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Mats of Bonnemaisonia on infralittoral muddy gravel

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

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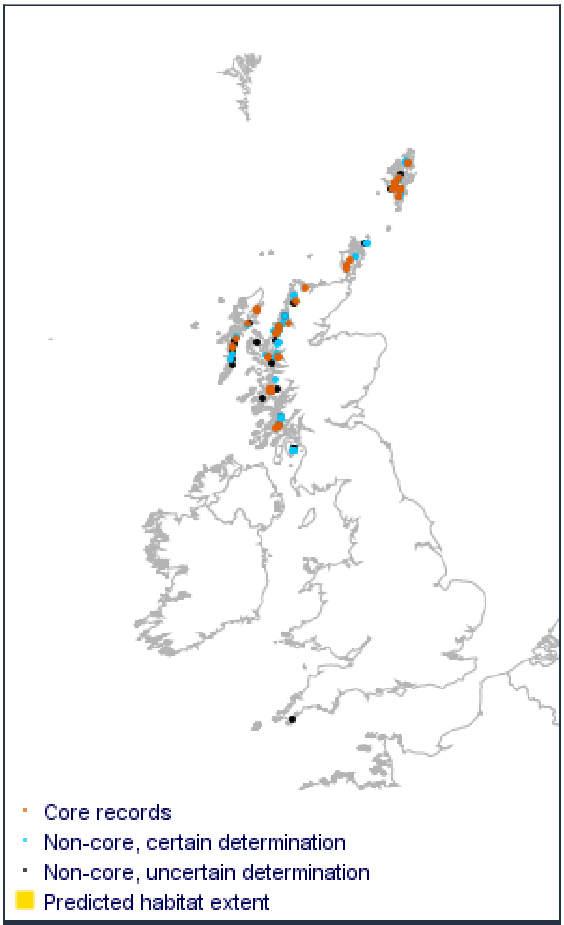

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Biotope distribution data provided by EMODnet Seabed Habitats (www.emodnet-seabedhabitats.eu)

Researched by Dr Harvey Tyler-Walters **Refereed by** Admin

Summary

UK and Ireland classification

EUNIS 2008	A5.526	Mats of *Trailliella* on infralittoral muddy gravel
JNCC 2015	SS.SMp.KSwSS. Bon	Mats of *Bonnemaisonia* on infralittoral muddy gravel
JNCC 2004	SS.SMp.KSwSS.Tra	Mats of Trailliella on infralittoral muddy gravel
1997 Biotope	SS.IMX.KSwMx.Tra	Mats of Trailliella on infralittoral muddy gravel

Description

Dense loose-lying beds of the '*Trailliella*' phase of *Bonnemaisonia hamifera* may occur in extremely sheltered shallow muddy environments. Beds of this alga are often 10 cm thick but may reach 100 cm at some sites. Other loose-lying algae may also occur such as *Audouinella floridula* and species of *Derbesia*. Often the mud is gravely or with some cobbles and may be black and anoxic close to the sediment surface. This biotope is widely distributed in lagoons, sea lochs and voes but should only be described as SMp.KSwSS.Tra when a continuous mat is found. It is likely that the infaunal component of this biotope may be considerably modified by the overwhelming quantity of loose-lying algae. (Information from Connor *et al*., 2004).

Depth range

0-5 m, 5-10 m, 10-20 m

Additional information

The '*Trailliella*-phase' is the filamentous tetrasporophtye stage of *Bonnemaisonia* spp. (Dixon & Irvine, 1977, Guiry & Guiry, 2015). The filamentous tetrasporophyte and the feathery fronds of the gametophyte are so different in morphology that they were originally described as two species. The *Trailliella*-phase of *Bonnemaisonia hamifera* was originally called *Trailliella intricata* (Dixon & Irvine, 1977, Guiry & Guiry, 2015).

Little information was available on the ecology of the *Bonnemaisonia hamifera* and its *Trailliella*-phase. In addition, this biotope is unique and occurs in specific habitats, so that even less information on the ecology of the biotope was available. Therefore, the sensitivity assessments are based on the general biology of *Bonnemaisonia hamifera* and its *Trailliella*-phase, the biotope description and expert judgement, and should be interpreted with caution.

Listed By

- none -

Further information sources

Search on:

JNCC

Sensitivity review

Sensitivity characteristics of the habitat and relevant characteristic species

The biotope is defined by the presence of mats of the '*Trailliella*' phase of *Bonnemaisonia hamifera*. Connor *et al.* (2004) note that the biotope can only be described where a continuous mat of *Trailliella* is present. The sediment probably contains an infauna typical of similar sediment in the surrounding area, except that the algal mats may modify the infauna by modifying oxygen exchange at the sediment surface. Other red algae may also occur but the loss of the *Trailliella* mats or a reduction in their cover would result in the loss of the biotope as described under the habitat classification. Therefore, the sensitivity of the biotope is based on the sensitivity of the important characterizing species '*Trailliella*' phase of *Bonnemaisonia hamifera*.

Resilience and recovery rates of habitat

Bonnemaisonia hamifera exhibits a heteromorphic life cycle that alternates between a radially branched dioecious gametophyte (with characteristic 'hooks') and an alternately branched, filamentous, tetrasporophyte (the *Trailliella* phase) (Dixon & Irvine, 1977; Chen *et al.*, 1969; Breeman *et al.*, 1988; Breeman & Guiry, 1989). Reproduction was regulated by temperature and day length (Breeman *et al.*, 1988, Breeman & Guiry, 1989). In Galway Bay, Ireland, tetrasporophytes reproduced (formed tetrasporangia) in short day lengths (<12 hrs) when temperatures were between 11 and 18°C. Tetrasporangia were recorded between September 1985 and February 1986 but were most abundant in early autumn (October to November) (Breeman *et al.*, 1988). Gametophytes developed from tetraspores released between September and February. Gametophytes became fertile between 5 and 20°C but not at 0°C or 25°C. Spermatangia were observed in young male gametophytes between mid-December and February and in adult gametophytes from late March to the end of May. Spermatangia were absent in mid-winter when temperatures of less than 2°C inhibited their formation. Carpogonia were observed on female gametophytes at the end of April when seawater temperature had risen to above 10°C. Carpogonia developed between 10 and 20°C mainly in long days (>12 hrs) but in short days were only abundant above 15°C. Fertile carpogonia were present until early July (Breeman *et al.*, 1988). Breeman *et al.* (1988) noted that gametophyte growth stopped once reproduction was initiated and that the plants died within 2-3 months of reproduction. However, Breeman *et al.* (1988) noted that the different temperature regimes in different parts of the North Atlantic cause a lack of synchronisation of male and female plants. For example, female reproduction may be delayed by low temperatures in spring by which time the males gametophytes may have already died and fertilization does not take place.

The *Trailliella*-phase may act as the nursery for young gametophytes until they develop the 'hook's (Breeman *et al.*, 1988). Breeman *et al.* (1988) suggested that the 'hooks' promoted vegetative reproduction in the gametophytes by fragmentation, although the still died after sexual reproduction. They noted that the presence of gametophytes was dependent on the induction of tetrasporangia in the previous years and that unusually cold winters prevented a crop of gametophytes in the following year. Breeman & Guiry (1989) noted that the 'effective' day length and temperatures required for initiation of tetrasporangia were influenced by tides. For example, high water springs at the beginning and end of the day reduced the effective day length and caused the early onset of reproduction. In addition, low water of spring tides in the middle of the day exposed the plants to higher air temperatures when the seawater temperatures were otherwise below those required to induce tetrasporangia.

Breeman *et al.* (1988) suggested that the *Trailliella* phase persisted solely by vegetative reproduction, based on its range in the North Atlantic. Breeman *et al.* (1988) suggested that the lack of synchronisation of male and female gametophyte production, and the distinct temperature and day length restrictions across the North Atlantic explained the lack of gametophytes observed in various parts of the North Atlantic. They noted that its phenology was best suited to its country of origin, namely Japan.

Bonnemaisonia hamifera is widely distributed around the coasts of Britain, Ireland and Europe, from the Baltic and Scandinavia, to the Faeroes Islands, Netherlands, France, Spain, and into the Mediterranean. It is also recorded across the North Atlantic, including the Azores and Canary Isles, the coasts of North and South America, Africa, and Asia (Guiry & Guiry, 2015). Nash *et al.* (2005) noted that the *Trailliella* phase is usually present all year-round but may be most abundant in summer when growth is optimal.

Resilience assessment. No information on recruitment or recovery from disturbance was found. *Bonnemaisonia hamifera* (and the *Trailliella*-phase) is a non-native species introduced to the British Isles from Japan and first recorded in 1890 (Dixon & Irvine, 1977; Maggs & Stegenga, 1998; Gollasch, 2006). It is thought to have been introduced by shipping or with shellfish and to have dispersed by drifting on water currents (Gollasch, 2006). *Bonnemaisonia hamifera* (and the *Trailliella*-phase) has spread around the British Isles and Europe, into the Mediterranean and the Canary Isles and north to the Orkneys and the Norwegian coast (Lüning, 1990, Maggs & Stegenga, 1998; Gollasch, 2006). Kain & Norton (1990) note that many of the family Bonnemaisoniaceae readily entangle with other algae so that drifting may be a possible dispersal mechanism. The gametophytes are often unattached but are found entangled by their hooks to other algae.

Therefore, a rapid recovery is assumed, based on its widespread distribution, its potential ability to disperse by drifting as adult plants, especially the gametophytes, fragmentation and vegetative growth. If the abundance of the mat of *Trailliella* is reduced (e.g. resistance is Medium or Low) then resilience is probably **High**. However, where the abundance is severely reduced (resistance is Low) then resilience may be **Medium**. Confidence in the resilience assessment is Low as it is an expert judgment based on life history traits and distribution.

Hydrological Pressures

	Resistance	Resilience	Sensitivity
Temperature increase (local)	Low Q: High A: High C: Medium	High Q: Low A: NR C: NR	Low Q: Low A: Low C: Low

Breeman *et al.* (1988) reported that gametophytes and tetrasporophytes survived between 0°C and 25°C but that 30°C was lethal after 2-6 weeks. Tetrasporophytes grew faster than gametophytes at 20-25°C in culture. The maximum growth of tetrasporophytes was between at 15-25°C. Gametophytes exhibited maximum growth at 15°C but growth deformities at 25°C. Nash *et al.* (2005) also reported maximum biomass production of the tetrasporophyte (*Trailliella* phase) at 15-20°C, long day length (16:8 hrs L:D) in culture.

Temperature and day length regulate reproduction (Breeman *et al.*, 1988, Breeman & Guiry, 1989). In Galway Bay, Ireland, tetrasporophytes reproduced (formed tetrasporangia) in short day lengths (<12 hrs) when temperatures were between 11 and 18°C. Tetrasporangia were recorded between September 1985 and February 1986 but were most abundant in early autumn (October to November) (Breeman *et al.*, 1988). Gametophytes developed from tetraspores released between

September and February. Gametophytes became fertile between 5 and 20°C but not at 0°C or 25°C. Spermatangia were observed in young male gametophytes between mid-December and February and in adult gametophytes from late March to the end of May. Spermatangia were absent in mid-winter when temperatures of less than 2°C inhibited their formation. Carpogonia were observed on female gametophytes at the end of April when seawater temperature had risen to above 10°C. Carpogonia developed between 10 and 20°C mainly in long days (>12 hrs) but in short days were only abundant above 15°C.

Breeman & Guiry (1989) noted that the 'effective' day length and temperatures required for initiation of tetrasporangia were influenced by tides. For example, high water springs at the beginning and end of the day reduced the effective day length and caused the early onset of reproduction. In addition, low water spring tides in the middle of the day exposed the plants to higher air temperatures when the seawater temperatures were otherwise below those required to induce tetrasporangia.

In Japan, mature female gametophytes are seen regularly, and sexual reproduction is synchronised. Gametophytes develop in winter when temperatures are optimal for reproduction and growth (15°C) but disappear by mid-June when temperatures reach lethal values of around 25°C (Breeman *et al.*, 1988). Van Hoek (1982; cited in Lüning, 1990) reported that the southern distribution of the tetrasporophyte (the *Trailliella* phase) in the North Atlantic was limited by the 25°C isotherm while its northern distribution was limited by the 10°C summer isotherm.

Sensitivity assessment. An increase in temperature is likely to interfere with reproduction depending on the time of year. A long-term increase of 2°C may help to synchronise sexual reproduction and improve growth rates. A short-term increase of 5°C for a month may be lethal to gametophytes and tetrasporophytes in summer but may trigger tetrasporophyte reproduction in winter. Therefore, a resistance of **Low** is suggested to represent potential mortality in the summer months. Resilience is probably **High** so that sensitivity is assessed as **Low**.

Temperature decrease (local)	Low Q: High A: High C: Medium	High Q: Low A: NR C: NR	Low Q: Low A: Low C: Low

Breeman *et al.* (1988) reported that gametophytes and tetrasporophytes survived between 0°C and 25°C but that 30°C was lethal after 2-6 weeks. Tetrasporophytes grew faster than gametophytes at 20-25°C in culture. The maximum growth of tetrasporophytes was between at 15-25°C. Gametophytes exhibited maximum growth at 15°C but growth deformities at 25°C. Nash *et al.* (2005) also reported maximum biomass production of the tetrasporophyte (*Trailliella* phase) at 15-20°C, long day length (16:8 hrs L:D) in culture.

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Breeman & Guiry (1989) noted that the induction of tetrasporangia was limited to a brief period in autumn when short days coincide with temperatures above 11°C because in winter and early spring the temperature is too low for induction, such as on the coasts of America and northern Europe. This is the case on the American (west Atlantic) coasts where the autumnal fall in seawater temperatures is steeper than on east Atlantic coasts. Van Hoek (1982; cited in Lüning, 1990) reported that the southern distribution of the tetrasporophyte (the *Trailliella* phase) in the North Atlantic was limited by the 25°C isotherm while its northern distribution was limited by the 10°C summer isotherm.

Sensitivity assessment. A long-term decrease in temperature (e.g. 2°C) may prevent the induction of tetrasporangia and reduce reproductive output. A short-term 5°C change may, however, result in some mortality of both tetrasporophytes in the winter months. Therefore, a resistance of **Low** is suggested. Resilience is probably **High** so that sensitivity is assessed as **Low**.

Salinity increase (local)	No evidence (NEv) Q: NR A: NR C: NR	Not relevant (NR) Q: NR A: NR C: NR	No evidence (NEv) Q: NR A: NR C: NR

Bonnemaisonia hamifera is recorded from lower shore tidal pools and the subtidal (Guiry & Guiry, 2015). Leidenburger *et al.* (2015) reported that *Bonnemaisonia hamifera* was found at sea surface salinities of between 14.26 and 37.55 psu (based on satellite data and distribution). This biotope (SMp.KSwSS.Tra) occurs in lagoons, sea lochs and voes, in full and variable salinity (Connor *et al.*, 2004). However, no further information on salinity tolerance was found.

Sensitivity assessment. An increase in salinity from full or variable conditions would result in hypersaline conditions (>40 psu). But no evidence was found on which to base an assessment.

Salinity decrease (local)	Medium Q: Low A: NR C: NR	High Q: Low A: NR C: NR	Low Q: Low A: Low C: Low

Bonnemaisonia hamifera is recorded from lower shore tidal pools and the subtidal (Guiry & Guiry, 2015). Leidenburger *et al.* (2015) reported that *Bonnemaisonia hamifera* was found at sea surface salinities of between 14.26 and 37.55 psu (based on satellite data and distribution). This biotope (SMp.KSwSS.Tra) occurs in lagoons, sea lochs and voes, in full and variable salinity (Connor *et al.*, 2004). However, no further information on salinity tolerance was found.

Sensitivity assessment. A decrease in salinity from full or variable conditions would result in reduced salinity conditions (18-30 psu). If the biotope can survive variation in salinity to e.g. 18 psu and *Bonnemaisonia hamifera* is recorded from sites as low as 14.26 psu, then it may be able to survive reduced conditions for a year. However, the species diversity of the faunal component of the biotope is likely to be reduced. Therefore, a tentative resistance of **Medium** is suggested. Resilience is probably **High** so that the sensitivity is assessed as **Low** at the benchmark level but at Low confidence.

Water flow (tidal current) changes (local)	Low Q: Low A: NR C: NR	High Q: Low A: NR C: NR	Low Q: Low A: Low C: Low

This biotope (SMp.KSwSS.Tra) occurs in weak (<0.5 m/s) to very weak (negligible) flow in wave sheltered environments such as lagoons, sea lochs and voes (Connor *et al*., 2004). The tetrasporophytes (*Trailliella* phase) is attached to the substratum by unicellular rhizoids or multicellular haptera formed at intervals (Dixon & Irvine, 1977). Dixon & Irvine (1977) noted that the *Trailliella* phase is usually epiphytic. But in this biotope, it forms mats on shallow muddy sediments in the sublittoral (Connor *et al*., 2004). It is presumably anchored loosely to larger fragments of substrata, stones etc. It is known to fragment and both the *Trailliella* phase and gametophytes are known to drift. While fragmentation and drift may be advantageous to the spread of the species, it may make the mats of *Trailliella* susceptible to damage from water flow and wave action, especially as the density or abundance of the mats is a key descriptor for the biotope.

Sensitivity assessment. The biotope is recorded from weak to very weak tidal flow so that a further decrease is not relevant. However, an increase in water flow as low a 0.1-0.2 m/s (the benchmark), especially in the winter months, may result in loss of a proportion of the *Trailliella* mats and loss of the biotope. Therefore, a resistance of **Low** is suggested. Resilience is probably **High** so that the sensitivity is assessed as **Low** at the benchmark level but at Low confidence.

Emergence regime changes	None Q: Low A: NR C: NR	High Q: Low A: NR C: NR	Medium Q: Low A: Low C: Low

Trailliella is recorded from the subtidal and low water tidepools (Dixon & Irvine, 1977) or low water (Breeman & Guiry, 1989). An increase in emergence is only relevant to the shallowest examples of the biotope. The species appears to be restricted to low water, low water tide pools and the subtidal. In addition, Breeman & Guiry (1989) noted that the timing of high and low tides, day length and temperature, affected the induction of reproduction in the tetrasporophyte (*Trailliella*). Therefore, it may not survive an increase in emergence or may be out-competed and overgrown by other species. A resistance of **None** is suggested. Resilience is probably **Medium** so that sensitivity is assessed as **Medium** but with Low confidence.

Wave exposure changes (local)	Low Q: Low A: NR C: NR	High Q: Low A: NR C: NR	Low Q: Low A: Low C: Low

This biotope (SMp.KSwSS.Tra) occurs in weak (<0.5 m/s) to very weak (negligible) flow in wave sheltered (sheltered to extremely wave sheltered) environments such as lagoons, sea lochs and voes (Connor *et al*., 2004). The tetrasporophytes (*Trailliella* phase) is attached to the substratum by unicellular rhizoids or multicellular haptera formed at intervals (Dixon & Irvine, 1977). Dixon & Irvine (1977) noted that the *Trailliella* phase is usually epiphytic. But in this biotope, it forms mats on shallow muddy sediments in the sublittoral (Connor *et al*., 2004). It is presumably anchored loosely to larger fragments of substrata, stones etc. It is known to fragment and both the *Trailliella* phase and gametophytes are known to drift. While fragmentation and drift may be advantageous to the spread of the species, it may make the mats of *Trailliella* susceptible to damage from water flow and wave action, especially as the density or abundance of the mats is a key descriptor for the biotope.

Sensitivity assessment. The biotope is recorded from wave sheltered to extremely wave sheltered environments so that a further decrease is not relevant. However, an increase in wave action is likely to remove the mats from the substratum and the biotope is likely to be lost. A change in significant wave height of only 3-5% (the benchmark) represents a minor change in wave action but may still remove a proportion of the mats in shallow example of the biotopes as the

Trailliella phase is probably only loosely attached to the muddy sediment on which this biotope is found. Therefore, a resistance of **Low** is suggested. Resilience is probably **High** so that the sensitivity is assessed as **Low** at the benchmark level but at Low confidence.

Chemical Pressures

	Resistance	Resilience	Sensitivity
Transition elements & organo-metal contamination	Not Assessed (NA) Q: NR A: NR C: NR	Not assessed (NA) Q: NR A: NR C: NR	Not assessed (NA) Q: NR A: NR C: NR

This pressure is **Not assessed** but evidence is presented where available.

Hydrocarbon & PAH contamination	Not Assessed (NA) Q: NR A: NR C: NR	Not assessed (NA) Q: NR A: NR C: NR	Not assessed (NA) Q: NR A: NR C: NR

This pressure is **Not assessed** but evidence is presented where available.

Synthetic compound contamination	Not Assessed (NA) Q: NR A: NR C: NR	Not assessed (NA) Q: NR A: NR C: NR	Not assessed (NA) Q: NR A: NR C: NR

This pressure is **Not assessed** but evidence is presented where available.

Radionuclide contamination	No evidence (NEv) Q: NR A: NR C: NR	Not relevant (NR) Q: NR A: NR C: NR	No evidence (NEv) Q: NR A: NR C: NR

No evidence was found

Introduction of other substances	Not Assessed (NA) Q: NR A: NR C: NR	Not assessed (NA) Q: NR A: NR C: NR	Not assessed (NA) Q: NR A: NR C: NR

This pressure is **Not assessed**.

De-oxygenation	No evidence (NEv) Q: NR A: NR C: NR	Not relevant (NR) Q: NR A: NR C: NR	No evidence (NEv) Q: NR A: NR C: NR

Nash *et al.* (2005) noted that aeration improved growth in culture. However, no other evidence on the effect of hypoxia on *Trailliella* was found.

Nutrient enrichment	Not relevant (NR) Q: NR A: NR C: NR	Not relevant (NR) Q: NR A: NR C: NR	No evidence (NEv) Q: NR A: NR C: NR

No information on the effects of nutrient enrichment on *Trailliella* was found. Nevertheless, this biotope is considered to be **'Not sensitive'** at the pressure benchmark that assumes compliance with good status as defined by the WFD.

Organic enrichment	No evidence (NEv) Q: NR A: NR C: NR	Not relevant (NR) Q: NR A: NR C: NR	No evidence (NEv) Q: NR A: NR C: NR

No information on the effects of nutrient enrichment on *Trailliella* was found.

Physical Pressures

	Resistance	Resilience	Sensitivity
Physical loss (to land or freshwater habitat)	None Q: High A: High C: High	Very Low Q: High A: High C: High	High Q: High A: High C: High

All marine habitats and benthic species are considered to have a resistance of '**None**' to this pressure and to be unable to recover from a permanent loss of habitat (resilience is '**Very Low**'). Sensitivity within the direct spatial footprint of this pressure is, therefore '**High**'. Although no specific evidence is described confidence in this assessment is '**High**', due to the incontrovertible nature of this pressure.

Physical change (to another seabed type)	None Q: High A: High C: High	Very Low Q: High A: High C: High	High Q: High A: High C: High

If sedimentary substrata were replaced with rock substrata the biotope would be lost, as it would not longer be a sedimentary habitat.

Sensitivity assessment. Resistance to the pressure is considered '**None**', and resilience '**Very low**' or 'None' (as the pressure represents a permanent change) and the sensitivity of this biotope is assessed as '**High**'.

Physical change (to another sediment type)	High Q: Low A: NR C: NR	High Q: High A: High C: High	Not sensitive Q: Low A: Low C: Low

This biotope is recorded from sandy gravelly muds (Connor *et al*., 2004, sediment matrix). *Bonnemaisonia hamifera* and *Trailliella* are found on other substrata, including rock and other seaweeds. The low energy environment of the biotope, i.e. low water flow and wave sheltered conditions, determines the nature of the sediment. The muddy sediment is probably inhospitable to most other macroalgae so that *Trailliella* can become abundant. However, it would probably grow on other sedimentary substrata under the same conditions. Therefore, the biotope is probably **Not sensitive** (resistance and resilience are High).

Habitat structure changes - removal of substratum (extraction)	None Q: Low A: NR C: NR	Medium Q: Low A: NR C: NR	Medium Q: Low A: Low C: Low

The biotope is an epifloral mat sitting on the surface of the sediment. Extraction of the sediment to any depth would result in removal of the *Trailliella* mat from the affected area. Therefore, a resistance of **None** is suggested. Resilience is probably **Medium** and sensitivity is assessed as **Medium** but with Low confidence due to the lack of any direct evidence.

Abrasion/disturbance of the surface of the substratum or seabed	Low Q: Low A: NR C: NR	High Q: Low A: NR C: NR	Low Q: Low A: Low C: Low

The biotope is an epifloral mat sitting on the surface of the sediment. *Bonnemaisonia hamifera* and *Trailliella* are known to fragment and disperse by drifting (Breeman *et al*., 1988). Any passing bottom gear is liable to remove the mat of *Trailliella*. Similarly, as the *Trailliella* is delicate and filamentous it may also be easy to damage by trampling in the shallow subtidal and in rock pools. Therefore, a resistance of **Low** is suggested. Resilience is probably **High** so that the sensitivity is assessed as **Low** at the benchmark level but with Low confidence due to the lack of any direct evidence.

Penetration or disturbance of the substratum subsurface	Low Q: Low A: NR C: NR	High Q: Low A: NR C: NR	Low Q: Low A: Low C: Low

The biotope is an epifloral mat sitting on the surface of the sediment. *Bonnemaisonia hamifera* and *Trailliella* are known to fragment and disperse by drifting (Breeman *et al*., 1988). Any passing bottom gear or another activity that penetrates the surface of the sediment is liable to remove the mat of *Trailliella*. Therefore, a resistance of **Low** is suggested. Resilience is probably **High** so that the sensitivity is assessed as **Low** at the benchmark level but with Low confidence due to the lack of any direct evidence.

Changes in suspended solids (water clarity)	Low Q: Low A: NR C: NR	High Q: Low A: NR C: NR	Low Q: Low A: Low C: Low

An increase in suspended sediment and, hence turbidity, will reduce the light available to macroalgae for photosynthesis and growth. Nash *et al.* (2005) noted that *Trailliella* occurred in “more or less shaded” habitats, which explained its high growth potential in low photon irradiance in culture. Breeman *et al.* (1988) showed that the *Trailliella* phase grew faster at 20 and 40 μmol/m^2/s than at 10 μmol/m^2/s at 15-25°C. Breenman & Guiry (1989) estimated that photo irradiances of about 10 μmol/m^2/s were perceived as light but that 1-5 μmol/m2/s were perceived as darkness. They noted that about 10 μmol/m^2/s could be reached at the sea surface at sunrise or sunset on bright days. Breeman & Guiry (1989) reported that a change in the timing of high and low tide could affect the timing of reproduction in the tetrasporophyte (*Trailliella*), and Breeman *et al.* (1988) demonstrated that day length and temperature were important cues for reproduction in *Bonnemaisonia hamifera*. Therefore, an increase in suspended sediment and the resultant decrease in light could affect reproduction and growth in *Bonnemaisonia hamifera*, especially in the deeper examples of the biotope. No information on the effects of scour was found. Therefore, a resistance of **Low** is suggested with Low confidence. Resilience is probably **High** so that sensitivity is assessed as **Low**.

Smothering and siltation rate changes (light)	None Q: Low A: NR C: NR	Medium Q: Low A: NR C: NR	Medium Q: Low A: Low C: Low

Bonnemaisonia hamifera gametophytes grow up to 35 cm in length but the tetrasporophyte *Trailliella* grows in dense cotton-wool-like tufts of up to 2.5 cm in diameter (Guiry & Guiry, 2015). Therefore, a deposit of 5 cm will completely smother a mat of *Trailliella*. The biotope is found in low energy habitats so that the deposited sediment is likely to remain and the mat is likely to die beneath the sediment. Therefore, a resistance of **None** is suggested. Resilience is likely to be **Medium** and sensitivity is assessed as **Medium** but with Low confidence due to the lack of any direct evidence.

Smothering and siltation rate changes (heavy)	None Q: Low A: NR C: NR	Medium Q: Low A: NR C: NR	Medium Q: Low A: NR C: NR

Bonnemaisonia hamifera gametophytes grow up to 35 cm in length but the tetrasporophyte *Trailliella* grows in dense cotton-wool-like tufts of up to 2.5 cm in diameter (Guiry & Guiry, 2015). Therefore, a deposit of 30 cm will completely smother a mat of *Trailliella*. The biotope is found in low energy habitats so that the deposited sediment is likely to remain and the mat is likely to die beneath the sediment. Therefore, a resistance of **None** is suggested. Resilience is likely to be **Medium** and sensitivity is assessed as **Medium** but with Low confidence due to the lack of any direct evidence.

Litter	Not Assessed (NA) Q: NR A: NR C: NR	Not assessed (NA) Q: NR A: NR C: NR	Not assessed (NA) Q: NR A: NR C: NR

Not assessed.

Electromagnetic changes	No evidence (NEv) Q: NR A: NR C: NR	Not relevant (NR) Q: NR A: NR C: NR	No evidence (NEv) Q: NR A: NR C: NR

No evidence was found.

Underwater noise changes	Not relevant (NR) Q: NR A: NR C: NR	Not relevant (NR) Q: NR A: NR C: NR	Not relevant (NR) Q: NR A: NR C: NR

Not relevant

Introduction of light or shading	Low Q: Low A: NR C: NR	High Q: Low A: NR C: NR	Low Q: Low A: Low C: Low

Nash *et al.* (2005) noted that *Trailliella* occurred in “more or less shaded” habitats, which explained its high growth potential in low photon irradiance in culture. Breeman *et al.* (1988) showed that the *Trailliella* phase grew faster at 20 and 40 μmol/m^2/s than at 10 μmol/m^2/s at 15-25°C. Breenman & Guiry (1989) estimated that photo irradiances of about 10 μmol/m^2/s were perceived as light but that 1-5 μmol/m2/s were perceived as darkness. They noted that about 10 μmol/m^2/s could be reached at the sea surface at sunrise or sunset on bright days. Breeman & Guiry (1989) reported that a change in the timing of high and low tide could affect the timing of reproduction in the tetrasporophyte (*Trailliella*), and Breeman *et al.* (1988) demonstrated that day length and temperature were important cues for reproduction in *Bonnemaisonia hamifera*. Therefore, an change in artificial light might change the timing of reproduction in both gametophytes and tetraporophytes and, as tetrasporogenesis is triggered by short days, might prevent the induction of reproduction in tetrasporophytes. But growth of *Trailliella* might be increased in summer as Nash *et al.* (2005) found that maximum biomass production of the (*Trailliella* phase) at 15-20°C, occurred in long day length (16:8 hrs L:D) in culture. Conversely, shading may reduce growth, or result in loss of the biotope if intense and permanent. Therefore, a resistance of **Low** is suggested with Low confidence. Resilience is probably **High** so that sensitivity is assessed as **Low** but with Low confidence due to the lack of any direct evidence.

Barrier to species movement	Not relevant (NR) Q: NR A: NR C: NR	Not relevant (NR) Q: NR A: NR C: NR	Not relevant (NR) Q: NR A: NR C: NR

Not relevant

Death or injury by collision	Not relevant (NR) Q: NR A: NR C: NR	Not relevant (NR) Q: NR A: NR C: NR	Not relevant (NR) Q: NR A: NR C: NR

The pressure definition is not directly applicable to seabed biotopes so **Not relevant** has been recorded. Collision via ship groundings or terrestrial vehicles is possible but the effects are probably similar to those of abrasion above.

Visual disturbance	Not relevant (NR) Q: NR A: NR C: NR	Not relevant (NR) Q: NR A: NR C: NR	Not relevant (NR) Q: NR A: NR C: NR

Not relevant

Biological Pressures

	Resistance	Resilience	Sensitivity
Genetic modification & translocation of indigenous species	No evidence (NEv) Q: NR A: NR C: NR	Not relevant (NR) Q: NR A: NR C: NR	No evidence (NEv) Q: NR A: NR C: NR

No evidence of the translocation, breeding or species hybridization in '*Trailliella*' phase of *Bonnemaisonia hamifera* was found.

Introduction or spread of invasive non-indigenous species	No evidence (NEv) Q: NR A: NR C: NR	Not relevant (NR) Q: NR A: NR C: NR	No evidence (NEv) Q: NR A: NR C: NR

Bonnemaisonia hamifera (and the *Trailliella*-phase) is a non-native species introduced to the British Isles from Japan and first recorded in 1890 (Dixon & Irvine, 1977; Maggs & Stegenga, 1998; Gollasch, 2006). It is thought to have been introduced by shipping or with shellfish and to have dispersed by drifting on water currents (Gollasch, 2006). *Bonnemaisonia hamifera* (and the *Trailliella*-phase) has spread around the British Isles and Europe, into the Mediterranean and the Canary Isles and north to the Orkneys and the Norwegian coast (Lüning, 1990, Maggs & Stegenga, 1998; Gollasch, 2006).

No evidence of the effects of *Bonnemaisonia hamifera* on native flora or fauna was found. And no evidence of the effects of other non-natives on *Bonnemaisonia hamifera* was found.

Introduction of microbial pathogens	No evidence (NEv) Q: NR A: NR C: NR	Not relevant (NR) Q: NR A: NR C: NR	No evidence (NEv) Q: NR A: NR C: NR

No evidence was found

Removal of target species	Not relevant (NR) Q: NR A: NR C: NR	Not relevant (NR) Q: NR A: NR C: NR	Not relevant (NR) Q: NR A: NR C: NR

Bonnemaisonia hamifera is unlikely to be targetted by any commercial or recreational fishery or harvest.

Removal of non-target species	None Q: Low A: NR C: NR	Medium Q: Low A: NR C: NR	Medium Q: Low A: Low C: Low

Accidental physical disturbance due to access (e.g. trampling), grounding, or passing fishing gear is examined under abrasion above. However, the accidental removal of the *Trailliella* mat would result in a significant change in the biological character of, and loss of, the biotope. Therefore, a resistance of **None** is suggested. Resilience is probably **Medium** so that sensitivity is assessed as **Medium** but with 'Low' confidence.

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