Slender sea pen (*Virgularia mirabilis*)

MarLIN – Marine Life Information Network
Marine Evidence–based Sensitivity Assessment (MarESA) Review

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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/1396]. All terms and the MarESA methodology are outlined on the website (https://www.marlin.ac.uk)

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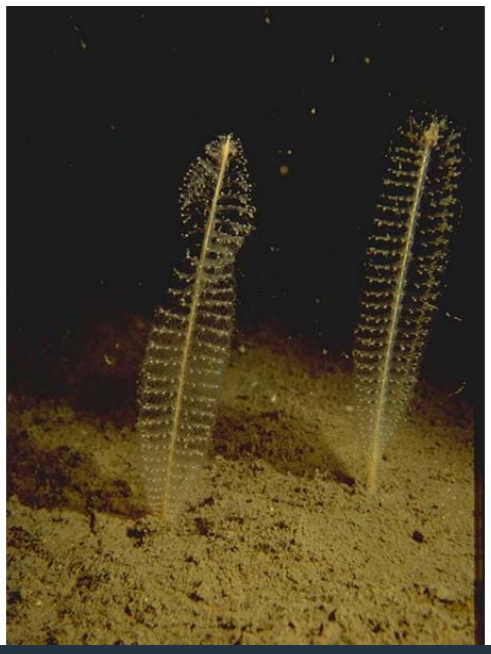

Sea pens, *Virgularia mirabilis* extending from muddy sediment.
Photographer: Sue Scott
Copyright: Sue Scott

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 & Emily Wilson	**Refereed by**	This information is not refereed.
Authority	(Müller, 1776)		
Other common names	-	**Synonyms**	-

Summary

Description

A slender sea pen up to 60 cm long with a central stem only a few millimetres thick. Retractile tentacled polyps are fused into small 'leaves' which are arranged in two opposing lateral rows on the central stem. The colony varies in colour from white to creamy yellow in colour. May luminesce in darkness.

Recorded distribution in Britain and Ireland

Found of all British and Irish coasts but less frequent in the south.

Global distribution

Western Europe and Mediterranean, occurs throughout the North Atlantic possibly as far as North America.

Habitat

Virgularia mirabilis lives in fine sediments (muddy sand to soft mud). The species is found in sheltered inshore waters, or in deeper water offshore, from 12 - 400 m depth. The species is often very abundant in sea lochs or man-made harbours.

Depth range

10-400m

Identifying features

See additional information for explanation of terms.

- Very slender sea-pen, up to 60 cm long with the axial polyp 2-4 mm in diameter.
- Axis round in cross-section.
- Stalk about equal in length to the rachis, or a little shorter.
- Up to 12 autozooids on each leaf; they are long when expanded and very retractile due to the absence of sclerites.
- Sclerites (skeletal element) are totally absent.
- Non-retractile siphonozooids are located in a single oblique row a the foot of each leaf but are small and inconspicuous.
- Colouration of the colony from white to creamy yellow.

Additional information

As is the case for all octocorals, sea pens are actually colonies of polyps. What distinguishes sea pens is polyp dimorphism. One polyp grows very large and loses its tentacles, forming the central axis. The central axial polyp is divided into two regions: a lower peduncle or stalk, which never bears secondary polyps and functions as a burrowing organ, and an upper stem or rachis, from which numerous secondary polyps bud. Some of these secondary polyps, called autozooids, are typical feeding polyps. Others, the larger and fewer siphonozooids, serve as intakes for water, which circulates within the colony and helps keep it upright. The axial polyp contains a slender, unbranched, calcareous skeletal rod (axis). In this species the axis is round in section and often protrudes from the top of the colony.

Virgularia mirabilis live upright with their stalks thrust into a mucus-lined burrow into which the whole colony can withdraw when disturbed.

Listed by

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Further information sources

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Biology review

Taxonomy

Phylum	Cnidaria	Sea anemones, corals, sea firs & jellyfish
Class	Anthozoa	Sea anemones, soft & cup corals, sea pens & sea pansies
Order	Pennatulacea	
Family	Virgulariidae	
Genus	Virgularia	
Authority	(Müller, 1776)	
Recent Synonyms	-	

Biology

Typical abundance	
Male size range	<60cm
Male size at maturity	
Female size range	Large(>50cm)
Female size at maturity	
Growth form	Pinnate
Growth rate	
Body flexibility	Low (10-45 degrees)
Mobility	
Characteristic feeding method	No information, Passive suspension feeder
Diet/food source	
Typically feeds on	Plankton and organic particles.
Sociability	
Environmental position	Epifaunal
Dependency	Independent.
Supports	Substratum the nudibranch *Armina loveni*.
Is the species harmful?	No

Biology information

- **Typical abundance:** usually found at densities of ca >5 individuals / m.
- **Flexibility:** Eno *et al.*, (1996) found that sea pens bent away from lobster pots dropping on top of them in a passive response to the pressure wave travelling ahead of the dropping pot.
- **Feeding:** *Virgularia mirabilis* does possess nematocysts and so the species is probably capable of both passive predation on small zooplanktonic organisms and suspension feeding of suspended material (Hoare & Wilson, 1977). Laboratory experiments have shown that the polyps of *Virgularia mirabilis* are capable of capturing (by trapping with nematocysts) and ingesting small active organisms such as *Artemia* nauplii. However, *Virgularia mirabilis* is a passive carnivore, waiting for small animals that stumble, or are swept, into the tentacles of the sea pen. Suspension feeding occurs when very small

particles become trapped in mucus on the tentacles and are then transported to the mouth by cilia. Suspension feeding is evidenced by the orientation of many colonies at right angles to the water current.
- Evidence of predation on *Virgularia mirabilis* seems limited to a report by Marshall & Marshall (1882 in Hoare & Wilson, 1977) that the species was found in the stomach of haddock. Observations by Hoare & Wilson (1977) suggest however, that predation pressure on this species is low.

Habitat preferences

Physiographic preferences	Offshore seabed, Sea loch / Sea lough, Enclosed coast / Embayment
Biological zone preferences	Circalittoral offshore, Lower circalittoral, Lower infralittoral, Upper circalittoral
Substratum / habitat preferences	Coarse clean sand, Fine clean sand, Mud, Muddy sand, Sandy mud
Tidal strength preferences	Very Weak (negligible), Weak < 1 knot (<0.5 m/sec.)
Wave exposure preferences	Extremely sheltered, Sheltered, Ultra sheltered, Very sheltered
Salinity preferences	Full (30-40 psu)
Depth range	10-400m
Other preferences	No text entered
Migration Pattern	Non-migratory / resident

Habitat Information

No text entered

Life history

Adult characteristics

Reproductive type	Gonochoristic (dioecious)
Reproductive frequency	Annual episodic
Fecundity (number of eggs)	No information
Generation time	Insufficient information
Age at maturity	Insufficient information
Season	June - October
Life span	See additional information

Larval characteristics

Larval/propagule type	-
Larval/juvenile development	Lecithotrophic
Duration of larval stage	See additional information
Larval dispersal potential	Greater than 10 km

Larval settlement period	Insufficinet information

Life history information

- The sexes are separate in sea pens. Each colony of polyps is either male or female.
- There is very little information on population structure or life cycles in any of the British sea pens, but the limited data available from other species would lead one to predict a similar pattern of patchy recruitment, slow growth and long lifespan (Hughes, 1998(b)).
- In other species of sea pen the eggs and sperm are released from the polyps and fertilization takes place externally. The sea pen *Ptilosarcus guerneyi* spawns in late March, with up to 200,000 eggs produced per female colony. Chia & Crawford, (1973) found free-swimming larvae of this species did not feed, suggesting a lecithotrophic larvae, and settled within seven days if a suitable substratum was encountered. Birkeland, (1974) found the lifespan of *Ptilosarcus guerneyi* to be up to 15 years, taking 5 or 6 years to reach sexual maturity.

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	Moderate	Moderate	Moderate

The species lives in the substratum so substratum loss will mean loss of the population. There is very little information on population structure or life cycles in any of the British sea pens, but the limited data available from other species would lead one to predict a similar pattern of patchy recruitment, slow growth and long life-span (Hughes, 1998(b)). Larval settlement is likely to be patchy in space and highly episodic in time with no recruitment to the population taking place for some years. In Holyhead harbour, for example, animals show a patchy distribution, probably related to larval settlement (Hoare & Wilson, 1977). Therefore, provided that a suitable substratum remains, recoverability is expected to be moderate.

Smothering	Low	Immediate	Not sensitive	Moderate

Individual colonies extend up to 30cm above the sediment so are unlikely to be significantly affected by smothering by 5cm of sediment. There may be an increase in the energetic cost of cleaning sediment from the polyps. Eno *et al*., (1996) found that another species of sea pen, *Funiculina quadrangularis* when partially buried still showed signs of polyp activity on parts of the sea pen that were visible. In an investigation into the effect of shellfish traps on benthic habitats (Eno *et al*., 1996) creels were dropped on sea pens and left for extended periods to simulate the effects of smothering which could occur during commercial operations. The sea pens consistently righted themselves following removal of the pots indicating recovery is likely to be immediate.

Increase in suspended sediment	Low	Immediate	Not sensitive	Moderate

The effect of increased deposition of fine silt is uncertain but it is possible that feeding structures may become clogged. When tested *Virgularia mirabilis* quickly seized and rejected inert particles (Hoare & Wilson, 1977). Hiscock (1983) observed *Virgularia mirabilis* secretes copious amounts of mucus and, as a species living in a very sheltered area subject to high suspended sediment loads, the mucus could clearly keep the polyps clear of silt. Hoare & Wilson (1977) also suggested there is a tendency for animals to withdraw into the sediment when there was a high level of tidally-suspended sediment in the water. There was however, much variation. Eno *et al*., (1996) found that another species of sea pen, *Funiculina quadrangularis*, was quick to remove any adhering mud particles by the production of copious quantities of mucus. *Virgularia mirabilis* is also likely to be able to self-clean. However, if feeding is reduced by increases in siltation the viability of the population will be reduced. Once siltation levels return to normal, feeding will be resumed therefore recoverability will be immediate.

Decrease in suspended sediment

Dessication	Not relevant	Not relevant	Not relevant	High

Virgularia mirabilis is a sub-tidal species that is likely to be highly intolerant of desiccation.

Exposure to air for a period of an hour would probably result in the death of individuals. However, the species only occurs in the circalittoral zone (below 10 m) where desiccation is not a factor so intolerance has been assessed as not relevant.

Increase in emergence regime Not relevant Not relevant Not relevant High

Virgularia mirabilis is a sub-tidal species that is likely to be highly intolerant of emergence. Emersion from seawater for a period of an hour, where the species would be subject to conditions such as desiccation and temperature changes, would probably result in the death of individuals. However, the species only occurs in the circalittoral zone (below 10 m) where emergence does not occur so intolerance has been assessed as not relevant.

Decrease in emergence regime

Increase in water flow rate High Moderate Moderate High

Virgularia mirabilis is found in habitats associated with physically-sheltered conditions of weak and very weak water flow rates, therefore intolerance to water flow rate is likely to be high. As water flow rates increase, *Virgularia mirabilis* first responds by swinging polyps around the axial rod to face away from the current, then polyps face downstream. With further increases the stalk bends over and the pinnae are pushed together to an increasing amount with increasing velocity of flow. Finally, tentacles retract and at water speeds greater than 0.5m/s (i.e. 1 knot) the stalk retracts into the mud (Hiscock, 1983). If water speeds remain at this level or above the sea-pen will be unable to extend above the sediment, unable to feed and will die. Therefore, intolerance to an increase in water flow, at the benchmark level is high. There is very little information on population structure or life cycles in any of the British sea pens, but the limited data available from other species would lead one to predict a similar pattern of patchy recruitment, slow growth and long life-span (Hughes, 1998(b)). Larval settlement is likely to be patchy in space and highly episodic in time with no recruitment to the population taking place for some years. Therefore, provided that a suitable substratum remains, recoverability is expected to be moderate.

Decrease in water flow rate

Increase in temperature Intermediate Moderate Moderate Low

No information was found on the upper or lower limits of *Virgularia mirabilis* tolerance to temperature changes. The species occurs from North America to the Mediterranean and so may be able to tolerate long term changes in temperature. However, the species is subtidal where wide variations in temperature, such as experienced in the intertidal, are not so common and so may be more intolerant of short term changes. Intolerance has therefore, been assessed as intermediate.

Decrease in temperature

Increase in turbidity Tolerant Not relevant Not sensitive Not relevant

Virgularia mirabilis is insensitive to light (Hoare & Wilson, 1977) therefore an increase or decrease in light levels caused by changing turbidity levels will have little or no effect on the sea pen population.

Decrease in turbidity

Increase in wave exposure High High Moderate Moderate

Virgularia mirabilis is found in habitats with low wave exposure. In Holyhead Harbour Hoare & Wilson (1977) found that, with increasing distance from the breakwater of the harbour, where

wave exposure increases, individuals became smaller and less common. An increase of two scales in the exposure scale is likely to kill *Virgularia mirabilis* populations so intolerance is high. However, only those populations in relatively shallow water are likely to be affected by the factor. Recruitment is probably sporadic and so recovery is assessed as moderate.

Decrease in wave exposure

Noise Low Immediate Not sensitive Low

Virgularia mirabilis can withdraw into its burrow when disturbed. The species is likely to be sensitive to vibrations in the surrounding water rather than noise itself. The presence of noise, at the benchmark level such as the regular passing of a 30 metre trawler at 100 metres, effects are likely to be minimal and if disturbed the sea-pen would re-emerge as soon as conditions return to normal. Thus, recovery would be immediate.

Visual Presence Tolerant Not relevant Not sensitive High

Virgularia mirabilis has very limited, if any, ability for visual perception. The sea pen is unlikely to be sensitive to visual presence.

Abrasion & physical disturbance Intermediate Moderate Moderate Moderate

Sea pens retract slowly and are likely to be intolerant of abrasion by trawling for instance, which is likely to break the rachis of *Virgularia mirabilis*. Species obtained by dredges were invariably damaged (Hoare & Wilson, 1977). However, the densities of *Virgularia mirabilis* were similar in trawled and untrawled sites in Loch Fyne and no changes in sea pen density was observed after experimental trawling over a 18 month period in another loch (Howson & Davies, 1991; Tuck *et al*., 1998; Hughes, 1998b). Hughes (1998b) concluded that *Virgularia mirabilis* and *Pennatula phosphorea*, which can withdrawn into the sediment, were probably less susceptible to the effects of damage by fishing gear than *Funiculina quadrangularis*, which is unable to withdraw. In an investigation into the effect of shellfish traps on benthic habitats (Eno *et al*., 1996), creels were dropped on sea pens and left for extended periods to simulate the effects of smothering which could occur during commercial operations. Sea pens were seen to bend away in response to the pressure wave travelling ahead of the dropping pot. The sea pens consistently righted themselves following removal of the pots.
Eno *et al*. (1996) found that even if damaged, another species of sea pen, *Funiculina quadrangularis*, appeared to remain functional and this could also be true of *Virgularia mirabilis*. However, the long term effects are unknown. Overall, a proportion of the population may be damaged and die. Hence, an intolerance of intermediate has been recorded. Recoverability is likely to be moderate.

Displacement Low Immediate Not sensitive Moderate

Displaced individuals, which are not damaged (see Abrasion above for damage), will re-burrow (Jones *et al*., 2000) and recover completely within 72 hours, provided the basal peduncle remains in contact with the sediment surface. Eno *et al*., (1996) found that even when damaged another species of sea pen, *Funiculina quadrangularis*, appeared to remain functional. This could also be true of *Virgularia mirabilis*. During a manipulative experiment to examine the effect of extensive and repeated experimental trawl disturbance over an 18 month period Tuck *et al*. (1998) reported no effects on the abundance and distribution of *Virgularia mirabilis*. The authors suggest the reason for this may be the species ability to rapidly withdraw into the sediment, thereby avoiding damage.

Chemical Pressures

	Intolerance	Recoverability	Sensitivity	Confidence
Synthetic compound contamination				Not relevant

Insufficient information.

Heavy metal contamination				Not relevant

Insufficient information.

Hydrocarbon contamination				Not relevant

Insufficient information.

Radionuclide contamination	Low	High	Low	Low

Virgularia mirabilis occurred in high density (10/m□) at a sampling station immediately offshore from the Sellafield outfall pipeline in the Irish Sea (Hughes & Atkinson, 1997). Bottom sediments in this area contains particles of long half life radionuclides from the liquid effluent and so intolerance is assessed as low.

Changes in nutrient levels	Low	High	Low	Moderate

Hoare & Wilson (1977) noted that *Virgularia mirabilis* was absent from part of the Holyhead Harbour heavily affected by sewage pollution. However, the species was abundant near the head of Loch Harport, Skye, close to a distillery outfall discharging water enriched in malt and yeast residues and other soluble organic compounds (Nickell & Anderson, 1977 in Hughes, 1998). The organic content of the sediment was up to 5%. *Virgularia mirabilis* was also present in Loch Sween in Scotland where organic content is also as high as 5%. Thus it seems likely that sea pen communities are able to tolerate some nutrient enrichment and so intolerance is assessed as low.

Increase in salinity	High	Moderate	Moderate	Low

Jones *et al*. (2000) suggest that *Virgularia mirabilis* appears to be somewhat tolerant of occasional lowering of salinity. However, the species is found only in fully marine conditions and so is likely to be intolerant of a long term, chronic change; e.g., a change of one category from the MNCR salinity scale for one year and so intolerance is assessed as high. Recovery is assessed as moderate because of the sporadic nature of recruitment.

Decrease in salinity

Changes in oxygenation	High	Moderate	Moderate	Low

Stratification of the water column and hypoxia in near-bottom water is especially likely to occur during warm temperatures in semi-enclosed water bodies such as sea lochs. *Virgularia mirabilis* is often found in sea lochs so may be able to tolerate some reduction in oxygenation. However, Jones *et al*., (2000) found sea pen communities to be absent from areas which are deoxygenated and characterised by a distinctive bacterial community and Hoare & Wilson (1977) reported *Virgularia mirabilis* absent from sewage related anoxic areas of Holyhead harbour. Intolerance is therefore, assessed as high. There is very little information on population structure or life cycles in any of the British sea pens, but the limited data available from other species would lead one to predict a similar pattern of patchy recruitment, slow growth and long life-span (Hughes, 1998(b)). Larval settlement is likely to be patchy in space and highly episodic in time with no recruitment to the population taking place for some years.

Biological Pressures

	Intolerance	Recoverability	Sensitivity	Confidence

Introduction of microbial pathogens/parasites Not relevant

No information on diseases of *Virgularia mirabilis* was found.

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

There are no non-native species of sea-pens that compete with *Virgularia mirabilis* (Eno *et al.*, 1997).

Extraction of this species Intermediate High Low Moderate

It is extremely unlikely that *Virgularia mirabilis* would be subject to extraction so this factor is assessed as not relevant. However, individuals may be removed by dredging activities. If some individuals remain recovery should be good because of the availability of larval supply.

Extraction of other species Tolerant Not relevant Not sensitive Low

Virgularia mirabilis has no known obligate relationships so removal of other species is unlikely to have any direct effect.

Additional information

There have been no long-term studies of British sea pen populations so any assessment of intolerance is hindered by lack of information.

Importance review

Policy/legislation

Northern Ireland Priority Species ☑

Status

National (GB) importance	Not rare/scarce	**Global red list (IUCN) category**	-

Non-native

Native	-		
Origin	-	**Date Arrived**	-

Importance information

The nudibranch *Armina loveni* is found crawling on the surface or burrowing in muddy sand, usually in company with sea-pens *Virgularia mirabilis*, on which it is presumed to feed (Picton & Morrow, 1994).

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