Maerl (*Lithothamnion glaciale*)

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

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

Please note. This MarESA report is a dated version of the online review. Please refer to the website for the most up-to-date version [https://www.marlin.ac.uk/species/detail/1314]. All terms and the MarESA methodology are outlined on the website (https://www.marlin.ac.uk)

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***Lithothamnion glaciale* nodules amongst pebbles with the sunstar *Crossaster papposus*, Isle of Lewis.**
Photographer: Christine Howson

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**	This information is not refereed.
Authority	Kjellman, 1883		
Other common names	-	**Synonyms**	-

Summary

Description

The form of this calcareous alga is very variable. It occurs in two main forms, a thin, hard crust on hard substrata as well as an unattached, fragile, branched nodules. When young, the crustose form is smooth with some scattered young mounds but develops branches with age. The loose-lying nodules may form dense beds of algal gravel. Encrusting individuals may reach up to 20 cm across and free-living plants may reach 4 - 5 cm across. In the free-living form the branches are up to 4 mm in diameter and 15 mm in length. The plants, when alive, are reddish to deep pink in colour with a violet tinge and white when dead.

Recorded distribution in Britain and Ireland

Most abundant in the sea lochs of western Scotland, Orkney and Shetland. Recorded along the east coast south to Flamborough. Occasional on the south coast, Wales, Isle of Man and Lundy. Sparse records from north and south-western Ireland.

Global distribution

In the NE Atlantic from the British Isles north to Arctic Russia including the Faeroe Isles, Iceland

and western Baltic. In the NW Atlantic from Cape Cod north to Arctic Canada and Greenland. Also northern Japan and China in the western Pacific.

Habitat

Lithothamnion glaciale occurs in two main growth forms - as a thin encrusting species on rock, boulders, pebbles and shells etc. and also as a loose-lying algal gravel. This species occurs mainly in the mid-lower regions of the photic zone where there is considerable but not excessive water movement, either from wave exposure or tidal currents.

Depth range

0-70

Identifying features

- Forms a branching crust or a free-living branching nodule.
- Smooth, matt surface.
- Branches hard, not brittle.
- Branch diameter variable but up to 4 mm.
- Reddish to deep pink with violet tinge.
- May be an important component of maerl beds.

Additional information

This genus was previously called *Lithothamnium* but now *Lithothamnion* is the preferred name. Previous classifications included two varieties (sometimes formerly given species status): *Lithothamnium granii* (Foslie); and *Lithothamnium colliculosum*. It is quite difficult to differentiate between *Lithothamnion glaciale* and *Lithothamnion corallioides*. The hard surface and the absence of numerous surface mounds on *Lithothamnion glaciale* may help separate them although for greater accuracy the cortical cell structure should be used.

Listed by

Further information sources

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Biology review

Taxonomy

Phylum	Rhodophyta	Red seaweeds
Class	Florideophyceae	
Order	Corallinales	
Family	Hapalidiaceae	
Genus	Lithothamnion	
Authority	Kjellman, 1883	
Recent Synonyms	-	

Biology

Typical abundance	High density
Male size range	
Male size at maturity	
Female size range	Medium(11-20 cm)
Female size at maturity	
Growth form	Algal gravel
Growth rate	13
Body flexibility	None (less than 10 degrees)
Mobility	
Characteristic feeding method	Autotroph
Diet/food source	
Typically feeds on	
Sociability	
Environmental position	Epifloral
Dependency	Independent.
Supports	See additional information
Is the species harmful?	No

Biology information

- Maerl has been found in densities of up to 22,000 thalli per square metre. The proportion of live to dead nodules varies considerably (Birkett *et al.*, 1998). In the British Isles, *Lithothamnion glaciale* is found in relative abundances of up to 36 of coralline red algae and up to 80 further north (Adey & Adey, 1973)
- Individual thalli of this species may occur as male female, asexual or non-breeding plants depending on the development of the various types of reproductive conceptacles.
- Crustose plants adhere strongly to the substratum and reach 20 cm in diameter at least (Suneson, 1943; Irvine & Chamberlain, 1994). Unattached plants probably reach 4-5 cm in diameter.
- Little is known about growth rates of this species. Maerl is amongst the slowest growing species in the North Atlantic (Birkett *et al.*, 1998). Adey, (1970) recorded rates of up to 13 microns per day in the lab. This is fast in comparison to other sub-arctic maerl species

which may explain why *Lithothamnion glaciale* is often the most abundant North Atlantic crustose coralline alga.
- Mobility and sociability is not applicable to algal species.
- Maerl beds in general are known as a particularly diverse habitat with over 150 macro algal species and 500 benthic faunal species recorded (Birkett *et al.*, 1998(a)). The loose structure of these beds permits water circulation and oxygenation to considerable depth. As a consequence of this loose structure, maerl provides shelter for an astonishing variety of fauna e.g. molluscs (Hall-Spencer, 1998) and amphipods (Grave De, 1999).

Habitat preferences

Physiographic preferences	Open coast, Strait / sound, Sea loch / Sea lough, Ria / Voe, Estuary
Biological zone preferences	Lower circalittoral, Lower infralittoral, Upper circalittoral, Upper infralittoral
Substratum / habitat preferences	Bedrock, Cobbles, Gravel / shingle, Large to very large boulders, Maerl, Pebbles, Small 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, Moderately exposed, Sheltered, Very sheltered
Salinity preferences	Full (30-40 psu), Variable (18-40 psu)
Depth range	0-70
Other preferences	No text entered
Migration Pattern	Non-migratory / resident

Habitat Information

- Information on distribution of *Lithothamnion glaciale* in Fair Isle is available at http://www.fairisle.org.uk/FIMETI/Reports/Safeguarding_Our_Heritage/appendix5.htm
- Detail about British Isles distribution is found in Hall-Spencer (1985).
- Most abundant from 6-30 metres (Suneson, 1943). In the clear waters around northern Japan it may be found as deep as 60-70 m. Depth range is highly dependent on turbidity although temperature plays a role. Below 4-6 °C growth rate has little dependence on light availability (Adey, 1970).
- Occasionally found in shallow waters and even in large tide pools on the shore (Adey, 1970).
- Deposits from maerl beds can sometimes form quite extensive white 'coral sand' beaches, such as those in the Western Isles and Orkney.

Life history

Adult characteristics

Reproductive type	Vegetative
Reproductive frequency	Annual protracted
Fecundity (number of eggs)	No information
Generation time	Insufficient information

Age at maturity	Insufficient information
Season	Insufficient information
Life span	20-100 years

Larval characteristics

Larval/propagule type	-
Larval/juvenile development	Spores (sexual / asexual)
Duration of larval stage	Not relevant
Larval dispersal potential	No information
Larval settlement period	Insufficient information

Life history information

- Adey, (1970) estimates the lifespan of individual plants to be from 10-50 years.
- Little is known about the reproductive mechanisms of this species. However, sexual reproduction can occur between gonochoristic plants. Asexual reproduction occurs through the formation of spores. In some populations sexual individuals are rare (e.g. in the Gulf of Maine, (Adey, 1966)) and reproduction is mediated mainly if not entirely by the production of asexual conceptacles.
- Reproduction is probably mainly controlled by temperature (Adey, 1970). In Greenland and Sweden, *Lithothamnion glaciale* has reproductive conceptacles all year round whereas in Scotland, although conceptacles are common in winter, the plants are sterile in summer (Hall-Spencer, 1994 cited in Birkett *et al.*, 1998)
- A further form of propagation is by vegetative growth and division of a single thallus into two or more competent individuals that continue to grow. In the other main maerl species that occur round the British Isles (*Phymatolithon calcareum* and *Lithothamnion corallioides*), this vegetative growth is the main form of propagation (Irvine & Chamberlain, 1994). Spores can potentially disperse long distances although if dispersal is dependent on vegetative propagation, then distances will be extremely limited.

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	Very low / none	Very High	Moderate

Both the crustose and free living forms of this species will be highly intolerant of substratum loss. The crustose form is closely adherent to hard substrata (Suneson, 1943; Irvine & Chamberlain, 1994). For the loose-lying form, loss of the substratum (which may include maerl itself) will also cause loss of the living *Lithothamnion glaciale*. Because the species is photosynthetic it is only found on the surface of the maerl bed or other substratum. Information on reproduction and recruitment is rather limited, particularly round the British Isles. Sexual and asexual reproduction has been recorded but in some areas there may be virtually no sexual plants (e.g. The Gulf of Maine, Adey, 1966). In Scotland, although *Lithothamnion glaciale* conceptacles are common in winter, the plants are sterile in summer (Hall-Spencer, 1994 cited in Birkett *et al*., 1998) Propagation can also occur through vegetative growth and division of existing crusts or nodules, although this requires there to be a proportion of the population to remain. Once a population has become extinct, sexual or asexual propagules from other populations may recolonize the area. Even if recolonization occurs, with the slow growth rates of coralline algae, it will take a very long time to re-establish a similar population although this may be faster for *Lithothamnion glaciale* than for other maerl species (Irvine & Chamberlain, 1994). It will probably take much longer for maerl beds to recover than for crustose populations.

Smothering	High	Very low / none	Very High	Moderate

Smothering will block light penetration to the algal thalli preventing photosynthesis. Information on reproduction and recruitment is rather limited, particularly round the British Isles. Scallop dredging is one of the main causes of smothering in maerl beds. A single passage of a dredge may bury and kill 70 % of living maerl in their path (Hall-Spencer & Moore, 2000(a)). Sexual and asexual reproduction has been recorded but in some areas there may be virtually no sexual plants (e.g. The Gulf of Maine, Adey, 1966). In Scotland, although *Lithothamnion glaciale* conceptacles are common in winter, the plants are sterile in summer (Hall-Spencer, 1994 cited in Birkett *et al*., 1998) Propagation can also occur through vegetative growth and division of existing crusts or nodules, although this requires there to be a proportion of the population to remain. Once a population has become extinct, sexual or asexual propagules from other populations may recolonize the area. Even if recolonization occurs, with the slow growth rates of coralline algae, it will take a very long time to re-establish a similar population although this may be faster for *Lithothamnion glaciale* than for other maerl species (Irvine & Chamberlain, 1994). It will probably take much longer for maerl beds to recover than for crustose populations.

Increase in suspended sediment	Intermediate	Low	High	Low

Increased siltation will cause deposition of a thin layer of material on the surface of the algae blocking incident light and preventing photosynthesis. There is no specific mechanism for clearing this material although some coralline species can slough off outer cell layers to remove epiphytic species etc. Increased siltation may also fill up the spaces between nodules in maerl beds changing the substratum. Information on reproduction and recruitment is rather limited, particularly round the British Isles. Sexual and asexual reproduction has been recorded but in some areas there may be virtually no sexual plants (e.g. The Gulf of Maine, Adey, 1966). In Scotland, although *Lithothamnion glaciale* conceptacles are common in winter, the plants are sterile in summer (Hall-Spencer, 1994 cited in Birkett *et al*., 1998). On loss of a proportion of a population, sexual or asexual propagules from this or other populations may recolonize the area. Propagation can also occur through vegetative growth and division of existing crusts or nodules. With the slow growth rates of coralline algae, it will take a very long time to re-establish a similar population although this may be faster for *Lithothamnion glaciale* than for other maerl species (Irvine & Chamberlain, 1994). It will probably take much longer for maerl beds to recover than for crustose populations.

Decrease in suspended sediment

Dessication High Very low / none Very High High

Maerl species (unlike most seaweeds) have a very poor ability to tolerate desiccation - only a few minutes exposure to the air would be sufficient to cause death (Birkett *et al*., 1998). Information on reproduction and recruitment is rather limited, particularly round the British Isles. Sexual and asexual reproduction has been recorded but in some areas there may be virtually no sexual plants (e.g. The Gulf of Maine, Adey, 1966). In Scotland, although *Lithothamnion glaciale* conceptacles are common in winter, the plants are sterile in summer (Hall-Spencer, 1994 cited in Birkett *et al*., 1998) Propagation can also occur through vegetative growth and division of existing crusts or nodules, although this requires there to be a proportion of the population to remain. Once a population has become extinct, sexual or asexual propagules from other populations may recolonize the area. Even if recolonization occurs, with the slow growth rates of coralline algae, it will take a very long time to re-establish a similar population although this may be faster for *Lithothamnion glaciale* than for other maerl species (Irvine & Chamberlain, 1994). It will probably take much longer for maerl beds to recover than for crustose populations.

Increase in emergence regime High Very High High

Maerl species (unlike most seaweeds) have a very poor ability to tolerate desiccation - only a few minutes exposure to the air would be sufficient to cause death (Birkett *et al*., 1998). Information on reproduction and recruitment is rather limited, particularly round the British Isles. Sexual and asexual reproduction has been recorded but in some areas there may be virtually no sexual plants (e.g. The Gulf of Maine, Adey, 1966). In Scotland, although *Lithothamnion glaciale* conceptacles are common in winter, the plants are sterile in summer (Hall-Spencer, 1994 cited in Birkett *et al*., 1998) Propagation can also occur through vegetative growth and division of existing crusts or nodules, although this requires there to be a proportion of the population to remain. Once a population has become extinct, sexual or asexual propagules from other populations may recolonize the area. Even if recolonization occurs, with the slow growth rates of coralline algae, it will take a very long time to re-establish a similar population although this may be faster for *Lithothamnion glaciale* than for other maerl species (Irvine & Chamberlain, 1994). It will probably take much longer for maerl beds to recover than for crustose populations.

Decrease in emergence regime

Increase in water flow rate Intermediate Low High Low

Changes in water flow rate may have some effect on *Lithothamnion glaciale*. Conditions with 'streaming water' are noted as being the best for this species (Suneson, 1943). Increases in water flow rate are unlikely to affect crustose individuals. Extreme water movement may cause movement of maerl nodules into less favourable conditions (e.g. deeper water). A reduction in water flow rate may allow greater build up of deposited particulate matter effectively covering the algae and restricting photosynthesis (see also siltation and smothering). Information on reproduction and recruitment is rather limited, particularly round the British Isles. Sexual and asexual reproduction has been recorded but in some areas there may be virtually no sexual plants (e.g. The Gulf of Maine, Adey, 1966). In Scotland, although *Lithothamnion glaciale* conceptacles are common in winter, the plants are sterile in summer (Hall-Spencer, 1994 cited in Birkett *et al*., 1998). On loss of a proportion of a population, sexual or asexual propagules from this or other populations may recolonize the area. Propagation can also occur through vegetative growth and division of existing crusts or nodules. With the slow growth rates of coralline algae, it will take a very long time to re-establish a similar population although this may be faster for *Lithothamnion glaciale* than for other maerl species (Irvine & Chamberlain, 1994). It will probably take much longer for maerl beds to recover than for crustose populations.

Decrease in water flow rate

Increase in temperature Intermediate Low High Moderate

Adey, (1970) found optimal growth rates at between 10-12 °C. Long term chronic temperature decreases are likely to have little effect since the species is primarily subarctic and occurs in waters down to 0 °C (Adey, 1970). This species differs to *Lithothamnion corallioides* where the minimum survival temperature is between 2 and 5 °C. Information on reproduction and recruitment is rather limited, particularly round the British Isles. Sexual and asexual reproduction has been recorded but in some areas there may be virtually no sexual plants (e.g. The Gulf of Maine, Adey, 1966). However, the species does appear to be intolerant of increases in temperature. In Scotland for example, although *Lithothamnion glaciale* conceptacles are common in winter, the plants are sterile in summer (Hall-Spencer, 1994 cited in Birkett *et al*., 1998). Intolerance to temperature changes has, therefore, been assessed as intermediate. On loss of a proportion of a population, sexual or asexual propagules from this or other populations may recolonize the area. Propagation can also occur through vegetative growth and division of existing crusts or nodules. With the slow growth rates of coralline algae, it will take a very long time to re-establish a similar population although this may be faster for *Lithothamnion glaciale* than for other maerl species (Irvine & Chamberlain, 1994). It will probably take much longer for maerl beds to recover than for crustose populations.

Decrease in temperature

Increase in turbidity Intermediate Low High Moderate

Depth distribution of photosynthesising coralline algae is strongly affected by available light. In clearer waters the bottom depth limit is much greater than in turbid waters (e.g. Adey *et al*., 1976). The lower clarity of coastal waters of the British Isles restricts the distribution of maerl to shallow waters - typically less than 10 metres but occasionally down to around 30 m. Increases in turbidity would further restrict the depth distribution of a population. However, light availability is apparently not a limiting factor in temperatures below 4-6 °C (Adey, 1970).

Decreases in turbidity would facilitate photosynthesis and benefit the population. Information on reproduction and recruitment is rather limited, particularly round the British Isles. Sexual and asexual reproduction has been recorded but in some areas there may be virtually no sexual plants (e.g. The Gulf of Maine, Adey, 1966). In Scotland, although *Lithothamnion glaciale* conceptacles are common in winter, the plants are sterile in summer (Hall-Spencer, 1994 cited in Birkett *et al.*, 1998). On loss of a proportion of a population, sexual or asexual propagules from this or other populations may recolonize the area. Propagation can also occur through vegetative growth and division of existing crusts or nodules. With the slow growth rates of coralline algae, it will take a very long time to re-establish a similar population although this may be faster for *Lithothamnion glaciale* than for other maerl species (Irvine & Chamberlain, 1994). It will probably take much longer for maerl beds to recover than for crustose populations.

Decrease in turbidity

Increase in wave exposure Intermediate Low High Moderate

Increases in wave action will probably have little effect on crustose populations of *Lithothamnion glaciale* since it is a hard, thin, strongly adherent species. Maerl beds with loose-lying nodules are restricted to less wave exposed areas (e.g. sea lochs for *Lithothamnion glaciale* beds). Some wave action may be beneficial in creating the 'streaming water' flow that this species prefers. Strong wave action can break up the nodules into smaller pieces and scatter them from the maerl bed. Wave action during storms can be very important in determining the loss rates of thalli from maerl beds (Birkett *et al.*, 1998). Information on reproduction and recruitment is rather limited, particularly round the British Isles. Sexual and asexual reproduction has been recorded but in some areas there may be virtually no sexual plants (e.g. The Gulf of Maine, Adey, 1966). In Scotland, although *Lithothamnion glaciale* conceptacles are common in winter, the plants are sterile in summer (Hall-Spencer, 1994 cited in Birkett *et al.*, 1998). On loss of a proportion of a population, sexual or asexual propagules from this or other populations may recolonize the area. Propagation can also occur through vegetative growth and division of existing crusts or nodules. With the slow growth rates of coralline algae, it will take a very long time to re-establish a similar population although this may be faster for *Lithothamnion glaciale* than for other maerl species (Irvine & Chamberlain, 1994). It will probably take much longer for maerl beds to recover than for crustose populations.

Decrease in wave exposure

Noise Tolerant Not relevant Not sensitive High

It is highly unlikely that noise vibrations will affect crustose corallines such as *Lithothamnion glaciale*.

Visual Presence Tolerant Not relevant Not sensitive High

It is highly unlikely that visual disturbance will affect crustose corallines such as *Lithothamnion glaciale*.

Abrasion & physical disturbance High Very High Moderate

Abrasion and physical disturbance may break up loose-lying maerl nodules or highly branching crustose plants into smaller pieces resulting in easier displacement by wave action. Abrasion may also disrupt the physical integrity of accreted maerl beds. Boat moorings and dragging anchor chains have been noted to damage the surface of maerl beds as has demersal fishing gear. Hall-Spencer & Moore (2000a, c) reported that a single pass of a scallop dredge could bury and kill 70% of the living maerl (usually found at the surface), redistributed coarse

sediment and affected the associated community. Dredge tracks remained visible for 2.5 years. Hall-Spencer & Moore (2000a, c) suggested that repeated anchorage could create impacts similar to towed fishing gear. Overall, Hall-Spencer & Moore (2000a, c) concluded that maerl beds were particularly vulnerable to damage from scallop dredging activities. Therefore, intolerance has been recorded as high. Information on reproduction and recruitment is rather limited, particularly round the British Isles. Sexual and asexual reproduction has been recorded but in some areas there may be virtually no sexual plants e.g. the Gulf of Maine (Adey, 1966). In Scotland although *Lithothamnion glaciale* conceptacles are common in winter, the plants are sterile in summer (Hall-Spencer, 1994 cited in Birkett *et al.*, 1998). On loss of a proportion of a population, sexual or asexual propagules from this or other populations may recolonize the area. Propagation can also occur through vegetative growth and division of existing crusts or nodules. With the slow growth rates of coralline algae, it will take a very long time to re-establish a similar population although this may be faster for *Lithothamnion glaciale* than for other maerl species (Irvine & Chamberlain, 1994). It will probably take much longer for maerl beds to recover than for crustose populations.

Displacement Intermediate High Low

Crustose plants of *Lithothamnion glaciale* are strongly adherent to hard substrata. Branches that break off from these attached plants can continue to live and grow as loose-lying nodules but if the entire plant was removed form the substratum, it may die. Some maerl beds are highly mobile and displacement may have little effect. Other beds may be accreted and the branching nodules highly interlocked. Displacement from these 'fixed' beds may cause dispersion of the nodules into more unsuitable habitat. Information on reproduction and recruitment is rather limited, particularly round the British Isles. Sexual and asexual reproduction has been recorded but in some areas there may be virtually no sexual plants (e.g. The Gulf of Maine, Adey, 1966). In Scotland, although *Lithothamnion glaciale* conceptacles are common in winter, the plants are sterile in summer (Hall-Spencer, 1994 cited in Birkett *et al.*, 1998). On loss of a proportion of a population, sexual or asexual propagules from this or other populations may recolonize the area. Propagation can also occur through vegetative growth and division of existing crusts or nodules. With the slow growth rates of coralline algae, it will take a very long time to re-establish a similar population although this may be faster for *Lithothamnion glaciale* than for other maerl species (Irvine & Chamberlain, 1994). It will probably take much longer for maerl beds to recover than for crustose populations.

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				Not relevant
Insufficient information				
Changes in nutrient levels	Intermediate	Low	High	Moderate

Cabioch (1969) has suggested that maerl is tolerant to increases in nutrients. However, in

shallower waters, growth of ephemeral algae may be increased, smothering the maerl and restricting photosynthesis. King & Schramm, (1982) report that ionic calcium concentration is the main factor affecting growth of maerl in culture experiments rather than salinity *per se* (although this has not been shown in the field). For *Phymatolithon calcareum*, uptake of calcium carbonate occurs optimally at 30 psu. Information on reproduction and recruitment is rather limited, particularly round the British Isles. Sexual and asexual reproduction has been recorded but in some areas there may be virtually no sexual plants (e.g. The Gulf of Maine, Adey, 1966). In Scotland, although *Lithothamnion glaciale* conceptacles are common in winter, the plants are sterile in summer (Hall-Spencer, 1994 cited in Birkett *et al*., 1998). On loss of a proportion of a population, sexual or asexual propagules from this or other populations may recolonize the area. Propagation can also occur through vegetative growth and division of existing crusts or nodules. With the slow growth rates of coralline algae, it will take a very long time to re-establish a similar population although this may be faster for *Lithothamnion glaciale* than for other maerl species (Irvine & Chamberlain, 1994). It will probably take much longer for maerl beds to recover than for crustose populations.

Increase in salinity	Low	Very high	Very Low	Moderate

Unlike *Lithothamnion corallioides* and *Phymatolithon calcareum*, *Lithothamnion glaciale* is tolerant to some variation in salinity. It is found regularly in sea lochs off the west coast of Scotland where riverine in-put and precipitation run-off cause variable salinity. Growth rates are decreased by reduced salinity (Adey, 1970). Resumption of normal growth rates will probably occur on return to full salinity.

Decrease in salinity

Changes in oxygenation	Low	Very high	Very Low	Moderate

Anoxia will kill live maerl (J. Hall-Spencer, pers. comm.) but exposure to low oxygen concentrations for a week may not kill the plants. Respiration, growth and reproduction may be affected by hypoxia but the effects are likely to be short lasting on return to normal oxygen concentrations.

Biological Pressures

	Intolerance	Recoverability	Sensitivity	Confidence
Introduction of microbial pathogens/parasites	Intermediate	Low	High	Moderate

No diseases of European maerl species are known. However, the bacterial pathogen 'coralline lethal orange disease' from the Pacific is highly virulent (Littler & Littler, 1985). Information on reproduction and recruitment is rather limited, particularly round the British Isles. Sexual and asexual reproduction has been recorded but in some areas there may be virtually no sexual plants (e.g. The Gulf of Maine, Adey, 1966). In Scotland, although *Lithothamnion glaciale* conceptacles are common in winter, the plants are sterile in summer (Hall-Spencer, 1994 cited in Birkett *et al*., 1998). On loss of a proportion of a population, sexual or asexual propagules from this or other populations may recolonize the area. Propagation can also occur through vegetative growth and division of existing crusts or nodules. With the slow growth rates of coralline algae, it will take a very long time to re-establish a similar population although this may be faster for *Lithothamnion glaciale* than for other maerl species (Irvine & Chamberlain, 1994). It will probably take much longer for maerl beds to recover than for crustose populations.

Introduction of non-native species	Intermediate	Low	High	Moderate

The introduced species *Crepidula fornicata* has radically altered the ecology of maerl beds in the Rade de Brest, France through increasing siltation and provision of substrata (J. Hall-Spencer pers. comm.). This alien species may impact the few populations of *Lithothamnion glaciale* recorded in southern Britain but has not spread far enough north to affect areas where *Lithothamnion glaciale* is abundant. Information on reproduction and recruitment is rather limited, particularly round the British Isles. Sexual and asexual reproduction has been recorded but in some areas there may be virtually no sexual plants (e.g. The Gulf of Maine, Adey, 1966). In Scotland, although *Lithothamnion glaciale* conceptacles are common in winter, the plants are sterile in summer (Hall-Spencer, 1994 cited in Birkett *et al*., 1998). On loss of a proportion of a population, sexual or asexual propagules from this or other populations may recolonize the area. Propagation can also occur through vegetative growth and division of existing crusts or nodules. With the slow growth rates of coralline algae, it will take a very long time to re-establish a similar population although this may be faster for *Lithothamnion glaciale* than for other maerl species (Irvine & Chamberlain, 1994). It will probably take much longer for maerl beds to recover than for crustose populations.

Extraction of this species Intermediate Low High High

It is extremely unlikely that crustose populations of *Lithothamnion glaciale* would be targeted for extraction. In contrast, maerl beds, of which *Lithothamnion glaciale* can form an important component, particularly in Scotland, may be subject to exploitation Harvesting of maerl beds is one of the greatest threats. In England only dead maerl is extracted. However, even this can have detrimental effects, resuspending sediments that resettle and cover the algae reducing photosynthesis. In live beds the living nodules are typically on the surface so these are the first to be removed. Information on reproduction and recruitment is rather limited, particularly round the British Isles. Sexual and asexual reproduction has been recorded but in some areas there may be virtually no sexual plants (e.g. The Gulf of Maine, Adey, 1966). In Scotland, although *Lithothamnion glaciale* conceptacles are common in winter, the plants are sterile in summer (Hall-Spencer, 1994 cited in Birkett *et al*., 1998). On loss of a proportion of a population, sexual or asexual propagules from this or other populations may recolonize the area. Propagation can also occur through vegetative growth and division of existing crusts or nodules. With the slow growth rates of coralline algae, it will take a very long time to re-establish a similar population although this may be faster for *Lithothamnion glaciale* than for other maerl species (Irvine & Chamberlain, 1994). It will probably take much longer for maerl beds to recover than for crustose populations.

Extraction of other species Intermediate Low High High

Lithothamnion glaciale has no known obligate relationships so the loss of other species should not have a great effect on the viability of the plant population. However, the physical effects of removal of other species can be very serious. Extraction of other organisms such as scallops using dredges can cause great damage through physical disruption, crushing, burial and the loss of stabilising algae (Hall-Spencer & Moore, 2000(a)). Other large burrowing bivalves such as *Ensis* sp. and *Venerupis* sp. are harvested using suction dredging which causes structural damage and resuspends sediment that resettles, covering the algae and reducing photosynthesis (Hall-Spencer & Moore, 2000(a)). These effects are best addressed using the relevant physical factors above. Information on reproduction and recruitment is rather limited, particularly round the British Isles. Sexual and asexual reproduction has been recorded but in some areas there may be virtually no sexual plants (e.g. The Gulf of Maine, Adey, 1966). In Scotland, although *Lithothamnion glaciale* conceptacles are common in winter, the plants are sterile in summer (Hall-Spencer, 1994 cited in Birkett *et al*., 1998). On loss of a proportion of a population, sexual or asexual propagules from this or other populations may

recolonize the area. Propagation can also occur through vegetative growth and division of existing crusts or nodules. With the slow growth rates of coralline algae, it will take a very long time to re-establish a similar population although this may be faster for *Lithothamnion glaciale* than for other maerl species (Irvine & Chamberlain, 1994). It will probably take much longer for maerl beds to recover than for crustose populations.

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

It is proposed that *Lithothamnion glaciale* is added to Annex V of the EC Habitats Directive. The other British Isles maerl species (*Phymatolithon calcareum* and *Lithothamnion corallioides*) are already listed. Maerl beds are also identified as a key habitat within the EC Habitats Directive Annex I category 'Sand banks which are covered by sea-water at all times'. Maerl biotopes are covered by a UK Biodiversity Habitat Action Plan that, therefore, also addresses *Lithothamnion glaciale*.

In 1996, a licence was granted to take some 20,000 cubic metres (approximately 36,000 tonnes) from Orkney waters (http://www.rbge.org.uk/search-bin/nph-readbtree.pl/usedata/maxvals=10/firstval=1?SPECIES_XREF=Lithothamnion+glaciale).

Bibliography

Adey, W.H. & Adey, P.J., 1973. Studies on the biosystematics and ecology of the epilithic crustose corallinacea of the British Isles. *British Phycological Journal*, **8**, 343-407.

Adey, W.H., 1966. The genera *Lithothamnium*, *Leptophytum* (nov. gen.) and *Phymatolithon* in the Gulf of Maine. *Hydrobiologia*, **28**, 321-370.

Adey, W.H., 1970. The effects of light and temperature on growth rates in boreal-subarctic crustose corallines. *Journal of Phycology*, **6**, 269-276.

Adey, W.H., Masaki, T. & Akioka, H., 1976. The distribution of crustose corallines in Eastern Hokkaido and the biogeographic relationships of the flora. *Bulletin of the Faculty of Fisheries, Hokkaido University*, **26**, 303-313.

Birkett, D.A., Maggs, C.A. & Dring, M.J., 1998a. Maerl. an overview of dynamic and sensitivity characteristics for conservation management of marine SACs. *Natura 2000 report prepared by Scottish Association of Marine Science (SAMS) for the UK Marine SACs Project.*, Scottish Association for Marine Science. (UK Marine SACs Project, vol V.). Available from: http://www.ukmarinesac.org.uk/publications.htm

Cabioch, J., 1969. Les fonds de maerl de la baie de Morlaix et leur peuplement vegetale. *Cahiers de Biologie Marine*, **10**, 139-161.

Cardinal, A., Cabioch, J., & Gendron, L., 1979. Les corallinacées (Rhodophytes; Cryptonemiales) des c&#244tes du Québec II. *Lithothamnium* Philippi emend Adey (I). *Cahiers be Biologie Marine*, **20**, 171-179.

Grave De, S., 1999. The influence of sediment heterogeneity on within maerl bed differences in infaunal crustacean community. *Estuarine, Coastal and Shelf Science*, **49**, 153-163.

Hall-Spencer, J.M. & Moore, P.G., 2000a. Impact of scallop dredging on maerl grounds. In *Effects of fishing on non-target species and habitats.* (ed. M.J. Kaiser & S.J., de Groot) 105-117. Oxford: Blackwell Science.

Hall-Spencer, J.M. & Moore, P.G., 2000c. Scallop dredging has profound, long-term impacts on maerl habitats. *ICES Journal of Marine Science*, **57**, 1407-1415.

Hall-Spencer, J.M., 1995. *Lithothamnion corallioides* (P. & H. Crouan) P. & H. Crouan may not extend into Scottish waters. http://www.botany.uwc.ac.za/clines/clnews/cnews20.htm, 2000-10-15

Hall-Spencer, J.M., 1998. Conservation issues relating to maerl beds as habitats for molluscs. *Journal of Conchology Special Publication*, **2**, 271-286.

Hardy, F.G. & Guiry, M.D., 2003. *A check-list and atlas of the seaweeds of Britain and Ireland.* London: British Phycological Society

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.]

Irvine, L. M. & Chamberlain, Y. M., 1994. *Seaweeds of the British Isles*, vol. 1. *Rhodophyta*, Part 2B *Corallinales, Hildenbrandiales.* London: Her Majesty's Stationery Office.

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

Littler, M., & Littler, D., 1995. CLOD (Coralline Lethal Orange Disease). http://www.botany.uwc.ac.za/clines/clnews/cnews20.htm, 2000-10-15

Rosenvinge, L.K., 1917. The marine algae of Denmark. Contributions to their natural history. II Rhodophyceae II (Cryptomeniales). *Kongelige Dansk Videnskabernes Selskabs Skrifter, Naturvidenskabelig Matematik Afdeling*, **7**, 153-284.

Suneson, S., 1943. The structure, life-history, and taxonomy of the Swedish Corallinaceae. *Lunds Universitets Årsskrift* N.F. Avd 2, **39**, 1-66. *Kungliga Fysiografiska Sållskapets Handlingar* N.F. **54**(9).

Datasets

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.

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

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.

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. Non-vascular Plants, Outer Hebrides. Occurrence dataset:

https://doi.org/10.15468/goidos accessed via GBIF.org on 2018-10-01.

Royal Botanic Garden Edinburgh, 2018. Royal Botanic Garden Edinburgh Herbarium (E). Occurrence dataset: https://doi.org/10.15468/ypoair accessed via GBIF.org on 2018-10-02.