found in areas where hypersaline conditions may occur, such as rock pools or lagoons, so it seems likely that the species would be intolerant of increases in salinity. See additional information below for recovery.

Decrease in salinity	Intermediate	High	Low	Low

No information was found on the effect of lowered salinity on *Serpula vermicularis*. Bosence (1979(b)) suggests that the layer of lower salinity water in the upper layers of the water in Ardbear Loch in Galway, Eire is partly responsible for the lack of individuals above a depth of 2m. However, *Serpula vermicularis* is known to tolerate reduced salinities (Hartmann-Schröder, 1971 and Mastrangelo & Passeri, 1975 cited in Moore *et al.*, 1998) and in Loch Creran in Scotland individual specimens of *Serpula vermicularis* were commonly observed in shallow waters where salinities can fall to around 23psu. Small enclosed lochs such as Ardbear Loch are often subject to extremely variable salinity so the species seems to be tolerant of shorter term changes. *Serpula vermicularis* reefs were also observed in intertidal areas of Loch Creran, where salinity is likely to vary, during the last century. Therefore, it seems likely that the species can tolerate some decreases in salinity. However, long term reductions would probably reduce abundance so intolerance is set to intermediate. See additional information below for recovery.

Changes in oxygenation	Intermediate	High	Low	Very low

There is no information regarding the tolerance of *Serpula vermicularis* to deoxygenation. Cole *et al.* (1999) suggest possible adverse effects on marine species below 4 mg/l and probable

adverse effects below 2mg/l. Bosence (1980) observed that the lower limit of larval settlement in Ardbear Lough, Eire coincided with mud-rich and possibly oxygen poor water. Therefore, the species, and the larvae in particular, may be intolerant of deoxygenated water and an intolerance of intermediate is reported.

Biological Pressures

	Intolerance	Recoverability	Sensitivity	Confidence
Introduction of microbial pathogens/parasites				Not relevant

No information on diseases of *Serpula vermicularis* was found. However, the species is known to be parasitized by the protozoan *Haplosporidium parisi* (Ormieres, 1980) but the effects of this infestation are unknown.

Introduction of non-native species	Tolerant	Not relevant	Not sensitive	Moderate

Although several species of serpulid polychaetes have been introduced into British waters none are reported to compete with *Serpula vermicularis* (Eno *et al*., 1997). However, there is always the potential for introduced species to either prey upon or compete with *Serpula vermicularis*.

Extraction of this species	Intermediate	High	Low	Moderate

The species is not likely to be extracted for it has no commercial or research value. Recovery from removal of 50% of the population is likely to be high - see additional information below.

Extraction of other species	Tolerant	Not relevant	Not sensitive	Low

Serpula vermicularis does not depend on other species so the extraction of other species is not likely to have any effect. However, when *Serpula vermicularis* forms reefs in enclosed and sheltered locations some species may play a key role in the strengthening of the reef (Moore, 1995(b)).

Additional information

Recovery

Provided there is a suitable substratum for the settlement of larvae, recolonization by individual *Serpula vermicularis* is expected to be high. The species is fairly widespread, probably reaches sexual maturity in its first year and reproduces every year thereafter. The planktonic larvae, which is thought to stay in the water column for one to eight weeks, may be able to disperse widely. Recovery is high only for individuals and reefs will take longer to recover (see the CMS.Ser biotope review for more information on reefs). Also, in sheltered and enclosed areas where *Serpula vermicularis* forms reefs recovery may not be possible if populations are lost. This is because hard substrata is a sparse feature in these locations and if, as suggested, limited water exchange keeps larvae in the local system, recruitment may not occur because the supply of larvae from outside the system is minimal.

Importance review

Policy/legislation

- no data -

Status

National (GB) importance	-	**Global red list (IUCN) category**	-

Non-native

Native	-		
Origin	-	**Date Arrived**	-

Importance information

When *Serpula vermicularis* forms reefs in sheltered locations the species creates a habitat for many other species. The aggregated tubes provide a substratum for a sessile macrofaunal community dominated by other tube worms, bryozoans, ascidians and sponges (Moore *et al*., 1998b). See the CMS.Ser biotope review for more information on *Serpula vermicularis* reefs.

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