

Scallop (Queen) Dredge on Maerl

Introduction

The Assessing Welsh Fisheries Activities Project is a structured approach to determine the impacts from current and potential fishing activities, from licensed and registered commercial fishing vessels, on the features of Marine Protected Areas.

1. Gear and Feature	Scallop (Queen) Dredge on Maerl
2. Risk Level	Purple (High risk)
3. Description of Feature	<p>Maerl is a generic term for nodule forming calcareous red algae and is comprised of three species in Britain; <i>Phymatolithon calcareum</i>, <i>Lithothamnion coralloides</i> and <i>Lithothamnion glaciale</i>.</p> <p>The 'maerl beds' biotope complex (SS.SMp.Mrl) encompasses a number of biotopes (see annex 1 for full biotope description). <i>Phymatolithon calcareum</i> dominates in SMp.Mrl.Pcal (and its sub-biotopes SMp.Mrl.Pcal.R and SMp.Mrl.Pcal.Nmix), <i>Lithothamnion coralloides</i> dominates in SMp.Mrl.Lcor and <i>Lithothamnion glaciale</i> dominates in variable salinity (SMp.Mrl.Lgla). In all cases the dominant maerl forms a unique habitat that supports a diverse assemblage of species (Perry & Tyler-Walters, 2016).</p> <p>Both <i>Phymatolithon calcareum</i> and <i>Lithothamnion coralloides</i> are listed in the EC Habitats Directive Annex V (EC, 1992) which restricts the exploitation and taking in the wild. <i>Lithothamnion coralloides</i> is listed on Section 7 of the Environment (Wales) Act 2016 and the OSPAR list of threatened and/or declining species and habitats.</p> <p><i>Phymatolithon calcareum</i> and <i>Lithothamnion coralloides</i> form the only live maerl bed known in Wales (Bunker <i>et al</i>, 2007; Carro <i>et al</i>, 2014).</p> <p>Beds of maerl predominantly occur in coarse clean sediments of</p>

	<p>gravels and clean sands, either on the open coast or in tide-swept channels or sheltered areas of marine inlets. In fully marine conditions the dominant maerl is typically <i>Phymatolithon calcareum</i> (SMp.Mrl.Pcal) (Perry & Tyler-Walters, 2016).</p> <p>Maerl is a fragile long lived and slow growing calcified red algae which grows in unattached nodules on the seabed. It favours clear clean seawater, is intolerant of siltation (Wilson <i>et al</i>, 2004) and thrives mainly in areas of moderate tidal flow (Bunker <i>et al</i>, 2007). Maerl beds are an important habitat for a multitude of animals and plants which live attached to the branches, in the spaces between, or burrow in the coarse gravel of dead maerl beneath (Bunker <i>et al</i>, 2007).</p> <p>As maerl requires light to photosynthesize, the depth of live beds is determined by water turbidity, it can occur from the lower shore to approximately 40m (Hall-Spencer <i>et al</i>, 2010), although in Welsh waters the distribution is restricted to shallower waters.</p>
<p>4. Description of Gear</p>	<p>Queen scallops (<i>Aequipecten opercularis</i>) are predominantly targeted using towed fishing gear, either in the form of skid dredges (modified Newhaven dredges) or modified otter trawls.</p> <p>Queen scallops are more active swimmers than king scallops and do not recess into the seabed (Brand, 2006). Dredges and otter trawls take advantage of the natural propensity of queen scallops to swim up into the water column when disturbed, rather than relying on extraction of the scallops from the sediment as is the case for Newhaven dredges (Beukers-Stewart & Beukers-Stewart, 2009).</p> <p>A modified Newhaven dredge can be about 1.95m wide, often with a higher front opening. Instead of metal teeth it can have a rubber lip or sometimes the front part of the dredge consists of a metal grid mounted on four rubber rollers, two on each side of the grid. Alternatively, the tooth bar is replaced with a tickler chain. The modified dredge is normally fitted with skis or skids on either side designed to run along the top of the seabed. The dredge has a traditional metal belly bag with a mesh size of 60mm to retain the</p>

	<p>queen scallops (Humphrey, 2009).</p> <p>Traditional toothed king scallop dredges are occasionally used to target queen scallops, these dredges are approximately 0.76m wide, with a chain mail belly bag and a 60mm mesh. Each dredge bar usually has 17 metal teeth of around 6cm in length on it (Hinz <i>et al</i>, 2009). The amount of dredges per side of the vessel can vary between 1 and 16 depending on the size and power of the vessel.</p> <p>The choice of skid dredges or otter trawls is largely governed by the nature of the substrate on different fishing grounds, with skid dredges being more effective in rough/coarse sediment areas and trawls in sandy/muddy areas (Vause <i>et al</i>, 2007).</p>
<p>5. Assessment of Impact Pathways:</p> <ol style="list-style-type: none"> 1. Damage to a designated habitat feature (including through direct physical impact, pollution, changes in thermal regime, hydrodynamics, light etc). 2. Damage to a designated habitat feature via removal of, or other detrimental impact on, typical species. 	<p>The three types of queen scallop fishing gear described above are all bottom contacting gear and as such impose a similar effect upon the seabed. The assessment below incorporates all three gears and will be referred to collectively as scallop (queen) dredge gear. Any differences in gear interactions will also be described below.</p> <ol style="list-style-type: none"> 1. A study by Hall-Spencer & Moore (2000a) investigated the profound long term impacts of scallop dredging on maerl habitats, and although the study title gear differs slightly, a comparison is frequently drawn between scallop dredging and demersal trawling throughout the article. Hall-Spencer & Moore (2000a) state that the integrity of maerl habitat depends upon the survival of a surface layer of slow-growing algae. <p>The Newhaven dredges and trawls employed in this fishery are also known to cause considerable damage and disturbance to benthic communities and associated nursery habitat (Eleftheriou & Robertson, 1992; Jennings <i>et al</i>, 2001; Kaiser <i>et al</i>, 2006). The action of the scallop (queen) dredge gear, like the impacts from king scallop dredges, will affect the maerl by coming into direct physical contact with the slow growing surface layers, causing lethal disturbance and destruction of the maerl.</p>

Scallop (queen) dredge gear have penetration depths of 1-15cm in sand and 1-35cm in mud (Eigaard *et al*, 2016; Paschen *et al*, 2000).

In maerl areas, rhodolith-forming algae disappears under moderate trawling pressure and recovery would take many decades or never happen, due to the slow growth rates of these species (Bordehore *et al*, 2003). Growth rates of European maerl species range between tenths of a millimetre to 1 millimetre per annum (Bosence & Wilson, 2003). Maerl beds represent a non-renewable resource as extraction and disruption far out-strips their slow rate of accumulation (Barbera *et al*, 2003).

Hall-Spencer & Moore (2000a) also indicated that the maerl will be indirectly affected by smothering from redistributed sediment after the gear has passed. Maerl algae will eventually die in prolonged periods without sunlight. The study concludes that a single tow of three dredges caused sediment redistribution onto the live maerl that was clearly discernible four years after the event. Given the similar nature of sediment disturbance caused by these towed demersal fishing gears, it can be assumed that scallop (queen) dredge gear could cause a similar degree of sediment disturbance and live maerl burial.

Wilson *et al* (2004) recognise trawling as one of the main anthropogenic hazards for live maerl. In their study (Environmental tolerances of free-living coralline algae (maerl): implications for European marine conservation) they conclude that maerl burial, especially in fine or anoxic sediments, was lethal or caused significant stress.

In conclusion, one pass of scallop (queen) dredge gear could cause lethal damage to a maerl bed. However, recovery could occur, but due to slow growth rates this may take many decades. Repeated fishing would further reduce the rate of recovery or it may not happen at all.

2. Maerl beds support diverse communities of burrowing infauna, especially bivalves, and interstitial invertebrates; including suspension feeding polychaetes and echinoderms (Perry and Tyler Walters,

2016). Maerl is known as a particularly diverse habitat with over 150 macroalgal species and 500 benthic faunal species recorded (Birkett *et al*, 1998). The sea cucumber *Neopentadactyla mixta* can reach densities of up to 400/m² in loose gravels such as maerl (Smith & Keegan, 1985).

Hall-Spencer & Moore (2000b,c) examined the recovery of maerl community after scallop dredging in previously un-dredged and dredged sites in Scotland. In comparison with control plots, mobile epibenthos returned within one month; fleshy macroalgae within six months; the abundance of *Cerianthus lloydii* was not significantly different after 14 months; other epifauna (e.g. *Lanice conchilega* and *Ascidella aspersa*) returned after 1-2 years; but some of the larger sessile surface species (e.g. sponges, *Metridium senile*, *Modiolus modiolus* and *Limaria hians*) exhibited lower abundances on dredged plots after four years.

Work by Hall-Spencer & Moore (2000b) on maerl beds showed that four years after the initial disturbance had occurred, certain fauna, such as the nest building bivalve *Limaria hians*, had still not recolonized trawl tracks. It was also shown that live maerl was buried up to 8cm below the sediment surface and carbonate structures (maerl thalli, echinoid test plates and bivalve shells) were crushed and compacted. Although some of the live maerl that had been buried was still alive initially, if the area is sheltered and the tidal movement did not wash away the sediment then the maerl would eventually die.

Hall-Spencer (1999) discovered days after dredging had taken place that natural bottom features (e.g. sediment ripples, crab feeding pits and megafaunal burrows) were eliminated along the dredge tracks and boulders up to 1m² had been dragged along the sediment surface. A shift in granulometric structure of the surface layer of sediment was evident by comparison with adjacent, unfished areas. Mud and sand had been brought to the surface of the tracks and maerl gravel had been sculpted into 3cm high ridges at the edge of each dredge path.

		<p>It is also suggested that maerl beds are a nursery ground for a number of marine shellfish species such as king scallops <i>Pecten maximus</i>, queen scallops <i>Aequipecten opercularis</i> and <i>Mya arenaria</i> (Kamenos <i>et al</i>, 2004).</p> <p>Both the scallop dredges and trawls used in the UK scallop fishery capture a wide variety of non-target mobile megafauna, including some commercially important species. Examples include; fish (flatfish, dogfish, skates, rays, monkfish and dragonets), crustaceans (edible crabs, swimmer crabs, spider crabs and hermit crabs), urchins, molluscs (bivalves and gastropods), starfish, brittlestars and cephalopods (octopus and cuttlefish) (Hill <i>et al</i>, 1996; Veale <i>et al</i>, 2001; Enever <i>et al</i>, 2007).</p> <p>Biogenic substrates and their associated benthic communities are the most sensitive to disturbance by scallop fisheries, particularly scallop dredging (Collie <i>et al</i>, 2000; Hall-Spencer & Moore, 2000a; Kaiser <i>et al</i>, 2006).</p> <p>In conclusion, the current evidence regarding the recovery of maerl suggests that if maerl is removed, fragmented or killed then it has almost no ability to recover. If the maerl is killed but the bed remains (a bed of dead maerl) then then the resident community (but not the maerl) may recover within 2-10 years, but where the maerl is fragmented, species richness will probably decrease (Perry and Tyler Walters, 2016).</p>
<p>6. MPAs where feature exists</p>	<p>Pembrokeshire Marine SAC</p>	<p>In Milford Haven, <i>Phymatolithon calcareum</i> and <i>Lithothamnion corallioides</i> form the only live maerl bed known in Wales. It is an ancient bed with a sample of fossil maerl collected from Stack Rock having a calibrated age of between 184 BC to 12 AD (Blake, 2005).</p> <p>The maerl bed is confined (with high confidence) between the LNG jetty access trestle and Stack Rock Fort (Bunker <i>et al</i>, 2007).</p> <p>The maerl bed is a component part of the Estuaries and the Large Shallow Inlet and Bays features of the Pembrokeshire Marine SAC.</p>

		<p>Within the area the maerl bed occurs the Welsh Government's Byelaw 39 limits the size of a beam to 4m. The assessment information presented above can be used to conclude that the impact from a smaller 2 or 3m beam will cause the same initial damage as a larger beam, over the area covered.</p>
--	--	--

7. Conclusion

The information presented above indicates that the action of fishing with scallop (queen) dredge gear directly on maerl beds is likely to cause lethal damage to the maerl and associated species, whilst recovery, which may take many years, is potentially possible, this would be less likely if fishing activity was repeated. Additionally, fishing with scallop (queen) dredge gear adjacent to maerl beds could have a negative impact from short or long term smothering; this impact would depend on the extent and frequency of the activity and the tidal and environmental conditions in the area of the habitat.

8. References

- Barbera, C., Bordehore, C., Borg, J.A., Glémarec, M., Grall, J., Hall-Spencer, J.M., De La Huz, C.H., Lanfranco, E., Lastra, M., Moore, P.G., Mora, J., Pita, M.E., Ramos-Esplá, R.M., Sánchez-Mata, A., Schembri, P.J. & Valle, C. (2003). "Conservation and management of northeast Atlantic and Mediterranean maerl beds." *Aquatic conservation: marine and freshwater ecosystems* 13, no. S1: S65-S76.
- Beukers-Stewart B.D. & Beukers-Stewart, J.S. (2009). Principles for the management of inshore scallop fisheries around the United Kingdom. Report to Natural England, Countryside Council for Wales and Scottish Natural Heritage. University of York. 57pp.
- Birkett, D.A., Maggs, C.A. & Dring, M.J. (1998). 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.).
- Blake, C. (2005). Use of fossil and modern coralline algae as a biogenic archive. PhD thesis, Queen's University Belfast.
- Bordehore, C., Ramos-Esplá, A.A. & Riosmena-Rodriguez, R. (2003). Comparative study of two maerl beds with different otter trawling history, southeast Iberian Peninsula. *Aquatic Conserv: Mar. Freshw. Ecosyst.*13: S43–S54.
- Bosence, D. & Wilson, J. (2003). Maerl growth, carbonate production rates and accumulation rates in the northeast Atlantic. *Aquatic Conservation: Marine and Freshwater Ecosystems*, 13, S21-S31.
- Brand, A.R. (2006). Scallop Ecology: Distributions and Behaviour. In: Shumway S, Parsons GJ (eds) *Scallops: Biology, Ecology and Aquaculture*. Elsevier, Amsterdam, p 1460
- Bunker, F.StP.D. & Camplin, M.D. (2007). A study of the Milford Haven maerl bed in 2005 using drop down video and diving. A report to the Countryside Council for Wales by Marine Seen. CCW Contract Science Report 769. Countryside Council for Wales, Bangor, 174pp + iii.

- Carro, B., Lopez, L., Peña, V., Bárbara, I. & Barreiro, R. (2014). DNA barcoding allows the accurate assessment of European maerl diversity: a Proof-of-Concept study. *Phytotaxa* 190 91): 176-189.
- Collie, J.S., Hall, S.J., Kaiser, M.J. & Poiner, I.R. (2000). A quantitative analysis of fishing impacts on shelf-sea benthos. *J Animal Ecol* 69:785-798
- EC. (1992). European Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora. Official Journal L 206 , 22/07/1992 P. 0007 – 0050
- Eigaard, O.R., Bastardie, F., Breen, M., Dinesen, G.E., Hintzen, N.T., Laffargue, P., Mortensen, L.O., Nielsen, J.R., Nilsson, Hans C., O'Neill, F.G., Polet, H., Reid, D.G., Sala, A., Sko'ld, M., Smith, C., Sorensen, T.K., Tully, O., Zengin, M. & Rijnsdorp, A.D. (2016). Estimating seabed pressure from demersal trawls, seines, and dredges based on gear design and dimensions. – *ICES Journal of Marine Science*, 73: i27–i43.
- Eleftheriou, A. & Robertson, M.R. (1992). The effects of experimental scallop dredging on the fauna and physical environment of a shallow sandy community. *Neth J Sea Res* 30:289–299
- Enever, R., Revill, A. & Grant, A. (2007). Discarding in the English channel, western approaches, Welsh and Irish seas (ICES Subarea VII). *Fish Res*, 86: 143-152
- Hall-Spencer, J.M. (1999). Effects of towed demersal fishing gear on biogenic sediments: A 5-year study. In O. Giovanardi (ed.), *Impact of Trawl fishing on Benthic Communities*. Pp. 9-20. ICRAM, Rome.
- Hall-Spencer, J.M. & Moore, P.G. (2000a). "Scallop dredging has profound, long-term impacts on maerl habitats." *ICES Journal of Marine Science*: 57 1407-1415.
- Hall-Spencer, J.M. & Moore, P.G. (2000b). Impacts of scallop dredging on maerl grounds. *The Effects of Fishing on Non-Target Species and Habitats: Biological, Conservation and Socio-Economic Issues* (eds M.J. Kaiser & S.J. de Groot). pp. 105-118. Blackwell Science, Oxford, UK
- Hall-Spencer, J.M. & Moore, P.G. (2000c). *Limaria hians* (Mollusca: Limacea): A neglected reef-forming keystone species. *Aquatic Conservation: Marine and Freshwater Ecosystems*, 10, 267-278.
- Hall-Spencer, J.M., Kelly, J. & Maggs, C.A. (2010). Background document for Maerl beds. Report for Department of the Environment, Heritage & Local Government (DEHLG), Ireland
- Hill, A.S., Brand, A.R., Wilson, U.A.W., Veale, L.O. & Hawkins, S.J. (1996). Estimation of by-catch composition and numbers of by-catch animals killed annually on Manx scallop fishing grounds. *Greenstreet SPR, Tasker ML* (eds) *Aquatic Predators and their Prey*. Blackwell Scientific, Oxford, p111-115
- Hinz, H., Murray, L.G. & Kaiser, M.J. (2009). Efficiency and environmental impacts of three different Queen scallop fishing gears. *Fisheries & Conservation report No. 8*, Bangor University. pp.23.
- Humphey, M. (2009). Testing Materials used in Queen Scallop dredge Construction. SEAFISH report: SR612
- Jennings, S., Kaiser, M.J. & Reynolds, J.D. (2001). *Marine fisheries ecology*. Blackwell Science, Oxford
- Kaiser, M.J., Clarke, K.R., Hinz, H., Austen, M.C.V., Somerfield, P.J. & Karakassis, I. (2006). Global analysis of response and recovery of benthic biota to fishing. *Mar Ecol Progr Ser* 311:1–14
- Kamenos, N.A., Moore, P.G. & Hall-Spencer, J.M. (2004). Nursery-area function of maerl grounds for juvenile queen scallops *Aequipecten opercularis* and other invertebrates. *Marine Ecology Progress Series Vol. 274*: 183-189

- Paschen, M., Richter, U. & Ko"pnick, W. (2000). Trawl Penetration in the Seabed (TRAPESE). Final report Contract No. 96–006. University of Rostock, Rostock, Germany. 150 pp.
- Perry, F. & Tyler-Walters, H. (2016). Maerl beds. In Tyler-Walters H. and Hiscock K. (eds) Marine Life Information Network: Biology and Sensitivity Key Information Reviews, [on-line]. Plymouth: Marine Biological Association of the United Kingdom. Available from: <http://www.marlin.ac.uk/habitat/detail/255>
- Smith, T.B. & Keegan, B.F. (1985). Seasonal torpor in *Neopentadactyla mixta* (Ostergren) (Holothuroidea: Dendrochirotida). In Echinodermata. Proceedings of the Fifth International Echinoderm Conference. Galway, 24-29 September 1984. (B.F. Keegan & B.D.S O'Connor, pp. 459-464.
- Vause, B.J., Beukers-Stewart, B.D. & Brand, A.R. (2007). Fluctuations and forecasts on the fishery for queen scallops (*Aequipecten opercularis*) around the isle of man. *Ices Journal of Marine Science* 64: 1124-1135.
- Veale, L.O., Hill, A.S., Hawkins, S.J. & Brand, A.R. (2001). Distribution and damage to the bycatch assemblages of the northern Irish sea scallop dredge fisheries. *J Mar Biol Assoc UK* 81: 85-96
- Wilson, S., Charmaine, B., Berges, J.A. & Maggs, C.A. (2004). Environmental tolerances of free-living coralline algae (maerl): implications for European marine conservation. *Biological Conservation* 120: 279-289.

Annex 1

Biotope descriptions (version 15.03) (JNCC - <http://jncc.defra.gov.uk/marine/biotopes/hierarchy.aspx?level=5>)

SS.SMp.Mrl.Pcal - *Phymatolithon calcareum* maerl beds in infralittoral clean gravel or coarse sand

Maerl beds characterised by *Phymatolithon calcareum* in gravels and sands. Associated epiphytes may include red algae such as *Dictyota dichotoma*, *Halarachnion ligulatum*, *Callophyllis laciniata*, *Cryptopleura ramosa*, *Brongniartella byssoides* and *Plocamium cartilagineum*. Algal species may be anchored to the maerl or to dead bivalve shells amongst the maerl. Polychaetes, such as *Chaetopterus variopedatus*, *Lanice conchilega*, *Kefersteinia cirrata*, *Mediomastus fragilis*, *Chone duneri*, *Parametaphoxus fultoni* and *Grania* may be present. Gastropods such as *Gibbula cineraria*, *Gibbula magus*, *Calyptrea chinensis*, *Dikoleps pusilla* and *Onoba aculeus* may also be present. *Liocarcinus depurator* and *Liocarcinus corrugatus* are often present, although they may be under-recorded; it would seem likely that robust infaunal bivalves such as *Circomphalus casina*, *Mya truncata*, *Dosinia exoleta* and other venerid bivalves are more widespread than available data currently suggests. It seems likely that stable wave-sheltered maerl beds with low currents may be separable from SMP.Pcal; having a generally thinner layer of maerl overlying a sandy /muddy substratum with a diverse cover of epiphytes (e.g. Bosence 1976; Blunden et al. 1977; 1981; Davies & Hall-Spencer 1996) but insufficient data currently exists on a national scale. Wave and current-exposed maerl beds, where thicker depths of maerl accumulate, frequently occur as waves and ridge / furrows arrangements (see Bosence 1976; Blunden et al. 1977; 1981; Irvine & Chamberlain 1994; Hall-Spencer 1995). At some sites where Pcal occurs, there may be significant patches of maerl gravel containing the rare burrowing anemone *Halcampoides elongatus*; this may be a separate biotope, but insufficient data exists at present. Northern maerl beds in the UK do not appear to contain *L. corallioides* but in south-west England and Ireland *L. corallioides* may occur to some extent in Pcal as well as Lcor, where it dominates.

SMp.Pcal.R - *Phymatolithon calcareum* maerl beds with red seaweeds in shallow infralittoral clean gravel or coarse sand

Upper infralittoral maerl beds characterised by *Phymatolithon calcareum* in gravels and sand with a wide variety of associated red seaweeds. These algae typically include *Dictyota dichotoma*, *Plocamium cartilagineum*, *Phycodrys rubens*, *Chondrus crispus*, *Halarachnion ligulatum*, *Chylocladia verticillata*, *Hypoglossum hypoglossoides* and *Nitophyllum punctum*. These species are not restricted to maerl beds but their abundance on maerl beds differentiates this biotope from Pcal.Nmix. Anthozoans and echinoderms are much less common in this biotope than in Pcal.Nmix, which typically occurs deeper than Pcal.R.

SMp.Pcal.Nmix - *Phymatolithon calcareum* maerl beds with *Neopentadactyla mixta* and other echinoderms in deeper infralittoral clean gravel or coarse sand

Lower infralittoral maerl beds characterised by *Phymatolithon calcareum* in gravels and sand with a variety of associated echinoderms. The echinoderm *Neopentadactyla mixta* is frequently observed in this biotope. Other echinoderms such as *Echinus esculentus*, *Ophiura albida* and rarely *Luidia ciliaris* may also be present. Red seaweed such as *Plocamium cartilagineum* may be present but at a much lower abundance than in Pcal.R and with fewer species present. Other, more ubiquitous echinoderms such as *Asterias rubens* may also be found in low numbers throughout Pcal biotopes.

SMP.Mrl.Lcor - *Lithothamnion corallioides* maerl beds on infralittoral muddy gravel

Live maerl beds in sheltered, silty conditions which are dominated by *Lithothamnion corallioides* with a variety of foliose and filamentous seaweeds. Live maerl is at least common but there may be noticeable amounts of dead maerl gravel and pebbles. Other species of maerl, such as *Phymatolithon calcareum* and *Phymatolithon purpureum*, may also occur as a less abundant component. Species of seaweed such as *Dictyota dichotoma*, *Halarachnion ligulatum* and *Ulva* spp. are often present, although are not restricted to this biotope, whereas *Dudresnaya verticillata* tends not to occur on other types of maerl beds. The anemones *Anemonia viridis* and *Cerianthus lloydii*, the polychaetes *Notomastus latericeus* and *Caulleriella alata*, the isopod *Janira maculosa* and the bivalve *Hiatella arctica* are typically found in SMP.Lcor where as *Echinus esculentus* tends to occur more in other types of maerl. The seaweeds *Laminaria saccharina* and *Chorda filum* may also be present in some habitats. Lcor has a south-western distribution in Britain and Ireland. Sheltered, stable, fully saline maerl beds in the north of Great Britain (where *L. corallioides* has not been confirmed to occur) may need to be described as an analogous biotope to Lcor (see Pcal).

SMP.Lgla - *Lithothamnion glaciale* maerl beds in tide-swept variable salinity infralittoral gravel

Upper infralittoral tide-swept channels of coarse sediment in full or variable salinity conditions support distinctive beds of *Lithothamnion glaciale* maerl 'rhodoliths'. *Phymatolithon calcareum* may also be present as a more minor maerl component. Associated fauna and flora may include species found in other types of maerl beds (and elsewhere), e.g. *Pomatoceros triqueter*, *Cerianthus lloydii*, *Sabella pavonina*, *Chaetopterus variopedatus*, *Lanice conchilega*, *Mya truncata*, *Plocamium cartilagineum* and *Phycodrys rubens*. Lgla, however, also has a fauna that reflects the slightly reduced salinity conditions, e.g. *Psammechinus miliaris* is often present in high numbers along with other grazers such as chitons and *Tectura* spp. *Hyas araneus*, *Ophiothrix fragilis*, *Ophiocomina nigra* and the brown seaweed *Dictyota dichotoma* are also typically present at sites. In Scottish lagoons this biotope may show considerable variation but the community falls within the broad description defined here.

SMP.Mrl.Lfas - *Lithophyllum fasciculatum* maerl beds on infralittoral mud

Shallow, sheltered infralittoral muddy plains with *Lithophyllum fasciculatum* maerl. This rarely recorded maerl species forms flattened masses or balls several centimetres in diameter (Irvine & Chamberlain 1994). Lfas may be found on mud and muddy gravel mixed with shell. Species of anemone typical of sheltered conditions may be found in association, for example, *Anthopleura ballii*, *Cereus pedunculatus* and *Sagartiogeton undatus*. Polychaetes such as *Myxicola infundibulum* and terebellids, also characteristic of sheltered conditions, may be present as may hydroids such as *Kirchenpaueria pinnata*. Occasional *Chlamys varia* and *Thyone fuscus* are present in all records of this biotope and red seaweeds such as *Plocamium cartilagineum*, *Calliblepharis jubata* and *Chylocladia verticillata* are often present.