Conservation and Management Advice

LOCH CRERAN SAC AND MPA

FEBRUARY 2025

This document provides advice to Public Authorities and stakeholders about the activities that may affect the protected features of Loch Creran Special Area of Conservation (SAC) and Marine Protected Area (MPA). It provides advice from Scottish Natural Heritage (SNH) (operating under the name of and hereinafter referred to as NatureScot) under Regulation 33(2) of the Conservation (Natural Habitats, andc.) Regulations 1994 (as amended in Scotland) to other relevant authorities about any activities/operations which may cause deterioration of the habitats or species, or disturbance of species protected in the SAC, and the Conservation Objectives for the site. It also provides advice from NatureScot under Section 80 of the Marine (Scotland) Act to public authorities as to matters which are capable of damaging or otherwise affecting the protected features of Nature Conservation MPAs, how the Conservation Objectives of the site may be furthered or their achievement hindered, and how the effects of activities on MPAs may be mitigated. It covers a range of different activities and developments but is not exhaustive. It focuses on where there is a risk to achieving the Conservation Objectives. The paper does not attempt to cover all possible future activities or eventualities (e.g. as a result of accidents) and does not consider cumulative effects.

Further information on marine protected areas and management is available at - https://www.gov.scot/policies/marine-environment/marine-protected-areas/

For the full range of MPA site documents and more on the fascinating range of marine life to be found in Scotland's seas, please visit - www.nature.scot/mpas or https://jncc.gov.uk/advice/marine-protected-areas/

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Contents

1 Overview of document

This document provides details of the Conservation Objectives and Advice to Support Management for Loch Creran Special Area of Conservation (SAC) and Loch Creran Marine Protected Area (MPA). It is divided into eight main sections. The introduction in section 2 gives an overview of Loch Creran SAC and MPA and its contribution in terms of conservation and wider benefits. Section 3 provides an overview of the roles of the various bodies involved with advising, regulating and managing the Marine Protected Area (MPA). Section 4 describes the protected features and their condition, and section 5 introduces the Conservation Objectives for the site. Section 6 describes the threats and pressures to which the protected features are sensitive, and section 7 provides the management advice for these activities. Section 8 identifies what further research and surveys may be required to increase our understanding of how the protected features utilise the site for which they are designated.

Throughout this document, the terms Special Areas of Conservation (SAC) and Nature Conservation Marine Protected Area (NCMPA) are used when discussing issues that are specific to that type of designation. Otherwise, the term Marine Protected Area (MPA) is used when discussing the site overall or the MPA network generally. The term *qualifying features* is used in the Conservation Objectives (Annex 1) to refer to habitats and species that the Loch Creran SAC has specifically been designated to protect. The term *protected features* is used in in the Conservation Objectives (Annex 2) for the features protected by the Loch Creran MPA and in the wider document text to refer to all the features protected in the site.

2 Introduction

2.1 Purpose statement

Loch Creran has been designated as a SAC to protect reefs and as an NC MPA to protect flame shell beds and one geodiversity feature (Quaternary of Scotland). By doing so it contributes to the Scottish, UK and OSPAR MPA networks, the conservation of the wider marine environment around Scotland, and progress towards Good Environmental Status within the UK. The conservation of all the protected features within Loch Creran contributes towards the OSPAR MPA network in the UK. In addition, the reefs of Loch Creran SAC contribute to the favourable conservation status of reefs in the UK.

2.2 Conservation benefits

Loch Creran MPA provides conservation benefits by affording protection to reefs (reef sub types include serpulid reefs, horse mussel beds and rocky reefs) and flame shell beds and their associated species and to a geodiversity feature, Quaternary of Scotland. In summary the conservation benefits of this designation are:

- The MPA contains the only example of well-developed serpulid reefs in Scotland and the UK and is one of only a handful of locations where this habitat exists worldwide.
- Loch Creran MPA also encompasses numerous good examples of horse mussel beds and flame shell beds, which have a restricted distribution in north-west European waters with much of the habitat distributed within Scottish waters.
- Serpulid reefs, rocky reefs, horse mussel beds and flame shell beds features provide habitat complexity that supports a high diversity of flora and fauna.
- Loch Creran provides a source of horse mussel, and potentially flame shell larvae, for beds outside the site.
- The Quaternary of Scotland feature is scientifically important for the understanding it provides of ice sheet dynamics and climate change during the last glacial period. This is relevant to understanding ice sheet dynamics in the coming decades.

2.3 Wider benefits

The protected features of Loch Creran provide ecosystem services locally and to the wider marine ecosystem. We describe these ecosystem services in terms of their functions (the support or provision of something to the wider ecosystem e.g. habitat, nutrient cycling, sediment stabilisation) and natural resources (e.g. fish and shellfish, aggregates, wildlife), which in turn lead to benefits for people.

Figure 1 illustrates how the protected features of Loch Creran MPA contribute to benefits for people. There can be many complex interactions and dependencies amongst the protected features, their functions, associated natural resources and the benefits we gain from them.

The functions associated with the protected features of Loch Creran MPA are described in Annex 1 and 2 as part of the site's Conservation Objectives. This outlines the relationship between the protected features and the functions. The features together, especially when taken within the context of the whole MPA and/or local ecosystem, contribute to certain functions more than others, e.g. carbon storage and nutrient cycling. These functions are fundamental to the continued supply of natural resources and benefits associated with Loch Creran, and to the long-term health of the protected features.

Loch Creran is a unique sea loch which has resulted in the development of diverse and productive biogenic habitats that support a variety of natural resources. The fish and shellfish (including juveniles), and seaweeds living within the MPA that can be harvested by people and/or utilised by other marine species, are the most obvious resource. Loch Creran supports wildlife, including the largest known example of serpulid reefs in the UK. Loch Creran is valued by the local community, for its unique and special habitats. At a wider scale, the glaciated channels/troughs (deeper basins of the sea loch) and moraines which make up the Quaternary of Scotland geodiversity feature help us in reconstructing past ice sheets, telling a story of past global climate change that is relevant to future climate change projections.

Loch Creran is a location where people can engage in outside pursuits for health and wellbeing e.g. walking and sailing and is home to wildlife and habitats that can be watched, enjoyed and studied. It is a place where communities and visitors can spend time connecting with and enjoying nature.

The benefits that arise from the functions and natural resources of Loch Creran are typically small in the context of the whole of Scotland, but some are of greater importance for this MPA and the people that use it. There is potential for benefits to be enhanced. This may be achieved by improving the quantity or quality (health) of the protected features themselves and/or through promoting, for example, more recreational enjoyment or use of natural resources that is compatible with the site's Conservation Objectives.

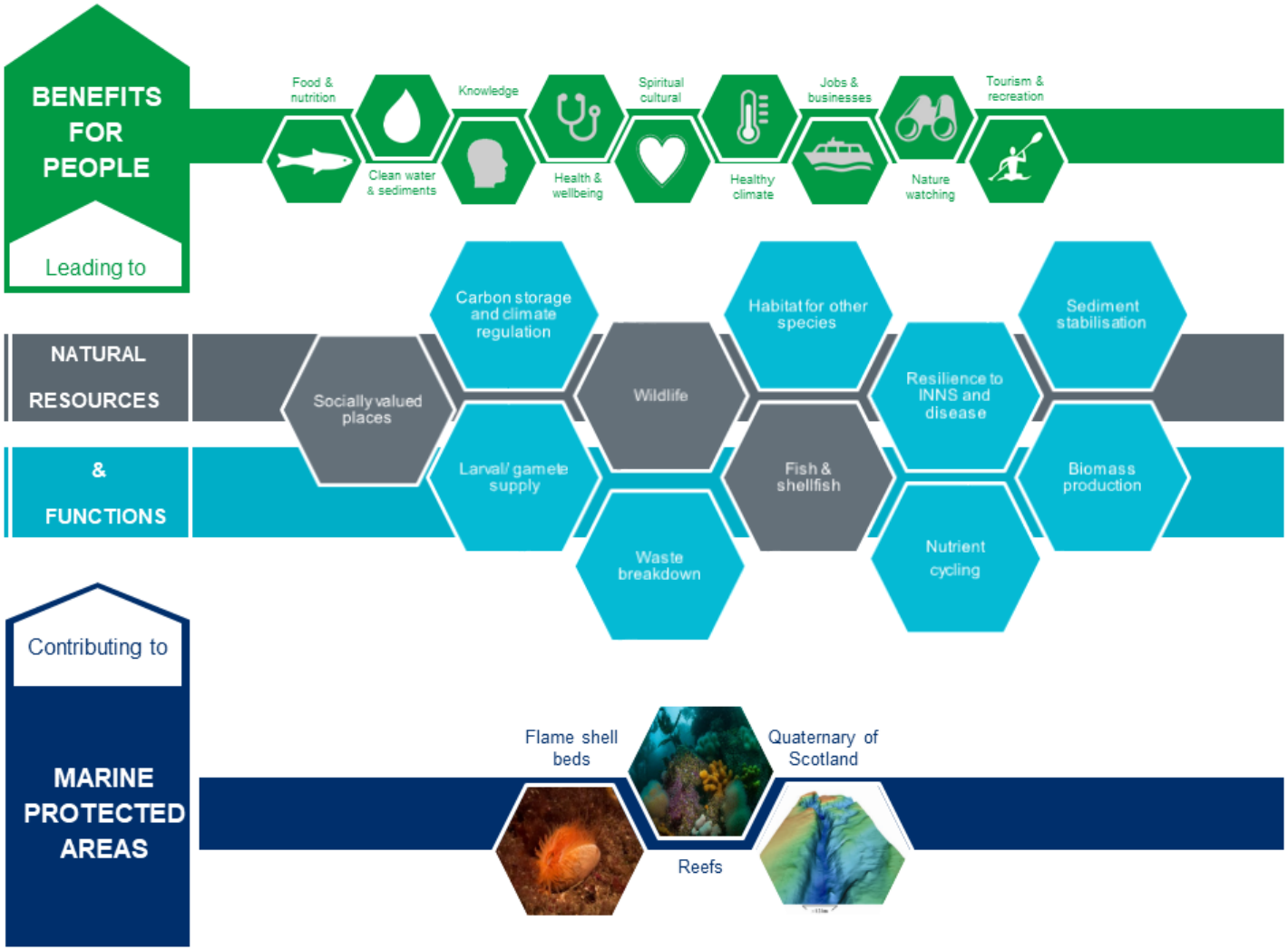

Figure 1 Benefits to people associated with protected features of the Loch Creran MPA.

2.4 Contribution to policy commitments

Managing this MPA to maintain the reefs and conserve the flame shell beds and Quaternary of Scotland in favourable condition, will ensure the continued provision of the benefits above as well as the site's contribution to:

- An ecologically coherent network of MPAs which are well managed, under the OSPAR convention and national legislation.
- Achieving Favourable Conservation Status for reefs in the UK.
- The protection of horse mussel beds which are OSPAR threatened and declining habitats.
- Progress towards achieving Good Environmental Status in relation to biological diversity and seafloor integrity.
- Making a significant contribution to the protection, enhancement and health of the marine area under the National Marine Plan.
- Restoring marine and coastal ecosystems and increasing the environmental status of our seas under the Scottish Biodiversity Strategy.
- Helping to adapt to climate change under The Scottish National Adaptation Plan.

3 Roles

This document provides advice for Loch Creran MPA in relation to activities that may affect the protected features. More detail can be provided to public authorities to inform their decision making as required. In doing this, our aim is to ensure the Conservation Objectives for the protected features are met.

The Conservation (Natural Habitats, andc.) Regulations 1994 (as amended in Scotland) (hereafter referred to as the Habitats Regulations) transpose the EC Habitats Directive into domestic legislation. Regulation 33(2) gives NatureScot a statutory responsibility to advise other relevant authorities about any activities/operations which may cause deterioration of the habitats or species, or disturbance of species protected in the SAC, and the Conservation Objectives of the site.

Section 80 of the Marine Scotland Act gives NatureScot the remit to provide advice and guidance to public authorities as to the matters which are capable of damaging or otherwise affecting the protected features of Nature Conservation MPAs, how the Conservation Objectives of the site may be furthered or their achievement hindered, and how the effects of activities on MPAs may be mitigated.

It is the role of the relevant and competent authorities[1] to ensure that the activities they regulate, permit or license do not risk the achievement of the Conservation Objectives of the Loch Creran SAC or hinder the achievement of the Conservation Objectives of the Loch Creran NC MPA. The management advice in this document is provided to assist authorities in managing the activities outlined in Annex 2, undertaking Habitats Regulations Appraisals of plans and projects and carrying out their duties under Section 82 and 83 of the Marine (Scotland) Act 2010.

[1] Relevant authorities are defined in Regulation 5 of the Habitats Regulations and encompass those authorities that have functions in relation to land/water within or adjacent to a European Marine Site (includes marine SACs). They are nature conservation bodies, local authorities, water undertakers, navigation authorities, harbour authorities, lighthouse authorities, SEPA, district salmon fishery board and, National Park Authorities and local fisheries committees. Competent authorities include any Minister, government department, public body, or person holding public office.

Stakeholders can provide additional evidence to support the development of management including local knowledge of the environment and of activities. This will contribute to the development of well-designed and effective management measures.

4 Protected features and status

The Loch Creran MPA has been selected to become part of Scotland's MPA network which in turn has been established to help conserve and recover a range of Scotland's important marine habitats, wildlife, geology and landforms.

Table 1 provides a summary of the protected features within the MPA, their condition within the site, and the broader conservation status of the protected features.

The locations and extent of the protected features within the Loch Creran MPA are shown in Figure 2. This may not be the most up-to-date information on extent/distribution of features. The most up-to-date distribution of the features described is available to view at National Marine Plan Interactive.

Table 1. Protected features and condition for the Loch Creran MPA.
Feature condition refers to the condition of the protected feature assessed at a site level. Broader conservation status is the overall condition of the feature throughout its range.

Protected Features	Designation	Feature condition	Assessment date	Broader conservation status*
Reef[#]	SAC	Unfavourable declining	2020	UK: Unfavourable – Inadequate European region: Unfavourable – bad
Flame shell beds	NC MPA	Favourable	2020	Good Environmental Status has not yet been achieved
Quaternary of Scotland	NC MPA	Favourable	2014	NA

* For flame shell beds this is the broad UK Marine Strategy status[2] of biogenic habitats. For Reef this is the conservation status of the protected features within the UK as reported in the Habitats Directive, Article 17 Report 2019[3] and the Marine Atlantic Biogeographic Region in Europe as reported in Article 17 Report 2013.

[#]The reefs protected features encompasses the sub-types serpulid reefs, horse mussel beds and rocky reefs.

[2] https://moat.cefas.co.uk/summary-of-progress-towards-good-environmental-status/
[3] https://jncc.gov.uk/our-work/article-17-habitats-directive-report-2019

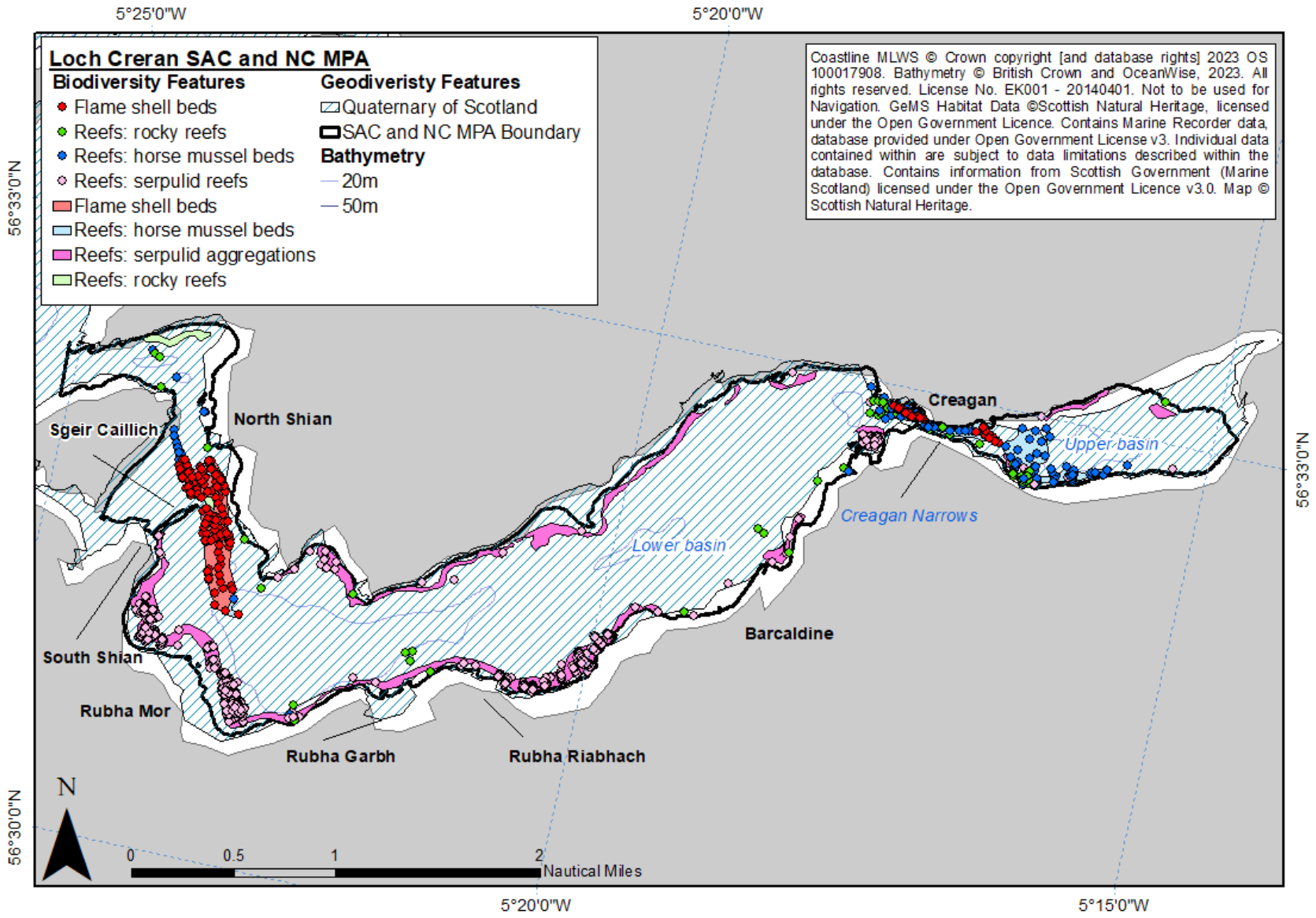

Figure 2 Location of the Loch Creran SAC and NC MPA and distribution of the protected features

5 Setting Conservation Objectives

5.1 Background

Under Regulation 33(2) of the Habitats Regulations, Scottish Natural Heritage (now referred to as NatureScot) has responsibility for providing the Conservation Objectives for European marine sites in Scottish territorial waters. These site-level Conservation Objectives seek to define the contribution that each site should make to the attainment of Favourable Conservation Status for the qualifying features.

The Conservation Objectives form part of the designation order for the Loch Creran MPA and are in place at the time the site is formally designated.

The Conservation Objectives provide the framework for the setting of site conservation measures (management) and form the basis for the Habitats Regulations Appraisal of projects and plans for the Loch Creran SAC and for authorities carrying out duties under Section 82 and 83 of the Marine (Scotland) Act 2010 for the Loch Creran NC MPA.

The Conservation Objectives for Loch Creran MPA are provided in Annex 1 and 2.

5.2 Relationship between feature condition and Conservation Objectives

The Conservation Objectives seek to *maintain* protected SAC feature(s) where evidence exists that it is in favourable condition in the site, or where there is uncertainty concerning the assessed condition of a feature (see section 4) but no reason to suspect deterioration in condition since designation. Where evidence exists that a feature is declining and/or damaged and therefore not in a favourable condition in the site, the Conservation Objectives relating to the SAC will seek to *restore* the protected feature. Where restoring the protected feature is not possible at a site level for example, human intervention is not feasible or the reasons causing the unfavourable condition lie outwith the site, the site-specific advice seeks to ensure the conditions within the SAC are appropriate to support a recovery.

Reef habitat is in unfavourable condition at Loch Creran SAC and therefore the Conservation Objectives seek to restore this condition by supporting recovery.

The restore Conservation Objective for reefs reflects the condition of the serpulid reef which declined by approximately 20% between 2005 and 2019 (Moore et al., 2020 and Tulbure, 2015). The reason for this decline is not yet clear. A recent desk study (Hughes *et al.,* 2024) which investigated available evidence on changes in plankton community, land use in the catchment and local weather could not attribute the decline to a single cause or a combination of causes. Furthermore, analysis of the results of restoration projects carried out during this period suggest that fouling of reef rubble is preventing reef regeneration (Heriot-Watt unpublished). It is possible that the decline is part of a natural cycle of growth and collapse in the habitat. Large numbers of individual worm tubes appear first growing on rocks and shells followed by aggregations of worm tubes growing up off the seabed and then worms twisting together and supporting each other to form reefs (the true definition of a biogenic reef being live material growing on dead material). Next, the reefs that struggle to support their own weight collapse and then regenerate when larvae settle on the dead worm tubes and begin to grow. Therefore, development of reefs relies on a number of physical (e.g. water temperature and movement, and availability of suitable substrate), biological factors (e.g. availability of food and larvae, presence of predators and grazers) and the timing and interaction of these factors. Aggregations have been observed elsewhere in Scotland (e.g. Loch Teacuis, Loch Ailhort) but have not developed into reefs. Reefs have been reported from other locations where they now no longer exist for example Linne Mhuirch in Loch Sween where aggregations were reported again recently suggesting the natural cycle of reef growth and collapse has begun here again (Dodd *per comms*).

The Conservation Objectives seek to *conserve* protected feature(s) of an MPA where evidence exists that it is in favourable condition in the site, or where there is uncertainty concerning the assessed condition of a feature (see section 4) but no reason to suspect deterioration in condition since designation. Where evidence exists that a feature is declining and/or damaged and therefore is in unfavourable condition in the site, the Conservation Objectives relating to the MPA will seek to *recover* the protected feature.

The flame shell beds and geodiversity features are in favourable condition at Loch Creran NC MPA and therefore the Conservation Objectives seek to conserve this condition.

5.3 Conservation priorities

Amongst Annex I reef sub-types

The qualifying feature for the Loch Creran SAC is Annex I reefs and it contains three distinct subtypes of reefs: serpulid reefs (constructed by the worm *Serpula vermicularis*), horse mussel beds (constructed by the bivalve *Modiolus modiolus*) and rocky reefs (composed of bedrock and stones/boulders). This site was primarily designated for serpulid reefs and horse mussel beds, and both features have high levels of sensitivity. At present, there are no apparent management conflicts between the subtypes of reefs. If any conflicts between the subtypes were to arise consideration should first be given to serpulid reefs and horse mussel beds. However, the impact of any proposed management measure on all the subtypes should first be considered as part of an HRA.

Between SAC and NC MPA features

At Creagan Narrows, reefs (horse mussel beds) of the SAC and the flame shell bed feature of the NC MPA form patches of habitat next to each other interspersed with patches of gravel. We do not yet know whether horse mussel beds and flame shell beds compete or coexist when they occur alongside each other in a habitat mosaic as they do here. In other locations on the west coast, flame shell beds have been recorded growing over horse mussel beds. The hydrodynamic conditions (water depth and flow rate) to the west of Creagan Narrows seem to suit both habitats and their presence may be cyclical, where one is more dominant than the other at times. There is no intention to intervene to manage either feature in order to favour the other.

5.4 Overlapping Protected Area Boundaries

The following protected area boundaries overlap with the Loch Creran MPA:

- Glen Creran Woods SAC
- Glen Creran Woods Site of Special Scientific Interest (SSSI)
- South Shian and Balure SSSI

Conservation measures in the overlapping and adjacent protected areas need to ensure the Conservation Objectives of Loch Creran SAC and Loch Creran NC MPA are not affected.

There are no apparent management conflicts between the protected features of the overlapping protected areas. Site information for the MPAs overlapping Loch Creran MPA, including the Conservation Objectives, are available on SiteLink.

6 Feature sensitivity

The following sections provide an overview of the pressures most relevant to the protected features. Further information on feature sensitivity can be found at Feature Activity Sensitivity Tool (FeAST)[4] and also for the features not covered by FeAST, Marine Evidence

[4] https://feature-activity-sensitivity-tool.scot/

based Sensitivity Assessment (MarESA)[5]. The information in FeAST reflects our current understanding of the interactions between activities, pressures and features. It highlights that activities can give rise to a range of pressures, which the protected features may be sensitive to. Our assessment of sensitivity is based on a feature's tolerance (response to change) and its ability to recover.

6.1 Reefs

Serpulid reefs

Serpulid reefs are sensitive to physical disturbance, which damages the physical structure of the reefs which are slow to recover. They are also sensitive to deoxygenation and heavy siltation, which may block the water flow and exchange of oxygen, nutrients and also food for the serpulid worms which are filter feeders. Serpulid reefs are also thought to be sensitive to changes in salinity. Serpulid aggregations are slow to grow and develop into reefs. Aggregations do not always develop into reefs (the definition of a biogenic reef is live material growing on dead material) and have been observed to disappear before reaching the reef stage. It is possible that serpulid reefs undergo a natural process of development from large numbers of individual *Serpula vermicularis* to aggregations to reefs if the correct conditions (retention of larvae in the system and sufficient food) persist. It could also be possible that a natural cycle of reef collapse (when the reefs are too large to support their own weight) and regeneration exists. The recovery of this feature is dependent on the reason for the decline in reef condition. If the decline is due to human pressures, the reef may recover if the pressures they are sensitive to are removed/avoided. If the decline in reef condition is part of the natural cycle, recovery will be dependent on suitable environmental conditions being maintained including availability of suitable substrate (rocks, shells, live reef material and dead reef material) that is free of biofouling, and larval and food supply. There is the potential for serpulid reefs to not recover following collapse.

Rocky reefs

Typical rocky reef habitats are most sensitive to physical disturbance, smothering and siltation. Physical disturbance may detach sessile organisms. Smothering and siltation may block the water flow and exchange of oxygen, nutrients and also food for filter feeders. If the pressure is removed typical rocky reef habitats can recover relatively quickly depending upon the type and scale of the disturbance and the environmental conditions, such as levels of water movement, at the site.

Horse mussel beds

Horse mussel beds are most sensitive to physical disturbance, siltation and smothering. Changes in environmental conditions such as temperature, salinity and water flow would also impact upon horse mussel beds. Horse mussel beds are likely to take considerable time to recolonize and to develop into a bed similar in size and in the diversity and species richness they support. Recruitment is sporadic, highly variable and some areas receive little or no recruitment for several years therefore recoverability is low.

6.2 Flame shell beds

Flame shell beds are highly sensitive to physical disturbance including surface abrasion[6]. Activities that cause physical disturbance can break up the nest structure that the flame shells create, remove and kill individuals and damage the delicate shells, subsequently leaving them vulnerable to predation. In addition to direct impacts, flame shell beds are sensitive to increased levels of sedimentation[7]. This causes smothering of the bed, blocking the water flow and exchange of oxygen, a reduction in light and a reduction in the ability to

[5] https://www.marlin.ac.uk/sensitivity/sensitivity_rationale

[6] Includes Physical removal (extraction of substratum) and sub-surface abrastion/penetration pressures in FEAST.

[7] Includes siltation changes (low/high), organic enrichment pressures in FEAST.

feed, affecting the flame shells and other plants and animals associated with the beds. Flame shell beds do have the capacity to recover from impacts (albeit this may be slowly) provided that pressures that they are sensitive to are removed/avoided, suitable environmental conditions are maintained, and there are existing flame shell beds in the locality to provide a source of larvae and suitable substrate for larvae to settle on.

6.3 Quaternary of Scotland

Moraines are relict ridges composed of glacial till. Their resistance to erosion is highly variable and depends upon the composition and level of consolidation of the till. As a result, and because they cannot recover under the current non-glacial conditions, moraines have a high sensitivity to physical removal. They also have medium sensitivity to sub-surface and surface abrasion, and changes in water flow and/or wave exposure.

Glaciated channels/troughs are highly resistant (having been formed originally by glacial scouring) and are considered to have no or very low sensitivity to pressures arising from human activities. The resistance of the megascale glacial lineations depends on the composition of the seabed and its degree of consolidation. Those formed in bedrock or well-compacted sediment can be highly resistant, while those in poorly consolidated sediment have medium sensitivity to (e.g.) sub-surface abrasion and changes in tidal flow. As all of the landforms comprising this feature are relicts of past processes, should any damage occur, they are considered to have no recovery potential.

7 Management

7.1 Conservation Measures

The following conservation measures are currently in place for the Loch Creran MPA:

- The Habitats Regulations require all plans or projects that may cause an effect on the protected features of a SAC to be assessed against the Conservation Objectives for that site. This process is known as a Habitats Regulations Appraisal (HRA). An HRA is a rigorous statutory procedure that ensures the integrity of the site is maintained. It also provides an opportunity to consider appropriate mitigation that can reduce impacts, avoid adverse effects and permit plans or projects to proceed having taken full account of the protected features of an SAC.
- For the NC MPA, activities and developments subject to licensing that could affect the protected features of the NC MPA also need to be assessed. Authorities need to determine whether if by carrying out their duties e.g. permitting an activity to take place, it would hinder the achievement of the Conservation Objectives of the MPA. This is referred to as an assessment under Section 82 or Section 83 of the Marine (Scotland) Act 2010.
- *Fishing* **–** fishing for sea fish with any fishing gears is prohibited within the boundaries of the SAC and MPA in accordance with The Inshore Fishing (Prohibition of Fishing and Fishing Methods) (Scotland) Order 2015 No. 435. Fishing for horse mussels is also prohibited under the same legislation. The prohibition does not apply to fishing with a rod and line or handline, and fishing with a creel or parlour creel is allowed in the Loch Creran First Creel Fishing Excepted Area and the Loch Creran Second Creel Fishing Excepted Area.
- New moorings must have a survey done by a diver to confirm the absence of serpulid reefs according to the agreed guidance. This includes those moorings within the areas managed by mooring associations in order to make sure they are sited away from these sensitive habitats. Marine Scotland Licensing Operations Team (MS LOT) consult NatureScot on mooring applications within the MPA.
- The invasive colonial sea squirt *Didemnum vexillum* is present in Loch Creran, first being found on an oyster farm in 2017. There is a Species Control Agreement (SCA) in place between Scottish Ministers and the oyster farm for the control and management of the species, including a monitoring component to facilitate adaptative management of control measures. There are potential implications for the conservation status of protected biogenic habitats if this species were to colonise these habitats, however, subtidal monitoring of the reefs indicates this has not occurred. SCAs and Species Control Orders and the powers of access related to them are set out in the Wildlife and Countryside Act 1981 (as amended).

Further information relevant to the management of MPAs in Argyll was developed through the MarPAMM project and is available through this link.

7.2 Advice to support management

Table 2 provides NatureScot's advice on management for activities where we consider this may be necessary to achieve the Conservation Objectives for the protected features. The advice is focused on the activities that cause an effect (a pressure) that a feature is sensitive to. Pressures can be physical (e.g. abrasion of the seabed), chemical or biological. Different activities may cause the same pressure, e.g. fishing using bottom gears and aggregate dredging both cause abrasion which can damage the surface of the seabed.

Our advice takes a risk-based approach, i.e. we are focusing on providing advice where we believe there is a risk to achieving the Conservation Objectives. We have identified risks to achieving the Conservation Objectives where there is an overlap between protected features and activities associated with pressures that the features are sensitive to. We have provided management advice to support public authorities and others in managing these risks. Our advice is based on existing data and information on protected features and relevant activities, and our understanding of the relationships between the features and activities. We have identified a range of management advice:

- management to remove or avoid pressures;
- management to reduce or limit pressures; or
- no additional management required.

For our advice on fisheries management we have also stated where we think this should be 'considered.' This term is included to highlight that an issue exists, but circumstances mean that a specific recommendation for action cannot / or need not be made at this point. However, there is sufficient cause to make fishery managers aware of the issue and for them to consider if a fishery management measure may be helpful in achieving Conservation Objectives – particularly where there may be a synergy between the benefits of management actions for the fishery and the Conservation Objectives for the feature. The term 'recommended' highlights that an issue of fishery-feature interaction exists, there is a reasonable evidence base and a specific recommendation action can be made/ justified.

New or other activities not identified within the table would need to be considered on a case-by-case basis.

We recognise that stakeholders can provide local environmental knowledge and more detailed information on activities, including in relation to intensity, frequency and methods. This additional information will help public authorities and others develop more specific management, focussed on the interaction between features and activities. If new information becomes available our management advice may be revised. Where management measures are required, the development of these would be undertaken through discussion and consultation with the relevant stakeholders.

Table 2 describes the activities that are considered capable of affecting the protected features. Activities that are considered not likely to affect the protected features (other than insignificantly) are listed in Table 3. Spatial data relating to the location and extent of the activities listed can be accessed on Marine Scotland's National Marine Plan Interactive[8] (where available).

7.3 Best Practice

In our management advice for activities in Table 2 we refer to the development, adoption or use of 'best practice' as a way of managing interactions between activities and the features. Best practice is taken to mean approaches or procedures that are developed and accepted by regulators and relevant stakeholders as being an effective way of dealing with an interaction between a habitat or species and the pressures created by an activity. Much of this best practice is already being implemented by sectors and regulators, e.g. pre-application discussions between developers and regulators, the Scottish Marine Wildlife Watching Code (SMWWC) and Technical Standards for Scottish Finfish Aquaculture.

[8] https://marinescotland.atkinsgeospatial.com/nmpi/

Table 2. NatureScot's advice to support management for Loch Creran MPA for activities which are considered capable of affecting the protected features.

The text under the 'Advice to support management' columns provides NatureScot's management advice for the features in relation to the activities (further details about the terminology used are provided in section 7.2). Where a cell is coloured grey this indicates that management is already in place, this includes where there are existing regulatory requirements for new proposals. Cells are also coloured grey where it is considered there is no additional management required to achieve the Conservation Objectives. For some activities, the pressures associated with new proposals are considered unlikely to affect some the features either because these activities do not occur in the same locations as the features or the pressure is unlikely to be at levels that can affect the features (see also Table 3). In these cases, we have not provided advice however, where regulated; this does not exempt new plans or projects related to these activities undergoing a Habitats Regulations Appraisal (HRA) for the SAC.

In table 2, the reefs qualifying feature is split into its subtypes: serpulid reefs, horse mussel beds and rocky reefs.

Activities considered capable of affecting the protected features	**Advice to support management**			
	Serpulid reefs (part of reefs feature)	**Horse mussel beds (part of reefs feature)**	**Rocky reefs (part of reefs feature)**	**Flame shell beds**
Aquaculture	**Remove or avoid pressures** associated with new farms and undeveloped consents as well as the expansion or relocation of existing farms.	**Remove or avoid pressures** associated with new farms and undeveloped consents as well as the expansion or relocation of existing farms.	**Reduce or limit pressures** associated with new farms and undeveloped consents as well as the expansion or relocation of existing farms. Spatial mitigation to avoid pressures on key components of rocky reef may be required and will be considered on a case by case basis.	**Remove or avoid pressures** associated with new farms and undeveloped consents as well as the expansion or relocation of existing farms.
Anchorages	**No additional management required** for current anchorages.	**No additional management required** for current anchorages.	**No additional management required** for current anchorages.	**No additional management required** for current anchorages.

Activities considered capable of affecting the protected features	Advice to support management			
	Serpulid reefs (part of reefs feature)	**Horse mussel beds (part of reefs feature)**	**Rocky reefs (part of reefs feature)**	**Flame shell beds**
	Remove or avoid pressures associated with new anchorages.	**Remove or avoid pressures** associated with new anchorages.	**Reduce or limit pressures** associated with new anchorages.	**Remove or avoid pressures** associated with new anchorages.
Coastal developments	**Remove or avoid pressures** associated with new coastal developments where they will impact serpulid reefs.	**Remove or avoid pressures** associated with new coastal developments where they will impact horse mussel beds.	**Reduce or limit pressures** associated with new coastal developments where they will impact rocky reefs.	**Remove or avoid pressures** associated with new coastal developments.
Dredging/ extraction of material	**Remove or avoid pressures** is recommended	**Remove or avoid pressures** is recommended	**Remove or limit pressures** is recommended	**Remove or avoid pressures** is recommended
Discharges – industrial and agricultural	**Reduce or limit pressures**	**Reduce or limit pressures**	*Pressures unlikely to affect this feature.*	**Reduce or limit pressures**
Discharges - sewage	**Reduce or limit pressures**	**Reduce or limit pressures**	**Reduce or limit pressures**	**Reduce or limit pressures**
Fishing - demersal mobile/active gear	**Remove or avoid pressures** is recommended - *existing management measures in place (see section 7.3)*	**Remove or avoid pressures** is recommended - *existing management measures in place (see section 7.3)*	**Remove or avoid pressures** is recommended - *existing management measures in place (see section 7.3)*	**Remove or avoid pressures** is recommended - *existing management measures in place (see section 7.3)*
Fishing – static gear	**Remove or avoid pressures is recommended** - *existing management measures in place (see section 7.3)*	**Reduce or limit pressures should be considered** - *existing management measures in place (see section 7.3)*	**Reduce or limit should be considered** - *existing management measures in place (see section 7.3)*	**Reduce or limit pressures should be considered** - *existing management measures in place (see section 7.3)*
Fishing – hydraulic (diver or vessel)	**Remove or avoid**	**Remove or avoid**	**Remove or avoid**	**Remove or avoid**

Activities considered capable of affecting the protected features	Advice to support management			
	Serpulid reefs (part of reefs feature)	**Horse mussel beds (part of reefs feature)**	**Rocky reefs (part of reefs feature)**	**Flame shell beds**
	pressures is recommended - *existing management measures in place (see section 7.3)*	**pressures is recommended** - *existing management measures in place (see section 7.3)*	**pressures is recommended** - *existing management measures in place (see section 7.3)*	**pressures is recommended** - *existing management measures in place (see section 7.3)*
Fishing – diver collection of bivalves	**Remove or avoid** pressures is recommended in relation to collection of horse mussels associated with this habitat – *existing management measures in place (see section 7.3).*	**Remove or avoid pressures is recommended** in relation to collection of horse mussels – *existing management measures in place (see section 7.3).*	**Remove or avoid pressures is recommended** in relation to collection of horse mussels associated with this habitat - *existing management measures in place (see section 7.3).*	*Pressures unlikely to affect this feature.*
Forestry (off-site)	**Reduce or limit pressures** where these may influence sedimentation on reefs.	**Reduce or limit pressures** where these may influence sedimentation on reefs.	**Reduce or limit pressures** where these may influence sedimentation on reefs.	**Reduce or limit pressures** where these may influence sedimentation on flame shell beds.
Moorings	**No additional management required** for current moorings. **Remove or avoid pressures** associated with new moorings.	**No additional management required** for current moorings. **Remove or avoid pressures** associated with new moorings.	**No additional management required** for current moorings. **Reduce or limit pressures** associated with new moorings.	**No additional management required** for current moorings. **Remove or avoid pressures** associated with new moorings.
Scientific survey/research	**Reduce or limit pressures** Pressures associated with survey work in areas where there would be likely to be an impact upon reefs should be minimised, particularly at	**Reduce or limit pressures** Pressures associated with survey work in areas where there would be likely to be an impact upon reefs should be minimised, particularly at	**Reduce or limit pressures** Pressures associated with survey work in areas where there would be likely to be an impact upon reefs should be minimised, particularly at locations	**Reduce or limit pressures** Pressures associated with survey work in areas where there would be likely to be an impact upon flame shell beds should be minimised. Early discussion of the survey/research proposals is

Activities considered capable of affecting the protected features	Advice to support management			
	Serpulid reefs (part of reefs feature)	**Horse mussel beds (part of reefs feature)**	**Rocky reefs (part of reefs feature)**	**Flame shell beds**
	locations with aggregations of more sensitive epifauna. Early discussion of the survey/research proposals is recommended to reduce potential impacts.	locations with aggregations of more sensitive epifauna. Early discussion of the survey/research proposals is recommended to reduce potential impacts.	with aggregations of more sensitive epifauna. Early discussion of the survey/research proposals is recommended to reduce potential impacts.	recommended to reduce potential impacts.
Seaweed harvesting	*Pressures unlikely to affect this feature.*	*Pressures unlikely to affect this feature.*	**No additional management** for existing seaweed harvesting activities for hand-harvesting. **Reduce or limit pressures**, biosecurity planning should take place to prevent the introduction and spread of INNS. **Remove or avoid pressures** associated with mechanical harvesting.	*Pressures unlikely to affect this feature.*

Table 3. Activities that are considered not likely to affect the protected features (other than insignificantly)[9]

Activity	Comments
Boat use	Boat maintenance, antifoulant use and commercial vessel use of the site is likely to occur but not at levels that are likely to affect the features.
Commercial shipping	The following activities take place in Loch Creran but are not considered to affect the protected features: • There is a regular transport route of staff to Glensanda quarry from Rubh Garbh. • Fish farm cage building at Marine Resource Centre Barcaldine, transport through the loch. • Transport of aggregate to the Marine Resource Centre at Barcaldine (from Glensanda) for onward transport by road.
Fishing – recreational	Line-fishing does take place but is not considered to be at a level where it will affect the features.
Tourism and recreation	Charter and recreational vessels as well as activities such as scuba diving take place but not at levels that are likely to affect the features.

[9] Only the specific examples of activities listed in the table have been excluded, rather than the broad activity types. New plans or projects will still need to be considered by the relevant competent authority (see Annex 1 for further details).

8 Research and survey requirements

We recognise that there are still important gaps in our understanding and knowledge of the features of this site. We will identify research and survey projects to inform our understanding of these aspects. The requirements identified below are not a commitment to undertake this work. However, by highlighting these gaps we hope to inform future discussions with parties interested in undertaking research in this site and/or on these features, to help direct research and aid monitoring priorities.

- Monitoring of the flame shell beds to establish trends in condition and extent.
- Improved understanding of serpulid reef development, collapse and potential recovery cycles.
- To ensure representative monitoring of whole horse mussel beds, monitoring sites would benefit from being increased in number and more spatially dispersed, and would probably benefit from focussing on mussel density, rather than percentage cover. A better understanding of horse mussel bed distribution in the lower basin of the loch would contribute to better focussed monitoring.
- Monitoring and research relating to the invasive non-native species *Didemnum vexillum.* This includes monitoring of presence and distribution of the sea squirt in the oyster farm by Marine Directorate and subtidal monitoring of *Didemnum* presence on serpulid reefs, *Limaria* beds and artificial structures managed by NatureScot. Monitoring of *D. vexillum* is agreed for 2024/25 and will be reviewed thereafter.
- Research into the impacts of creeling on protected features with a focus on *Limaria hians*.
- Further survey work on the rocky reefs of the SAC as it is currently limited to three transects (undertaken in 2005).

Annex 1. Loch Creran SAC Conservation Objectives

The box below provides the high-level Conservation Objective statements for Loch Creran SAC. The full Conservation Objectives, which includes site-specific advice and information on the features that form part of this MPA, are provided in the tables that follow. A definition of the terms used is in the Glossary.

These tables are grouped split by feature type, i.e. habitats or geodiversity feature. The site-specific advice and information provides more detail in relation to each of the high-level Conservation Objective statements for each feature type, e.g. detail on the extent of a habitat within a site and what the supporting features are for a species.

Information is also provided below on how minor changes to features should be considered and the influence of environmental change on features, particular in relation to climate change. Temporary impacts on the qualifying features resulting from plans or projects can only be permitted where there is certainty that the features will be able to quickly recover. Further details on the potential for each qualifying feature to recover are described in more detail in Annex 3 '*Factors determining the potential of features to recover'*.

A map of the SAC, the location of the features and the place names mentioned in the site-specific information is provided in Figure 2.

The qualifying feature for the Loch Creran SAC is reefs. There are three subtypes of reefs within Loch Creran – serpulid reefs (constructed by the tubeworm *Serpula vermicularis*), horse mussel beds (constructed by the bivalve *Modiolus modiolus*) and rocky reefs (composed of bedrock and stones/boulders). Therefore, the advice for the SAC is specific to each of these.

Loch Creran SAC
Qualifying habitat: reefs
1. To ensure that the qualifying features of Loch Creran SAC are in favourable condition and make an appropriate contribution to achieving Favourable Conservation Status. 2. To ensure that the integrity of Loch Creran SAC is maintained in the context of environmental changes by meeting objectives 2a, 2b and 2c: 2a. Extent and distribution of reefs within the site. 2b. Structure and function of reefs and the supporting environment on which it relies. 2c. Distribution and viability of typical species of reefs.

1. To ensure that the qualifying features of Loch Creran SAC are in favourable condition and make an appropriate contribution to achieving Favourable Conservation Status.
Favourable Conservation Status (FCS) is assessed across the UK. Reefs is currently assessed as having an overall conservation status of 'unfavourable – inadequate' (2019). When carrying out appraisals of plans and projects against these Conservation Objectives, it is not necessary to understand the status of qualifying features within each individual SAC. The focus of the appraisal should be at a site level. If the site Conservation Objectives are met then the site's contribution to FCS across the UK will also be met. Further advice on how appraisals should be focussed is provided by Conservation Objective 2. Note '*Appropriate'* within this part of the Conservation Objectives is included to indicate that the contribution to FCS varies from site to site, and feature to feature.

2. To ensure that the integrity of Loch Creran SAC is maintained in the context of environmental changes by meeting objectives 2a, 2b and 2c.
This objective recognises that reefs are in unfavourable condition at Loch Creran SAC and consequently site integrity is compromised. For Loch Creran SAC when carrying out appraisals of plans or projects, the focus of the appraisal should be to understand the impact of the plan or project on site integrity by ensuring that it does not prevent or reduce the potential for recovery. The expectation is not for the plan or project to restore site integrity. Should the plan or project compromise the ability of the site to recover (e.g. result in a further decline or accelerate the rate of decline), then Loch Creran SAC will continue not to make an appropriate contribution to achieving FCS across the UK. Similarly, when determining whether management measures are required to meet the Conservation Objectives, the focus is on ensuring the conditions are appropriate to support habitat and species recovery and subsequently restore site integrity. Further advice on how these appraisals should be focussed in relation to site integrity is provided in 2a, b and c. Temporary impacts on these objectives resulting from plans or projects can only be permitted where there is a high degree of certainty that the features will be able to quickly recover from the impact and that impacts do not prevent the ability of features assessed as unfavourable to fully recover in the long-term. ***Environmental changes*** These Conservation Objectives recognise that reefs are part of a complex, dynamic and multidimensional marine environment and that marine habitats are exposed to a wide range of drivers of change. 'Environmental changes' for the purpose of these Conservation Objectives means

any change to reefs reflecting their natural cycle, and also broader environmental changes, i.e. those related to climate change and environmental variability that are beyond the scope of the site. The impact of human activities on the site that can be managed will not be considered as part of the broader context of environmental change, i.e. where required they should be managed.

Some site-level changes are natural (e.g. population fluctuations/shifts or habitat changes resulting from natural processes) and are not a direct result of human influences. Changes in reefs extent, distribution, structure, function, and typical species which are brought about by entirely natural drivers, directly or indirectly, are normally considered compatible with the site's Conservation Objectives.

There may also be historical human influences that have now ceased but have modified and continue to drive change within the site. It is also recognised that climate change pressures could affect qualifying features within the site. These changes cannot be prevented, so the Conservation Objectives at a site level seek to take account of them and where possible, improve the habitats' resilience to environmental change when considering future plans or projects. The magnitude of the future impacts will depend on the nature, scale, duration and intensity of the activity and the tolerance and ability of qualifying features to recover from such an impact.

Additionally, management of human activities at a wider scale (i.e. regional, Scotland or the area covered by an international agreement such as the OSPAR Convention), may also affect qualifying features in this site (either by making a positive contribution or by having a negative impact). Wider scale impacts may affect the ability of the features to recover from site level changes, and therefore additional precaution over the impacts of any future human activities may be necessary.

An assessment of whether a change is natural or human-induced, or a combination of both, will need to be looked at on a case-by-case basis.

In relation to Loch Creran SAC and its qualifying feature, the following effects of environmental change (climate change) are relevant. These effects should be taken into account when considering plans and projects as additional pressures may reduce the habitat's resilience to climate change, and conversely climate change impacts may start to hinder the features' ability to recover from human activities. This is particularly relevant for areas that may have been impacted by storms and are going through a process of recovery, as additional pressures may slow or hinder their ability to recover and their future resilience.

Reefs:

- **Serpulid reefs -** Serpulid reefs are thought to go through natural cyclical growth and collapse. The reefs reach a certain size (large reefs, around 0.75m tall and 1m across) and begin to collapse, usually from the centre because they can no longer support their own weight. Collapsed reef can continue to grow and if the reef dies the dead worm tubes provide habitat for new reefs to colonise. Serpulid reefs may be sensitive to storm damage, which can increase water movement and subsequently break reef material. However, attempts to relate storm events to reef damage have so far been unsuccessful as reefs typically form in sheltered locations (Moore *et al.,* 2020; Hughes *et al.,* 2024).

If currently sheltered areas become more exposed with increasing storms (intensity and frequency) through climate change, this could result in reef collapse in some areas. Additionally, this could also result in a decline in suitable habitat for the typical species associated with these reefs, and subsequently a reduction in diversity, and abundance as well as changes in their distribution in the SAC. It is important that any areas previously colonised as serpulid reef are not recognised as potential areas for human development/activity as recovery of serpulid reefs will only be possible if conditions are suitable. The worm tubes of *Serpula vermicularis*, the building blocks of serpulid reef, along with several of the typical species associated, e.g. crabs, squat lobsters, whelks could be subject to reduced growth and lower survival rates as larvae and juveniles/adults under increased ocean acidification (Strong et al., *unpublished*), making their recovery from other impacts more difficult, and resulting in changes in the typical species abundance, diversity and distribution in the SAC.

- **Horse mussel beds -** Predictive habitat modelling has estimated that under projected ocean temperature increases there would be around a 60% reduction in the most suitable habitat for horse mussels in Scotland, based on where horse mussels are currently restricted to in the UK (Gormley *et al.,* 2013). Under this model, by 2030, around 75% of the most suitable habitat will be in the northern parts of Scotland. Horse mussels have been assessed as having high sensitivity to the predicted increases in ocean acidification, and several of the typical species associated with this habitat, e.g. crabs, squat lobsters, whelks could be subject to reduced growth and lower survival rates as larvae and juveniles/adults under the projections (Strong *et al.*, unpublished). The development of horse mussel beds and the dispersal of larvae between beds (connectivity) are also reliant on adequate water flow and patterns of circulation, and horse mussel beds are moderately sensitive to changes in these which might occur under climate change (Strong *et al.*, unpublished). Changes in the supporting environment as outlined above could result in a change in the extent, distribution and density of horse mussel beds, and the dispersal of larvae between beds (connectivity) of this feature within this SAC and throughout the whole habitat's range in the future, as well as changes in typical species abundance, diversity and distribution in the SAC.
- **Rocky reefs** - Kelp and animal communities associated with rocky reef can be removed in storm events, and associated plant and animal communities may take time to recover their extent and distribution, and contribution to the structure of the rocky reef community. Increased storm impact through climate change could result in this process happening more frequently, with less recovery time in between episodes, and this may result in the extent, distribution and the three-dimensional structure created by the animal and plant communities associated with rocky reefs, changing over time. Subsequently, there may also be declines in the diversity, abundance and distribution of typical species associated with rocky reefs. Additionally, several of the typical species associated with rocky reefs, e.g. crabs, echinoderms have bodies as larvae and adults that are subject to reduced growth and lower survival rates from increased ocean acidification (Strong *et al.*, unpublished) and this may also lead to changes in the associated typical species.

2a. Extent and distribution of the habitat within the site

The reefs qualifying feature at Loch Creran SAC is in unfavourable condition reflecting the condition of the serpulid reef sub-feature (Moore *et al.*, 2020; Tulbure, 2015). Both the horse mussel beds and rocky reef sub-features are considered to be in favourable condition. Currently, the factors behind the decline in serpulid reefs at Loch Creran are unknown (Hughes *et al.,* 2024). Whilst a number of factors (including changes in the planktonic community structure, changes in land use in the loch catchment area, and alterations in the localised weather; Tulbure, 2015) may have contributed to the decline, the decline may also be part of a natural cycle of growth and collapse (Hughes *et al.,* 2024). Human intervention to restore the loss of extent of serpulid reef is not a viable option as the key factors influencing the recovery include the availability of a sufficient larval and food supply and suitable substrate for larval settlement (Lancaster *et al.*, 2014). The collapse and failure of the reef to regenerate may be part of a natural process (Hughes *et al.,* 2024;, Heriot-Watt, *unpublished*).

For Loch Creran SAC this objective therefore recognises that the reasons for the unfavourable condition may be part of the natural cycle and that no direct conservation measures can be taken at a site level to address the causes of the unfavourable condition of serpulid reefs. Therefore, the focus of the Conservation Objectives for reefs is maintaining the horse mussel beds and rocky reefs sub-features and ensuring that the conditions on site are suitable to support a recovery of serpulid reefs.

Temporary short-term and/or minor changes in the extent and distribution of the qualifying features due to human activity may be considered provided recovery can be demonstrated with a high degree of certainty. The exceptions to this would be serpulid reefs and horse mussel beds, where further explanation is provided. Assessments should consider the timing, duration and scale of the impact on the qualifying features and their ability to recover. Factors limiting the recovery of qualifying features vary between features. Temporary change in the distribution of associated fauna and flora are covered under 2b and 2c.

Feature	Site specific advice	Site specific information
Reefs: Serpulid reefs	Ensure the extent and distribution of serpulid reefs within the site has the ability to recover.	There is no baseline extent for serpulid reefs at designation. In 2005, the estimated extent of the serpulid reefs was 97 ha (2005; Moore *et al.* 2006). In 2005, large reefs (>50 cm^2) were noted to cover approximately 57 ha (Moore *et al.* 2006). Between 2005 and 2019 there has been an approximate 20% decline in serpulid reefs in Loch Creran (Moore *et al.,* 2020). There is no clear cause for the decline (Moore *et al.,* 2020; Hughes *et al.,* 2024), although the decline may be part of the natural cycle of reef formation (Heriot-Watt, *unpublished*). The estimated extent of 97 ha is still considered the most appropriate habitat extent to use for assessments of plans and projects as this decline may be part of the natural life cycle of serpulid reefs, and reefs in these areas could recover. Serpulid reef extent and distribution is limited by environmental factors, particularly depth and suitable substrate (rocks, shells) for the larvae to settle and grow on. Serpulid reefs are distributed most predominantly in a band around the lower basin of Loch Creran 6-10 m below chart datum. A broad band of

		reef occurs along the southern shore of the lower basin with only a single interruption at Rubha Mor. Above Barcaldine, the band width is generally less than 50 m, but reefs are present along most of the coastline. Reefs are absent in the stronger currents in the vicinity of Creagan Narrows and the narrow entrance of the loch west of Sgeir Caillich. The serpulid reefs in Loch Creran are thought to have been present for over 100 years (Anderson-Smith, 1887), demonstrating that this is not a transient habitat, but its current extent is less than it was historically. Serpulid reef was found to be absent from a stretch of coastline at Barcaldine, the site of an alginate factory until 1996. Around 10 years after the discharge from the factory which smothered the seabed with a layer of organic matter ceased, serpulids were reported to have begun to re-colonise the margins of the affected area (Moore et al., 2006). The timescales for the recovery of serpulid reef from this and other types of damage/disturbance are unknown, but it is known to be slow. Three-metre-wide tracks of reef rubble, possibly caused by dredging activity, were first observed off Rubha Mòr in 1998 and were still clearly evident in sidescan imagery obtained in 2017 (Moore *et al*., 2020; Scottish Government, 2020). Human intervention to restore the loss of extent of serpulid reef is not a viable option as the key factors influencing the recovery include the availability of a sufficient larval and food supply and suitable substrate for larval settlement (Lancaster et al., 2014). The serpulid reef should be left to recover naturally. Serpulid reefs are likely to have a slow rate of recovery. Any loss in extent or distribution of serpulid reefs within the site therefore has the potential to cause a long-term or permanent reduction of the habitat and/or change the local distribution on a continuing basis. Therefore, any damage that would lead to a reduction in extent or a restricted/modified distribution should be avoided.
Reefs: Horse mussel beds	Maintain the current extent and distribution of horse mussel beds within the site.	The extent of horse mussel (*Modiolus*) beds in Loch Creran is approximately 30 ha (GeMS 2024). Horse mussels are distributed throughout the site. The largest bed (16.31 ha) is located in the upper basin of the loch over a depth range of 5-27 m in an area of weak tidal currents (Moore et al., 2020). Another large bed (4.3 ha) lies to the east of Creagan Narrows at a depth range of 1-4 m. Here, tidal currents are stronger and run at up to 5 knots (Moore at al., 2020). A smaller bed (3.5 ha) lies to the west of Creagan Narrows between 2-11 m, although the bed may lie further to the south than currently estimated. Scattered beds lie within a tide-swept channel between North and South Shian (Moore at al., 2020). The beds are found over a depth of 6-26 m occupying a total area of approximately 5.89 ha, although the spatial extent of horse mussel beds is likely underestimated in the north (Moore at al., 2020). Often, horse mussel beds are found alongside patches of flame shell beds as a mosaic of two habitats. The largest known area of horse mussel bed and flame shell bed mosaic is between North and South Shian

		(Moore *et al.,* 2013, 2020). Here horse mussels are scattered over the flame shell bed, with patches forming along the periphery of the *Limaria* bed, both in areas of stronger currents in the north and weaker currents in the south (Moore *et al.,* 2013, 2020). East of the Creagan Narrows horse mussel beds gradually reduce in density and are replaced by flame shell beds. (Moore at al., 2020) Historically, there is no evidence for any change in extent or distribution of the horse mussel beds from 1999 to 2005 (Moore et al. 2006). Surveys in 2020 noted a decline in density at some beds, but not spatial extent. Horse mussel bed extent and distribution are limited by environmental factors, in particular depth and suitable habitat. Horse mussel beds have a slow rate of recovery. Any loss in extent or distribution of horse mussel beds within the site has the potential to cause a long-term or permanent reduction in the extent of the habitat and/or change the local distribution on a continuing basis. Therefore, any damage that would lead to a reduction in extent or a restricted/modified distribution should be avoided. Key factors influencing the recovery of their extent and distribution are suitable habitat, sufficient adults to provide a substrate for settlement and protection of juveniles and a supply of larvae from within/outwith the site.
Reefs: Rocky reefs	Maintain the current extent and distribution of all rocky reefs within the site.	There is no baseline extent for rocky reef from the time of designation. The current estimated extent is 5.68 ha (GeMS, 2024) which is likely significantly underestimated. Tide swept cobbles and patches of bedrock covered with anemones carpet the Eriska Narrows at around 15 m. Deeper rocky reefs occur between Rubh Riabhach and Rubh Garbh and Rubh Mor and Dalrannoch (Moore *et al*. 2006) and boulder reef covered in kelp forest and kelp park are located in the clear, shallow, fast moving waters of Creagan Narrows. There is no evidence of any historical changes in the extent or distribution of this habitat in the loch. Due to the physical nature of this habitat (hard bedrock and boulders/cobbles) we would not expect this aspect of the feature to change in its extent or modify its distribution in a significant way via natural processes. Temporary change in the associated fauna and flora are covered under 2b and 2c.

2b. Structure and function of the habitat and the supporting environment on which it relies.

Structure:

Structure includes what the habitat is created from and what it requires to exist, e.g. habitat-forming species, geological features or sediment; the depth of the substrate or thickness or height of the biogenic structures from the seabed; biogenic material forming the structure should still retain a live component where this exists at baseline.

Temporary changes in the structure of the qualifying features due to human activity may be considered, provided recovery of the associated biodiversity can be demonstrated with a high degree of certainty. The exception to this would be serpulid reefs and horse mussel beds where further explanation is provided. Assessments should consider the timing, duration and scale of the impact on the qualifying features and their ability to recover. Factors determining the potential of qualifying features to recover vary between features.

Function:

Functions include the environmental conditions and processes required for the habitat to exist and the key functions provided by the habitat to the site and wider supporting environment i.e. those where there is inter-dependence between the habitats and the supporting environment.

Loch Creran is a typical fjordic sea loch with four deep basins separated by rocky sills. The topography of Loch Crean creates a range of environmental conditions including tidal flow rates which function together to support the habitats and species within them. For example, areas of moderately strong water currents exist where water flows between basins, and where water enters the main basin at Sgeir Caillich. Areas of weaker currents exist within basins, especially in the upper basin at Dallachulish.

The site-specific advice below identifies the environmental conditions required to maintain the habitat and the key functions each habitat provides to the supporting environment. Different habitats contribute to different functions to different degrees, all of which contribute to the supporting environment on which it in turn relies. Collectively the features contribute to a wider range of functions, while some such functions also operate more clearly at an ecosystem scale (e.g. at the scale of the sea loch). An exhaustive list is not practical but the following are functions best considered at the scale of the whole site:

- Resilience to invasive non-native species (INNS) and disease – the combined function of healthy and biodiverse habitats in Loch Creran is likely to make significant contribution to the ability of the local ecosystem to resist, recover from or adapt to the introduction of a non-native or disease/pathogen.
- Supply of recruits to other parts of the site.

- Carbon storage and climate regulation – the relative standing stock, production and sequestration of biological carbon is relatively low for Loch Creran. However, the loch ranks highly in geological organic carbon per unit area. The presence and maintenance of this stock is linked to other habitat functions and external factors. (Burrows *et al.,* 2017)

The key functions provided by each habitat will continue into the future if the habitats are maintained in a favourable condition. Temporary changes in the environmental conditions due to human activity may be considered, provided recovery of the habitats can be demonstrated with a high degree of certainty. Assessments should consider the timing, duration and scale of the impact on the qualifying features and their ability to recover. Factors determining the potential of qualifying features to recover vary between features.

Feature	Site specific advice	Site specific information
All qualifying habitats	Maintain the overall water body condition status of Loch Creran	Loch Creran was assessed as having a 'Good' overall water body status in 2022 (SEPA, 2022). This assessment includes consideration of water chemistry, pollutants, the physical condition of the water body, plant and animal communities, including plankton, and the risk from invasive non-native species.
Reefs: Serpulid reefs	Ensure the serpulid reefs have the ability to recover the three dimensional structure of medium and large reefs.	Serpulid reefs form bush-like structures on the seabed and they can grow up to 1 m tall and 1 m wide. For the purposes of monitoring, they are described as small (5-50 cm^2), medium (50-500 cm^2) and large (>500 cm^2). The complex three-dimensional branched structure of the serpulid reefs provides habitat for other animals, lifting them up off the seabed to facilitate filter feeding, and providing shelter from predators. The medium and large reefs provide the greatest contribution to habitat complexity. In 2005, extensive serpulid reef habitat was recorded at Loch Creran at sites including South Shian, Rubha Mór, Sea Life Centre Bay and South Creagan (Moore et al., 2020). In 2014 there was clear visual evidence of reef degradation throughout the MPA. For example, at South Shain 90 - 99% broken reef material was recorded, with reef material more dispersed, having collapsed to the extent that individual reefs were no longer identifiable. The fragmented reef material occupied around 50% of the seabed to an average height of less than 10 cm, although occasional reef segments still supported clusters of inhabited, vertically orientated tubes (overall 1 - 10% occupied) with some clusters possibly attaining a height of around 20 - 30 cm. No pristine reefs were observed at South Shian, Rubha Mór, Sea Life Centre Bay or South Creagan in 2014 (Moore et al., 2020). There has been poor recovery of damaged reefs at Loch Creran with reef degradation recorded throughout the MPA between 2017 and 2019 (Moore *et al.,* 2020). Currently, the reason or combination of reasons for the decline in serpulid reefs at Loch Creran are uncertain (Hughes *et al.,* 2024; Heriot-Watt, *unpublished*). Whilst a number of factors (including

		changes in the planktonic community, change in land use in the loch catchment area, alterations in the localised weather and lack of habitat including biofouling of reef rubble; Tulbure, 2015; Hughes *et al.,* 2024) may contribute to the decline, it may also be part of a natural cycle of growth and collapse (Heriot-Watt *unpublished*). Available environmental data is incomplete meaning that the reasons for the decline may never be concluded (Hughes *et al.,* 2024). Neither the hypothesis that the collapse is part of the natural life cycle, or that human activities contributed to the collapse, can currently be ruled out (Hughes *et al.,* 2024). Human intervention to restore the damaged serpulid reef is not a viable option as the key factors influencing the recovery include the availability of a sufficient larval supply and suitable substrate for larval settlement (Lancaster *et al.,* 2014) Recovery may be part of a natural cycle (Hughes *et al.,* 2024; Heriot-Watt, *unpublished*). The serpulid reef should be left to recover naturally.
	Maintain the environmental conditions (processes) required to support a healthy functioning serpulid reef.	Key factors limiting the recovery of their structure include, the availability of a sufficient larval supply and food, the presence of existing live reefs and reef rubble clear of biofouling upon which larvae can settle (Lancaster *et al.,* 2014). Individual *Serpula vermicularis* are common around the coast of the UK but the combination of the water movement and ecology of Loch Creran allows the growth of rare serpulid reefs. The conditions of faster water movement created when the incoming and outgoing tides pass through the narrow, shallow sills at Eriska Narrows and Creagan Narrows prevents reef growth close to these areas. Serpulid reefs prefer the slower moving waters of the larger lower basin. Current thinking suggests that before serpulid reefs are able to develop, individual *S. vermicularis* have to be present in sufficient numbers in a restricted sea loch for larvae to settle on existing worm tubes or reef rubble. The narrow entrance to the loch encourages reef growth by retaining the serpulid larvae within the loch so they are more likely to settle on worm tubes. Additionally the entrance helps retain plankton within the loch system, and the continually moving currents created by the tide, keep this food supply passing by the filter-feeding reefs. Serpulid reefs also require good water quality for their survival and growth, including an adequate larvae and food supply. Loch Creran is highly productive. Despite investigation, it has not been possible thus far to identify a change in a single condition or combination of conditions that is responsible for the decline in serpulid reef extent and condition and its failure to regenerate (Hughes *et al.,* 2024). It is possible that an increase in biofouling of reef rubble and decrease in larval recruitment (Heriot-Watt *unpublished*) is preventing the regeneration of reefs (Heriot-Watt, unpublished).

	Maintain the functions provided by the serpulid reef to the wider ecosystem.	The key functions provided by serpulid reefs at Loch Creran is that it provides habitat for other species. The complex physical structure of serpulid reef provides habitat for various fish and shellfish species.
Horse mussel beds	Maintain the current density of live individuals, and associated proportions of dead shell material and fine sediments.	Horse mussel beds provide a hard carpet composed of live and dead *Modiolus* shells on the seabed that would otherwise be soft sediment. This hard substrate provides a stable surface for the attachment of animals, e.g. peacock worms and brittle stars, and the cracks and crevices provide refuge for small animals and juvenile species from the tide and predators. The density of horse mussel beds is influenced by current flow in the area (Fariñas-Franco *et al.,* 2014). The horse mussel beds in sea lochs can be naturally less dense and patchier compared to those on the open coast which is the case with Loch Creran. The horse mussel beds at Dallachulish are in an area of low current and are a congregation of horse mussel clumps, the clumps are closer together at the centre of the bed and more dispersed towards the edges, Population density at the largest bed is fairly low for a *Modiolus* bed with scattered individuals and small clumps attaining a SACFOR density of common over most of the area (Moore et al., 2020). Localised reductions in horse mussel density were recorded in three of the horse mussel beds between 2005 and 2018 with evidence of long-term, poor recruitment in the most extensive, upper basin bed (Moore et al., 2020). Recruitment is likely to have been poor for many years, with beds strongly dominated by large individuals. Temporal changes in the horse mussel beds are consistent with natural temporal variation. Horse mussel beds have a slow rate of recovery. Any loss in extent or distribution of horse mussel beds within the site has the potential to cause a long-term or permanent reduction in the extent of the habitat and/or change the local distribution on a continuing basis. Therefore any damage that would lead to a reduction in extent or a restricted/modified distribution should be avoided. Key factors influencing the recovery of their structure include adequate water current, sufficient adults to provide a substrate for settlement and protection of juveniles, and a supply of larvae from within/outside the site.
	Maintain the environmental conditions (processes) required to support a healthy	Maintaining the horse mussel beds relies on adequate supply of larval recruits and food (plankton), the presence of suitable habitat (existing beds) to act as a settlement site for larvae, and suitable environmental conditions for growth. Environmental conditions, including water movement patterns

	functioning horse mussel bed.	and water quality are important in the provision of these requirements. The tide entering and leaving Loch Creran is squeezed through the Eriska Narrows, a shallow area, creating tidal currents and the conditions necessary for the development of horse mussel beds just to the west and east. Horse mussels are filter feeders and the highly productive and enclosed nature of Loch Creran may be important for the development and maintenance of these beds due to the levels of plankton and its retention. Recent genetic analysis of horse mussels (*Modiolus*) from beds inside and outside Loch Creran suggests that it is a source of larvae rather than a sink (Mackenzie *et al.,* 2017), likely to be partly driven by the water movement pattern. Horse mussel beds also require good water quality, to maintain the conditions needed for their survival and growth, including an adequate food supply. Loch Creran is highly productive in terms of plankton. The current status of these parameters provides suitable conditions for sustaining the horse mussel beds. A change in these environmental conditions could detrimentally affect the quality and variety and therefore functions of the beds in the loch.
	Maintain the functions provided by the horse mussel bed to the wider ecosystem.	The key functions provided by horse mussel beds at Loch Creran are: habitat for other species, larval/gamete supply, nutrient cycling, sediment stabilisation, waste breakdown and detoxification of water and sediments. Horse mussel beds provide habitat for hydroids, crinoids, crustaceans and small fish which provide a consequential supply of larvae/gametes that are carried through currents to other reefs. As relatively large filter-feeding bivalves, they are also important in the breakdown, cycling and/or detoxification of organic and inorganic matter from the water column. Recent genetic studies (Mackenzie et al., 2017) suggest that these mussel beds are a source of larva for beds elsewhere. Their physical structure also helps with sediment stabilisation. The wide-scale filtration function of the Loch Creran bed is difficult to quantify, however, assuming this process is related to the density of horse mussels, the average number of live mussels per m^2 in each bed should be maintained throughout the loch.
Rocky reefs	Maintain the three dimensional structure created by fauna and flora (e.g. kelp, sponges) that are associated with this habitat. The physical structure of rocky reef in the site should be maintained.	The structure of rocky reefs varies through the loch. The current-swept, shallow sites at the mouth of the loch where the water is clear, provides suitable conditions for dense kelp forests, the stipes of which are clothed in dense red algae, especially *Delesseria sanguinea* and *Membranoptera alata*. Below these forests the rock supports scattered but spectacular massive sponge colonies (*Pachymatisma johnstoni* and *Clione celata*). Further towards the head of the loch the rocky reefs are more sheltered and the kelp forest and park is absent. Here the rocky reef is covered with a layer of silt, aggregations of *Serpula vermicularis* and abundant green sea urchins (*Psammechinus milliaris*) (Moore *et al*., 2006).

		Due to the physical nature of this habitat (hard bedrock and boulders/cobbles) we would not expect the structure of the bedrock to change via natural processes. The benthic fauna and flora associated with rocky reefs do have the ability to recover from temporary impacts. Therefore, temporary changes in the fauna and flora structure due to human activity may be considered, provided recovery of the associated biodiversity can be demonstrated with a high degree of certainty. Assessments should consider the timing, duration and scale of the impact on the benthic fauna and flora of rocky reefs and their ability to recover. The key factors influencing the recovery are, the supply of recruits from within/outwith the site, and suitable environmental conditions, e.g. light, hydrography, substrate for them to recolonise.
	Maintain the environmental conditions (processes) required to support a healthy functioning rocky reef.	Environmental conditions, including water movement patterns, water quality and water clarity are important in maintaining the variety and condition of the rocky reefs. The tides entering and leaving the loch are squeezed through the narrow, shallow sill at Eriska Narrows creating fast water flow and the optimum tidal conditions for the development of dense kelp forests on the shallow bedrock, boulder and cobble reef. The shallower depths and clear waters in Loch Creran allow for adequate light penetration in order to sustain the presence and growth of the kelp forests here that support high levels of biodiversity and primary productivity. Towards the head of the loch away from the influence of the tidal Creagan Narrows the water movement is slower and as a result kelps are absent from the rocky reefs. Here bedrock, boulder and cobble reefs are covered with a dusting of muddy sediment and support animals such as sea urchins, individual *S. vermicularis*, hydroids and sea squirts / ascidians. The current status of these parameters provides suitable conditions for sustaining rocky reefs. A change in these environmental conditions could detrimentally affect the quality and variety and therefore functions of the reefs in the loch.
	Maintain the functions provided by the rocky reef to the wider ecosystem.	The key functions provided by rocky reefs at Loch Creran are: habitat for other species, larval/gamete supply, biomass production and nutrient cycling. Rocky reefs provide habitat for kelp, hydroids, crinoids, crustaceans and small fish which provide a consequential supply of larvae/gametes that are carried through currents to other reefs. A healthy functioning reef, particularly when supporting kelp beds and other macroalgal communities where biomass production is high, also has a role in nutrient cycling.

2c. Distribution and viability of typical species of the habitat.		
It is expected that the viability of the typical species will continue to be maintained if Objective 2b is met and therefore the site specific advice and information does not provide any additional detail on this. This objective focuses on the distribution and diversity of typical species. The list of species provided below should be used as a guide to inform Habitats Regulations Appraisals of plans or projects with regard to this Conservation Objective. This summarises our knowledge as it currently stands but may be updated in the future as our knowledge improves. Temporary changes in abundance and distribution of typical species, due to human activity may be considered, provided recovery of the typical species can be demonstrated with a high degree of confidence. The exception to this would be horse mussels, where further explanation is provided. Assessments should consider the timing, duration and scale of the impact on the qualifying features and their ability to recover.		
Feature	Site specific advice	Site specific information
All qualifying habitats	Maintain the diversity, abundance and distribution of typical species associated with the marine environment of Loch Creran.	Loch Creran's marine habitats support otters, grey seal, harbour seal and a variety of birds (including common gull, common term, shag, eider, wigeon and oystercatcher) and fish (including wrasse, salmon and sea trout).
Reefs: Serpulid reefs	Ensure the diversity, abundance and distribution of typical species associated with the habitat (including *Serpula vermicularis*) has the ability to recovery.	Typical species of serpulid reefs include *Serpula vermicularis*, crabs (*Carcinus maenas*, *Necora puber*), squat lobsters (*Munida rugosa*), hermit crabs (*Pagurus bernhardus*), whelks (*Buccinum undatum*), sea urchins (*Psammechinus milliaris*) feather stars (*Antedon bifida*), brittle stars (*Ophiothrix fragilis*), peacock worms (*Sabella pavonina*), sponges (*Halichondria panacea*), and sea squirts (*Ascidia mentula*). There is geographical variation in the diversity and composition of the communities. In terms of the mean number of taxa particularly species rich reefs are found at Sea Life Centre Bay (west of Barcaldine) where 15 taxa were recorded in 2016 in comparison to 13 taxa at South Shian, 12 taxa at Rubha Mor and 11 taxa at South Creagan (Moore *et. al.,* 2006). We would expect there to be very little variation in the distribution of species associated with the serpulid reefs throughout Loch Creran. It is likely there has been a temporal change in biota with an apparent reduction in epibiotic diversity and a reduction in the abundance of *Ophiothrix fragilis* as well as *S. vermicularis* (Moore *et al.,* 2020). Human intervention to restore the diversity, abundance and distribution of typical species is not a viable option as the key factors influencing the recovery include the availability of a sufficient larval supply and

		suitable substrate for larval settlement (Lancaster *et al.,* 2014). The serpulid reef should be left to recover naturally. Serpulid reefs are known to have a slow rate of recovery. Any loss in distribution of the key reef building species *S. vermicularis* within the site therefore has the potential to cause a long-term or permanent reduction of the habitat and/or change the local distribution on a continuing basis. Therefore any damage that would lead to a loss or restricted/modified distribution of this typical species should be avoided. The key factors influencing the recovery of the distribution and diversity of typical species are the supply of recruits from within/outside the site, and suitable environmental conditions, e.g. water movement, substrate for them to recolonise.
Horse mussel beds	Maintain the diversity, abundance and distribution of typical species associated with the habitat (including *Modiolus modiolus*).	Typical species supported by horse mussel beds in this loch include horse mussels, serpulid tubeworms, barnacles, sea squirts / ascidians and hydroids. Mobile species recorded include abundant common star fish (*Asterias rubens)* and brittle star (*Ophiothrix fragilis).* All of these species are typical of *Modiolus* beds (Moore *et al.,* 2006). Four clumps of *Modiolus* sampled revealed a mean of 95.75 species present (Moore *et. al.,* 2006). Only slight changes in species composition and diversity of the community associated with horse mussels were recorded over the years 2005 – 2017 (Moore et al., 2020). Horse mussels are an important prey item for common eider. Horse mussel beds have a slow rate of recovery. Any loss in diversity or distribution of key bed building species (*Modiolus modiolus*) within the site has the potential to cause a long-term or permanent reduction in the extent of the habitat and/or change the local distribution on a continuing basis. Therefore any damage that would lead to a loss or a restricted/modified distribution of this typical species should be avoided. The key factors influencing the recovery of the distribution and diversity of typical species are the supply of recruits from within/outside the site, and suitable environmental conditions, e.g. water movement, substrate for them to recolonise.
Rocky reefs	Maintain the diversity, abundance and distribution of typical species associated with the habitat (including kelps,	Typical species at the more tide-swept rocky reef sites in Loch Creran include a narrow band of the large brown kelp *Laminaria digitata* giving way to a forest of *Laminaria hypoborea*. The stipes of the *L. hyperborea* typically support dense red algal flora especially *Delesseria sanguinea* and *Membranoptera alata* and profuse growths of the bryozoan *Alcyonidium hirsutum*. Beneath the kelp forest the rock characteristically supports abundant brittle stars (*Ophiocomina nigra)* and a red algal turf. At around 9 or 10 m the kelp forest is likely to thin out to kelp park with the kelp stipes still supporting dense *A. hirsutum*, a

	hydroids and sponges).	profuse red algal flora, with *D. sanguinea* dominant, and didemnid sea squirts. Under the kelp, the red algal turf beneath the kelp is likely to be reduced and echinoderms, star fish, brittle stars and feather stars such as *O. nigra*, *Crossaster papposus*, *Asterias rubens* and *Antedon bifida* dominate. In deeper waters the kelp disappears and the assemblage is likely to be dominated by animals, especially sponges including dead man's fingers *Alcyonium digitatum* (superabundant in patches), brittle stars *O. nigra* and hydroids, particularly *Nemertesia* spp., *Halecium halecinum* and *Abietinaria abietina*. The circalittoral zone is also likely to support large growths of the sponges, *Pachymatisma johnstoni* and *Clione celata*. At the more sheltered rocky reef sites in Loch Creran typical species include the sugar kelp *Saccharina latissima* in the shallow water and abundant (locally superabundant) green sea urchin *Psammechinus miliaris*. Slightly deeper (7-17 m) on the rock slope the larger pink sea urchin *Echinus esculentus* is common and the green sea urchin *is* still abundant. There may also be a scattering of hydroids and sea squirts / ascidians (particularly *Ascidiella aspersa*, *Ascidia mentula* and *Pyura microcosmus*). There is no data to provide any indication of the temporal change in the rocky reef communities of Loch Creran, but they appear to be in good condition. Seventy-six and 70 taxa were recorded at the more tide swept Woodhall and Rubha nam Faoileann compared to 47 on the Rubha Riabhach South, reflecting the difference between the species associated with the more exposed and sheltered rocky reefs (Moore *et al.,* 2006). The benthic fauna and flora of rocky reefs have the ability to recover from temporary impacts, and at a faster rate compared to serpulid reefs and horse mussel beds. Therefore, temporary changes in the diversity or distribution of typical species due to human activity may be considered, provided recovery of the associated biodiversity can be demonstrated with a high degree of certainty. Assessments should consider the timing, duration and scale of the impact on the benthic fauna and flora of rocky reefs and their ability to recover. The key factors influencing the recovery of the distribution and diversity of typical species are the supply of recruits from within/outside the site, and suitable environmental conditions, e.g. light, water movement, substrate for them to recolonise.

Annex 2. Loch Creran NC MPA Conservation Objectives

The box below provides the high-level Conservation Objective statements. The full Conservation Objectives, which includes site-specific advice and information on the features that form part of this NC MPA, are provided in the tables that follow.

These tables are grouped split by feature type, i.e. habitats, species, large scale features, and geomorphology. The site-specific advice and information provides more detail in relation to each of the high level Conservation Objective statements for each feature type, e.g. detail on the extent of a habitat within a site and what the supporting features are for a species.

Information is also provided below on how minor changes to features should be considered and the influence of environmental change on features, particularly in relation to climate change for context.

A definition of the terms used is in the Glossary.

A map of the MPA, the location of the features and the place names mentioned in the site-specific information is provided in Figure 2.

Loch Creran NC MPA

Protected features(s):
Habitats - Flame shell beds
Geomorpholigcal features – Quaternary of Scotland

The Conservation Objectives of the Loch Creran NC MPA, are that the protected features

- so far as already in favourable condition, remain in such condition; and
- so far as not already in favourable condition, be brought into such condition, and remain in such condition.

"Favourable condition", with respect to a marine habitat, means that

a) its extent is stable or increasing; and
b) its structures and functions, its quality, and the composition of its characteristic biological communities are such as to ensure that it is in a condition which is healthy and not deteriorating.

In paragraph (b) the reference to the composition of the characteristic biological communities of a marine habitat includes a reference to the diversity and abundance of species of marine flora and fauna forming part of, or inhabiting, that habitat

Any temporary deterioration in condition is to be disregarded if the habitat is sufficiently healthy and resilient to enable its recovery from such deterioration.

"Favourable condition", with respect to a feature of geomorphological interest, means that

a) its extent, component elements and integrity are maintained;
b) its structure and functioning are unimpaired; and
c) its surface remains sufficiently unobscured for the purposes of determining whether the criteria in paragraphs (a) and (b) are satisfied.

For the purpose of determining whether a feature of geomorphological interest is sufficiently unobscured under paragraph (3)(c), any obscuring of that feature entirely by natural processes is to be disregarded.

For the purpose of determining whether a protected feature is in favourable condition any alteration to that feature brought about entirely by natural processes is to be disregarded.

Interpretation of temporary deterioration in condition (for marine habitats) and consideration of minor changes
For marine habitats any temporary deterioration in condition is to be disregarded if the marine habitat is sufficiently healthy and resilient to enable its recovery from such deterioration. In order to determine what “temporary deterioration” is we must know the longevity of the habitat and timescales involved to enable a habitat (protected feature) to fully recover. Resilience can vary widely between ecosystems and ecological resilience has been defined as "the capacity of a system to absorb disturbance and reorganize while undergoing change so as to still retain essentially the same function, structure, identity, and feedbacks". It is generally recognised that high biodiversity in a system makes it more resilient to some forms of disturbance. For the other features (geomorphological features) minor changes in the proposed protected features due to human activity may be considered not to compromise the Conservation Objectives and will be considered on a case-by-case basis. Assessments should consider the timing, duration and scale of the impact on the features and their ability to recover. Factors determining the potential for features to recover following temporary deterioration vary between features. These are described in more detail in Annex 3 ‘‘*Factors determining the potential for features to recover’*.

Environmental Change	
The Conservation Objectives recognise and acknowledge that the protected features of the MPA are part of a complex, dynamic and multi-dimensional marine environment. Habitats are exposed to a wide range of drivers of change. This may include changes to their population and habitats that reflect their natural cycles, and also broader environmental changes, i.e. those related to climate change and environmental variability that are beyond the scope of the MPA. Any alterations to the proposed protected features that are brought about by entirely natural processes are to be disregarded when assessing against the Conservation Objectives. In relation to the Loch Creran NC MPA and its protected features, the following effects of climate change are relevant as outlined below. These effects should be taken into account when considering plans and projects within Loch Creran NC MPA as additional pressures may reduce the habitat’s resilience to climate change, and additionally climate change impacts may start to hinder the habitat’s ability to recover from human activities.	
Flame shell beds	These have been assessed to have high sensitivity to the physical disturbance and damage as a result of increased storm and wave impact from climate change. Flame shell beds are also likely to have high sensitivity to predicted increases in ocean acidification, which could affect larval settlement, reproduction and growth (Strong *et al.,* unpublished). Several of the species associated with flame shell beds (e.g. crabs, echinoderms) have bodies as larvae and adults that are subject to reduced growth and lower survival rates from increased ocean acidification (Strong *et al.*, unpublished). The development of flame shell beds and the dispersal of larvae between beds (connectivity) are also reliant on adequate water flow and patterns of water movement, and flame shell beds are moderately sensitive to changes in these, which might occur under climate change. These climate change pressures could result in a change in the extent, distribution, structure (bed thickness and density of individuals) of flame shell beds, and changes in their characteristic communities in the MPA, and throughout the habitat’s range in the future.

Quaternary of Scotland	As erosional features formed by ice over millennia the glaciated channel/troughs and landscape of areal glacial scour are likely to be highly resistant to climate change. The resilience of the megascale glacial lineations is highly variable and depends upon the composition of the seabed and its degree of consolidation. Lineations formed in well-consolidated sediment can be considered highly resistant to climate change. Those preserved in poorly consolidated sediment may well be sensitive to large-scale changes in water flow, wave exposure and sedimentation associated with climate change. Such sensitivities constitute a worthy consideration, particularly given that climate change may drive an increase in mean annual maximum wave height and a change in wind speed over the century (Palmer et al, 2018).

Habitats: Flame shell beds

(a) Extent of flame shell beds	
Site specific advice	**Site specific information**
Conserve the current extent and distribution of the flame shell beds within the site so that they are stable or increasing.	The current total estimated extent of the flame shell (*Limaria hians*) beds is approximately 35 ha, composed of three beds (Moore et al., 2020). The aerial extent of the South Shian bed in 2017/18 was 32.62 ha. The flame shell bed off Creagan lies in the western approaches to Creagan Narrows in a narrow strip about 300 m in length and 30 m in width, approximately 0.86 ha. The third bed lies in the eastern approaches to the Creagan Narrows in the upper basin of the loch with a likely spatial extent of the order of 1.40 ha (Moore et al., 2020). The extent and distribution of flame shell beds are limited by depth and suitable habitat. Historical data are too sparse to identify any temporal trends in the flame shell beds of Loch Creran in terms of whether its extent and distribution is stable or increasing or decreasing. Flame shell beds are likely to have a slow rate of recovery (Trigg and Moore, 2009), and the key factors influencing the recovery of their extent and distribution include, water flow, the availability of a sufficient larval supply and suitable substrate for larval settlement. Recovery of flame shell beds may be quicker if flame shells are not completely removed from the bed with early evidence from Loch Carron suggesting that beds have nearly recovered after a couple of years. All disturbance to flame shell beds by human activities is likely to be judged detrimental. This is because it has the potential to cause a long-term or permanent reduction in the extent of the habitats and/or change the local distribution on a continuing basis. Therefore, any damage or disturbance that would lead to a reduction in extent and/or a restricted/modified distribution of the flame shell beds should be avoided. Assessments should focus on activities involving significant abrasion or disruption of seabed sediments. Such pressures may significantly physically damage flame shell beds and break up nest structure. Pressures may also alter local water hydrographic and sedimentary processes leading to an increase in sedimentation rates and organic particulate matter in the immediate area. This could result in smothering and block the exchange of water and oxygen.

(b) Structures of flame shell beds	
Site specific advice	**Site specific information**
Conserve the current bed thickness, density of individuals, and associated sediments so that they are stable or increasing.	The mean flame shell turf coverage within South Shian bed in 2017/18 was 67% which was similar to the 76% recorded in 2012 (Moore et al., 2020) the bed at South Shian has a nest thickness of 5.4 cm on average, with a range of 2 - 15 cm (Moore *et al.,* 2013). The bed off Creagan has high byssal turf coverage towards the edges (>50%) and low - medium coverage in the central region (mostly 10 - 50%). Mean cover over the bed as a whole in 2017 was 45%. The mean turf cover in 2017 was recorded at 45% (51% in 2012). The bed thickness at Creagan is much lower with an average of 1.1cm and a range of 2-5 cm (Moore *et al*., 2013). The bed in the upper basin was recorded over a depth range of 1.6 - 5.7 m in an area of coarse sand with dense shells and pebbles consolidated by *Limaria* byssus but not overtopped by it and supporting an algal turf. The matrix of byssus, shells and stones averaged 48% cover. The density of flame shells in beds is influenced by current flow in the area. Historical data are too sparse to identify any temporal trends in the flame shell beds of Loch Creran in terms of whether the thickness of beds of the density of individuals is stable or increasing or decreasing. Assessments should focus on activities which may significantly alter water flow and sedimentation characteristics, involve significant abrasion or disruption of the seabed and increase in organic particulate matter in the immediate area.

Function and quality of flame shell beds
The boxes below provide the site specific advice on the '**function of the habitat and its quality'** element of this Conservation Objective. Information on 'Structure**'** is provided separately above. 'Quality' in this context is taken to mean the processes relevant to the features e.g. water movement, chemical water quality parameters etc and are referred to as environmental conditions in the table below. Consideration of the functioning of the habitat and supporting environment on which it relies needs to take into account the wider functioning and environmental conditions within this sea loch. Loch Creran consists of two basins, the main lower basin is separated from Loch Linnhe by a narrow entrance and shallow sill at Eriska Narrows and the upper basin is separated from the main basin by a shallow sill at Creagan Narrows. The tides entering and leaving the loch are

squeezed through the narrow, shallow sill at Eriska Narrows creating fast water flow. Towards the head of the loch away from the influence of the tidal narrows at Creagan the water movement is slower. Loch Creran is considered to be a well-mixed water body with no isolation of high and low salinity areas. The flushing time for the loch is 3 days, during which time around 60% of the loch's volume is exchanged with the neighbouring coastal waters and this reduces the risk of problematic levels of soluble contaminants (Edwards and Sharples, 1986).

The sections below identify key functions associated with the flame shell beds of the MPA. However, the habitat also contributes to a wider range of functions, some of which operate more clearly at an ecosystem scale (e.g. at the scale of the sea loch). An exhaustive list is not practical but the following are functions best considered at the scale of the whole site:

- Resilience to invasive non-native species (INNS) and disease – the combined function of healthy and biodiverse habitats in Loch Creran is likely to make significant contribution to the ability of the local ecosystem to resist, recover from or adapt to the introduction of a non-native or disease/pathogen.
- Carbon storage and climate regulation – the relative standing stock, production and sequestration of biological carbon is relatively low for Loch Creran. However, the loch ranks highly in geological organic carbon per unit area. The presence and maintenance of this stock is linked to other habitat functions and external factors.

There is inter-dependence between the functions of the habitats in Loch Creran and the supporting environment. The sections below identify key functions each habitat provides to the supporting environment and the environmental conditions required to maintain the habitat and these functions. Different habitats contribute to different functions to different degrees, all of which contribute to the supporting environment on which it in turn relies.

Temporary changes in the environmental conditions due to human activity may be considered, provided recovery of the key functions can be demonstrated with a high degree of certainty. Assessments should consider the timing, duration and scale of the impact on the protected feature and their ability to recover.

Site specific advice	**Site specific information**
Conserve the functions provided by flame shell beds and the environmental conditions that support them.	Loch Creran was assessed as having a 'good' overall water body status in 2023 (SEPA, 2023). This assessment includes consideration of water chemistry, pollutants, the physical condition of the water body, plant and animal communities, including plankton, and the risk from invasive non-native species. The key functions provided by flame shell beds at Loch Creran are: habitat for other species, larval/gamete supply, nutrient cycling, sediment stabilisation and waste breakdown and detoxification. Flame shell beds stabilise a seabed that would otherwise consist of mobile sand or gravel, increasing biodiversity by creating habitat for organisms such as kelps, peacock worms and brittle stars. Although little is known about the connectivity of flame shells in Loch Creran, their abundance in the loch would indicate that

	they provide an important source of larval supply for this species. Although their lower abundance compared to horse mussels limits the volume of water they filter, as bivalves they do contribute to nutrient cycling, waste breakdown and detoxification. Maintaining the flame shell beds relies on adequate supply of larval recruits and food (plankton) and suitable environmental conditions for growth. Environmental conditions, including water movement patterns and water quality are important in providing these requirements. Flame shell beds are strongly associated with areas of high current flow. The tide entering and leaving Loch Creran is squeezed through the narrow, shallow Eriska Narrows and past Sgeir Caillich creating the tidal currents necessary for the development of a flame shell bed here. A similar narrows is present at Creagan where another flame shell bed has developed as a mosaic with the horse mussel bed. Loch Creran is also highly productive with the narrow entrance retaining plankton within the loch system. The continually moving currents created by the tide entering and leaving the loch keep this food supply passing by the filter feeding flame shells, supporting bed growth. With the apparent decline of flame shell beds elsewhere in the Loch Linnhe system, the Shian bed in Loch Creran now represents the most important bed in the area and possibly the principal source of flame shell larvae for Loch Linnhe (Moore *et al*., 2012) due to its size, quality, water movement patterns and the proximity to the mouth of Loch Creran. The current status of these parameters provides suitable conditions for sustaining flame shell beds. A change in these environmental conditions could detrimentally affect the quality and variety and therefore functions of the flame shell bed.

(b) Composition of its characteristic biological communities	
Consideration of characteristic biological communities of flame shell beds should not be limited to the list provided below, however it does give an indication of the main species we would expect to be present.	
Site specific advice	**Site specific information**
Conserve the diversity, abundance and distribution of characteristic biological communities associated with the habitat (including *Limaria hians* and *Modiolus modiolus*).	The flame shell bed at Shian supports the large brown kelp *Laminaria hyperborea* forest and park in places and occasional *Modiolus modiolus*, but brittlestars appeared sparse throughout the bed (Moore *et al.,* 2012). The Creagan *Limaria* beds support a blanket of brittle stars (*Ophiothrix fragilis),* and other dominant members of the faunal community include the common hermit crab (*Pagurus bernhardus)*, shore crab (*Carcinus maenas)*, common star fish (*Asterias rubens)* and the green sea urchin (*Psammechinus miliaris)*. Apart from kelp, *Laminaria hyperborea* and *Saccharina latissima*, algae are poorly represented at Creagan (Moore *et al.,* 2012). Historical data are too sparse to identify any temporal trends in the characteristic biological communities of the

	flame shell beds of Loch Creran. *Modiolus modiolus* was common within the bed in the upper basin (Moore et al., 2020). Although smaller than flame shell beds elsewhere, the bed at Shian has a rich infaunal community. A mean of 63 taxa were recorded on the Shian bed and a mean of 40 taxa on the Creagan bed. The populations of characteristic biological communities described above need to be maintained by maintaining suitable environmental conditions and limiting activities which these populations may be sensitive to. Flame shell beds are rare in an international context. Therefore, any damage or disturbance to the diversity, abundance and distribution of characteristic biological communities should be avoided. Assessments should focus on activities which involve physical change to and/ or the removal of substratum, those which may significantly alter local hydrographic and sedimentary processes and those which may lead to an increase in organic particulate matter in the immediate area.

GEOMORPHOLOGICAL FEATURE: QUATERNARY OF SCOTLAND

(a) Extent, component elements and integrity	
Site specific advice	**Site specific information**
Conserve the feature extent, component elements and integrity of the Quaternary of Scotland geomorphological feature (glaciated channels /troughs and moraines).	Component elements refers to the landforms which make up the feature, namely glaciated channels/troughs and moraines, whilst integrity relates to the collective assemblage of these landforms and their inter-relationships. The deep basins (glaciated channels/troughs) of Loch Creran were carved out by glaciers during the last ice age (multiple periods of glaciation during the Quaternary - the last 2.6 million years). Where the ice met harder rocks, or melted on reaching the sea or lower ground, rock and boulder ridges resulted (moraines). These form shallow areas or sills between the two main basins and at the seaward entrance of the loch. Assessments should focus on activities which may significantly alter water flow characteristics as well as those involving significant abrasion or disruption of seabed sediments. A consideration of the scale of the impact or activity in relation to individual component elements and to the full assemblage should also be a key component of any assessment in order to conserve the integrity of the feature in its entirety.

	Minor reductions in the feature's extent and component elements due to human activity may be considered not to compromise the Conservation Objectives and will be considered on a case-by-case basis taking full account of potential cumulative effects.

(b) Its structure and functioning are unimpaired	
Site specific advice	**Site specific information**
Conserve the structure and functioning of the Quaternary of Scotland feature (glaciated channels /troughs and moraines) so that it is unimpaired.	The morphology of the deep basins (glaciated channels/troughs) and shallows sills (moraines) leads to effective trapping of sediments. This record of layered sediments can provide critical information on how the area's last glaciers functioned. Loch Creran is one of a number of west coast fjordic sea lochs that contain important records of de-glaciation, which aid understanding of the Late Quaternary history of the British-Irish Ice Sheet (Stoker *et al*., 2009; McIntyre and Howe, 2010). The region is also critical for furthering scientific understanding of the Younger Dryas, a brief episode of ice re-advance around 11,000 years ago. Thus in its entirety the feature has a function of 'scientific importance' for furthering our understanding of de-glaciation. This function may be impaired by activities which are detrimental to the extent, component elements and integrity, as set out above under (a). Assessments should therefore focus on activities which have the potential to significantly alter water flow characteristics as well as those involving significant abrasion or disruption of seabed sediments. Minor alterations to the feature's structure and functioning due to human activity may be considered not to compromise the Conservation Objectives and will be considered on a case-by-case basis taking full account of potential cumulative effects.

(c) Its surface remains sufficiently unobscured for the purposes of determining whether the criteria in paragraphs (a) and (b) are satisfied.	
Site specific advice	**Site specific information**
Conserve the surface of the Quaternary of Scotland feature (glaciated channels /troughs and moraines) so that it remains sufficiently unobscured for the purposes of determining whether the criteria in conservation objectives (a) and (b) are satisfied.	Assessments should focus on whether the activity or development has the potential to significantly obscure the surface of the *glaciated channels/troughs and moraines* to the extent that conservation objectives (a) and (b) could not be fully assessed. Whilst the feature as a whole is of a size which is unlikely to be obscured, assessments should consider the degree to which any of the component landforms, and crucially their inter-relationships, might be obscured. This will vary greatly according to the size and nature of the component elements concerned. Therefore the type of data and/or assessment required will vary likewise.

Annex 3. Supporting information

Factors determining the potential for features to recover

Reefs: Serpulid reefs

If lost serpulid reefs may take considerable time to recover and possibly never return (Lancaster et al. 2014). The combination of the hydrology and ecology of Loch Creran allows the growth of serpulid reefs. The maintenance and recovery of serpulid reefs relies on the hydrography of the loch system being maintained, an adequate source of food (plankton), an abundant supply of larval recruits, from either individuals or reefs within the loch, and the presence of suitable habitat for settlement (existing worm tubes, other hard substrate and particularly bivalve shells (Moore et al.,1998) (Lancaster et al., 2014). There is also temporal variability in larval settlement, with this occurring predominantly from mid-June to mid-October, peaking in mid-August to mid-September (Chapman et al. 2007). Therefore, activities that could affect the viability of larvae and their ability to settle would have the greatest effect during this period. The importance of this is highlighted by the die out of serpulid reefs in other localities i.e., Loch Sween, where the reasons for the loss are still not understood. At Loch Sween, it is unlikely that the reefs will regenerate naturally because of a lack of a viable population in the loch to provide a dense enough supply of larvae, although aggregations have been recently reported in Linne Mhuirich, Loch Sween, which may supply larvae to other localities within the Loch. Efforts to recolonise Loch Sween using transplanted reef were not successful (Hughes et al., 2008), and whilst this may remain technically feasible (Herriot-Watt *unpublished*) the scale of the task is likely to be impractical (Lancaster et al., 2014).

Tubes of *Serpula vermicularis* (which form the serpulid reefs) have been observed to have a growth rate of 33 mm yr-1 and are estimated at this rate to take 6 years to fully develop (Hughes et al. 2008), although it can take much longer for a reef to develop. The larger reefs can therefore take many periods of recruitment to form and recover from any impact. Recovery of serpulid reefs has been documented in Loch Creran, following organic pollution from an alginate factory destroying reef on the south side of the loch (Holt et al., 1998). Around 10 years after the discharge ceased, serpulid began to re-colonise the margins of the affected area (Moore et al. 2006). However, this is not full recovery and the timescales for this or recovery from other types of damage/disturbance are unknown. Further details are available in Mazik et al. (2015).

Reef: Horse mussel beds

To date, no studies have observed recovery of horse mussel beds, following either passive re-colonisation or active restoration after a disturbance. Several elements of the biology and ecology of the horse mussel (*Modiolus modiolus*) significantly reduce the ability of the species and the beds it forms to recover. *M. modiolus* is a relatively long-lived species taking 3-8 years to reach maturity (Holt et al., 1998), and their recruitment is sporadic with high variability between seasons, years and with location. Recruitment success is generally reported to be very low and is likely to be erratic, which is partly due to the length of time it takes juveniles to reach adulthood, during which time mortality can be very high, e.g. from predation. The development and recovery of horse mussels beds requires suitable depth, current flow and substrate (in particular larvae prefer to settle on adult shells) (Fariñas-Franco et al., 2014), as well as sufficient larvae and growth of juveniles/adults from within and outside the bed. Therefore, where environmental conditions change, adults are reduced in number and sources of larvae inside/outside the site are affected, this will negatively affect the ability of the horse mussel beds to recover. Further details are available in Mazik et al., (2015).

Reefs: Rocky reefs

If the physical habitat (bedrock/stony reef) remains and the environmental conditions are suitable (light, hydrography) then the ability of rocky reefs to recover largely depends on the

recruitment and growth rates of the typical species. For rocky reefs dominated by kelp communities, in both the more exposed and sheltered parts of the sound, these habitats have overall a moderate to high ability to recover from a range of pressures including changes to hydrology, increased eutrophication and abrasion. Whilst these pressures can cause a decline in typical species and overall species diversity, many of the species associated with these communities e.g. kelps, are known to be rapid colonizers and fast growing, although the re-establishment of a community containing the range of typical species may take several years. Reefs dominated by kelp communities are less able to recover in relation to increased sedimentation (siltation/smothering) as this reduces light penetration (and thus photosynthesis), thereby causing a decline in the kelp. It can also increase the number of filter feeding organisms which then compete with kelp for space. Recovery may take longer from such impacts.

For the more exposed rocky reef communities that are dominated by animal communities, including soft corals and sponges, brittle stars and hydroids the ability to recover is moderate-high for pressures such as changes to hydrology, increased eutrophication and abrasion. Common typical species, may be able recruit onto bare surfaces within 2 years, but it may take 5 years to become a dominant component of the community again. For more sheltered rocky reef communities with ascidians and hydroids the ability to recover is also moderate-high, as many ascidians and hydroids can recruit and grow quickly and therefore achieve significant coverage again within a couple of years.

Flame shell beds

Whilst studies on the recovery of flame shells (*Limaria hians*) are limited, there is some evidence that indicates that this species can recover following the removal of pressures, assuming suitable environmental conditions are present. Following contamination by TBT, Minchin (1995) indicated that recovery may take less than 10 years for recovery of the species and bed, although no information was available for the recovery of the associated bed communities. In contrast, Trigg and Moore (2009) indicated that following physical disturbance associated with scallop dredging, recovery may take over 100 years to achieve spatial coverage but the time for recovery of nest thickness is not known. Early evidence from Loch Carron suggests that beds can recovery within a couple of years if flame shells are not completely removed. The ability of flame shell beds to recover depends on the level and type of disturbance (with more extensive areas of damage taking longer to recover) and the density of remaining individuals and the fragmentation of the bed (higher remaining densities, lower levels of fragmentation are likely to recover more quickly). Within Loch Creran, flame shells are considered generally self-recruiting (Millar *et al*., 2019) meaning that the ability for beds to recover depends on local spawning and recruitment.

Quaternary of Scotland

The processes which formed the component elements of the Quaternary of Scotland geodiversity feature no longer exist and therefore the feature has no recovery potential.

Glossary for Conservation Objectives

Conservation Objective term	Definition
Distribution and diversity of typical species of the habitat	This should outline the typical species that are associated with the habitat. The typical species include those that are especially relevant to the habitat's definition, e.g. species that form the structure of a bivalve bed, or sea pens on burrowed mud. Viability of the typical species will be achieved if the structure and the function of the habitat is maintained/restored as appropriate. Therefore this Conservation Objective focuses on outlining their distribution within the site in relation to the habitat.
Extent and distribution	The "extent" of a habitat is the total area that it covers. This should also include consideration of the "distribution" i.e. how it is spread out within the site. A habitat could be continuous and contained within one area, dispersed in smaller patches over a wider area, or as a mosaic with other habitats. Indeed, it could also be a combination of these.
Favourable condition	This refers to the assessed condition of a feature through Site Condition Monitoring. Features considered to be in favourable condition for the purposes of these Conservation Objectives are those that have an assessed condition of either: • Favourable Maintained - the attribute targets set for the natural features have been met, and the natural feature is likely to be secure on the site under present conditions. • Favourable Recovered - the condition of the natural feature has recovered from a previous unfavourable condition, and attribute targets are now being met.
Favourable Conservation Status	This is a measure of the condition of habitats and species listed in Annex I or II of the Habitats Directive and is assessed across the UK. It is achieved when a habitat or species throughout the zone is maintained in size and range and the conditions for its long-term existence are in place. Habitats and species within Scottish SACs contribute to achieving favourable conservation status within the UK.
Function	This encompasses both the environmental processes on which the condition of each habitat depends and the key functions that each habitat provides to the wider site ecosystem. The text within the supplementary advice explains function in relation to both of these factors for the feature concerned where information is available.
Maintain	Where a qualifying feature of the SAC is assessed as being in favourable condition the conservation objective is 'maintain'. This means that the various attributes of the feature should be kept at that favourable level. This can include increasing/improving condition as well, but not a permanent decline.
Restore	Where a qualifying feature of the SAC is assessed as being in unfavourable condition the conservation objective is 'restore'. This means that the various attributes of the feature should be returned to the favourable level by increasing/improving condition.
Site integrity	The integrity of a site is defined in general terms as the coherence of its ecological structures and function, across its whole area, which enables it to sustain the habitat, complex of habitats and and/or the levels of populations of the species for which it was designated.

Conservation Objective term	Definition
Supporting environment	This includes the following environmental conditions (but is not limited to) which are important for maintaining/restoring the protected features, e.g. hydrography and supporting water currents, chemical water quality parameters, suspended sediment levels, radionuclide levels.
Structure	The structure of a habitat includes what the habitat is created from and what it requires to exist, e.g. habitat forming species, geological features or sediment; the depth of the substrate or thickness or height of the biogenic structures from the seabed; biogenic material forming the structure should still retain a live component where this exists at baseline.
Unfavourable condition	This refers to the assessed condition of a feature through Site Condition Monitoring. Features considered to be in unfavourable condition for the purposes of these Conservation Objectives are those that have an assessed condition of either: • Favourable declining - The attribute targets set for the natural feature have been met, but evidence suggests that its condition will worsen unless remedial action is taken. • Unfavourable recovering - One or more of the attribute targets have not been met on the site, but management measures are in place to improve the condition. • Unfavourable no change - One or more of the attribute targets have not been met, and recovery is unlikely under the present management and activity on the site. • Unfavourable declining - One or more of the attribute targets have not been met, evidence suggests that condition will worsen unless remedial action is taken.

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