

PRIORITY MARINE FEATURE (PMF) - FISHERIES MANAGEMENT REVIEW

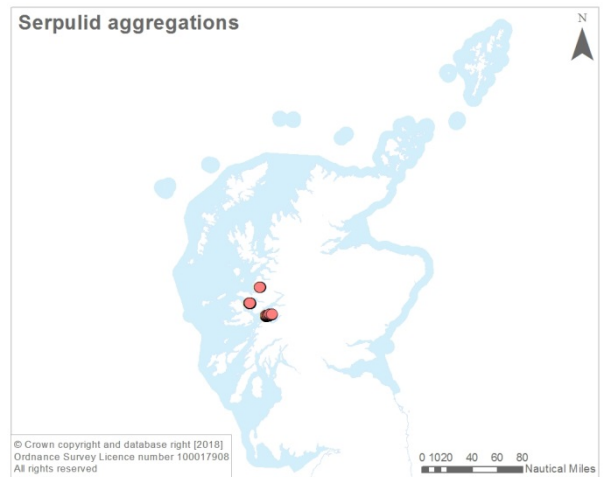
Feature

SERPULID AGGREGATIONS

Image



Map



Description

Characteristics - Dense clumps of white chalky tubes, each containing a *Serpula vermicularis* worm. When feeding, the worms extend red, white or orange feathery tentacles. Serpulid aggregations can reach over 1 m in height and 2 m wide, composed of individual tubes, each up to 5 mm wide and 15 cm in length, growing on top of one another anchored to pebbles, shells or stones in muddy sediment. Serpulid aggregations provide solid substrata in an otherwise sedimentary area. Sea squirts, sponges, sea firs and seaweeds grow on the calcareous tubes, while the complex three dimensional structures provide shelter and habitat for crabs, shrimps, squat lobsters, brittlestars, starfish, worms and snails. The aggregations also provide refuge for a number of fish species (Chapman *et al.*, 2012).

Definition - Serpulid aggregations are not defined by a minimum number of tubes but rather their clumping together, growing vertically up from the seabed (generally greater than 10 cm in height) and forming a discrete community different from the surrounding seabed. More substantial aggregations (approx. >1 m diameter) are recognised as biogenic reefs (see also Holt *et al.*, 1998; European Commission, 2013). The calcareous remains of old serpulid tubes may serve as substrate for new aggregations to grow on.

Environmental preferences - Serpulid aggregations occur in sheltered to extremely sheltered sea lochs or inlets with weak or very weak water flow, at depths of 6-10 m.

Distribution

Scottish distribution - Loch Creran, Loch Teacuis (an arm of Loch Sunart) and Loch Ailort.

Estimated known Scottish extent - Aggregations in Loch Teacuis and Loch Ailort can be up to 0.5 m in diameter and height. The aggregations in Loch Creran have developed into larger reefs up to 3 m across, although typically only a metre, and 0.75 m high. An estimated ~108 ha of serpulid habitat was present in Loch Creran in 2005 (Moore *et al.*, 2006).

Wider distribution - Only recorded from a few other locations worldwide: Killary Harbour, Ardbear Lough and Blacksod Bay (MERC Consultants, 2008) in Ireland; and Mar Piccolo, a lagoon near Taranto in Italy.

Status

Scottish waters support all UK records of this habitat. The reefs in Loch Creran represent the best example and the largest extent of this habitat in the world.

The first accounts described serpulid reefs in 1882 standing above the surface of Loch Creran at low tide (Moore *et al.*, 1998). This suggests their distribution has declined over the last 120 years. The extent of the reefs within Loch Creran appeared to be stable through the 1990s, however recent survey work indicates there has been a significant deterioration in condition since 2005 (Tulbure, 2015). It is hypothesised that serpulid reefs go through natural cycles of growth and collapse and ongoing academic studies in Loch Creran are exploring this in more detail. The biogenic reefs in Loch Creran are afforded protection under the EU Habitats Directive (European Commission, 2013).

Small aggregations of serpulid worms were discovered in Loch Teacuis in 2006 (Mercer *et al.*, 2006; Dodd *et al.*, 2007), but these have also since declined (SNH, 2015). The aggregations in Loch Ailort were first recorded in 2015 by recreational Seasearch divers.

Sensitivity (including recovery)

[Key source: [FEAST](#); [Fisheries Management Guidance](#)]

Serpulid aggregations are extremely sensitive to physical disturbance and abrasion, and are also sensitive to changes in water flow and salinity. Threats to serpulid aggregations include bottom-contacting fishing activities (including creels and nets), anchoring (e.g. boats and aquaculture facilities) and coastal developments that alter water flow. Projected increases in the frequency and strength of storm events associated with climate change and changes in seawater chemistry also pose a threat to serpulid aggregations (see Chan, 2013).

Towed bottom-contacting fishing gear can affect aggregations through direct mortality to the living serpulids and as a result of breaking up / modification of the habitat on which living worms can grow (including dead serpulid tube substrates).

There is evidence that habitat restoration may be possible in areas where serpulid aggregations have declined. Small aggregations are now well established on experimental scallop shell substrates deployed in Loch Creran in 2012 as part of restoration studies (Cook, 2016; Moore & Harries, 2017). However, in areas where there is no longer a viable population to provide larvae, regeneration will not occur naturally (Lancaster *et al.*, 2014). Serpulid growth has been estimated at c. 3 cm per annum (Moore *et al.*, 2006; Hughes *et al.*, 2008). Survivorship studies to determine the feasibility of artificial restoration in Loch Sween using stock translocated from Loch Creran were inconclusive. Aggregations present in Loch Sween during the 1980s died out in the 1990s for reasons that are still not understood (Hughes *et al.*, 2008).

Connectivity

Between serpulid aggregations - Serpulid aggregations are mostly present in sheltered locations with low larval dispersal potential. Populations tend to become self-seeding, especially when isolated. Serpulid worms (in non-aggregated form) are widely distributed on rocky habitats around the Scottish coastline.

With other PMFs - The only known functional link or association between serpulid aggregations and other PMFs is with *kelp and seaweed communities on sublittoral sediments* which occurs in the same depth band. Colonisation of serpulid aggregations in Loch Teacuis by the sugar kelp *Saccharina latissima* may have contributed to their decline here. When kelp grows on small serpulid aggregations it is likely that even modest tidal water flow generates sufficient drag to cause the aggregation attachment to snap off or dislodge from the hard substrates anchoring it to the soft muddy seabed. An accumulation of drifting sugar kelp with holdfasts overgrowing broken up serpulid tubes was observed to the east of the tidal narrows entrance to the loch in 2015 (SNH, 2015).

Ecosystem services

- | | |
|--|---|
| <ul style="list-style-type: none">• Biomass production• Larval/gamete supply (supporting connectivity)• Nutrient cycling• Formation of habitat for other species (supporting biodiversity)• Resilience to INNS & disease | <ul style="list-style-type: none">• Coastal protection• Waste breakdown & detoxification of water and sediments• Carbon storage & climate regulation• Sediment stabilisation• Socially valued places/seascapes• Watching/studying nature |
|--|---|

Existing Marine Protected Areas

Serpulid aggregations are a protected feature of Loch Sunart MPA and larger reef structures are a protected feature of Loch Creran MPA.

Existing and proposed fisheries measures providing PMF protection

Details of existing fisheries measures associated with the two MPAs are provided on Marine Scotland's web pages (<http://www.gov.scot/Topics/marine/marine-environment/mpanetwork/MPAMGT/protectedareasmgt>).

Examples of PMFs that have no or partial coverage by fisheries measures

- Loch Ailort.

Assessment against National Marine Plan General Policy 9:

Development and use of the marine environment must not result in significant impact on the national status of Priority Marine Features.

Serpulid aggregations are functionally important, biodiverse, sensitive, slow to recover and if lost completely may not recover. They are rare in Scotland and north-west Europe, with evidence of decline in Scottish waters. Therefore any activities that lead to the loss of aggregations or damage them to the extent that function or provision of ecosystem services cannot be maintained should be considered a significant impact on national status.

Existing licensing and consenting processes will continue to consider the potential for significant impacts on the national status of development proposals on serpulid aggregations. The following assessment relates to fishing using towed bottom-contacting gear only but is consistent with the approach taken for assessing proposed developments. Please refer to the *consultation overview* for further details.

The only known serpulid aggregations not currently managed in a fisheries context in Scottish waters are in **Loch Ailort**. The recommendation for serpulid aggregations needs to be considered alongside the recommendations for the other 10 PMFs considered as part of this review. The area identified provides a starting point for discussions regarding future fisheries management. These discussions will be led by Marine Scotland.

The Loch Ailort aggregations occur in shallow water close to a rocky shoreline which naturally affords some level of protection from towed bottom-contacting fishing gear. However, to ensure that there is no significant impact on the national status of this PMF, it is recommended that the need for management measures be considered.

Knowledge gaps and other records

Knowledge gaps - Seasearch divers observed the remains of former serpulid aggregations in soft muddy sediments in **West Loch Tarbert** in 2017 and also noted signs of potential new aggregation development. Serpulid worms were observed growing upwards from collapsed serpulid material in several small clumps (Paisley, 2017). Future survey work will be required to determine whether aggregations develop but conditions in the loch appear suitable.

Other records - There have been anecdotal reports of serpulid aggregations in other sheltered sea lochs (e.g. Loch Glendhu). New survey work would be required to validate these observations.

Data confidence

Records span 1989-2017. The majority of the records are from 2005 (>3000) and come from SNH-commissioned MPA monitoring studies, with additional records from Seasearch diving surveys. Records primarily come from diving, with some ROV and drop-down video surveys (e.g. Poloczanska *et al.*, 2004). New records of this feature (Loch Ailort) were made in 2015, with targeted mapping surveys undertaken in this location in 2016 (SNH, 2016) and 2017.

References

- Chan, B.S. 2013. *Climate change impacts on the serpulid tubeworm Hydroides elegans - a biomineralization perspective*. A thesis submitted for the degree of Doctor of Philosophy, University of Hong Kong. <<http://hub.hku.hk/handle/10722/196468>>
- Chapman, N.D., Moore, C.G., Harries, D.B. & Lyndon, A.R. 2012. The community associated with biogenic reefs formed by the polychaete, Serpula vermicularis. *Journal of the Marine Biological Association of the United Kingdom*, **92**(4): 679-685.
- Cook, R.L. 2016. *Development of techniques for the restoration of temperate biogenic reefs*. A thesis submitted for the degree of Doctor of Philosophy, Heriot-Watt University. <http://www.ros.hw.ac.uk/bitstream/handle/10399/3162/CookR_1016_sls.pdf>
- Dodd, J., Baxter, L. & Hughes, D.J. 2007. Mapping Serpula vermicularis (Polychaeta: Serpulidae) aggregations in Loch Teacuis, western Scotland, a new record. *Journal of Marine Biology Research*, **5**(2). <<https://www.tandfonline.com/doi/abs/10.1080/17451000802345858>>
- European Commission. 2013. *Interpretation manual of European Union habitats*. EUR 28. <http://ec.europa.eu/environment/nature/legislation/habitatsdirective/docs/Int_Manual_EU28.pdf>
- Holt, T.J., Rees, E.I., Hawkins, S.J. & Seed, R. 1998. *Biogenic reefs (volume IX). An overview of dynamic and sensitivity characteristics for conservation management of marine SACs*. Scottish Association of Marine Science (UK Marine SACs Project). <<http://www.ukmarinesac.org.uk/pdfs/biogreef.pdf>>
- Hughes, D.J., Poloczanska, E.S. & Dodd, J. 2008. Survivorship and tube growth of reef-building Serpula vermicularis (Polychaeta: Serpulidae) in two Scottish sea lochs. *Aquatic Conservation: Marine and Freshwater Ecosystems*, **18**: 117-129. <<https://onlinelibrary.wiley.com/doi/pdf/10.1002/aqc.839>>
- Lancaster, J. (Ed.), McCallum, S., Lowe A.C., Taylor, E., Chapman A. & Pomfret, J. 2014. Development of detailed ecological guidance to support the application of the Scottish MPA selection guidelines in Scotland's seas. *Scottish Natural Heritage Commissioned Report No. 491*. Serpulid aggregations - supplementary document.
- MERC Consultants. 2008. *Surveys of sensitive sublittoral benthic communities in Mullet/Blacksod Bay Complex SAC; Rutland Island and Sound SAC; and, Mulroy Bay SAC*. A report to the National Parks and Wildlife Service, Galway. <https://www.npws.ie/sites/default/files/publications/pdf/MERC_2008_NPWS_Subtidal_surveys.pdf>
- Mercer, T., Howson, C.M. & Moore, J.J. 2007. Site Condition Monitoring: Loch Sunart marine SAC and SSSI. *Scottish Natural Heritage Commissioned Report No. 286*. <<https://www.nature.scot/snh-commissioned-report-286-site-condition-monitoring-survey-marine-features-within-sunart-sac-and>>

Moore, C.G., Saunders, G.R. & Harries, D.B. 1998. The status and ecology of reefs of *Serpula vermicularis* L. (Polychaeta: Serpulidae) in Scotland. *Aquatic Conservation: Marine and Freshwater Ecosystems*, **8**(5): 645-656.

Moore, C.G., Saunders, G.R., Harries, D.B., Mair, J.M., Bates C.R. & Lyndon, A.R. 2006. The establishment of site condition monitoring of the subtidal reefs of Loch Creran Special Area of Conservation. *Scottish Natural Heritage Commissioned Report No. 151*. <<https://www.nature.scot/snh-commissioned-report-151-establishment-site-condition-monitoring-subtidal-reefs-loch-creran>>

Paisley, O. 2017. *Seasearch Argyll 2017 report*. <<http://www.seasearch.org.uk/downloads/Argyll-2017.pdf>>

Poloczanska, E.S., Hughes, D.J. & Burrows, M.T. 2004. Underwater television observations of *Serpula vermicularis* (L.) reefs and associated mobile fauna in Loch Creran, Scotland. *Estuarine, Coastal and Shelf Science*, **61**: 425-435.

Scottish Natural Heritage. 2015. *Loch Teacuis serpulid survey: March 2015*. SNH Field Report. Unpublished.

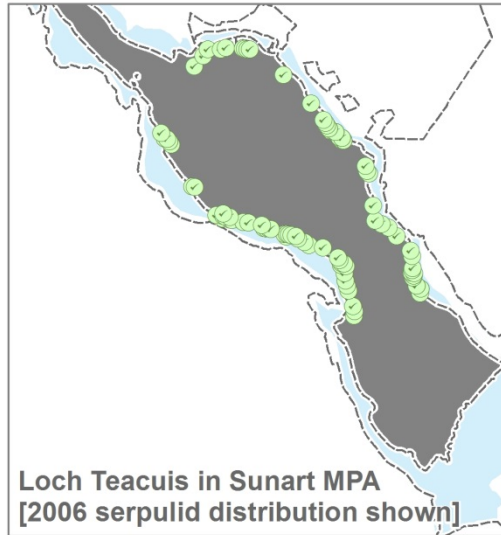
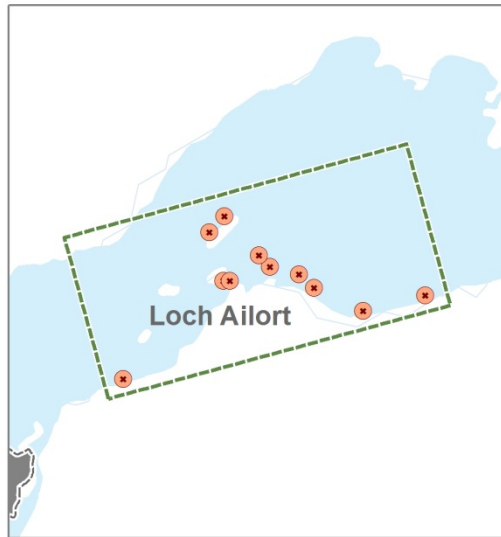
Scottish Natural Heritage. 2016. *SNH seabed habitats survey - September 2016. Sound of Arisaig and the head of Loch Ailort. Drop-down video and diver surveys*. SNH Field Report. <<https://www.nature.scot/sites/default/files/2017-10/A2438616-SNHSeabedHabitatsSurvey-SoundsofArisaigSAC-FieldReport.pdf>>

Tulbure, K.W. 2015. *Investigating the condition of the Priority Marine Feature, 'serpulid aggregations' (*Serpula vermicularis*) in Loch Creran Scotland*. BSc dissertation, Heriot-Watt University. Edinburgh.

Tyler-Walters, H., James, B., Carruthers, M. (eds.), Wilding, C., Durkin, O., Lacey, C., Philpott, E., Adams, L., Chaniotis, P.D., Wilkes, P.T.V., Seeley, R., Neilly, M., Dargie, J. & Crawford-Avis, O.T. 2016. Descriptions of Scottish Priority Marine Features (PMFs). *Scottish Natural Heritage Commissioned Report No. 406*. <<https://www.nature.scot/snh-commissioned-report-406-descriptions-scottish-priority-marine-features-pmfs>>

Areas where fisheries management should be considered to avoid a significant impact on the national status of the PMF

Serpulid aggregations



Existing and proposed fisheries management

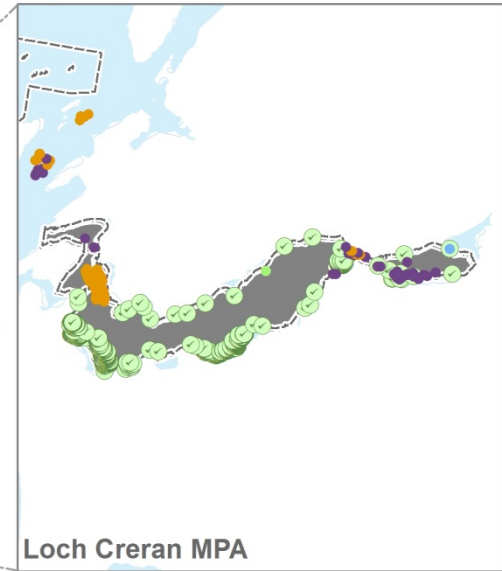
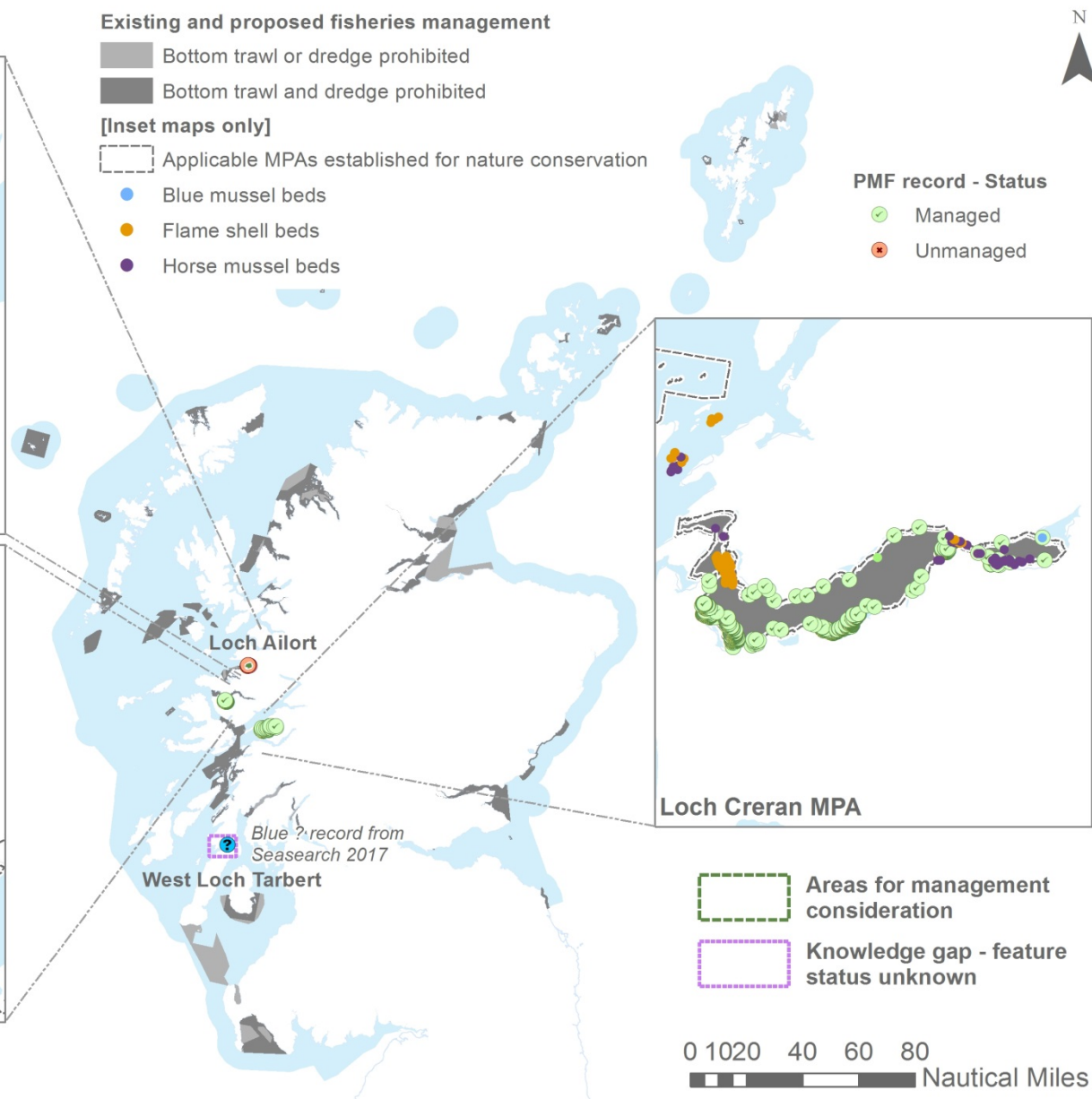
- Bottom trawl or dredge prohibited
- Bottom trawl and dredge prohibited

[Inset maps only]

- Applicable MPAs established for nature conservation
- Blue mussel beds
- Flame shell beds
- Horse mussel beds

PMF record - Status

- Managed
- Unmanaged



Areas for management consideration

Knowledge gap - feature status unknown

0 10 20 40 60 80
 Nautical Miles

© Crown copyright and database right [2018]
 Ordnance Survey Licence number 100017908
 All rights reserved