Common brittlestar (*Ophiothrix fragilis*)

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

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Ophiothrix fragilis **brittlestar bed.**
Photographer: Keith Hiscock
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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	Angus Jackson	**Refereed by**	Prof. Paul Tyler
Authority	(Abildgaard in O.F. Müller, 1789)		
Other common names	-	**Synonyms**	-

Summary

Description

A large brittlestar whose disk may reach up to 2 cm in diameter. The five arms are long (about five times the disk diameter) and spiny. The upper disk surface has a 5-rayed pattern of spines. This species is very varied in colour, commonly brown or grey but ranging through purple, red, orange, yellow, and white. Colouration may be plain or banded (particularly on the arms). The arms are fragile and often broken.

Recorded distribution in Britain and Ireland

All British and Irish coasts.

Global distribution

Widely distributed in the eastern Atlantic from northern Norway to the Cape of Good Hope.

Habitat

Found from the lower shore to circalittoral offshore habitats on hard substrata including bedrock, boulders and on coarse sediment. Most abundant on tideswept rock and on mixed coarse sediments. In the intertidal the species is found in crevices and under boulders.

Depth range

0-85

Identifying features

- Large, long-armed brittle star
- Pentagonal disk up to 2 cm in diameter.
- Conspicuous radial shields and 5-rayed pattern of small spines on disk.
- Arm length about 5 times diameter of disk with seven serrated spines on each segment.
- Keel on naked dorsal arm plates.

Additional information

No text entered

Listed by

Further information sources

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Biology review

Taxonomy

Phylum	Echinodermata	Starfish, brittlestars, sea urchins & sea cucumbers
Class	Ophiuroidea	Brittlestars
Order	Ophiurida	
Family	Ophiotrichidae	
Genus	Ophiothrix	
Authority	(Abildgaard in O.F. Müller, 1789)	
Recent Synonyms	-	

Biology

Typical abundance	High density
Male size range	2-20mm
Male size at maturity	
Female size range	Medium(11-20 cm)
Female size at maturity	
Growth form	Radial
Growth rate	See additional information
Body flexibility	Low (10-45 degrees)
Mobility	
Characteristic feeding method	Passive suspension feeder
Diet/food source	
Typically feeds on	Phytoplankton
Sociability	
Environmental position	Epibenthic
Dependency	Independent.
Supports	Host symbiotic sub-cuticular bacteria
Is the species harmful?	No Little evidence of toxicity (McClintock, 1989 cited in Sk&#246ld, 1998)

Biology information

- This species can be found in very high densities of up to 2000 individuals per square metre (Davoult, 1989).
- The smallest brittle stars found have a disk diameter of 2 mm and two segments per arm.
- Some gonad development is present in individuals with disks of 3 mm although full sexual maturity is probably achieved at about 10 mm disk diameter (Gage, 1990).
- Growth rate estimates vary considerably. Growth in juveniles may be between 1.6-3.1 and 3.5-10.3 increase in body disk diameter per day (Davoult *et al*., 1990) On average the body disk diameter is estimated to increase by 1.1 mm per month. Other growth rate estimates are much slower (Gage, 1990)

- Optimal feeding can occur at water flow rates below 20 cm per second (Davoult & Gounin, 1995). Water moving at above 25 cm per second causes the arms to be brought down from being extended in the water column (Warner & Woodley, 1975; Hiscock, 1983). Water flow rates refer to water movements at the seabed. Surface flow rates will be considerably higher.
- Although not an important dietary component, *Ophiothrix fragilis* may be found in the stomach contents of most common predators (Warner, 1971). *Ophiothrix fragilis* avoids predation by moving away from sources of mechanical disturbance (Warner, 1971). The escape response of *Ophiothrix fragilis* is slow in comparison to other brittle stars and it avoids visual predation through sheltering in crevices etc. and cryptic colouration (Sköld, 1998). Predatory starfish such as *Asterias rubens* and *Marthasterias glacialis* produce steroid glycoside chemicals that elicit an avoidance response in *Ophiothrix fragilis* (Mackie, 1970). Although not toxic, *Ophiothrix fragilis* achieves unpalatability through heavy calcification and possession of glassy spines (Sköld, 1998).
- Brittle stars, such as *Ophiothrix fragilis*, have symbiotic subcuticular bacteria. The host-bacteria association can be perturbed by acute stress and changes in bacterial loading may be used as an indicator of sub-lethal stress (Newton & McKenzie, 1995)
- The strong tidal current, coarse sediment communities from the English Channel are dominated by *Ophiothrix fragilis*, *Urticina felina* and *Alcyonium digitatum* (Migné & Davoult, 1997(c)).

Habitat preferences

Physiographic preferences	Offshore seabed, Open coast, Strait / sound
Biological zone preferences	Lower circalittoral, Lower eulittoral, Lower infralittoral, Sublittoral fringe, Upper circalittoral, Upper infralittoral
Substratum / habitat preferences	Bedrock, Cobbles, Crevices / fissures, Gravel / shingle, Large to very large boulders, Maerl, Muddy gravel, Other species, Pebbles, Small boulders, Under boulders
Tidal strength preferences	Moderately Strong 1 to 3 knots (0.5-1.5 m/sec.), Strong 3 to 6 knots (1.5-3 m/sec.), Weak < 1 knot (<0.5 m/sec.)
Wave exposure preferences	Exposed, Extremely exposed, Moderately exposed, Sheltered, Very exposed, Very sheltered
Salinity preferences	Full (30-40 psu), Low (<18 psu), Reduced (18-30 psu), Variable (18-40 psu)
Depth range	0-85
Other preferences	No text entered
Migration Pattern	Non-migratory / resident

Habitat Information

- *Ophiothrix fragilis* may be found in low densities on *Crepidula fornicata* (slipper limpet) beds (Bourgoin *et al*., 1985) or also overlying *Modiolus* shells (Magorrian et al., 1995)
- Wolff, (1968) notes the species occurring in normal salinities of 16 psu and even persisting down to 10 psu.

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	6-10 months - see additional information.
Season	June - October
Life span	5-10 years

Larval characteristics

Larval/propagule type	-
Larval/juvenile development	Planktotrophic
Duration of larval stage	11-30 days
Larval dispersal potential	Greater than 10 km
Larval settlement period	August to September

Life history information

- Longevity estimates vary from 9 months (Davoult *et al.*, 1990) to over 10 years (Gage, 1990). Work by Gage (1990) on skeletal growth bands in *Ophiothrix fragilis* indicate a slow rate of growth and considerable longevity suggesting that individuals with a disk diameter of 13mm are around 10 years old (disk diameters reach 20mm). N.B. This is not yet a validated age determining mechanism.
- Davoult *et al.*, (1990) consider development to maturity to take 6-10 months depending on the cohort and time of recruitment. Gonads are most developed in May-July (George & Warwick, 1985). Some gonad development is present in individuals with disks of 3 mm although full sexual maturity is probably achieved at about 10 mm disk diameter (Gage, 1990). Development of sexual maturity is dependent on day length and temperature although temperature is not believed to be a trigger for spawning (Davoult, *et al.*, 1990).
- Gamete release - Davoult *et al.*, (1990) record spawning in the eastern Channel from mid July to mid August. Spawning in the Plymouth area has been recorded from June to the start of September (Davoult *et al.*, 1990) and in October (Marine Biological Association 1957). In Kinsale Harbour on the south coast of Ireland Ball *et al.* (1995) found that *Ophiothrix fragilis* had a long breeding season, extending from May to January, with peak activity in summer/autumn, a small percentage of the population can breed throughout most of the year in certain regions. The evidence suggests that each animal spawns only once during a breeding season, although spawning may take place as several bursts over the period based on the presence of a number of different size classes of oocytes within the gonad at any particular time. Further north, in Sweden, spawning is recorded from August and September (Davoult *et al.*, 1990).
- Recruitment from the planktonic larvae occurs from August to September (Allain, 1974). Davoult *et al.*, (1990) consider there to be multiple recruitments in the eastern Channel, a primary one in September and three secondary ones in February, April and June. Individual cohorts can be followed for 4-6 months after which variable growth rates and overlap in size precludes their separation. These multiple recruitments indicate more than

one discrete spawning episode.

- Larvae appear in the water column about a week after gamete release and fertilisation of the eggs. The larvae metamorphose into juvenile brittlestars whilst still in the plankton. The pelagic phase lasts about 26 days (MacBride, 1907).
- The larvae may undertake a passive migration in areas such as the English Channel where there are strong water flow rates (Davoult *et al*., 1990). Here, with water that may move over 4 km per day and a larval duration of 26 days, the larvae can disperse up to 70-100 km. This may preclude auto-recruitment of local populations (Davoult *at al*., 1990).
- Mean disk diameter can decrease by up to 20 % during gamete production (Davoult *et al*., 1990).
- Although the species is gonochoristic Davoult *et al*., (1990) record a 1 % incidence of hermaphroditism.
- Recruitment success is heavily dependent on environmental conditions including temperature and food availability. In years after mild winters *Ophiothrix fragilis* occurred in extremely high densities in the Oosterschelde estuary in Holland (Smaal, 1994). Populations seem to be stable in the long-term although there may be strong variation from year to year. A multi annual cycle of around 4 years may exist in the eastern English Channel (Davoult *et al*., 1993). However, Holme (1984) notes long-term changes in *Ophiothrix fragilis* populations in the western Channel, possibly linked with predator abundance (*Luidia ciliaris* and *Luidia sarsi*) and water quality.

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	High

Ophiothrix fragilis is an epibenthic species so substratum loss would result in mortality. Breeding occurs annually and there may be multiple recruitment phases (Davoult *et al*., 1990). The larvae of this species can disperse over considerable distances in areas such as the English Channel where there are strong water flow rates (Davoult *et al*., 1990). With water that may move several kilometres per day due to residual flow (e.g. see Pingree & Maddock, 1977) and a larval duration of 26 days, the larvae can disperse up to 70-100 km and establish populations elsewhere. Adults, although mobile, are not highly active. Some immigration of adults from nearby populations may be possible. Longevity estimates vary from 9 months (Davoult *et al*., 1990) to over 10 years (Gage, 1990). Reproductive capability may be reached in 6-10 months depending on time of recruitment (Davoult *et al*., 1990).

	Intolerance	Recoverability	Sensitivity	Confidence
Smothering	High	High	Moderate	Low

Although *Ophiothrix fragilis* is an epibenthic crawling species, it has a low level of locomotory activity and lacks muscular development. Smothering by 5 cm of sediment would probably cause death as it is unlikely that the brittle star would be able to burrow out of the covering material. Breeding occurs annually and there may be multiple recruitment phases (Davoult *et al*., 1990). The larvae of this species can disperse over considerable distances in areas such as the English Channel where there are strong water flow rates (Davoult *et al*., 1990). With water that may move several kilometres per day due to residual flow (e.g. see Pingree & Maddock, 1977) and a larval duration of 26 days, the larvae can disperse up to 70-100 km and establish populations elsewhere. Adults, although mobile, are not highly active. Some immigration of adults from nearby populations may be possible. Longevity estimates vary from 9 months (Davoult *et al*., 1990) to over 10 years (Gage, 1990). Reproductive capability may be reached in 6-10 months depending on time of recruitment (Davoult *et al*., 1990).

	Intolerance	Recoverability	Sensitivity	Confidence
Increase in suspended sediment	Low	Very high	Very Low	Low

Ophiothrix fragilis is a passive suspension feeder. Increases in siltation of inorganic particles may interfere with the feeding of this species (Aronson, 1992 cited in Hughes, 1998), particularly in non current-swept areas. Respiration rate is low and the species can tolerate considerable loss of body mass during reproductive periods (Davoult *et* *al*., 1990) so restricted feeding may be tolerated. Once normal feeding recommences it may take a short time for condition to be regained.

Decrease in suspended sediment

Dessication	Intermediate	High	Low	Low

Although mainly subtidal, this species may also be found on the lower shore, sheltering under boulders etc. Consequently the brittle star may be tolerant to some degree of desiccation. However, increased desiccation through exposure to air and sunlight may kill part of the intertidal population. Breeding occurs annually and there may be multiple recruitment phases (Davoult *et al*., 1990). The larvae of this species can disperse over considerable distances in areas such as the English Channel where there are strong water flow rates (Davoult *et al*., 1990). With water that may move several kilometres per day due to residual flow (e.g. see Pingree & Maddock, 1977) and a larval duration of 26 days, the larvae can disperse up to 70-100 km and establish populations elsewhere. This may preclude auto-recruitment of local populations (Davoult *at al*., 1990) Adults, although mobile, are not highly active. Some immigration of adults from nearby populations may be possible. Longevity estimates vary from 9 months (Davoult *et al*., 1990) to over 10 years (Gage, 1990). Reproductive capability may be reached in 6-10 months depending on time of recruitment (Davoult *et al*., 1990).

Increase in emergence regime	Not relevant	Not relevant	Not relevant	Low

Ophiothrix fragilis is a mobile epibenthic crawler and should be able to relocate to a suitable location on the shore should the emergence regime be altered.

Decrease in emergence regime

Increase in water flow rate	Low	Very high	Very Low	Moderate

Ophiothrix fragilis frequently inhabits areas with strong tidal currents e.g. up to 1.5 m/s in the Dover Straits (Hughes, 1998b) (although water flow rate will not be continuously high e.g. during periods of slack water). A certain degree of water movement is important to the feeding mechanism of this species. However, above a certain water speed (25 cm/s) the feeding arms are withdrawn from the water column (Warner & Woodley, 1975; Hiscock, 1983). At water speeds above about 28 cm/s individuals or even small groups may be displaced from the substratum and they have been observed being rolled along the seabed by the current (Warner, 1971). Living in dense aggregations may reduce displacement by strong currents (Warner & Woodley, 1975). Water flow rates refer to water movements at the seabed. Surface flow rates will be considerably higher. Respiration rate is low and the species can tolerate considerable loss of body mass during reproductive periods (Davoult *et al*., 1990) so restricted feeding may be tolerated. Once normal feeding recommences it may take a short time for condition to be regained. *Ophiothrix fragilis* also has specific behaviours and abilities to relocate conspecifics following displacement (Broom, 1975).

Decrease in water flow rate

Increase in temperature	Intermediate	High	Low	Low

Changes in temperature can have a considerable effect on *Ophiothrix fragilis* populations. In years following mild winters *Ophiothrix fragilis* may recruit in very high numbers (Smaal, 1994). However, the distribution of *Ophiothrix fragilis* is large, ranging from northern Norway south to the Cape of Good Hope. Consequently this species is exposed to temperatures both above and below those found in the British Isles. In the long term, some populations in the English Channel have remained stable (Davoult *et al*., 1993). In other areas of the Channel considerable fluctuations have been noted over the last century, believed to be due to variations in water masses present (Holme, 1984). Long term chronic changes in temperature will probably have little effect on the species. Short term acute changes in temperature are noted to cause a reduction in the loading of subcutaneous symbiotic bacteria in echinoderms such as *Ophiothrix fragilis*. Reductions in these bacteria are probably indicative of levels of stress and may lead to mortality (Newton & McKenzie, 1995). The species is noted to exist in shallow, enclosed waters that regularly drop to 3 °C but is absent from areas where temperatures drop to 0 °C. Breeding occurs annually and there may be multiple recruitment phases (Davoult *et al*., 1990). The larvae of this species can disperse over considerable distances in areas such as the English Channel where there are strong water flow rates (Davoult *et al*., 1990). With water that may move several kilometres per day due to residual flow (e.g. see Pingree & Maddock, 1977) and a larval duration of 26 days, the larvae can disperse up to 70-100 km and establish populations elsewhere. This may preclude auto-recruitment of local populations (Davoult *at al*., 1990). Adults, although mobile, are not highly active. Some immigration of adults from nearby populations may be possible. Longevity estimates vary from 9 months (Davoult *et al*., 1990) to over 10 years (Gage, 1990). Reproductive capability may be reached in 6-10 months depending on time of recruitment (Davoult *et al*., 1990).

Decrease in temperature

Increase in turbidity	Low	Very high	Very Low	Low

Ophiothrix fragilis is likely to have poor facility for visual perception and consequently is probably not directly sensitive to changes in turbidity. However, the main food source of this species is phytoplankton which have a requirement for light. Increases in turbidity may limit the amount of phytoplankton available to the brittle stars. Food availability is one of the main factors controlling growth and development (Migné & Davoult, 1997; Davoult *et al*., 1990). Once normal feeding recommences it may take a short time for condition to be regained.

Decrease in turbidity

Increase in wave exposure	Low	Very high	Very Low	Moderate

The species occurs in a wide range of wave exposures as well as on offshore seabeds where wave action is less important. Increases in wave exposure may cause increases in the incidence of damaged individuals (*Ophiothrix fragilis* arms are brittle). Strong wave action may cause displacement of brittle stars. *Ophiothrix fragilis* has specific behaviours and abilities to relocate conspecifics following displacement (Broom, 1975). Brittle stars often have broken arms but are capable of arm and even some disk regeneration (Sköld, 1998).

Decrease in wave exposure

Noise	Low	Very high	Very Low	Low

Ophiothrix fragilis reacts to mechanical disturbance (predator evasion response) (Warner, 1971). Although there are no records of reaction to noise, sound vibrations may trigger this sort of behaviour. There is some evidence of autotomy of arms in response to predator threat (Emson & Wilkie, 1980). Brittle stars are capable of arm and even some disk regeneration (Sköld, 1998).

Visual Presence	Tolerant	Not relevant	Not sensitive	High

Ophiothrix fragilis is likely to have poor facility for visual perception and consequently is probably not sensitive to visual disturbance. Movement of a hand near to *Ophiothrix fragilis* elicits no escape response (Skö, 1998).

Abrasion & physical disturbance	Intermediate	High	Low	Moderate

Brittlestars have fragile arms that are likely to be damaged by abrasion. Brittlestars can tolerate considerable damage to arms and even the disk without suffering mortality and are capable of arm and even some disk regeneration (Sköld, 1998). Fishermen tend to avoid brittlestar beds since the animals clog their nets (Jones *et al*., 2000). However, a passing scallop dredge is likely to remove, displace, or damage brittlestars caught in its path. Although several species of brittlestar are reported to increase in abundance in trawled areas, Bradshaw *et al.* (2002) noted that the relatively sessile *Ophiothrix fragilis* decreased in the long term in areas subject to scallop dredging. Overall, a proportion of the population is likely to be damaged or removed and an intolerance of intermediate has been recorded.
Breeding occurs annually and there may be multiple recruitment phases (Davoult *et al*., 1990). The larvae of this species can disperse over considerable distances in areas such as the English Channel where there are strong water flow rates (Davoult *et al*., 1990). With water that may move several kilometres per day due to residual flow (e.g. see Pingree & Maddock, 1977) and a larval duration of 26 days, the larvae can disperse up to 70 -100 km and establish populations elsewhere. This may preclude auto-recruitment of local populations (Davoult *at al*., 1990). Adults, although mobile, are not highly active. Some immigration of adults from nearby populations may be possible. Longevity estimates vary from 9 months (Davoult *et al*., 1990) to over 10 years (Gage, 1990). Reproductive capability may be reached in 6-10 months depending on time of recruitment (Davoult *et al*., 1990).

Displacement	Tolerant	Not relevant	Not sensitive	High

Although not highly active, *Ophiothrix fragilis* is a crawling epibenthic species. Following displacement from a brittlestar bed, individuals will crawl back and forth across water currents until a conspecific is found (Broom, 1975). This may preclude auto-recruitment of local populations

(Davoult *at al*., 1990).

Chemical Pressures

	Intolerance	Recoverability	Sensitivity	Confidence
Synthetic compound contamination		Not relevant		Not relevant

Echinoderms tend to be very intolerant of various types of marine pollution (Newton & McKenzie, 1995) but there is no more detailed information than this broad statement. Breeding occurs annually and there may be multiple recruitment phases (Davoult *et al*., 1990). The larvae of this species can disperse over considerable distances in areas such as the English Channel where there are strong water flow rates (Davoult *et al*., 1990). With water that may move several kilometres per day due to residual flow (e.g. see Pingree & Maddock, 1977) and a larval duration of 26 days, the larvae can disperse up to 70-100 km and establish populations elsewhere. Adults, although mobile, are not highly active. Some immigration of adults from nearby populations may be possible. Longevity estimates vary from 9 months (Davoult *et al*., 1990) to over 10 years (Gage, 1990). Reproductive capability may be reached in 6-10 months depending on time of recruitment (Davoult *et al*., 1990).

	Intolerance	Recoverability	Sensitivity	Confidence
Heavy metal contamination		Not relevant		Not relevant

Adult echinoderms such as *Ophiothrix fragilis* are known to be efficient concentrators of heavy metals including those that are biologically active and toxic (Hutchins *et al*., 1996). There is no information available regarding the effects of this bioaccumulation.

	Intolerance	Recoverability	Sensitivity	Confidence
Hydrocarbon contamination	High	High	Moderate	High

Echinoderms tend to be very sensitive to various types of marine pollution (Newton & McKenzie, 1995). Adult *Ophiothrix fragilis* have documented intolerance to hydrocarbons (Newton & McKenzie, 1995). The sub-cuticular bacteria that are symbiotic with *Ophiothrix fragilis* are reduced in number following exposure to hydrocarbons. Exposure to 30,000 ppm oil reduces the bacterial load by 50 % and brittle stars begin to die (Newton & McKenzie, 1995). However, there are no field observations of mortalities caused by exposure to hydrocarbons. Breeding occurs annually and there may be multiple recruitment phases (Davoult *et al*., 1990). The larvae of this species can disperse over considerable distances in areas such as the English Channel where there are strong water flow rates (Davoult *et al*., 1990). With water that may move several kilometres per day due to residual flow (e.g. see Pingree & Maddock, 1977) and a larval duration of 26 days, the larvae can disperse up to 70-100 km and establish populations elsewhere. Adults, although mobile, are not highly active. Some immigration of adults from nearby populations may be possible. Longevity estimates vary from 9 months (Davoult *et al*., 1990) to over 10 years (Gage, 1990). Reproductive capability may be reached in 6-10 months depending on time of recruitment (Davoult *et al*., 1990).

	Intolerance	Recoverability	Sensitivity	Confidence
Radionuclide contamination		Not relevant		Not relevant

Adult echinoderms such as *Ophiothrix fragilis* are known to be efficient concentrators of radionuclides (Hutchins *et al*., 1996). There is no information available regarding the effects of this bioaccumulation.

Changes in nutrient levels	Intermediate	High	Low	Moderate

Decreases in sub-cuticular bacteria have also been recorded following nutrient limitation. Reductions in these bacteria are probably indicative of levels of stress and may lead to mortality (Newton & McKenzie, 1995). Breeding occurs annually and there may be multiple recruitment phases (Davoult *et al*., 1990). The larvae of this species can disperse over considerable distances in areas such as the English Channel where there are strong water flow rates (Davoult *et al*., 1990). With water that may move over several kilometres per day due to residual flow (e.g. see Pingree & Maddock, 1977) and a larval duration of 26 days, the larvae can disperse up to 70-100 km and establish populations elsewhere. This may preclude auto-recruitment of local populations (Davoult *at al*., 1990). Adults, although mobile, are not highly active. Some immigration of adults from nearby populations may be possible. Longevity estimates vary from 9 months (Davoult *et al*., 1990) to over 10 years (Gage, 1990). Reproductive capability may be reached in 6-10 months depending on time of recruitment (Davoult *et al*., 1990).

Increase in salinity	Low	High	Low	Moderate

Ophiothrix fragilis is predominantly a marine species. However, in the Dutch Oosterschelde Estuary, Wolff, (1968) notes dense aggregations of the species occurring in normal salinities of 16 psu and even persisting down to 10 psu. Therefore, the species may be tolerant of some change in salinity so intolerance is assessed as low.

Decrease in salinity

Changes in oxygenation	High	High	Moderate	Low

Cole *et al*. (1999) suggest possible adverse effects on marine species below 4 mg/l and probable adverse effects below 2mg/l. Although the species is known to have a low respiration rate (Migné & Davoult, 1997(b)), particularly during colder winter temperatures extreme hypoxia is known to cause mass mortality (Stachowitsch, 1984). Breeding occurs annually and there may be multiple recruitment phases (Davoult *et al*., 1990). The larvae of this species can disperse over considerable distances in areas such as the English Channel where there are strong water flow rates (Davoult *et al*., 1990). With water that may move over several kilometres per day due to residual flow (e.g. see Pingree & Maddock, 1977) and a larval duration of 26 days, the larvae can disperse up to 70-100 km and establish populations elsewhere. This may preclude auto-recruitment of local populations (Davoult *at al*., 1990). Adults, although mobile, are not highly active. Some immigration of adults from nearby populations may be possible. Longevity estimates vary from 9 months (Davoult *et al*., 1990) to over 10 years (Gage, 1990). Reproductive capability may be reached in 6-10 months depending on time of recruitment (Davoult *et al*., 1990).

Biological Pressures

	Intolerance	Recoverability	Sensitivity	Confidence

Introduction of microbial pathogens/parasites	Low	High	Low	Low

The brittle star *Ophiothrix fragilis* has symbiotic subcuticular bacteria. The host-bacteria association can be perturbed by acute stress and changes in bacterial loading may be used as an indicator of sub-lethal stress (Newton & McKenzie, 1995). The dense aggregations of brittlestars seen in certain habitats probably provide the ideal conditions for the spread of diseases or parasites. Although no such infestations have been recorded for *O. fragilis* brittlestar beds there are several examples of echinoderm populations, that have been dramatically reduced by sudden outbreaks of epidemic diseases. Therefore, although an intolerance rank of low is reported epidemic disease does have the potential to significantly affect the biotope.

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

There are no records of any non-native species that may compete with or predate upon *Ophiothrix fragilis* and so the species is assessed as not sensitive. However, as several species have become established in British waters there is always the potential for this to occur.

Extraction of this species	Not relevant	Not relevant	Not relevant	Low

It is extremely unlikely that this species would be subject to extraction as it has no commercial and limited research value.

Extraction of other species	Tolerant	Not relevant	Not sensitive	Low

Ophiothrix fragilis has no known obligate relationships with other species so removal of these species will not have any direct effect. The physical effects caused by removal of other species are addressed in the factors above.

Additional information

Importance review

Policy/legislation

- no data -

Status

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

Non-native

Native	-		
Origin	-	**Date Arrived**	-

Importance information

- Benthic suspension feeders such as *Ophiothrix fragilis* can occur in very high densities and can have a dominant role in the main nutrient exchanges in estuarine and coastal ecosystems (Dame 1993 cited in Smaal 1994; Lefebvre & Davoult, 1997).
- Suspension feeders are important in coastal ecosystems because they can remove large amounts of suspended particulate matter (Davoult & Gounin, 1995).
- *Ophiothrix fragilis* may be considered a keystone species in the coastal marine ecosystem of the eastern Channel and a dominant species of gravel communities (Lefebvre & Davoult, 1997).
- Dense brittle star beds form an area of considerable physical complexity with many crevices and places to shelter. Despite the apparent dominance of *Ophiothrix fragilis*, up to 78 species have been recorded from a brittle star bed (of which half the biomass was *O. fragilis*) the most common of which was the bivalve *Abra alba* (Warner, 1971).
- *Ophiothrix fragilis* has been recorded as representing up to 62 % of the biomass in coarse sediment communities (Migné & Davoult, 1997(b)).
- Precipitation of calcium carbonate in skeletal ossicles is a source of carbon dioxide in sea water (Ware *et al*., 1992). The *Ophiothrix fragilis* community in the English Channel could provide 35 % of the phytoplankton carbon requirements (Migné & Davoult, 1997(b)).

Bibliography

Allain, J-Y., 1974. Écologie des bancs d'*Ophiothrix fragilis* (Abildgaard) (Echinodermata: Ophiuroidea) dans le Golfe Normanno-Breton. *Cahiers de Biologie Marine*, **15**, 235-273.

Ball, B.J., Costelloe, J., Könnecker, G. & Keegan, B.F., 1995. The rocky subtidal assemblages of Kinsale Harbour (south coast of Ireland). In *Proceedings of the 28th European Marine Biology Symposium, Instiitute of Marine Biology of Crete, Iraklio, Crete, 1993. Biology and Ecology of Shallow Coastal Waters* (ed. A. Eleftheriou, A.D. Ansell & C.J. Smith), pp.293-302. Fredensborg: Olsen & Olsen.

Bourgoin, A., Guilloum, M. & Morvan, C., 1985. Étude préliminaire de l'épifaune des sédiments meubles de la Rade de Brest (Finistère, France) à l'aide d'une caméra vidéo sous-marine. *Annals de l'Institut Océanographique*, **61**, 39-50.

Broom, D.M., 1975. Aggregation behaviour of the brittle star *Ophiothrix fragilis*. *Journal of the Marine Biological Association of the United Kingdom*, **55**, 191-197.

Bruce, J.R., Colman, J.S. & Jones, N.S., 1963. *Marine fauna of the Isle of Man.* Liverpool: Liverpool University Press.

Campbell, A., 1994. *Seashores and shallow seas of Britain and Europe.* London: Hamlyn.

Davoult, D., & Gounin, F., 1995. Suspension feeding activity of a dense *Ophiothrix fragilis* (Abildgaard) population at the water-sediment interface: Time coupling of food availability and feeding behaviour of the species. *Estuarine, Coastal and Shelf Science*, **41**, 567-577.

Davoult, D., 1989. Demographic structure and production of the *Ophiothrix fragilis* population in the Dover Strait (French part). Proceedings of the 6th international symposium on Echinodermata. Echinoderms: living and fossils. Ile des Embiez (Var. France) 19-22 September, 1988. *Vie Marine. Hors Series*,**10**, 116-127.

Davoult, D., 1990. Biofaciès et structure trophique du peuplement des cailloutis du Pas de Calais (France). *Océanologica Acta*, **13**, 335-348.

Davoult, D., Dewarumez, J.M., & Frontier, S., 1993. Long-term changes (1979-90) in 3 benthic communities (eastern English Channel): Use of factor analysis and rank frequency diagrams for studying structural developments. *Netherlands Journal of Aquatic Ecology*, **27**, 415-426.

Davoult, D., Gounin, F. & Richard, A., 1990. Dynamique et reproduction de la population d'*Ophiothrix fragilis* (Abildgaard) du détroit du Pas de Calais (Manche orientale). *Journal of Experimental Marine Biology and Ecology*, **138**, 201-216.

Emson, R.H., & Wilkie, I.C., 1980. Fission and autotomy in echinoderms. *Oceanography and Marine Biology: an Annual Review*, **18**, 155-250.

Fish, J.D. & Fish, S., 1996. *A student's guide to the seashore.* Cambridge: Cambridge University Press.

Gage, J.D., 1990. Skeletal growth bands in brittle stars: Microstructure and significance as age markers. *Journal of the Marine Biological Association of the United Kingdom*, **70**, 209-224.

George, C.L. & Warwick, R.M., 1985. Annual macrofauna production in a hard-bottom reef community. *Journal of the Marine Biological Association of the United Kingdom*, **65**, 713-735.

Gorzula, S.J., 1976. The distribution of epibenthic ophiuroids in Cumbrae waters. *The Western Naturalist*, **5**, 71-80.

Gounin, F., Davoult, D., & Richard, A., 1995. Role of a dense bed of *Ophiothrix fragilis* (Abildgaard) in the transfer of heavy metals at the water-sediment interface. *Marine Pollution Bulletin*, **30**, 736-741.

Hayward, P., Nelson-Smith, T. & Shields, C. 1996. *Collins pocket guide. Sea shore of Britain and northern Europe.* London: HarperCollins.

Hayward, P.J. & Ryland, J.S. (ed.) 1995b. *Handbook of the marine fauna of North-West Europe.* Oxford: Oxford University Press.

Hiscock, K., 1983. Water movement. In *Sublittoral ecology. The ecology of shallow sublittoral benthos* (ed. R. Earll & D.G. Erwin), pp. 58-96. Oxford: Clarendon Press.

Holme, N.A., 1984. Fluctuations of *Ophiothrix fragilis* in the western English Channel. *Journal of the Marine Biological Association of the United Kingdom*, **64**, 351-378.

Howson, C.M. & Picton, B.E., 1997. *The species directory of the marine fauna and flora of the British Isles and surrounding seas.* Belfast: Ulster Museum. [Ulster Museum publication, no. 276.]

Hughes, D.J., 1998b. Subtidal brittlestar beds. An overview of dynamics and sensitivity characteristics for conservation management of marine SACs. *Natura 2000 report prepared for Scottish Association of Marine Science (SAMS) for the UK Marine SACs Project.*, Scottish Association for Marine Science. (UK Marine SACs Project, Vol. 3). Available from: http://www.ukmarinesac.org.uk/pdfs/britstar.pdf

Hutchins, D.A., Teyssié, J-L., Boisson, F., Fowler, S.W., & Fisher, N.S., 1996. Temperature effects on uptake and retention of contaminant radionuclides and trace metals by the brittle star *Ophiothrix fragilis*. *Marine Environmental Research*, **41**, 363-378.

JNCC (Joint Nature Conservation Committee), 1999. *Marine Environment Resource Mapping And Information Database (MERMAID): Marine Nature Conservation Review Survey Database*. [on-line] http://www.jncc.gov.uk/mermaid

Kaiser, M.J., Ramsay, K., Richardson, C.A., Spence, F.E. & Brand, A.R., 2000. Chronic fishing disturbance has changed shelf sea benthic community structure. *Journal of Animal Ecology*, **69**, 494-503.

Lefebvre, A., & Davoult, D., 1997. Recrutement d'Ophiothrix fragilis (Échinoderme: ophiuride) en Manche orientale: Étude biométrique. *Journal Recherche Océanographique*, **22**, 109-116.

MacBride, E.W., 1907. Development of *Ophiothrix fragilis*. *Quarterly Journal of Microscopical Science*, **51**, 557-606.

Mackie, A.M., 1970. Avoidance reactions of marine invertebrates to either steroid glycosides of starfish or synthetic surface-active agents. *Journal of Experimental Marine Biology and Ecology*, **5**, 63-69.

Magorrian, B.H., Service, M., & Clarke, W., 1995. An acoustic bottom classification of Strangford Lough, Northern Ireland. *Journal of the Marine Biological Association of the United Kingdom*, **75**, 987-992.

MBA (Marine Biological Association), 1957. *Plymouth Marine Fauna.* Plymouth: Marine Biological Association of the United Kingdom.

Migné, A. & Davoult, D., 1997b. Carbon dioxide production and metabolic parameters in the ophiurid *Ophiothrix fragilis*. *Marine Biology*, **127**, 699-704.

Migné, A., & Davoult, D., 1997c. Distribution quantitative de la macrofaune benthique du peuplement des cailloutis dans le détroit du Pas de Calais (Manche orientale, France). *Oceanologica Acta*, **20**, 453-460.

Migné, A., Davoult, D., & Gattuso, J-P., 1998. Calcium carbonate production of a dense population of the brittle star *Ophiothrix fragilis* (Echinodermata: Ophiuroidea): role in the carbon cycle of a temperate coastal ecosystem. *Marine Ecology Progress Series*, **173**, 305-308.

Newton, L.C. & McKenzie, J.D., 1995. Echinoderms and oil pollution: a potential stress assay using bacterial symbionts. *Marine Pollution Bulletin*, **31**, 453-456.

Pedrotti, M.L., 1993. Spatial and temporal distribution and recruitment of echinoderm larvae in the Ligurian Sea. *Journal of the Marine Biological Association of the United Kingdom*, **73**, 513-530.

Picton, B.E. & Costello, M.J., 1998. *BioMar* biotope viewer: a guide to marine habitats, fauna and flora of Britain and Ireland. [CD-ROM] *Environmental Sciences Unit, Trinity College, Dublin.*

Pingree, R.D. & Maddock, L., 1977. Tidal residuals in the English Channel *Journal of the Marine Biological Association of the United Kingdom*, **57**, 339-354.

Sides, E.M. & Woodley, J.D., 1985. Niche separation in three species of *Ophiocomina* (Echinodermata: Ophiuroidea) in Jamaica, West Indies. *Bulletin of Marine Science*, **36**, 701-715.

Sköld, M., 1998. Escape responses in four epibenthic brittle stars (Ophiuroidea: Echinodermata). *Ophelia*, **49**, 163-179.

Smaal, A.C., 1994. Theme V: The response of benthic suspension feeders to environmental changes. The Oosterschelde Estuary (The Netherlands): A case study of a changing ecosystem. *Hydrobiologia*, **282-283**, 355-357.

Stachowitsch, M., 1984. Mass mortality in the Gulf of Trieste: the course of community destruction. *Marine Ecology, Pubblicazione della Statione Zoologica di Napoli*, **5**, 243-264.

Ware, J.R., Smith, S.V. & Reaka-Kudla, M.L., 1992. Coral reefs: sources or sinks of atmospheric CO_2? *Coral Reefs*, **11**, 127-130.

Warner, G.F. & Woodley, J.D., 1975. Suspension feeding in the brittle star *Ophiothrix fragilis. Journal of the Marine Biological Association of the United Kingdom*, **55**, 199-210.

Warner, G.F., 1971. On the ecology of a dense bed of the brittle star *Ophiothrix fragilis. Journal of the Marine Biological Association of the United Kingdom*, **51**, 267-282.

Wilkie, I.C., 1978. Arm autonomy in brittlestars (Echinodermata: Ophiuroidea). *Journal of Zoology*, **186**, 311-330.

Wolff, W.J., 1968. The Echinodermata of the estuarine region of the rivers Rhine, Meuse and Scheldt, with a list of species occurring in the coastal waters of the Netherlands. *The Netherlands Journal of Sea Research*, **4**, 59-85.

Datasets

Centre for Environmental Data and Recording, 2018. IBIS Project Data. Occurrence dataset: https://www.nmni.com/CEDaR/CEDaR-Centre-for-Environmental-Data-and-Recording.aspx accessed via NBNAtlas.org on 2018-09-25.

Centre for Environmental Data and Recording, 2018. Ulster Museum Marine Surveys of Northern Ireland Coastal Waters. Occurrence dataset https://www.nmni.com/CEDaR/CEDaR-Centre-for-Environmental-Data-and-Recording.aspx accessed via NBNAtlas.org on 2018-09-25.

Cofnod – North Wales Environmental Information Service, 2018. Miscellaneous records held on the Cofnod database. Occurrence dataset: https://doi.org/10.15468/hcgqsi accessed via GBIF.org on 2018-09-25.

Environmental Records Information Centre North East, 2018. ERIC NE Combined dataset to 2017. Occurrence dataset: http://www.ericnortheast.org.uk/home.html accessed via NBNAtlas.org on 2018-09-38

Fenwick, 2018. Aphotomarine. Occurrence dataset http://www.aphotomarine.com/index.html Accessed via NBNAtlas.org on 2018-10-01

Fife Nature Records Centre, 2018. St Andrews BioBlitz 2014. Occurrence dataset: https://doi.org/10.15468/erweal accessed via GBIF.org on 2018-09-27.

Fife Nature Records Centre, 2018. St Andrews BioBlitz 2015. Occurrence dataset: https://doi.org/10.15468/xtrbvy accessed via GBIF.org on 2018-09-27.

Fife Nature Records Centre, 2018. St Andrews BioBlitz 2016. Occurrence dataset: https://doi.org/10.15468/146yiz accessed via GBIF.org on 2018-09-27.

Isle of Wight Local Records Centre, 2017. IOW Natural History & Archaeological Society Marine Invertebrate Records 1853- 2011. Occurrence dataset: https://doi.org/10.15468/d9amhg accessed via GBIF.org on 2018-09-27.

Kent Wildlife Trust, 2018. Kent Wildlife Trust Shoresearch Intertidal Survey 2004 onwards. Occurrence dataset: https://www.kentwildlifetrust.org.uk/ accessed via NBNAtlas.org on 2018-10-01.

Manx Biological Recording Partnership, 2017. Isle of Man wildlife records from 01/01/2000 to 13/02/2017. Occurrence dataset: https://doi.org/10.15468/mopwow accessed via GBIF.org on 2018-10-01.

Manx Biological Recording Partnership, 2018. Isle of Man historical wildlife records 1990 to 1994. Occurrence dataset:https://doi.org/10.15468/aru16v accessed via GBIF.org on 2018-10-01.

National Trust, 2017. National Trust Species Records. Occurrence dataset: https://doi.org/10.15468/opc6g1 accessed via GBIF.org on 2018-10-01.

NBN (National Biodiversity Network) Atlas. Available from: https://www.nbnatlas.org.

OBIS (Ocean Biogeographic Information System), 2019. Global map of species distribution using gridded data. Available from: Ocean Biogeographic Information System. www.iobis.org. Accessed: 2019-03-21

Outer Hebrides Biological Recording, 2018. Invertebrates (except insects), Outer Hebrides. Occurrence dataset: https://doi.org/10.15468/hpavud accessed via GBIF.org on 2018-10-01.

South East Wales Biodiversity Records Centre, 2018. SEWBReC Marine and other Aquatic Invertebrates (South East Wales). Occurrence dataset:https://doi.org/10.15468/zxy1n6 accessed via GBIF.org on 2018-10-02.

Yorkshire Wildlife Trust, 2018. Yorkshire Wildlife Trust Shoresearch. Occurrence dataset: https://doi.org/10.15468/1nw3ch accessed via GBIF.org on 2018-10-02.