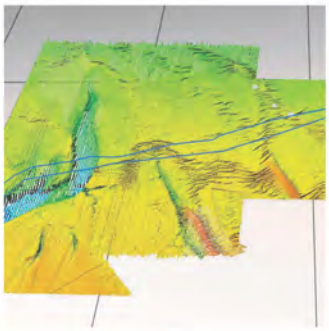
Marine Biopolymers Ltd

Wild Seaweed Harvesting

Scoping Report

July 2018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Source: Burrows *et al*, 2018

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Caroline Roberts	Elena San Martin	Stephen Hull
[Redacted]	[Redacted]	[Redacted]

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Contributing Authors

Jamie Oaten, Stephen Hull, Caroline Roberts, Tony Brooks, Elena San Martin, Monty Smedley

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ABPmer
Quayside Suite, Medina Chambers, Town Quay, Southampton, Hampshire SO14 2AQ
T: +44 (0) 2380 711844 W: http://www.abpmer.co.uk/

Contents

Appendix

Tables

Images

Figures

1 Introduction

1.1 Project background

This Scoping Report has been prepared on behalf of MBL, to inform the scope of an Environmental Report to accompany an application for one or more 5-year marine licences under the Marine (Scotland) Act 2010 to sustainably harvest wild kelp (*Laminaria hyperborea*) on the west coast of Scotland.

Scotland's Economic Strategy (Scottish Government, 2015), highlights the Scottish Government's commitment to the development of Scotland's marine resources for the country's sustainable economic benefit

One such marine resource is the abundant kelp beds around the islands and west of Scotland which, if sustainably harvested, has the potential to support an innovative marine biotechnology sector in Scotland (a priority sector under the EU Blue Growth Strategy), as well as employment and diversification opportunities for rural communities. Scotland is already a leading centre for marine biotechnology and development of this sector which is being supported the Highlands and Islands Enterprise (HIE).

Marine Biopolymers Ltd (MBL) is a Scottish owned and based company that has invested significant funding into developing a novel technology to produce high value products from seaweed for pharmaceutical and other markets. MBL has now attracted investment partners willing to fund the scaling-up of this technology into a commercial reality, through the development of a sustainable seaweed harvesting capability and processing plant in Scotland. Such an enterprise would create many employment and diversification opportunities in an economically challenged area.

Securing the investment to proceed with this new enterprise can only proceed in Scotland if an adequate supply of raw material can be assured. As such, in order to establish this business, MBL needs to obtain access to a sustainable supply of *L hyperborea*. This is an abundant kelp species in Scotland, with a resource estimated to be 19.7 million tonnes wet weight (Burrows *et al*., 2018). By year 5 of the licence(s), MBL will require harvests of approximately 30,000 tonnes wet weight of *L. hyperborea* per annum for a commercially viable operation. This amounts to approximately 0.15% of the estimated total standing biomass of this species in Scotland. As such, over 99% of Scotland's natural *L. hyperborea* resource would not be targeted for harvesting. Although, at-sea harvesting of *L. hyperborea* would be a new industry in Scotland, such harvesting has been carried out sustainably for many decades in Norway, France and Iceland.

The kelp would be harvested by specially designed harvesting vessels, using proven technology from Norway, and subsequently transported by boat to MBL's proposed processing plant at Mallaig. A separate planning application is being submitted to Highland Council for the construction and operation of this plant.

In anticipation of receiving marine licence applications for wild seaweed harvesting, Marine Scotland carried out a Strategic Environmental Assessment (SEA) of wild seaweed harvesting in Scottish waters in 2016 (Scottish Government *et al*., 2016). This SEA concluded that wild seaweed harvesting could be undertaken sustainably subject to the incorporation of mitigation measures and with appropriate monitoring to facilitate adaptive management.

Wild seaweed harvesting is not an activity that is subject to the requirements of the EC Environmental Impact Assessment Directive (2011/92/EU as amended) and therefore MBL is not required to submit a formal Environmental Statement with its marine licence application. However, MBL is committed to demonstrating high standards of environmental stewardship and will therefore provide a detailed Environmental Report alongside its marine licence application. This will:

- Provide a detailed description of the harvesting activity including embedded mitigation measures to avoid or reduce significant environmental effects;
- Assess the potential environmental effects of the proposed harvesting activities;
- Identify additional mitigation measures to avoid or reduce any significant environmental effects identified;
- Include a monitoring plan describing how the potential environmental effects of its operation will be monitored; and
- Incorporate an Adaptive Management Plan that will be used to adapt the harvesting activity in the light of monitoring data where necessary.

This Scoping Report describes MBL's seaweed harvesting proposals and sets out the proposed scope of the Environmental Report. It has been submitted to Marine Scotland Licencing Operations Team (MS-LOT) for its advice on the proposed scope of the Environmental Report.

1.2 Scoping methods

This scoping study sets out the environmental issues to be addressed within the Environmental Report that will be required to inform the licensing processes. These relevant issues have been identified from a range of existing and readily available sources of information describing the present (baseline) conditions and environmental value of the areas likely to be affected directly and indirectly by wild seaweed harvesting within the proposed harvesting areas.

The scoping study has also drawn upon information contained in the Wild Seaweed Harvesting SEA (Scottish Government *et al.*, 2016) and a recent report commissioned by Highlands & Islands Enterprise (HIE) which included advice on environmental information requirements for marine licence applications for wild seaweed harvesting as well as guidance on potential monitoring requirements (Burrows *et al*, 2018).

This Scoping Report will be used to inform MS-LOT's advice on the scope of the Environmental Report. The feedback regarding any additional issues or work requirements identified by key stakeholders and consultees will be addressed in the Environmental Report.

2 Project Description and Need

2.1 Project rationale

MBL is seeking to obtain one or more five-year marine licences to sustainably harvest *L. hyperborea* from a range of locations around the west coast of Scotland. By year 5 of the licence(s) MBL will require the capacity to harvest up to 30,000 tonnes wet weight per annum of *L. hyperborea*. This equates to approximately 0.15% of the estimated total standing biomass of this species in Scotland. Obtaining such licences is integral to establishing a natural products business with new technology for converting kelp into high value products for pharmaceutical and other markets. MBL's proposals represent a sustainable use of marine natural capital and ecosystem services.

To facilitate development and upscaling of the processing plant in Mallaig, the marine licences will need to provide for the following quantities (wet wt) of *L. hyperborea* over time (based on current projections of estimated demand or MBL products from its customers):

- Year 0 – 1,300 tonnes
- Year 1 – 5,700 tonnes;
- Year 2 – 11,400 tonnes;
- Year 3 – 18,700 tonnes;
- Year 4 – 25,000 tonnes;
- Year 5 – 29,800 tonnes;
- Year 6 – 33,800 tonnes.

MBL proposes to transport the harvested seaweed by boat to Mallaig for processing. MBL is submitting a planning application to the Highland Council for the construction and operation of the processing plant. The kelp will be harvested using specially adapted or (later) purpose built vessels. It is proposed that the vessels operate year-round to maintain a supply of kelp to the processing plant.

The plentiful supply of *L. hyperborea* around the Scottish coast has the potential to support a significant new industry in Scotland, with potential wider benefits to Scotland's coastal communities in terms of economic diversification.

The project is expected to create up to 32 full time equivalent jobs at the processing plant in Mallaig and around a further 10 full time equivalent jobs on the harvesting and transport vessels. In addition there will be many other jobs in local communities supported by this investment. There are also expected to be opportunities for local fishing vessels and Scottish marine research organisations to be involved in the proposed monitoring programmes.

2.2 Proposed approach to harvesting

2.2.1 Harvesting vessels

Harvesting will be undertaken using specially adapted or (later) purpose built vessels. Harvesting vessels may occasionally be used to transport kelp to Mallaig, particularly during the commission period. However, the plan is to use specialist transport vessels with kelp transferred from harvesting vessel to transport vessel in nets similar to long established practice in Iceland. It is anticipated that two harvesting vessels will be deployed year-round to maintain a supply of kelp to the processing plant. Vessels will be equipped with GPS technology to ensure accurate positioning during harvesting activities.

2.2.2 Harvesting equipment

The harvesting technique proposed by MBL is similar to that used in Norway for *L. hyperborea*. It comprises use of a comb-like harvesting head (3-4 m wide) that is situated within a curved frame (Image 2.2.1 and Image 2.2.2). It is deployed from a vessel, and trawled through the kelp bed at approximately 0.5 m above the rock substrate at a speed of around 3 knots. Trawls are made for approximately 2 minutes (covering a distance of around 200 m) before the head is recovered and the kelp removed. The distance between the tines (prongs) are designed to ensure that only kelp plants which have a diameter reached after 5 years of growth are targeted and removed.

The harvesting method typically removes entire kelp plants including holdfasts, although juvenile plants are largely left *in situ* to promote more rapid recovery (Image 2.2.3). Removal of whole plants creates bare rock for colonization by new kelp plants and can help to promote recovery of the kelp bed (Image 2.2.4).

Source: Steen, *et al,*-2014

Image 2.2.1 Rake used to harvest *L. hyperborea*

Source: Burrows *et al.* 2018a

Image 2.2.2 Norwegian kelp harvesting vessel

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Source: Steen *et al.*, 2012

Image 2.2.3 Freshly trawled track showing small juvenile kelp plants that are not removed by the harvesting comb with untouched mature plants on the right of the image

Source: Steen *et al.*, 2012

Image 2.2.4 Re-established kelp forest one year after harvesting; on the left is the original untouched forest

Using GPS technology, MBL will harvest within narrow harvesting strips (3-4 m wide) which will be separated from the next harvesting strip by broader unharvested (fallow) strips (typically 4-12 m wide). This will promote faster recolonization of harvested areas and therefore faster recovery times after harvesting. Harvesting strips will be orientated parallel to the shoreline. Each harvest regime will be defined within each harvest area following surveys conducted prior to harvesting.

Harvesting will not result in the complete removal of kelp from the substrata to leave bare rock, nor will it be an even strip. This is due to factors such as variable kelp density, orientation, and seabed topography. This causes the harvesting head to 'bounce' and miss areas of kelp. Furthermore, the harvesting head will be deployed and moved through the kelp bed at approximately 0.5 m above the seabed. This means juvenile *L. hyperborea* and shorter individuals will not be harvested. Evidence from harvesting *L. hyperborea* in Norway, using similar techniques as proposed here, suggests typical harvesting efficiencies of between 40% to 70%

2.2.3 Harvesting regime

MBL is conscious that kelp harvesting on this scale is a new activity in Scotland and that stakeholders will have understandable concerns about the potential environmental impacts of the activity and possible economic and social impacts on existing marine activities. MBL is committed to harvesting the kelp in a sustainable manner that avoids significant environmental effects. It is also committed to working with other marine users and local communities to avoid adverse economic or social impacts and, where possible, to deliver social and economic benefits.

A key means of avoiding significant effects is to obtain marine licences over a sufficiently large area of kelp resources that enables MBL to devise a harvesting plan that avoids sensitive locations and which requires only very low intensity harvesting of kelp across the licensed areas. This will be achieved as follows:

- The **licensed areas** will be divided into a number of **harvesting areas** – these will be geographically defined;
- Each **harvesting area** will be divided into five roughly equal **harvesting blocks;**
- Harvesting within a harvesting area will be limited to one of the five blocks in any given calendar year;
- No block will be re-harvested within a given time period. This may be around 5 years but could vary from location to location, dependent on rates of recovery;
- The proportion of a block over which harvesting occurs will typically not exceed 25% of the block; and
- Assuming 50-70% efficiency, the amount of kelp removed from any block in a calendar year will typically not exceed 15% of the estimated kelp biomass based on a survey undertaken prior to harvesting commencing.

MBL proposes that a key condition of its marine licence will be the production of one or more annual harvesting plans each year for agreement with MS-LOT. These harvesting plans will set out:

- Proposed harvesting plans for individual harvesting blocks for the forthcoming year based on prior survey;
- Identification of any exclusion areas within the harvesting blocks (to avoid sensitive ecological features or potential conflicts with other human activities); and
- Any seasonal restrictions to avoid disturbance to ecological features (e.g. breeding or moulting birds, seal haul outs or breeding colonies) or potential conflicts with other human activities.

MBL proposes to establish an adaptive management process for preparing its harvesting plans linked to a tailored monitoring programme (see Section 2.6). This is in line with the recommendations in Burrows *et al* (2018a). Under the adaptive management process, each year MBL will evaluate the accuracy of its planning process and develop confidence assumptions based on data collection during previous years i.e. monitoring data from previous years' surveys will be used to adapt harvesting plans for subsequent years. MBL proposes that the review of monitoring will be overseen by an Environmental Steering Group (ESG) comprising representatives from MS-LOT, SNH, SEPA, CES, relevant councils and MBL. Any recommendations from the ESG on changes to the harvesting regime will be incorporated into subsequent harvesting plans.

2.2.4 Harvest management

MBL's vessels/harvesting boats will be equipped to monitor all movements and coordinates of each harvested strip within each harvest block (similar to the electronic monitoring system (EMS) used in the marine aggregates industry). This will allow very precise targeting. Landed kelp weights will also be recorded as a means of quality control. All operations will be recorded and will be available for inspection by the statutory authorities.

The harvesting activity will target dense beds of *L. hypoborea* based on prior survey. These beds are effectively a monoculture. This will avoid any significant harvesting of non-target species. Any epiphytic material, for example, red algae, will initially be co-joined with the kelp bark for horticultural purposes. In the longer term, such epiphytic material will be incorporated into the biorefinery process.

It is estimated that the maximum weight of such epiphytic material will comprise 1.5% maximum of the harvested material.

2.2.5 Disposal of holdfasts

MBL intends to remove the holdfast of harvested kelp and dispose to sea within the harvest block they were taken from. Disposal to sea will facilitate the survival of invertebrates (see Section 4.4) and will return organic matter to the marine environment (see Section 4.3), which may provide a food source for various species. Holdfast disposal at sea is considered preferable to harvesting by cutting kelp and leaving the holdfast *in situ*. This is because any commercial scale underwater cutting mechanism will fail to discriminate between adult and juvenile individuals. Furthermore, leaving the holdfast attached to the rock substrate will inhibit new spores from settling and germinating, which may hinder kelp recovery.

Pending clarification from MS-LOT, it is understood that the disposal of kelp holdfasts may be a licensable activity which will also need to be included within the marine licence. If the disposal is confirmed as constituting a separate licensable activity, a Best Practicable Environmental Option (BPEO) assessment will be required to inform the decision on disposal.

2.3 Proposed harvesting areas

L. hyperborea occurs in fully marine conditions in shallow water depths, subject to a degree of wave exposure. To be suitable for commercial exploitation, *L. hyperborea* needs to be present at a density of at least 5kg/m^2. Such densities typically only occur close to shore in water depths <20m and on hard substrates (rock and boulder).

Based on the low intensity harvesting regime proposed above, in order to provide an eventual sustainable supply of 30,000 tonnes wet weight of *L. hyperborea* p.a., an initial **Area of Search** for potential harvesting areas has been defined (see Figure 2.3.1) based on the modelled distribution of *L. hyperborea* in Burrows *et al.* (2018) and taking account of potential key constraints, including:

- Kelp density (minimum predicted biomass of 5kg/m^2);
- Minimum size of harvestable areas (a minimum of 5 contiguous model cells (200m x 200m) with predicted biomass >5kg/m^2 based on Burrows *et al.* (2018a);
- Avoidance of Special Areas of Conservation (SACs) and Nature Conservation Marine Protected Areas (NCMPAs) containing protected kelp features;
- Avoidance of Burrows *et al.* (2018a) model grid cells containing sensitive Priority Marine Features (PMFs).

Based on these criteria, the Area of Search contains around 190 potential resource areas supporting an estimated *L. hyperborea* biomass of around 2 million tonnes (see Figure 2.3.2 to Figure 2.3.15 for maps of individual potential resource areas). These potential resource areas occupy a seabed area of around 300 km^2, although in any given year the area that would require harvesting to provide 30,000 tonnes wet wt would be around 20km^2, assuming an average kelp density in harvested areas of 10kg m^{-2}. To put this into context, such an area is equivalent to the footprint of seabed trawled by a single large scallop dredger over a period of around one month.

MBL proposes to further refine the harvesting areas to include within its marine licence application(s) through the environmental assessment process that will be undertaken in preparing the Environmental Report. This assessment process will enable MBL to take account of further site specific constraints for each potential resource area. Where potential resource areas have significant constraints they will either be partially or wholly removed from consideration as potential resource

areas. Based on the findings of the Environmental Report MBL will submit marine licence application(s) for a subset of the potential harvesting areas that are considered to pose the lowest level of constraint and thus are likely to be the most sustainable for long-term harvesting.

2.4 Consideration of alternatives

MBL has considered alternative options for wild harvesting on the west coast of Scotland. This has been based on a more intensive approach to harvesting *L. hyperborea*, practised in countries such as Norway, whereby the entirety of the resource in each harvesting block is harvested every 5 years. This approach was also endorsed by Burrows *et al* (2018). This approach would limit the Area of Search for harvesting areas to two areas around the Isle of Skye and Tiree (Figure 2.3.16).

2.5 Project mitigation measures

MBL is committed to sustainable harvesting of kelp resources. In particular, MBL proposes to adopt a low intensity harvesting regime as a primary measure to avoid significant effects on kelp beds and associated ecological receptors or social or economic interests. This will ensure that the maximum removal of kelp biomass within any harvesting block is limited to 15% of the standing biomass based on prior survey. This will represent less than 3% of the standing biomass within the marine licence area as a whole as harvesting excludes areas with low resource density (<5 kg/m^2) or small areas of higher resource density. No harvest block will be re-harvested for a period of around 5 years to allow for full recovery of the kelp resource.

MBL also proposes to exclude areas from harvesting that have particular sensitivities. These include:

- SACs and NCMPAs which are designated for kelp features. Within the marine licence application area this includes (Figure 2.3.17):
  - Loch nam Madadh SAC;
  - Lochs Duich, Long and Alsh Reefs SAC;
  - Sound of Barra SAC; and
  - Western Ross NCMPA.
- Sensitive PMFs that may be co-located with kelp beds, including:
  - Blue mussel beds (subtidal only);
  - Fan mussel aggregations Atrina fragilis;
  - Flame shell beds;
  - Horse mussel beds;
  - Maerl beds;
  - Maerl or coarse shell gravel with burrowing sea cucumbers;
  - Native oysters Ostrea edulis;
  - Northern sea fan and sponge communities;
  - Seagrass beds; and
  - Serpulid aggregations.
- Ecologically sensitive shorelines that may be susceptible to changes in local coastal processes (shorelines backed by machair or sand dunes);
- Infrastructure – no harvesting will take place within a specified distance of cables, jetties, flood & coastal defence structures or aquaculture installations;
- Coastline – no harvesting will take place within 50 m of the Mean High Water Mark (MHWM); and
- Locations of archaeological importance (shipwrecks, aircraft) – no harvesting will take place within a specified distance of locations of known archaeological importance.

MBL also proposes to adopt seasonal restrictions for areas that have seasonal ecological sensitivities or are subject to seasonal use by other marine activities. These include:

- Seal haul outs, breeding colonies;
- Bird breeding colonies and moulting sites; and
- Areas used for seasonal potting or diving for hand-collection of shellfish species.

MBL proposes that key mitigation measures are included as conditions within its marine licences. In addition, the harvesting plans as reviewed and agreed in advance with the ESG will include detailed mitigation requirements for each harvesting block which will take account of any additional survey or monitoring data and any recommendations from the ESG.

2.6 Marine monitoring

MBL is committed to establishing a robust monitoring programme to assess the sustainability of kelp harvesting. This monitoring programme will inform an Adaptive Management Plan that can be used to adjust future monitoring or harvesting activity should this be required. It is proposed that an ESG is established comprising MS-LOT, SNH, SEPA, CES, local councils and MBL. This ESG will be responsible for reviewing annual monitoring data and advising on any required changes to future years' monitoring activity or harvesting plans.

Burrows *et al.* (2018) identifies a number of techniques to be used for monitoring the impacts of kelp harvesting. MBL proposes the following requirements for monitoring and harvesting plans are attached as conditions to its marine licence:

- Kelp resource characterisation surveys for each harvesting block prior to harvesting occurring - MBL would propose to undertake these surveys in the spring of the year in which harvesting will occur using acoustic methods and drop-down camera/video surveys
- Ecological survey of each harvesting block prior to harvesting proceeding comprising:
    - Drop-down camera survey to identify kelp biotope and the possible presence of other PMFs; and
    - Additional baseline monitoring of representative harvesting areas to include grab sampling to collect kelp for age structure, holdfast and epiphyte analysis.
- Preparation of one or more harvesting plans (to be approved before harvesting commences) each year for harvesting blocks within which harvesting is to take place. These plans will take account of:
    - The location and density of kelp resource to seek to minimise the footprint of the harvested area;
    - Any exclusion areas identified on the basis of ecological surveys or other data sources;
    - Any seasonal restrictions to protect ecological features or avoid conflict with other marine users; and
    - Any recommendations from the ESG based on review of the previous year's monitoring.
- Requirement to inform mariners and fishermen of planned harvesting schedules.
- Annual post-harvest monitoring within representative harvesting blocks to monitor impacts and recovery. This monitoring would include:
    - Drop down camera/video survey to assess kelp recovery (density/size); and
    - Grab samples to assess holdfast and epiphyte communities.
- Submission of annual monitoring reports to MS-LOT for review by ESG.

Burrows *et al*. (2018a) recommend that monitoring methods should be developed through iterative discussion between the proposer, regulators and other stakeholders. The amounts of monitoring required will need be to be determined on a case by case basis, as some features may be particularly important at certain sites.

MBL accepts that robust environmental monitoring of representative harvesting areas is required in order to provide sufficient evidence on the environmental effects of its wild harvesting activity. MBL will agree with MS-LOT the locations at which such representative monitoring will be undertaken, taking account of the different characteristics of the harvesting areas (age and density of kelp, relative exposure etc.).

MBL proposes that the data collected as part of the monitoring programme is made publicly available subject to appropriate safeguards to protect MBL's commercial confidentiality. As more monitoring data is collected and more is known of the impacts of harvesting, the level of required monitoring will be better defined against the scale of operations. It is possible that the monitoring effort may be scaled up or down once more is known of the impacts of harvesting as part of the adaptive management process.

3 Legislative Framework and Requirement for Environmental Report

The wild seaweed harvesting will require a range of consents and approvals under different legislative acts, supported by detailed technical and environmental investigations to inform an Environmental Report, as well as appraisals in relation to the Habitats Regulations and Water Framework Directive (WFD). The principal consents are summarised in the following sections, although there is in addition a wide range of related environmental legislation with which the proposals will need to comply.

3.1 Seabed Ownership

The ownership of Scotland's territorial seabed, which extends out to 12 nm from the coast, is vested in the Crown in Scots law, and is managed by Crown Estate Scotland (Scottish Government, 2014). Crown Estate Scotland has a policy of retaining ownership and granting rights by lease or licence. Only in exceptional circumstances has Crown Estate Scotland sold portions of the seabed where permanent structures create liabilities or where third-party ownership already exists. These areas include some statutory harbour authorities or areas acquired for infrastructure development.

Permission of the relevant landowner is required for the harvesting of living or beach-cast seaweed in the wild (Sottish Government *et al*., 2016). Permission may also be required if the harvesting is to be undertaken in area managed for nature conservation, such as a Site of Special Scientific Interest (SSSI) or European designated sites (i.e. SACs or Special Areas of Protection (SPAs)), from the statutory nature conservation body (i.e. Scottish Natural Heritage; SNH).

Crown Estate Scotland can issue a licence for wild seaweed harvesting operations that collect seaweed for commercial reward (Scottish Government *et al*., 2016). They apply a proportionate approach to the information required from the operator, and can include the following:

- Stock biomass assessment;
- Sustainable harvesting strategy; and
- Monitoring strategy.

3.2 Marine Licence under the Marine (Scotland) Act 2010

Under the Marine (Scotland) Act 2010, Scottish Ministers are responsible for the marine licensing system and enforcement in the Scottish inshore region from 0-12 nautical miles (nm). The licensing regime allows regulation of the deposit and removal of substances and objects in the seas around Scotland. Activities must take place in accordance with licence conditions.

Under Section 21(1) Subsection 6 of the Marine (Scotland) Act 2010, Marine Scotland may regulate the use of "*a vehicle, vessel, aircraft, marine structure or floating container to remove any substance or object from the seabed*". In this case, seaweed is regarded as a 'substance or object'. A marine licence is therefore required for wild seaweed harvesting of the scale proposed by MBL.

Under Section 21(1) Subsection 1 a marine licence is also required '*to deposit any substance or object within the Scottish marine area, either in the sea or on or under the seabed, from a vehicle, vessel, aircraft or marine structure*..'. The proposed disposal of holdfasts will therefore also need to be

covered by the marine licence. A Best Practicable Environmental Option (BPEO) assessment will be prepared to inform the decision on disposal.

In considering the application, MS-LOT will act in accordance with UK Government and national policy statements and guidance, and with the principles of sustainable development, namely:

- Achieving a sustainable marine economy;
- Ensuring a strong, healthy and just society;
- Living within environmental limits;
- Promoting good governance; and
- Using sound science responsibly.

The UK Marine Policy Statement (Her Majesty's (HM) Government, 2011), contributes to the achievement of sustainable development in the UK marine area. It provides the framework for preparing Marine Plans and taking decisions affecting the marine environment, ensuring that marine resources are used in a sustainable way in line with the high level marine objectives and thereby:

- Promote sustainable economic development;
- Enable the UK's move towards a low-carbon economy, in order to mitigate the causes of climate change and ocean acidification and adapt to their effects;
- Ensure a sustainable marine environment which promotes healthy, functioning marine ecosystems and protects marine habitats, species and our heritage assets; and
- Contribute to the societal benefits of the marine area, including the sustainable use of marine resources to address local social and economic issues.

Scotland's National Marine Plan fulfils joint requirements under the Marine (Scotland) Act 2010 and Marine and Coastal Access Act 2009 to prepare marine plans, providing a cohesive approach to the management of both inshore and offshore waters in accordance with EU Directive 2014/89/EU on Maritime Spatial Planning (Scottish Government, 2014). It strives to promote development in a way that is compatible with the protection and enhancement of the marine environment (Scottish Government, 2014).

3.3 Environmental Impact Assessment

The Environmental Impact Assessment Directive (2011/92/EU) sets out the procedure that must be followed before approval is granted for a range of plans and projects, defined in Annexes I and II of the Directive. Annex I projects are considered to have significant effects on the environment and EIA is mandatory. The potential for significant effects on the environment as a result of Annex II projects, and thus whether an EIA is required, however, is at the discretion of the Competent Authority, in this case Marine Scotland, having regard to criteria set out in Annex III of the Directive.

Wild seaweed removal is not identified under either Annex I or Annex II of the Directive. Therefore, a formal EIA is not required. However, to inform its consideration of the marine licence application, MS-LOT will require MBL to provide information on the potential environmental effects of its proposed activities. This scoping report will inform MS-LOT's advice on the scope of the Environmental Report.

In order to promote stakeholder consultation, MBL also proposes to submit a voluntary pre-application consultation report consistent with the requirements of the Marine Licensing (Pre-application) Consultation (Scotland) Regulations 2013 (see Section 5).

3.4 Appropriate Assessment for Habitats Regulations Appraisal

Where a project, such as the proposed wild seaweed harvesting, is located close to, or within, an area designated or proposed under the Birds[1] and Habitats Directives[2] (European Sites) and/or the Ramsar Convention[3], the requirements of the Conservation (Natural Habitats, &c.) Regulations 1994 (the Habitats Regulations) apply. In essence, this requires the lead Competent Authority, in this case MS-LOT, to determine whether the proposed works are likely to have a significant effect on a European Site and, if so, to undertake an Appropriate Assessment (AA) of the implications of the proposals in light of the site's conservation objectives. The AA takes account of the in-combination effects of the proposal on the protected areas in association with other relevant projects and plans.

An AA signposting document will be included as an appendix in the Environmental Report.

3.5 Protected Habitats and Species

In July 2014, Scottish Ministers adopted a list of 81 priority marine features (PMFs). PMFs are species and habitats which have been identified as being of conservation importance to Scotland (SNH, 2018). Most are a subset of species and habitats identified on national, UK or international lists. The National Marine Plan includes a policy (GEN 9 Natural Heritage) for safeguarding PMFs whereby "Development and use of the marine environment must not result in significant impact on the national status of PMFs" (Scottish Government, 2015). Impacts of development and use on the national status of PMFs must be considered when decisions are being made, taking account of the advice of Statutory Advisors. Where planned developments or use have potential to impact PMFs, mitigation, including alternative locations, should be considered. Actions should also be taken to enhance the status of PMFs where appropriate.

Various species of marine animal are protected from being killed, injured or disturbed under provisions in the Habitats Regulations and Section 9(4) and Schedule 5 of the Wildlife and Countryside Act 1981 (as amended). These include cetaceans, turtles, basking sharks and otter. In particular, Section 39 of the Habitats Regulations makes it an offence to:

- Deliberately capture or kill a wild animal of a European protected species;
- Deliberately disturb such an animal;
- Deliberately take or destroy the eggs of such an animal; or
- Damage or destroy a breeding site or resting place of such an animal.

It is also an offence to keep, transport, sell or exchange, or offer for sale or exchange, any live or dead wild animal of a European protected species, or any part of, or anything derived from, such an animal.

Section 9(4) of the Wildlife and Countryside Act 1981 (as amended) makes it an offence to intentionally or recklessly disturb dolphins, whales or basking sharks subject to a defence that the act was the incidental result of a lawful operation and could not reasonably have been avoided.

1 Council Directive 79/409/EEC on the conservation of wild birds.
2 Council Directive 92/43/EEC on the conservation of natural habitats and wild fauna.
3 The Ramsar Convention on Wetlands - the Conservation on Wetlands of International Importance, especially on Waterfowl Habitat.

Marine Scotland has produced guidance on the protection of marine European protected species from injury and disturbance in Scottish inshore waters. It is specifically intended to help determine the likelihood of an offence being committed as result of an activity/project, if it can be avoided/minimised, and (where this cannot be avoided/minimised) whether the activity could go ahead under licence.

3.6 Water Framework Directive

The Water Framework Directive (WFD) (2000/60/EEC) establishes a framework for the management and protection of Europe's water resources. It is implemented in Scotland through the Water Environment Water Services (Scotland) Act 2003 (WEWS) and the Water Environment (Controlled Activities) (Scotland) Regulations 2011, more commonly known as the Controlled Activity Regulations (CAR). The overall objectives of the WFD as implemented by the Water Framework Regulations is to achieve 'good ecological and good chemical status' in all inland and coastal waters by 2015 (now working towards revised objectives for 2021) unless alternative objectives are set or there are grounds for time limited derogation. Where pressures preclude the achievement of good status (e.g. navigation, coastal defence) in heavily modified water bodies (HMWBs), the WFD provides that an alternative objective of "good ecological potential" is set. There is also a general "no deterioration" provision to prevent decline in status.

Although there is no need to obtain permission for the proposals under the WFD, the Environmental Report will need to determine the implications of proposals on relevant water bodies. A WFD compliance assessment is required for this application.

3.7 Nature Conservation Marine Protected Areas

The Marine (Scotland) Act 2010 provides for the designation of Nature Conservation Marine Protected Areas (NCMPAs) in Scottish inshore waters (within 12 nm of the territorial baseline) to protect features (habitats and species) considered to be of national importance. Seventeen nature conservation NCMPAs were designated in 2014 within Scottish inshore waters with a further site designated in 2017. Under Section 83 of the Act, when considering granting a marine licence, Marine Scotland has to take account of potential impacts to MPA features. The Environmental Report will provide information on the potential effects on NCMPAs.

3.8 Marine Strategy Framework Directive

The aim of the European Union (EU) Marine Strategy Framework Directive (MSFD) (2008/56/EC) is to protect more effectively the marine environment across Europe. It aims to achieve good environmental status of marine waters by 2020 and to protect the resource base upon which marine-related economic and social activities depend. The MSFD constitutes the vital environmental component of future maritime policy, designed to achieve the full economic potential of oceans and seas in harmony with the marine environment. It establishes European Marine Regions on the basis of geographical and environmental criteria. Each Member State is required to develop strategies for its marine waters.

A Statutory Instrument transposing the MSFD into UK law came into force on 15 July 2010, creating a clear legal framework to enable the MSFD to be implemented in the UK. In 2012, the UK produced Part One of the Marine Strategy, containing information on the first three elements of the MSFD. In 2014, Part Two which focuses on a co-ordinated monitoring programme for the ongoing assessment of Good Environmental Status (GES), was published. Part Three outlines a programme of measures that will contribute to the achievement and maintenance of GES, and was published in 2015.

The pressures exerted on the marine environment by wild seaweed harvesting will, therefore, be a small contribution in the context of UK Marine Regions and unlikely to be a significant issue. MSFD is a cyclical process, and updated assessments and Marine Strategy documents are anticipated in due course.

3.9 Marine Archaeology Legislation, Guidance and Protection

The key legislation, which relates specifically to the maritime historic environment in UK territorial waters, is the Protection of Wrecks Act 1973. Section 1 of the Protection of Wrecks Act 1973 enables the Secretary of State to protect specific wreck sites within UK territorial waters from unauthorised interference if they have been designated on the basis of their historic, archaeological or artistic importance.

The Protection of Military Remains Act 1986 makes it an offence to interfere with the wreckage of any crashed, sunken or stranded military aircraft or designated vessel without a valid License, irrespective of loss of life or whether the loss occurred during war or peacetime. All aircraft lost in military service are automatically designated as Protected Places under this legislation.

Historic Environment Scotland (HES), established through the Historic Environment Scotland Act 2014, is directly responsible for safeguarding the Scottish historic environment, including marine and coastal features. One mechanism whereby HES can provide protection to marine archaeological sites is through the designation of Historic Marine Protected Areas (HMPA). These areas are designated under the Marine (Scotland) Act 2010 for the purpose of preserving marine historic assets of national importance, including but not limited to significant historic shipwrecks, remains relating to important fleet anchorages, battle sites or navigational hazards (where multiple wrecks and other features exist) and submerged prehistoric landscapes (if structural or artefact-based evidence is identified on the seabed).

3.10 Regional and Local Planning

3.10.1 Flood Risk Management Plans

The Flood Risk Management (Scotland) Act 2009 introduces a more sustainable approach to flood risk management and creates a more coordinated approach to manage local national flood risk. This includes an assessment of flood risk and preparation of flood risk management plans. Licensing decisions should consider this in relation to potential impacts on the natural coastal protection afforded by seaweeds and seagrasses.

3.10.2 River Basin Management Plans

Programmes of measures under the WFD have been developed through a process of river basin management planning and are set out in a number of regionally based River Basin Management Plans (RBMPs). The WFD applies to surface waters out to one nautical mile seaward of the baseline for territorial waters and ground waters, divided into a number of discrete units termed 'water bodies'. The first cycle of RBMPs were implemented between 2009 and 2015. Updated RBMPs (second cycle) were published by the SEPA in late 2015 working towards revised objectives for 2027. There are two RBMPs in Scotland covering the Scotland River Basin District (RBD) and the Solway Tweed RBD. The marine licence application area lies wholly within the Scotland RBD.

3.10.3 Regional Marine Plans

The Scottish National Marine Plan included what should be considered when creating local, regional marine plans. Following a consultation period from 2012, eleven Scottish Marine Regions were created via the Scottish Marine Regions Order 2015, covering sea areas extending out to 12 nm. Regional Marine Plans will be developed in turn by Marine Planning Partnerships, allowing more local ownership and decision making about specific issues within their area. The Clyde and Shetland Isles will be the first regions to take forward regional marine planning. The marine licence application area encompasses parts of the West Highlands, Outer Hebrides and Argyll Marine Plan Regions.

4 Assessment Issues

4.1 Key issues to be considered

Based on the nature of the proposals for wild seaweed harvesting and existing knowledge of the baseline conditions within the study area, the following issues are considered to be potentially relevant to the Environmental Report:

- Physical processes (including coastline, hydrodynamic, seabed characteristics) (Section 4.2);
- Water and sediment quality (Section 4.3);
- Nature conservation and aquatic ecology (Section 4.4);
    - Nature conservation;
    - Benthic habitats and species;
    - Non-native species;
    - Fish and shellfish;
    - Marine mammals and turtles;
    - Ornithology; and
    - Coastal biotopes;
- Commercial and recreational fisheries (Section 4.5);
- Commercial and recreational navigation (Section 4.6);
- Marine archaeology and cultural heritage (Section 4.7);
- Coast protection and flood defence (Section 4.8);
- Air quality (including Greenhouse Gas (GHG) Emissions) (Section 4.9);
- Infrastructure and other marine users (Section 4.10);
- Human health (Section 4.11);
- Airborne noise and vibration (Section 4.12);
- Landscape/seascape (Section 4.13);
- Cumulative effects (Section 4.14).

The following sections provide a brief overview of the baseline environment for each of these topics (receptors) to determine the potential mechanisms by which sources of change are sufficient to cause an impact to a receptor, i.e. the establishment of an 'impact pathway'. A list of the remaining key issues to be addressed within the Environmental Report and specific studies and assessments that will be required is provided.

The impact pathways are considered against the following activities:

- **Harvesting using mechanical rake**: the use of a mechanical rake has the potential to damage habitats on the sea bed, as well as other features such as marine infrastructure or archaeological assets.
- **Removal of kelp resource**: the removal of kelp will cause the abundance and diversity of kelp forests to be reduced. It also has the potential to cause other secondary indirect effects such as increase wave exposure to coastlines during storms or the reduction of beach-cast material and its implications on traditional kelp foraging;
- **Disposal of holdfasts**: the disposal of holdfasts may increase beach-cast material causing visual and amenity issues on local beaches;
- **Vessel presence**: the presence of the vessel has the potential to displace other vessels and certain mobile fauna from the section of the harvesting area within which it is working and may also have such impacts during transit to and from the harvesting area. During the harvesting activity, the vessel remains active and, therefore, has associated potential noise, vibration and visual impacts. Spillages of fuel and oil are also possible during operation of vessels.

4.2 Physical processes

4.2.1 Description of the existing environment

The potential harvesting areas are all located in shallow water (<20m deep) adjacent to the coastline and are predominantly associated with hard geology (rock). Coastlines, adjacent to the potential harvesting areas are varied, ranging from rocky shores and cliffs through to boulders, shingle and sandy shores. The area of search for harvesting areas includes examples of non-tropical shelf carbonate systems around Tiree, Coll and Mull (there are also areas to the west of the Outer Hebrides that are outwith the Area of Search) (Figure 4.2.1). These areas contain carbonate rich sands derived from bivalve shells and maerl which are an important source of supply of carbonate rich sands to coastal machair. The machair supports specific grassland vegetation with a near unique ecosystem of high biodiversity and is recognized as having international natural heritage importance. The areas offshore of the machair are important as the past and present source of carbonate supply and, as such, these areas are considered to be critical to the functioning of the wider marine and coastal ecosystem.

There are a number of sources of general information on coastal geology, including BGS maps, the review of key geodiversity features in Scottish waters (Brooks *et al*., 2011), the coastal cells in Scotland series (Ramsey & Brampton, 2000) and a review of the beaches of Scotland (Ritchie & Mather, 1984). Google Earth also provides a good source of information on coastal geology.

Physical processes within the vicinity of the potential harvesting areas are principally dominated by waves. *L. hyperborea* occurs predominantly in semi-exposed shallow subtidal areas, subject to wave action. The wave climate in potential harvesting areas will vary depending on wind speed/direction and fetch. Figure 4.2.2 provides an overall indication of relative wave exposure of areas within the area of search, although this will vary significantly depending on local aspect.

4.2.2 Main assessment issues

Wild seaweed harvesting has the potential to affect physical processes through the following impact pathways:

- Reduction in wave dampening effect provided by kelp forests and increased wave exposure; however, it is likely that any possible effect from this will be much less than natural processes;
- Reduction in beach-cast seaweeds which may help stabilise local sediments and dune habitats through release of nutrients; and
- Reduction in flow attenuation resulting in increased scour/sediment transport.

Wild seaweed harvesting has the potential to indirectly change marine hydrodynamic processes including currents and waves (Scottish Government *et al*., 2016). The most important factors that drive these changes are the total volume of material removed and resulting change in kelp density. It is important to note that the extent of kelp beds will not be affected by proposed harvesting. The proposed strip harvesting regime and efficiencies associated with the harvesting method represent a low intensity method. This means that kelp removal in one harvesting block will not exceed 15% of the estimated biomass in one calendar year, representing less than 3% of the kelp resource in the entire harvesting area. This is a relatively minor change in kelp density, and it is unlikely that any significant changes in wave attenuation will be realised. Furthermore, changes in kelp bed density due to harvesting are likely to be much smaller than the natural variation of kelp density associated with storms and other natural events. It is estimated that on average approximately 34% of kelp biomass is removed from beds each year (Burrows *et al*, 2014a; MacLeod *et al*, 2014) and during large storms entire beds can be removed (Byrnes *et al*., 2011). Similarly, changes to flow attenuation and the

amount of beach-cast material are likely to be modest and to have relatively minor effects on sediment transport and stabilisation.

In addition, the proposed 5-year harvesting cycle and allowance for juvenile and shorter individuals to remain *in situ,* will allow kelp density to recover rapidly. This would allow for restoration of kelp density and the resumption of pre-harvest physical conditions prior to re-harvesting.

In order to seek to prevent and reduce potential physical processes impacts, mitigation will be embedded in the harvesting plans (Section 2.5). Specifically, this includes arranging harvesting strips broadly parallel to the shoreline to prevent wave projection being funnelled along harvested strips to the coastline.

Given the potential for kelp removal to affect existing physical processes, the effects to physical process are **scoped in** for further assessment.

4.2.3 Further work required for Environmental Report

In preparing the Environmental Report, further information will be collected on the coastal geology of proposed harvesting areas, including from the Beaches of Scotland Report (Ritchie & Mather, 1984)), the Coastal Cells of Scotland series (Ramsey & Brampton, 2000) and Google Earth.

A desk-based assessment of the potential for harvesting of *L. hyperborea* to cause changes in local coastal processes will be carried out, taking account of likely worst case changes in wave energy reaching the shore. Consideration will also be given to the potential for changes in sediment transport and coastal morphology taking account of local sediment types. This assessment will help to inform an assessment of potential indirect impacts to other receptors including:

- Increase in the vulnerability of kelp beds to storm damage;
- The vulnerability of coastal terrestrial habitats including machair, sand dunes, shingle and vegetated shingle associated with changes in sediment transport/morphology;
- Impacts to cultural heritage features;
- Impacts to coast defences and flood protection structures; and
- Impacts to other coastal infrastructure.

Where potential concerns are identified in relation to physical processes changes, it may be possible to exclude these areas from harvesting or to reduce harvesting intensity to a level that does not pose a risk of significant change to coastal processes.

4.3 Water and sediment quality

4.3.1 Description of the existing environment

Water quality standards are regulated at EU level through the WFD (2000/60/EC), the Priority Substances Directive (2008/105/EC, 2013/39/EU), the revised Bathing Water Directive (2006/113/EC) and the MSFD (2008/56/EC). The WFD provides for holistic management of all water bodies including rivers, estuaries, groundwater, lakes and coastal waters to 1 nm from territorial baselines. In Scotland, it is applied out to 3nm from the territorial baseline. The WFD integrates and requires protection of designated shellfish waters, through the Water Environment (Water Framework Directive) (England and Wales) (Amendment) Regulations 2016; bathing waters, through the Bathing Water Directive (2006/7/EC) (BWD); nature conservation sites, through the Habitats and Birds Directives (92/43/EEC, 2009/147/EC); and eutrophication, through the Nitrates Directive (91/676/EC).

Scottish Environment Protection Agency (SEPA) published River Basin Management Plan (RBMPs), which set out measures through which compliance with WFD objectives will be achieved. The Scotland RBMP identifies 122 surface waterbodies within the Area of Search[4]. Approximately 56% achieve 'good' overall status, and 44% achieve high overall status (Figure 4.3.1). No waterbodies achieve 'moderate' overall status or less. Chemical status of all waterbodies in the Area of Search is assessed as 'Pass' (Figure 4.3.2). Ecological status is reviewed further in Section 4.5. Groundwater is not considered further as it will not be affected by wild seaweed harvesting.

Gairloch Beach and Sand Beach bathing waters, located in the northern portion of the Area of Search in Western Ross in the northwest Highlands, are assessed as having excellent bathing water quality in 2017[5] (Figure 4.3.3). Within the Area of Search there are 28 designated shellfish water protected areas (Figure 4.3.3), 17 of which are 'not at target objective':

- SWPA53: Loch Scridain (not at target objective);
- SWPA58: Loch Spelve (at target objective);
- SWPA20: Isle of Ulva, Mull (Loch Tuath) (at target objective);
- SWPA27: Loch a Chumhainn (at target objective);
- SWPA77: Tobermory (not at target objective);
- SWPA1: Ardtoe and Loch Ceann Traigh (not at target objective);
- SWPA50: Loch Moidart, South Channel (not at target objective);
- SWPA28: Loch Ailort (not at target objective);
- SWPA30: Loch Beag (at target objective);
- SWPA2: Arisaig (not at target objective);
- SWPA51: Loch Nevis (not at target objective);
- SWPA34: Loch Eishort (at target objective);
- SWPA55: Loch Slapin (at target objective);
- SWPA29: Loch Ainort (at target objective);
- SWPA56: Loch Sligachan (at target objective);
- SWPA42: Loch Harport (not at target objective);
- SWPA31: Loch Caroy (not at target objective);
- SWPA57: Loch Snizort (not at target objective);
- SWPA44: Loch Kishorn (not at target objective);
- SWPA78: Upper Loch Torridon (not at target objective);
- SWPA38: Loch Ewe (at target objective);
- SWPA26: Little Loch Broom (not at target objective);
- SWPA7: Cais - bhaigh, Enard Bay (not at target objective);
- SWPA46: Loch Leurbost (not at target objective);
- SWPA36: Loch Erisort (not at target objective);
- SWPA54: Loch Seaforth (at target objective);
- SWPA14: East Loch Tarbert (at target objective);
- SWPA59: Loch Stockinish (not at target objective);

Water quality in Scotland is generally very good, and there are a few reported pressures on water quality in the inshore regions of the western Highlands and the Hebrides. However, harmful phytoplankton blooms were recorded in the Minch Sea (northern portion of Area of Search) in 2009, resulting in Diarrhetic Shellfish Poisoning (DSP) and Paralytic Shellfish Poisoning (PSP) in the Minch Sea resulting in shellfishery closures (Baxter *et al*., 2011).

[4] https://www.sepa.org.uk/data-visualisation/water-classification-hub/
[5] https://www.sepa.org.uk/data-visualisation/water-classification-hub/

4.3.2 Main assessment issues

Wild seaweed harvesting has the potential to affect water and sediment quality conditions through the following impact pathways:

- Water quality impacts from pollutants resulting from accidents, incidents or spillages;
- Potential changes to suspended sediment concentrations;
- Reduction in species abundance and diversity and consequences for biological quality elements and water quality status under WFD; and
- Disposal of holdfasts.

Up to three vessels will be used to collect and transport kelp within the harvest area. Each will be in a seaworthy condition and comply with vessel safety regulations. As such, risks to water quality as a result of accidental spillages of fuel or oil and deemed unlikely, but are **scoped in** for further assessment. Any other impacts associated with commercial and recreational navigation are considered in Section 4.6.

Kelp species secure themselves to substrate consisting of rock or cobble, and do not tend to colonise softer sediments. Dense areas of kelp likely to be suitable for harvesting only occur on hard substrates. Therefore, removal of kelp during harvesting is unlikely to disturb sediments, and any changes in water quality associated with suspended sediment concentrations (and potential sediment-bound contaminants) but are **scoped in** for further assessment.

WFD waterbody status is measured for a variety of quality elements, and combined to give and overall ecological and chemical classification. Assessment of the condition of macroalgae is required under the WFD (Annex V; 200/60/EC). Macroalgae composition, cover, abundance and disturbance-sensitive taxa are measured to derive a classification (WFD-UKTAG, 2014). Given the low intensity harvesting regime, changes to the density of kelp beds within the harvest area will be relatively minor (removal of <3% of resource within a harvesting area annually), and the extent of kelp habitats will not be altered. Furthermore, the adoption of a harvesting cycle, the low intensity strip harvesting regime and targeting mature kelp will facilitate rapid kelp recovery. Therefore, changes to harvested areas will be temporary. As such, a deterioration of the macroalgae quality element classification under the WFD is unlikely. This is considered further in Section 4.4.

Holdfast disposal at sea will return organic matter to the marine environment. Following decay of holdfasts, this has the potential to stimulate bacterial production, cause eutrophication through mineralisation of nutrients, cause organic enrichment by stimulation of detritivore production, increase oxygen demand, and contribute turbidity to the water column (UK MPA Centre, 2001). However, this is an autochthonous source or organic matter (originating from marine environment), and therefore does not represent an introduction of material above natural concentrations. Holdfasts will degrade naturally, in a similar way to that observed naturally in kelp beds following natural die back or removal following storms. Therefore, significant effects to water quality due to holdfast disposal are unlikely, but are **scoped in** for further assessment.

4.3.3 Further work required for Environmental Report

A separate WFD compliance assessment will be produced and included as an appendix to the Environmental Report. This will be undertaken following guidance provided by the Environment Agency - Clearing the Waters for All (unless newer guidance provided by SEPA is available at the time of writing).

4.4 Nature conservation and ecology

4.4.1 Description of the existing environment

Nature conservation

Within the Area of Search there are 30 SACs (including 3 candidate SACs/Sites of Conservation Interest (SCIs); Figure 4.4.1), 16 Special Protection Areas (SPAs; Figure 4.4.2), 73 Sites of Special Scientific Interest (SSSIs; Figure 4.4.3), and 9 NCMPAs (Figure 4.4.4). Appendix A provides details of the designations.

Benthic habitats and species

Kelp biotopes

Burrows *et al*. (2018) provides a modelled distribution of *L. hyopoborea* (Figure 4.4.5).

There are a number of specific kelp biotopes that are prevalent in Scotland. These occur on infralittoral rock, mostly in high and moderate energy environments. Some also occur in low energy infralittoral rock though are likely to be in smaller and less dense aggregations of kelp, and will therefore not be targeted by harvesting. The different kelp biotopes are described below and their mapped distribution (largely based on historic MNCR surveys) is shown in Figure 4.4.6[6].

Kelp with cushion fauna and/or foliose red seaweeds (IR.HIR.KFaR) comprise rocky habitats subject to exposed to extremely exposed wave action and strong tidal streams. A community of *L. hyperborea* is common with foliose seaweeds and animals. In some areas, there may be a band off dense foliose red or brown seaweeds below the kelp zone. The sublittoral fringe is characterised by dabberlocks *Alaria esculenta* whilst *L. hyperborea* dominates the infralittoral zone. Animals tend to be more prominent in areas with the strongest water movement. Further biotopes and sub-biotopes within IR.HIR.KFaR that occur in Scotland and are characterised by *L. hyperborea* include:

- *Laminaria hyperborea* forest with a faunal cushion (sponges and polyclinids) and foliose red seaweeds on very exposed upper infralittoral rock (IR.HIR.KFaR.LhypFa) – kelps are heavily epiphytised with foliose red algae such as *Delesseria sanguinea, Cryptopleura ramosa* or *Plocamium cartilagineum*. Other red seaweeds also found on the stipes or rock below can either be mono-specific or show considerable variation within a dense mixed turf. The faunal and floral understory is rich and typically includes soft coral *Alcyonium digitatum*, anthozoans *Sagartia elegans* and *Corynactis viridis*, sponges (forming a prominent part of the community) *Halichondria* panicea and *Pachymatisma johnstonia*, crab *Cancer pagurus,* starfish *Asterias rubens,* sea urchins *Echinus esculentus* and *Urticina feline*, hydroids, ascidians, and bryozoans.
- *Laminaria hyperborea* with dense foliose red seaweeds on exposed infralittoral rock (IR.HIR.KFaR.LhypR) – the fauna of these biotopes is markedly less abundant than areas of greater wave surge (L.hypFa above). Various sub-biotopes in Scotland include *L. hyperborea* forest on upper infralittoral rock (IR.HIR.KFaR.LhypR.Ft) and *L. hyperborea* park on upper infralittoral rock (IR.HIR.KFaR.LhypR.Pk).
- *Laminaria hyperborea* and red seaweeds on exposed vertical rock (IR.HIR.KFaR.LhypRVt) – vertical rock communities with *L. hyperborea* and its commonly associated red seaweeds. The jewel anemone *Corynactis viridis* is frequently found in dense aggregations. A variant of this biotope is characterised by frequent *Metridium senile* and occasional *Sagartia elegans* can be found on the west coast of Scotland.

[6] Note only biotopes with available datasets on EMODnet are mapped, and distribution may be underrepresented where Marine Nature Conservation Review surveys have not been specifically undertaken.

Kelp and red seaweeds (moderate energy infralittoral rock) (IR.MIR.KR) comprises stable bounders/bedrock subject to moderate wave exposure and tidal streams. There is typically a narrow band of kelp *L. digitata* in the sublittoral fringe which lies above a *L. hyperborea* forest and park. There is a greater variety of more delicate filamentous types of red algae than found on more exposed coasts (KFaR above), though the faunal component of the understorey is less prominent than in KFaR. Further biotopes and sub-biotopes within IR.MIR.KR that occur in Scotland and are characterised by *L. hyperborea* include:

- *Laminaria hyperborea* on tide-swept, infralittoral rock (IR.MIR.KR.LhypT) – moderately wave exposed, tide-swept bedrock and boulders with *L. hyperborea*, characterised by a rich under-storey and stipe flora of foliose seaweeds including the brown seaweed *Dictyota dichotoma*. The kelp stipes support epiphytes such as *Cryptopleura ramosa* and *Phycodrys rubens* or are heavily encrusted by the ascidian *Botryllus schlosseri*. Hydroids and bryozoans can grow on kelp stipes. Other epilithic species include crustose seaweeds, sponge, anthazoans, ascidians, tube worms, barnacles, gastropods, crab, and echinoderms.
- *Laminaria hyperborea* on tide-swept infralittoral mixed substrata (IR.MIR.KR.LhypTX) – similar to IR.MIR.KR.LhypT (above) with mixed substrata and other kelp species such as *L. saccharina,* sometimes in more sheltered environments.
- *Laminaria hyperborea* and foliose red seaweeds on moderately exposed infralittoral rock (IR.MIR.KR.Lhyp) – moderately exposed characterised by a canopy of the kelp *L. hyperborea* beneath which is an under-storey of foliose red seaweeds and coralline crusts. Five variants exist: kelp forest (Lhyp.Ft), kelp park (Lhyp.Pk), kelp with *Sabellaria spinulosa* reefs (Lhyp.Sab), grazed kelp forest (Lhyp.GzFt), grazed kelp park (Lhyp.GzPk). The latter two sub-biotopes are heavily grazed by the urchin *Echinus esculentus* in some areas, and occur in shallower and deeper water respectively. Therefore, rock surfaces lack any significant turf of foliose seaweeds and look bare, though can be covered in algal crusts and keel worm *Spirobranchus triqueter*. In the most extremely grazed areas, remaining kelp stipes are also devoid of epiphytic seaweeds, but more usually offer a refuge from grazing. Fauna is also generally sparser in these biotopes.
- *Laminaria hyperborea* on moderately exposed vertical rock (IR.MIR.KR.LhypVt) – found on moderately exposed coasts in moderately strong to weak tidal streams. It is characterised by *L. hyperborea*, the soft coral *Alcyonium digitatum* and crinoid *Antedon bifida*. This biotope is relatively species poor when compared to similar biotopes in more exposed environments (e.g. LhypRVt).

Silted kelp communities (sheltered infralittoral rock) (IR.LIR.K) comprises infralittoral rock in wave and tide-sheltered conditions with *L. hyperborea* and/or *L. saccharina* (though the former tends to occur in greater abundance). Associated seaweeds are typically silt-tolerant and include a high proportion of delicate filamentous types. Some areas are subject to intense grazing by urchins and chitons and may have poorly developed seaweed communities. Further biotopes and sub-biotopes within IR.IR.LIR.K that occur in Scotland and are characterised by *L. hyperborea* include:

- Mixed *Laminaria hyperborea* and *Laminaria saccharina* on sheltered infralittoral rock (IR.LIR.K.LhypLsac) – typically subject to weak tidal streams and silty conditions and found in sea lochs in Scotland. The faunal component is generally similar but less diverse than the more exposed kelp forests, dominated by the echinoderms *Echinus esculentus* and *Asterias rubens*, but other species (e.g. gastropods, crab, red algae species) are nevertheless common.
- Silted cape-form *Laminaria hyperborea* on very sheltered infralittoral rock (IR.LIR.K.LhypCape) – cape-form of *L. hyperborea* on very silted rock in extremely sheltered sea lochs of western Scotland. Below the huge kelp fronds (which often trail onto the seabed) are typical species associated with kelp such as foliose seaweeds, red filamentous seaweeds, ascidians, echinoderms, gastropods, hydroids, bryozoans, anthozoans (particularly in holdfasts), crab and tube building polychaete *Pomatoceros triqueter*.

Other biotopes in Scotland that contain *L. hyperborea* but not in dense aggregations/are not wholly dominant, or comprise primarily other kelp species include (and are therefore will not be targeted by wild seaweed harvesting):

- Sediment-affected or disturbed kelp and seaweed communities (IR.HIR.KSed) – the typical *L. hyperborea* and red seaweed communities of stable open coast rocky habitats (IR.MIR.KR) are replaced by those, which include more ephemeral species or those tolerant of sand and gravel abrasion (e.g. *L. saccharina*, *Saccorhiza polyschides* or *Halidrys siliquosa*) due to mobile substratum (boulders and cobbles).
- Kelp and seaweed communities in tide-swept sheltered conditions (IR.MIR.KT) – sheltered infralittoral rock exposed to strong tidal streams. Below the sublittoral fringe where dense *L. digitata* is found, bedrock and stable boulders supports a canopy of mixed kelp (primarily *L. hyperborea* and *L. saccharina*) with foliose red seaweeds, sponges and ascidians (XKT). This biotope is typically found in the sheltered narrows and sills of Scottish sealochs. Mixed substrata supports a reduced kelp canopy with a rich red seaweed component and maerl at some sites (XKTX).

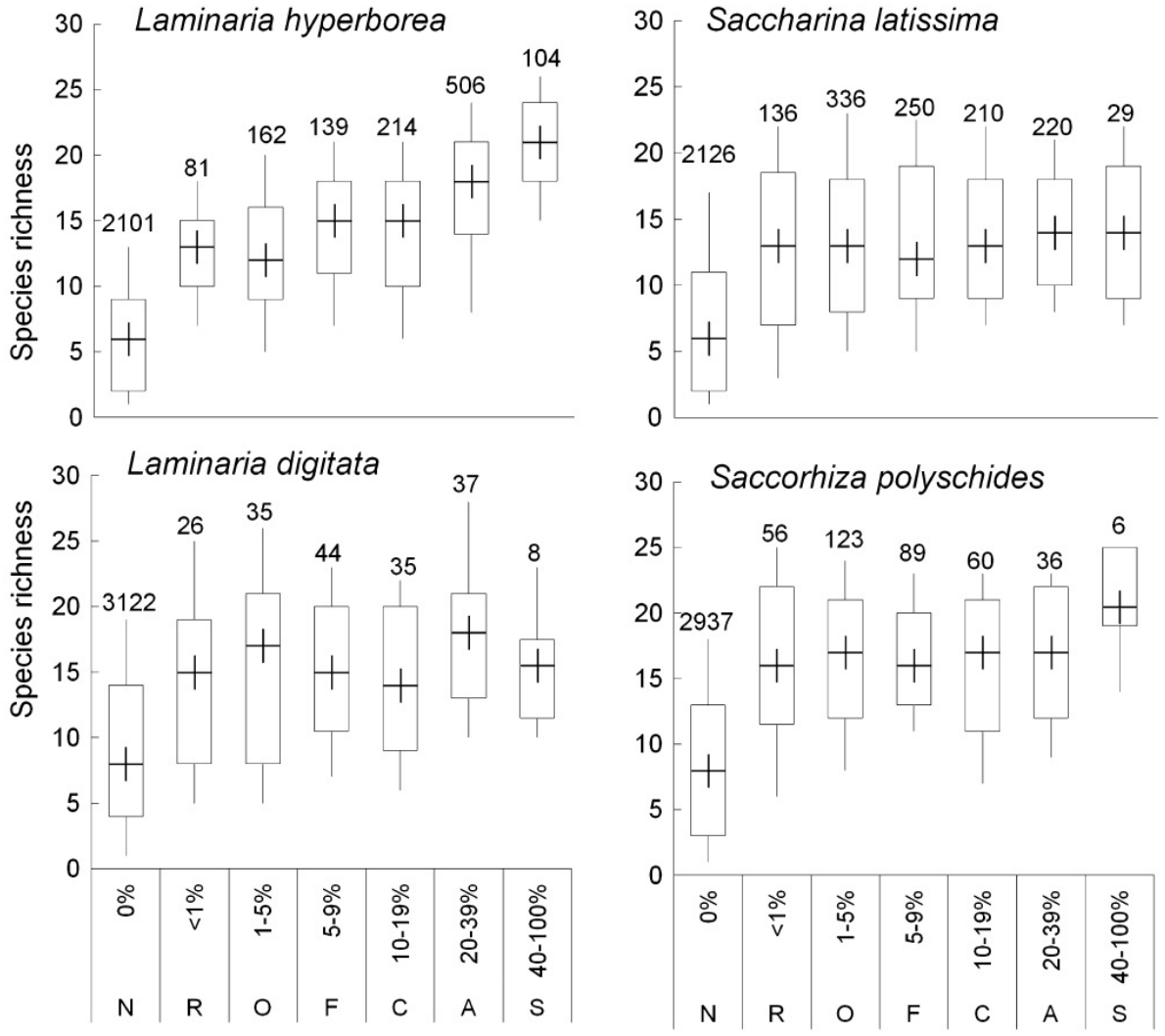
Kelp ecology

Broadly, kelp species have two predominant life stages, known as a heteromorphic life cycle: a macroscopic, asexual, diploid sporophyte phase (the visible plant); and a microscopic, sexual, haploid gametophyte phase (Hurd *et al.*, 2014; Burrows *et al.*, 2018). Diploid sporophytes produce haploid zoospores (males and female) from their blades which settle on the seabed and germinate into gametophytes. Gametophytes then produce sperm and eggs and fertilisation occurs to create a diploid zygote which develops into a sporophyte. The general reproductive period for *L. hyperborea* is September/October to April (Kain, 2009). Kelp spores remain in the water column for approximately 24 hours, and the dispersal is thought to be distances of at least 200 m from the sporophyte depending on release depth and local hydrographic conditions (Fredriksen *et al.*, 1995).

Kelps such as *L. hyperborea* contribute high levels of primary production to the marine ecosystem. Production rates have been found to vary widely between kelp species and depth, with *L. hyperborea* achieving a production rate of 1.3 kg C/m^2/yr at its most favourable depth in south-west England (Bellamy *et al.*, 1968; Whittick, 1969), with much of this production entering the carbon cycle as detritus or dissolved organic matter (Burrows *et al.*, 2014b). However, other estimates suggest annual growth as low as 0.4 kg C/m^2/yr for *L. hyperborea* (Kain and Jones, 1977). The main growth phase of *L. hyperborea* occur from early spring to summer, and decreases from late summer through autumn to winter (Burrow *et al.*, 2018). This species is perennial and sheds its blades in spring; it takes 5 to 10 months to regenerate blades (Sottish Government *et al.*, 2016). Kelp physiology consists of the holdfast which anchors individuals to the seabed (it is not involved in nutrient uptake), the stipe (similar to the stem in terrestrial plants), and the lamina (or blades). The major zone of growth is the meristem which is located between the stipe and lamina where new tissue is continuously produced (Kain and Jones, 1963). Growth also occurs at the lamina contributing to blade width and thickness (Kain and Jones, 1976).

Kelps tend to occur from extreme mean low water springs (MLWS) down to the limit of photic depth (up to 30 m in clear waters; Smale *et al.* 2013). They support biodiversity and biomass due to their complex habitat structure (Bodkin, 1988; Duggins *et al.*, 1989; Jackson *et al.*, 2001), and higher levels of biodiversity are observed in kelp beds than other areas (Image 4.4.1; Smale *et al.* 2013). Epiphytic and epizoic organisms may colonise various areas on the holdfast, stipe and fronds of seaweeds (Jones *et al.*, 2000). The holdfasts of larger kelp species are capable of supporting a very large number of species and diverse range of assemblages (Edwards, 1980; Christie *et al.*, 2003; Blight & Thompson, 2008; Burrows *et al.*, 2014a). In Norway, it was found on average that a single kelp plant supports

approximately 40 macroinvertebrate species represented by almost 8,000 individuals (Christie, *et al.*, 2003; Burrows *et al.*, 2014a). The majority of the fauna include invertebrates such as gastropods (such as the blue-rayed limpet *Patella pellucida*), crustaceans and echinoderms (Burrows *et al.*, 2014a). It is also noted that with increased age, the holdfast habitat volume and diversity increases (Wilkinson, 1995; Christie, *et al.*, 2003). In addition, by altering environmental factors, such as light and water movement, kelp forests are able to provide indirect habitat for understory organisms in the sheltered water column and the rock surface between holdfasts (Sjøtun *et al.*, 2006), and for infaunal species found within the sediment (Unsworth and Cullen-Unsworth, 2015).



Source: Smale *et al.* (2013)

Image 4.4.1 Kelp species abundance using the SACFOR scale (Super-abundant, Abundant, Common, Frequent, Occasional, Rare) and local species richness.

Kelp may be grazed by sea urchins reducing plant density (grazed *Laminaria hyperborea* park with coralline crusts on lower infralittoral rock). Norderhaug & Christie (2009) reviewed grazing of kelp by urchins. While grazing was reported to occur throughout the NE Atlantic region, only one instance of widespread grazing impact was recorded where kelp forests along the Norwegian and Russian coast were grazed by sea urchins during the early 1970s. While the particular species of sea urchin involved (*Strongylocentrotus droebachiensis* is found in Scottish waters, no significant grazing events have been observed there.

Other marine habitats and features

Other marine habitats and PMFs may be adjacent to kelp biotopes on both hard, soft, and mixed substrata (Figure 4.4.7). However, these are unlikely to be within dense kelp forests where wild seaweed harvesting will take place. Sensitive PMFs are listed in Section 2.5, for which management measures are being considered for their protection by Scottish Government, and their distribution within the Area of Search is shown in Figure 4.4.8. NCMPAs are also designated to protect PMFs (Figure 4.4.4; Appendix A). A description of PMFs is provided by Tyler-Walters *et al*. (2016) and are summarised below.

Maerl is a type of calcium-encrusted red alga comprising several species that accumulate subtidally as dense beds of calcareous material (Scottish Government *et al.*, 2016). The species found in Scotland are *Lithothamnion glaciale* and *Phymatolithon calcareum*. Both living and dead mearl provide important benthic substratum for a diverse range of species facilitated by the cicurlation of water through its structure. Typical organisms include red seaweeds, sea firs, sea urchins, brittlestars, starfish, sea anemones and scallops. In the west of Scotland, maerl is found within sea lochs and inlets on the mainland such as the Sound of Arisaig and Loch Laxford and areas such as Loch nam Madadh and the Sound of Barra in the Outer Hebrides (Scottish Government *et al.*, 2016; Figure 4.4.8).

A similar PMF to maerl beds consists of maerl or coarse shell gravel with burrowing sea cucumbers, specifically gravel sea cucumber *Neopentadactyla mixta*. Inhabiting species include scallops, brittlestars, crabs and dragonets on the surface of the sediment with widespread species such as tube dwelling sea anemones, sand mason worms and parchment worms living within the coarse substrates. These are found primarily along the west coast of Scotland and the Outer Hebrides (Figure 4.4.8.

Blue mussel *Mytilus edulis* beds or reefs comprise a single or multi-layered framework of individuals secured by byssus thread. They provide a habitat for a diverse community of species such as amphipods and polychaetes living within the sediment, and crabs, sea anenomes, whelks and starfish amongst the mussel bed. They also stabilise sediment, cycle nutrients and provide a food source for wildfowl and seabirds. Subtidal biotopes may be located close to kelp biotopes, and are generally scattered around the Scottish coast particularly at the mouth of sea lochs (Figure 4.4.8).

Flame shell *Limaria hians* creates nests formed of byssus threads and surrounding material such as seaweed, maerl and shell. Carpets of flame shell beds can form over several hectares. These stabilise sediments and provide an attachment surface for organisms such as hydroids, bryozoans, ascidians, and seaweeds. This in turn provides complexity and shelter for other species such as cod and saithe. These are found on the west coast of Scotland, with an extensive flame shell bed in Loch Sunart and Loch Alsh within the Area of Search (Figure 4.4.8).

Horse mussel *Modiolus modiolus* occurs in scattered clumps, thin layers or dense raised beds, which can extend up to several hectares in size. A matrix of byssus threads, silt, organically rich faeces and shells accumulate within the structure and raise the bed height. Horse mussel beds modify sedimentary habitats and provide hard substratum and refuge for organisms. They may also provide settling grounds for commercially important bivalves such as queen scallops *Aequipecten opercularis*. They are present down the west coast of Scotland, in sea lochs, and with scattered records from the Outer Hebrides (Figure 4.4.8).

Dense beds of native oyster *Ostrea edulis* (>5/m^2) provide habitat for a community that live on, amongst, or in the substratum beneath the bed. Dead oyster shells also provide a hard surface for ascidians, sponges, hydroids and algae. Polychaete worms, predatory fish, starfish and crabs are also common in native oyster beds. Native oyster beds are only known in Loch Scridain in the Area of Search but low population densities are present fringing sea lochs along the west coast (Figure 4.4.8).

Northern sea fan and sponge communities consists of aggregations northern sea fan *Swiftia pallida* and the cup coral *Caryophyllia smithii* on upper and vertical surfaces of bedrock and boulders. With increasing water depth (35-120m+), and in areas of low tidal flow, erect branching sponges replace sea fans as the most striking component of the habitat. Rock is colonised by sea firs, soft corals (e.g. dead man's fingers) and large ascidians, with crevices providing shelter for sea cucumbers, squat lobsters and wrasse. In silty conditions sea fans, cup corals, and red sea fingers are more common. In slightly more tide-swept areas less sea firs and sponges are present but biological diversity appears to increase; *S. pallida* can host the nationally rare sea fan anemone *Amphianthus dohrnii*. This PMF is present off the west coast of Scotland and the Inner and Outer Hebrides (Figure 4.4.8).

Seagrass beds are flowering marine plants in shallow sandy or muddy coastal areas present all around Scotland; notable beds are recorded in the Area of search in the Sounds of Barra and Harris in the Outer Hebrides (Figure 4.4.8). Two species form the two main biotopes: eelgrass (*Zostera* spp.) and tasselweed *Ruppia maritima*. The habitat provides nursery habitat for a range of species including commercial important fish species. It also stabilises sediment.

Serpulid aggregations form dense clumps or reefs of chalky tubes containing *Serpula vermicularis* worm. They can be 1 m in height and 2 m wide despite tubes being 5 mm wide and 15 mm long by forming in layers anchored to pebbles, shells or stones in muddy environments. Serpulid aggregations provide solid substrata in an otherwise sedimentary area which is advantageous for ascidians, sponges, sea firs and seaweeds grow on the tubes, while fish, crabs, shrimp, squat lobster, brittlestars, starfish, worms and snails find refuge in the calcareous tube network. These habitats to occur in Loch Creran, and Argyll and Loch Teacuis (an arm of Loch Sunart), Morvern (Figure 4.4.8).

Fan mussels *Atrina fragilis* are one of the UK's most threatened molluscs species. Fan mussels are infuanal species that bury their pointed end (umbo) in the sediment with the broad end (ventral) protruding from the surface and attach by byssal threads. They can occur in clusters or aggregations but are often solitary. Found on the west coast of Scotland, and the Minches; densest known aggregation of fan mussels in UK waters was recorded off Canna in 2009 (Figure 4.4.8).

Non-native species

All WFD waterbodies within the Area of Search have no recorded pressures regarding invasive non-native species (INNS), and all achieve good (or better) ecological status. However, a number of marine INNS are now widespread in Scotland, as summarised by SNH (2017b). These include:

- Green sea-fingers *Codium fragile subsp. tomentosoides*
- Red alga *Heterosiphonia japonica*
- Acorn barnacle *Austrominius modestus*
- Japanese skeleton shrimp *Caprella mutica*
- Leathery sea squirt *Styela clava*
- Japanese wireweed *Sargassum muticum*
- Common cordgrass *Spartina anglica*

Carpet sea squirt *Didemnum vexillum* and Pacific oyster *Crassostrea gigas* are found only in isolated locations in Scotland. Slipper limpet *Crepidula fornicata* and Chinese mitten crab *Eriocheir sinensis* are present in the rest of the UK but are yet to reach Scottish waters; their distribution may expand northwards into Scotland.

Fish and shellfish

European protected fish species (listed under Annex IV of the Habitats Directive and Schedule 2 of the Habitats Regulations) in Scotland include the sturgeon *Acipenser sturio* but this is a rare visitor to Scottish waters. Basking shark is protected under Schedule 5 of the Wildlife and Countryside Act 1981 meaning they are protected from killing, injury and reckless disturbance and harassment, and allis shad and twaite shad receive partial protection under Schedule 5 regulating how they can be killed or taken. Allis shad and twaite shad are also listed under Schedule 3 of the Habitats Regulations (and Annex V of the Habitats Directive) meaning they cannot be taken or killed or certain ways. Other Scottish sea fish species that are afforded protection as species of conservation importance include skates, European eel, and sea lamprey (Ellis *et al*., 2012).

Basking shark occur throughout the Sea of Hebrides pMPA (see Figure 4.4.4), particularly around Coll, Tiree, Skerryvore and Hyskier (Scottish MPA Project, 2014b; Figure 4.4.9). Witt *et al*. (2014) showed that tagged basking sharks displayed a degree of site fidelity during months of July, August and September between 2012 and 2014. Sharks migrated south during winter as far as the Canary Islands.

Scottish inshore waters are used as nursery grounds by several finfish species, such as tope *Galeorhinus galeus*, spurdog *Squalus acanthias*, common skate *Dipturus batis*, thornback ray *Raja clavata*, spotted ray *Raja montagui*, herring *Clupea harengus*, cod *Gadus morhua*, whiting *Merlangius merlangus*, blue whiting *Micromesistius poutassou*, ling *Molva molva,* hake *Merluccius merluccius*, angler fish *Lophius piscatorius*, plaice *Pleuronectes platessa*, sandeel *Ammodytes* sp., and mackerel *Scomber scombrus*. The latter two species are also thought to spawn in Scotland (Ellis *et al*., 2012). Herring also have recognised spawning ground on the west coast of Scotland around Tiree and Coll and the Isle of Lewis and Harris (Figure 4.4.10). Fish sensitivity maps identify the probability of the presence of high abundance for 0-group fish (fish in the first year of life) which give a broad indication of the distribution of nursery areas, though these can be limited by information gaps for inshore areas on the west coast of Scotland (Figure 4.4.11).

ICES gave advice in 2012 on coastal habitat use by commercial fish species and identified kelp to provide: nursery habitat for eel, cod, pollack, and saithe; a feeding area for eel, cod, and sea trout; and a migration route for salmon (Seitz *et al*., 2014). Juanes (2007) found that the mortality risk of cod is lower in more complex habitat structures provided by kelp forests and seagrass beds than in simple ones. It appears that the complexity of the habitat become less important to individual survival in older life stages (Seitz *et al*., 2014). Kelp forests are also feeding grounds for fish species such as ballan wrasse *Labrus bergylta* and Goldsinny wrasse *Ctenolabrus rupestris*, which prey on kelp associated invertebrates (Norderhaug *et al*. 2005), as well as attracting commercially important species (Smale *et al*. 2013).

Drifting macroalgae detached from kelp beds may also be important for juvenile fish providing shelter from predators (Orr, 2013). A number of commercially important benthic fish species, such as European plaice *Pleuronectes platessa* and dab *Limanda limanda* use beaches on the west coast of Scotland as nursery grounds (Gibson *et al*., 1993). This was exemplified in Western Australia where the abundance of juvenile fish in the surf-zone was positively related to the volume of drifting macroalgae (Orr, 2013 and references cited therein). Therefore, drifting macroalgae may be important for the survival of juvenile fish in nursery areas in Scotland where there are greater abundances of prey and enhanced habitat complexity (Orr, 2013).

Shellfish species in Scotland include nephrops *Nephrops norvegicus*, European lobster *Homarus gammarus*, brown crab *Cancer pagurus*, velvet swimming crab *Necora puber* and scallops *Pecten maximus*. Shellfish distribution is highly dependent on sediment type, and therefore distribution tends to be patchy and discrete due the complex distribution of habitats and sediment types (Marine

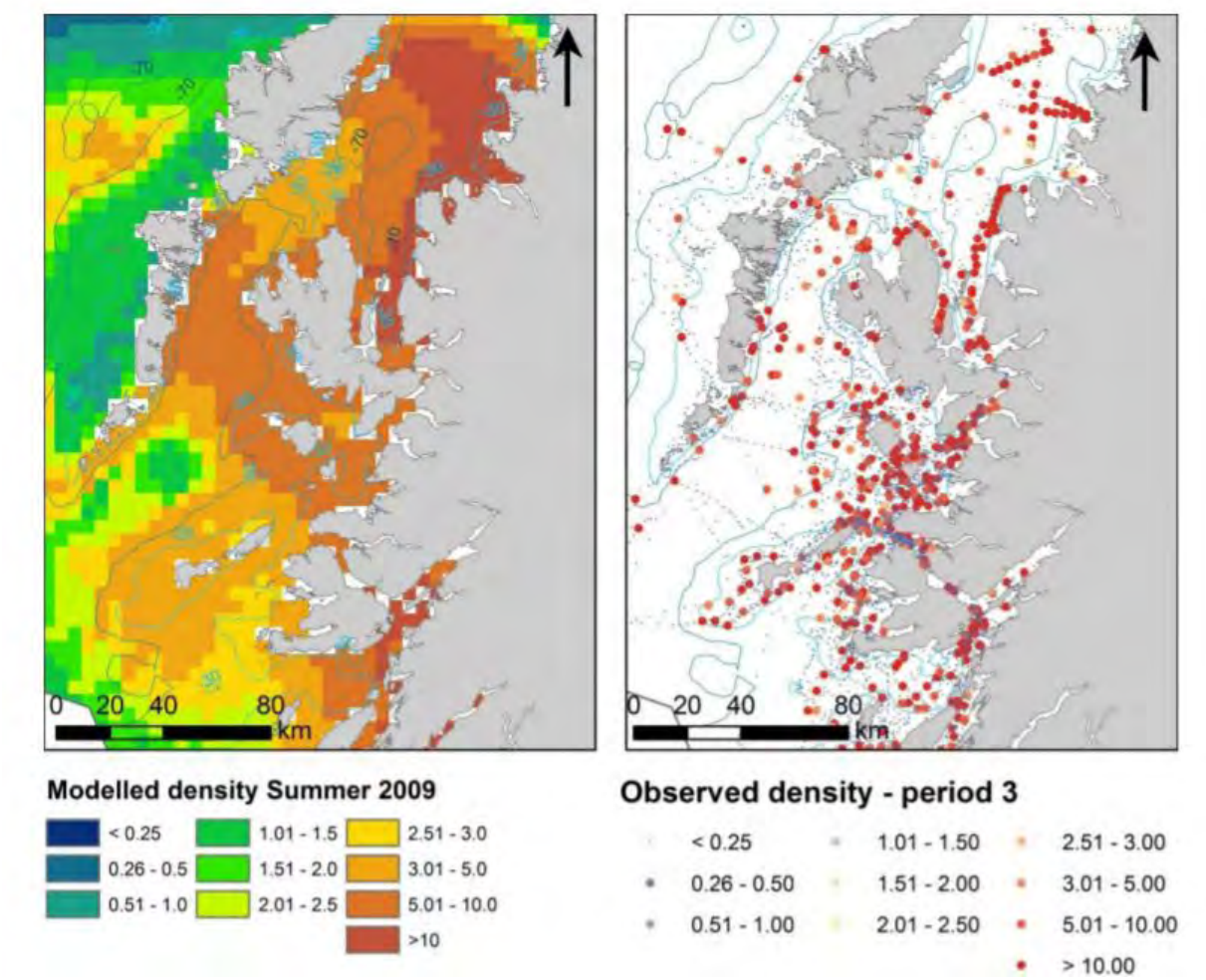
Scotland, 2013). European lobster *Homarus gammarus* and brown crab *Cancer pagurus* are known to inhabit kelp forests (Smale *et al*., 2013). Juvenile lobster and crab abundance has also been shown to be positively associated with kelp habitats (May, 2015). However, their use of kelp beds as nursery habitats is still relatively unknown (Scottish Government *et al.*, 2016), and there is evidence to suggest juvenile lobsters prefer coarse substrate (gravel) with suitable crevices or burrow in mud (Howard and Bennet, 1979; Seitz *et al*., 2014). There is evidence that some crab species actively settle in macroalgae as well as mussel beds, rocky shores, and seagrass beds (Moksnes, 2002), and that nursery habitats may vary depending on local biotic and abiotic factors (Heraghty, 2013).

Marine mammals and turtles

All species of dolphin, porpoise and whale are European protected species (Annex IV of Habitats Directive and Schedule 2 of Habitats Regulations). Bottlenose dolphin and harbour porpoise are also listed under Annex II of the Habitats Directive. Over 25 cetacean species are known to occur in Scottish waters, however resident or regular seasonal visitors include harbour porpoise *Phocoena phocoena*, Risso's dolphin *Grampus griseus*, shortbeaked common dolphin *Delphinus delphis*, bottlenose dolphin *Tursiops truncates*, orca *Orcinus orca*, minke whale *Balaenoptera acutorostrata* and white-beaked dolphins *Lagenorhynchus albirostris* (Scottish Government *et al.*, 2016).

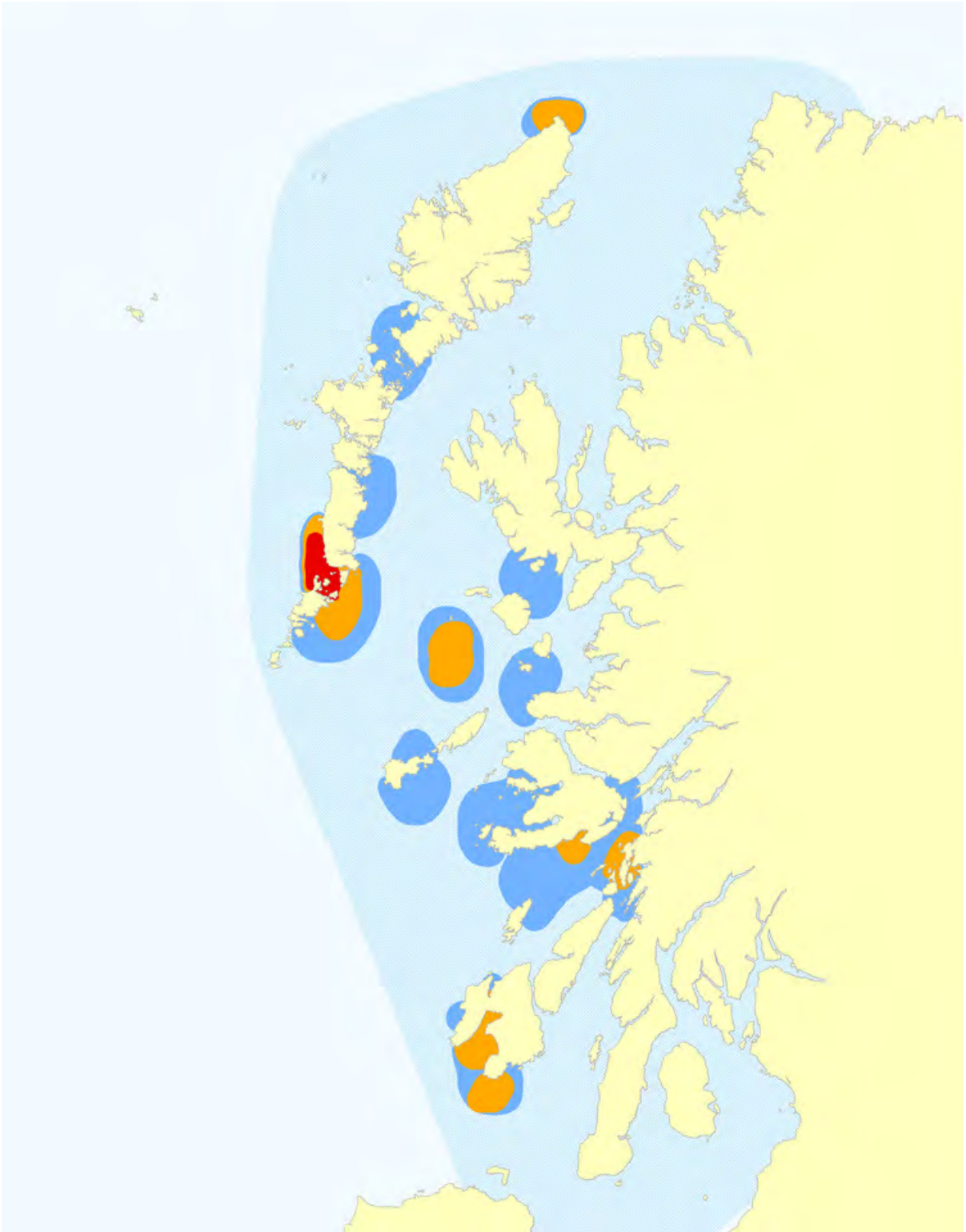
Harbour porpoise is the most abundant cetacean in UK waters (Clark et al. 2010). A population of 12,076 and density if 0.394 is estimated for the Minches and western Scotland (SCANS-II survey in 2005; SCANS-II, 2008). The Inner Hebrides and The Minches cSAC (Figure 4.4.1) is an important area for harbour porpoise, and follows the coastline of the Outer Hebrides across to Coll and Tiree and down to Islay. It encompasses a large proportion of the Area of Search. Within this environment there is a wide variety of fish associated with a range of seabed substrates providing a productive foraging area for harbour porpoise supporting them in high densities (Marine Scotland Science et al., 2016). The site supports approximately 31.4% of the harbour porpoise population present within the UK's part of the West Scotland management unit in depths of less than 200 m (Marine Scotland Science et al., 2016). The site incorporates the top 10% of persistent high-density areas identified for the West Scotland management unit (Heinanen and Skov, 2015), and the top 20% of densities derived from Booth et al. (2013). The predicted and observed densities of harbour porpoise within the Area of search is shown in Image 4.4.2.

Photo identification studies indicate around 200 to 300 individual bottlenose dolphin occur regularly in Scottish coastal waters. Bottlenose dolphin are present in small numbers off the coast of the Inner Hebrides, and is a separate management unit (coastal west Scotland and the Hebrides). A population of 45 bottlenose dolphins are estimated for the west coast of Scotland (Cheney et al., 2013). Estimates an order of magnitude higher have been estimated for offshore bottlenose dolphins from wide-scale surveys such as SCANS-II and CODA. On the west coast, there are two small and socially segregated communities of coastal dolphins, one of which includes approximately 15 individuals that have only been recorded in the waters around the Sound of Barra whereas the other of 25 individuals ranges more widely throughout the Inner Hebrides and mainland coasts (Thompson et al. 2011). Bottlenose dolphin also occur frequently within the Area of Search, and hotspots are shown off the west coast of Scotland in Image 4.4.3. Photo-identification data and genetic studies indicate that coastal bottlenose dolphins can make long-distance movements between the east and west coast of Scotland (Cheney et al. 2013). Robinson et al. (2009) recorded the first evidence for translocational movements of animals between the Moray Firth and the Inner Hebrides of the west coast of Scotland.



Source: Heinanen and Skov (2015)

Image 4.4.2 **High density (number/km^2) areas of harbour porpoise during summer in NW Scottish Waters MU showing predicted and observed densities. Observed densities are indicated by dots using the same colour range as used for the predicted densities**



Source: Hebridean Whale and Dolphin Trust (https://hwdt.org/bottlenose-dolphin/)

Image 4.4.3 Hotspots for bottlenose dolphin

Above average densities of Risso's dolphin are recorded within the North-east Lewis pMPA (Figure 4.4.4; Paxton *et al.*, 2014). The southern extent of this pMPA overlaps with the north east portion of the Area of Search but is located offshore of potential kelp harvesting areas. The highest number of encounters are recorded around the Eye peninsula on the Isle of Lewis (Figure 4.4.12). Repeated sightings of individual Risso's dolphin within the area suggest resident populations are present (Scottish MPA Project, 2014a).

Minke whale occur throughout the Sea of Hebrides pMPA (see Figure 4.4.4), recorded most frequently in the north-west along the coast of the Outer Hebrides and the Small Isles, within the Area of Search (Scottish MPA Project, 2014b). Minke whale is more frequently recorded in the summer months in Scottish waters (partly due to both survey effort and seasonal distributions).

Grey seal *Halichoerus grypus* and harbour seal *Phoca vitulina* are UK native species. About 38% of the world's population of grey seal is found in Britain with over 88% of the British grey seals breeding in Scotland with the main concentrations in the Outer Hebrides and in Orkney (SCOS, 2017). Both UK species are listed under Annex II and V of the Habitats Directive and therefore their populations should be monitored and maintained at a favourable conservation status. However, they are not listed under Annex IV, meaning killing and capture is allowed under strict conditions. Seals feed on fish species such as wrasse that occur in kelp forests (Tollit *et al.*, 1998; Wilkinson & Wood, 2003). Seal haul-out sites and breeding colonies within the Area of Search are shown in Figure 4.4.13. Haul-out sites are fairly evenly distributed throughout the Inner Hebrides, with congregations on the Isle of Mull, Coll and Tiree, Rum, Canna, and the Isle of Skye. There are also a number of haul out sites on the Outer Hebrides, but most tend to be located outside of the Area of Search. Breeding colonies are located on Soa Island, Coll, Glas-laec Beag, Trodday, Mingulay, Berneray, Pabbay, and Sandray. Recording of grey seal and harbour seal are prevalent throughout the Area of Search (Figure 4.4.14).

Otter *lutra lutra* are a European protected species (Annex IV of habitats Directive and Schedule 2 of Habitats Regulations). Coastal otters are widely distributed within the Area of Search and utilise the productive inshore waters where kelp habitats are present as they support high levels of fish and crustacean prey species (SNH, 2015). The foraging range of otters is considered to be 4 to 5 km (SNH, 2015), and most otters forage in water depths of less than 10m. Otter have been recorded throughout the west coast of Scotland and the Inner and Outer Hebrides (Figure 4.4.15).

Ornithology

Scotland supports a wide variety of seabirds; many areas are designated for supporting bird features throughout the Area of Search (Figure 4.4.16; Appendix A). This includes many areas that are important as breeding colonies for seabirds (Figure 4.4.17). The Shiant Isles, Rum, and Mingulay and Berneray are located in the Area of Search and are all breeding colonies that support in excess of 100,000 breeding seabirds each year (Scottish Government *et al.*, 2016). During the breeding season, the Shiant Isles supports 65,200 pairs of puffins (10% of the UK breeding population), 18,380 guillemots, 10,950 razorbills (7% of UK breeding population), 1,780 pairs of shags and thousands of pairs of kittiwakes and fulmars (RSPB, 2018b). Of the 332,000 pairs of Manx shearwater breeding in Britain, 82% were on Rum (and three adjacent islands of south west Wales) (Mitchell *et al.*, 2004). The islands of Mingulay and Berneray, located at the southern end of the Outer Hebrides (at the southern extent of the Area of Search), support 110,000 individuals of seabirds during the breeding season. This includes puffin, guillemot, kittiwake, shag, fulmar, and razorbill.

Seaweed habitats provide a food resource and foraging habitat for birds due to the high abundance of prey and biodiversity. Diving seabirds and sea ducks feed within kelp forests (Kelly, 2005). It has been shown in Norway that Common Eiders selected kelp forest as foraging grounds throughout winter (Scottish Government *et al.*, 2016. Black Guillemots also feed on fish (e.g. butterfish) in kelp

habitats (SNH, pers. comm.). There is also a possibility that other bird species that are not known to feed directly in kelp forests, prey on species that inhabit kelp forests such as fish and crustaceans.

Invertebrates within beach-cast seaweed also provide an important food source for migratory shorebirds and breeding waders in the summer (Orr, 2013). Some coastal habitats such as shingle, sand dunes and machair can also be important for breeding birds.

Coastal biotopes

Coastal and supralittoral habitats that are located within or on the immediately adjacent land to the Area of Search include sandy beaches, vegetated shingle, sand dunes, rocky shores, mudflats, sandflats, saltmarsh, machair, and grassland (Figure 4.4.18).

Along rock coastlines many subtidal kelp forests will be bordered by intertidal rocky shore biotopes. These are generally dominated by intertidal wracks (or fucoids). These biotopes are particularly abundant in Western Scotland and the Inner and Outer Hebrides (Scottish Government *et al.*, 2016). Invertebrate species that are typically associated with intertidal rocky shores include barnacles, gastropods such as littorinids, bivalves such as mussels, encrusting bryozoans, sponges, echinoderms, and crustaceans.

Sand dune habitats are thought to be stabilised by beach-cast seaweeds, particularly in the Uists (Orr, 2013). Beach-cast seaweeds provide nutrients to dune plants, which promotes their growth and survival, and thereby reduces aeolian (windblown) transport of sand (Scottish Government *et al.*, 2016). This encourages the retention of sediment and limits the erosion of sand dunes.

Machair is a coastal grassland habitat that is unique to Scotland, usually fronted by coastal sand dunes and backed by marsh and lochs. It is predominant on the Uists, Tiree and Barra (SNH, 2017a). Its formation is described in Section 4.2. As well as being formed by calcium rich sand being blown on to acidic soil, it is also heavily influenced by land management practices among traditional crofting and farming communities (RSPB, 2018a). This includes extensive grazing, low intensity crop rotation (RSPB, 2018a) and spreading beach-cast seaweeds as fertiliser (see Section 4.8). The habitat supports an array of wild flowers and associated invertebrates such as the yellow bumblebee *Bombus distinguendus* (SNH, 2017a). Wading bird species such as Dunlin and Ringed Plover also use the habitat, as do other Annex I migratory birds species (e.g. Corncrake *Crex crex*, Chough *Pyrrhocorax pyrrhocorax*).

The biotope talitrids on the upper shore and strand-line (LS.LSa.St.Tal) is formed by beach-cast seaweeds and debris washing up on predominantly sandy shores, though they can occur on any sediment. The biotope is common on many beaches around the UK. The decomposition of seaweeds supports a community of talitrid amphipods by providing humidity and cover.

Mudflats, sandflats, and saltmarsh tend to be present in sheltered environments with low wave exposure. As such, areas of dense kelp that will be targeted for harvesting are unlikely to be directly adjacent to these habitats.

4.4.2 Main assessment issues

Wild seaweed harvesting within the licence application area has the potential to affect marine ecological receptors through a number of key pathways. These are identified for each receptor below. The potential impacts upon designated nature conservation interest features will be assessed in the appropriate receptor group sections.

There is also the potential for impacts to occur through the cumulative effects from other activities within the proposed licence area. These effects are addressed under the relevant sub-headings below.

Benthic ecology

The main potential impacts comprise:

- Direct reduction in kelp biomass and primary production and increased susceptibility to storm damage;
- Reduction of habitat/shelter for range of plants and animals;
- Loss of direct and indirect food sources;
- Alterations in ecological functioning (e.g. changes in species communities);
- Change in climax community following harvesting;
- Impacts to PMFs; and
- Establishment of non-native species.

Diverse and abundant populations of benthic invertebrates and plants are present within kelp habitat. There is potential for these to be affected through the pathways mentioned above. For example, species which feed directly off kelp, such as sea urchins may be diminished by wild seaweed harvesting, as well as detrital feeders. Species which rely on *L. hyperborea* as habitat will also be affected by harvesting, such as the blue-rayed limpet *Patella pellucida*, various epiphytes, and holdfast communities (Jones *et al.*, 2000). In addition to providing direct habitat and food sources, kelp habitats provide indirect habitats by altering conditions understory in the water column, rock surface, or within nearby sediment and harvesting may affect dependant species. Reduction in invertebrate species which rely on kelp as a food source or as habitat may have implications for species at higher trophic levels.

It is important to ensure harvesting of climax seaweeds (*L. hyperborea*) does not tip the community to a less ecological valuable climax community (Scottish Government *et al.*, 2016). It is considered that this is relatively unlikely due to the proposed harvesting method whereby juvenile *L. hyperborea* will be left, and will be able to grow and replace harvested individuals. It is also unlikely that ecological functioning will alter significantly due to the small amount of kelp to be harvested within overall harvesting areas and the fact that complete clearance of kelp in harvest blocks will not be undertaken.

There is a risk that PMFs that co-locate with kelp habitats will be affected by harvesting operations, particularly potential damage from the harvesting head. This will be avoided, by excluding areas where PMFs are present from the harvest area as part of embedded mitigation (see Section 2.5).

Evidence suggests invasive non-native species are opportunistic and may establish themselves when native species are disturbed (Epstein and Smale, 2018). There may consequently be a risk that wild seaweed harvesting will proliferate the establishment of non-native seaweeds (or other species). As non-native species are difficult to eradicate, their proliferation may permanently change habitat functioning (ABPmer, 2013), having implications for species associated with kelp. However, considering that changes in kelp bed density due to harvesting are likely to be similar or smaller than the natural variation associated with storms and other natural events, it is considered unlikely that this impact will occur.

Given the importance of kelp beds to the ecological functioning of coastal systems all of the identified impact pathways are **scoped in** to the assessment.

Fish and shellfish

The main potential impacts comprise:

- Reduced capacity for kelp forests to provide nursery grounds for fish and shellfish; and
- Reduced foraging habitat.

The natural mortality of juveniles is higher than that of the adults of a species, as juveniles are often prey for other species, or simply have a larger proportion of their natural lives to survive. Consequently, the loss of a single juvenile does not equate to the loss of a breeding adult of the same species. The concept of the Equivalent Adult Value Metric (EAV) provides a means to relate the numbers of fatalities in juveniles to the corresponding number of adults. This allows for a realistic evaluation of the local impact of wild seaweed harvesting on local populations of fish.

Turnpenny (1989) estimated EAVs (the proportion surviving to adulthood) for a range of fish species including cod. For 0-group (0-year-old) cod estimated EAVs ranged from 0.0001 to 0.04, and for 1-group fish (1-year-old) between 7-12%. Even on the very conservative assumption that all juvenile codling in areas subject to harvesting were lost (around 3% of a harvesting area each year), this would translate into an EAV of <1%. This is not significant and particularly so in the context of fishing mortalities that are typically around 20-30% of spawning stock biomass (SSB).

Harvesting of kelp could potentially reduce the numbers of juvenile crab and lobster surviving to adulthood, as areas of potential nursery habitat are harvested. However, similar to finfish, this is unlikely to be significant due to the likely low EAVs for these species.

Protected species, such as shark, seahorse, and ray species will not be present in dense kelp beds and therefore will not be affected by harvesting activities.

Given the importance of fish and shellfish to the ecological functioning of coastal areas and their importance to commercial fisheries all of the identified impact pathways are **scoped in** to the assessment.

Marine mammals

The main potential impacts comprise:

- Reduced foraging habitat; and
- Disturbance to marine mammals from harvesting activity (e.g. noise disturbance from vessels).

The proposed harvesting regime is a low intensity activity, with a maximum of three vessels operating in an area, a low frequency of operations in a single area, and slow speeds (*circa*. 3 knots) during harvesting. This serves to reduce disturbance via noise and visual presence to marine mammals such as otter, seals and cetaceans.

Effects to protected species such as otter, dolphins, porpoise, whale and seals are possible due to wild seaweed harvesting. To avoid impacts, embedded mitigation will also be employed in the form of seasonal restrictions to harvesting in areas used by marine mammals, including seal haul outs and breeding colonies.

Given the importance of marine mammals, all of the identified impact pathways are **scoped in** to the assessment.

Ornithology

The main potential impacts comprise:

- Reduction of food source through loss of habitat/shelter for prey species;
- Loss of/damage to coastal breeding habitats as a result of disruption of existing sediment transport processes as a result of changes in coastal processes from a reduction in kelp biomass following harvesting
- Disturbance to birds from harvesting activity (e.g. noise disturbance from vessels); and
- Reduced foraging habitat.

Effects to coastal breeding birds could occur as a result of loss of or damage to coastal habitats such as shingly, sand dunes or machair. The assessment of potential impacts to coastal habitats (see below) can inform this assessment.

The proposed harvesting regime is a low intensity activity, with a maximum of three vessels operating in an area, a low frequency of operations in a single area, and slow speeds (*circa*. 3 knots) during harvesting. This serves to reduce disturbance via noise and visual presence to waders and seabirds.

Effects to seabirds are possible due to wild seaweed harvesting, particularly during the breeding season or moulting periods. To avoid impacts, embedded mitigation will also be employed in the form of seasonal restrictions to harvesting in relevant areas in line with SNH guidance[7].

Given the importance of seabirds, all of the identified impact pathways are **scoped in** to the assessment.

Coastal biotopes

The main potential impacts comprise:

- Loss of/damage to coastal habitats as a result of disruption of existing sediment transport processes as a result of changes in coastal processes from a reduction in kelp biomass following harvesting; and
- Reduction in beach-cast seaweeds and a consequent reduction in strandline biotope communities and sand dune habitat.

Wild seaweed harvesting will not directly impact coastal environments, but indirect impacts are possible primarily through changes to coastal processes (see Section 4.2). There is a risk that sensitive coastal environments could be affected through increased wave exposure and associated changes in sediment transport. As described in Section 4.2, changes in wave attenuation due to a reduction in kelp density is unlikely to result in a significant impact to coastal habitats. Furthermore, as already noted, changes in kelp bed density arising from harvesting will fall within the range of the natural variability that occurs when kelp is removed by storms and other natural events. Despite this, the risk will be managed through a strip harvesting regime orientated parallel to shoreline. Furthermore, given that less than 3% of the harvestable kelp resource will be removed via harvesting in any one calendar year and this is within natural variation of the density of kelp beds, sediment transport processes are unlikely to be significantly affected, particularly as impacts on kelp biomass (and thus impacts on prevailing coastal processes) are likely to be temporary.

[7] https://www.nature.scot/sites/default/files/2017-07/A2332152%20-%20Suggested%20seasonal%20definitions%20for%20birds%20in%20the%20Scottish%20Marine%20Environment%20-%203rd%20February%202017.pdf

A reduction in the amount of available beach-cast material may have implications for biotopes formed on decaying seaweeds. This may also cause sand beaches to become less stable and vulnerable to erosion from a lack of nutrients for coastal plants which act to stabilise sediments. However, given the small amount of kelp to be harvested the change in beach-cast material in unlikely to be significant (see Section 4.2).

In order to further reduce impacts to coastal environments, areas of kelp that are adjacent to shorelines at proven or agreed high risk will not be harvested, and harvesting will not take place within 50 m of MHWM. Furthermore, areas of kelp adjacent to shorelines at risk of erosion will not be harvested. This is part of embedded mitigation described in Section 2.5.

Given the importance of coastal habitats to ecological functioning of coastal areas, all of the potential impact pathways are **scoped in** to the assessment.

4.4.3 Further work required for Environmental Report

The following key elements of work will be undertaken in preparing the Environmental Report:

- Review of available sources of information for each potential harvesting area;
- Desk-based assessment on the effects of wild seaweed harvesting on the identified impact pathways for the relevant receptor groups associated with each potential harvesting area (see
- Section 4.4.2).

The assessment of potential impacts will take account of monitoring data from other kelp harvesting areas, particularly from Norway where systematic monitoring of kelp harvesting activity has been carried out over many years. It will also take account of the assessments in relation to coastal processes and water and sediment quality impacts.

Kelp harvesting is a simple and consistent process with harvesting occurring within a restricted range of biotopes (infralittoral high energy and moderate energy rock biotopes supporting dense stands of *L. hypoborea*). The effects of harvesting within these restricted biotopes are therefore, to a large extent, generic and will not vary significantly from site to site. The main differences between sites in terms of marine ecology features are likely to relate to the presence and abundance of seabirds and marine mammals which can be assessed on a site specific basis.

Where the assessment identifies the potential for significant environmental effects, MBL will identify mitigation measures to avoid or minimise such effects. These could include, for example, restricting or avoiding harvesting within particular resource areas. In this way, the assessment will be used to refine the number, size and location of harvesting areas to be included within the marine licence application(s).

No dedicated marine ecology surveys are proposed for the Environmental Report to inform the marine licence application(s) as it is considered that sufficient information is available on the distribution of key receptors to permit a robust assessment. Ecological surveys and baseline ecological monitoring will be carried out for each harvesting area prior to harvesting taking place. This will inform further specific mitigation measures to be put in place for each harvesting area which will be documented in the harvesting plans.

In preparation of the Environmental Report, a desk-based assessment of the impact on coastal processes will be undertaken for each proposed harvesting area (see Section 4.2). This will inform the assessment of potential indirect impacts to sensitive coastal habitats. A desk-based assessment of the

potential significance of changes in beach cast seaweed will be carried out, taking account of the nature of the adjacent coastline.

The potential impact of kelp harvesting on WFD objectives will be assessed as part of the WFD assessment (see Section 4.3.3).

As some potential harvesting areas will be located within or adjacent to Natura 2000 sites, it is concluded that the project has the potential for 'likely significant effect' on these sites. An Appropriate Assessment will be carried out to assess the impact of the project on the features for which the sites have been designated and included as an appendix to the Environmental Report. The assessment will be focused on the list of European designated sites identified in Appendix A.

The Environmental Report will also include an appendix providing information on the potential effects on features protected within NCMPAs.

An assessment will also be carried out of the potential for the project to disturb European Protected Species or features protected under Schedule 5 to the Wildlife & Countryside Act 1981 (as amended). features protected. Should the potential for such disturbance be identified, MBL will seek to avoid or minimise such disturbance. Should residual disturbance remain significant, MBL will discuss with MS-LOT and SNH, requirements for an EPS licence or a licence under the Wildlife & Countryside Act.

4.5 Commercial and recreational fisheries

4.5.1 Description of the existing environment

Commercial fisheries

The commercial fishing industry and associated downstream supply chain activities (e.g. processing) are important industries for remote coastal communities in Scotland. Table 4.5.1 shows the volume and value of fish and shellfish landed by 10m and under UK vessels and over 10m UK vessels in 2016 from ICES rectangles that are contained within or intersect with the Area of Search[8] (see Figure 4.5.1 and Figure 4.5.2; although it should be noted that some of these landings are caught to the west of the Outer Hebrides and hence outwith the Area of Search).

Table 4.5.1. Volume and value of landings by UK vessels in 2016 from ICES rectangles that intersect with the Area of Search

Vessel length category	Volume (Tonnes)	Value (£)
10m and under vessels	3,729	17,859,413
Over 10m vessels	14,459	34,834,383
Total	**18,188**	**52,693,796**

Source: MMO, 2017

Table 4.5.2 shows the ten most valuable species caught from these ICES rectangles in 2016. These data indicate the importance of shellfisheries within the Area of Search, particularly *Nephrops*, scallop and crab.

[8] ICES rectangles that are contained within or considered to overlap substantially with the Area of Search were 41E3 41E4, 42E2, 42E3, 42E4, 43E2, 43E3, 43E4, 44E2, 44E3, 44E4, 45E3 and 45E4.

Table 4.5.2. Volume and value of the ten most valuable species landed in 2016 from ICES rectangles that intersect with the Area of Search

Species	Volume (Tonnes)	Value (£)
Nephrops (Norway Lobster)	8016	32,576,729
Scallops	2761	6,775,399
Crabs (brown)	3089	3,991,673
Wrasses	49	3,179,015
Lobsters	211	2,436,636
Crabs (velvet)	572	1,552,431
Sprats	2177	501,904
Monks or Anglers	153	354,039
Mackerel	462	336,049
Razor Clam	59	307,998

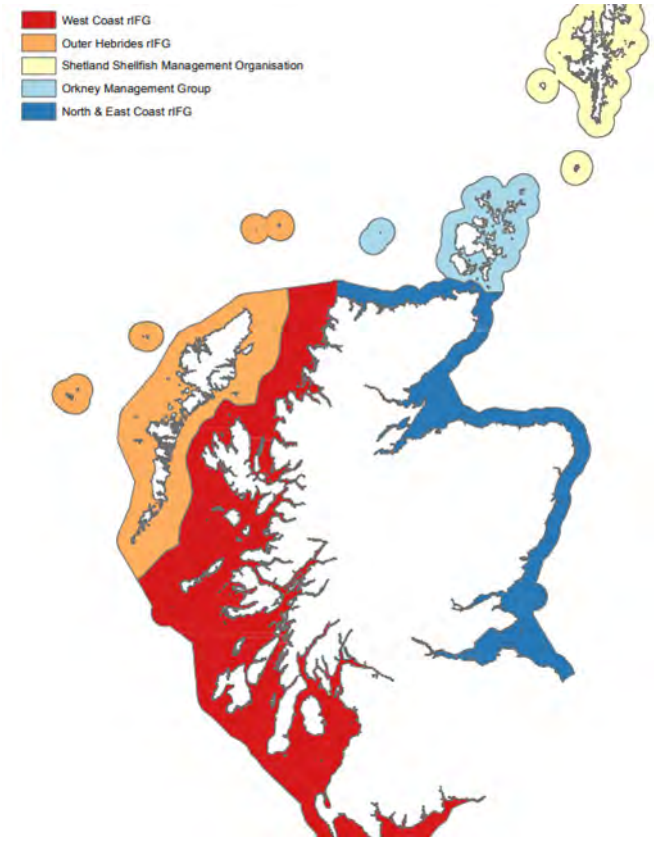
Source: MMO, 2017

Based on amalgamated VMS datalayers (for 2009-2013; see Figure 4.5.2) in the NMPi, the highest density of fishing for *Nephrops* using static gear (pots/creels) occurs between the Outer Hebrides and Skye whilst the highest density of trawling for *Nephrops* occurs further north (between the north of Harris and the Ullapool fisheries district) and further south (particularly around Barra, the Small Isles and between Mull and Tiree) compared the main static gear areas. The highest density of scallop dredging activity during this time occurred along the east coast of the Outer Hebrides, between Harris and Skye and between Tiree, Coll and the north of Mull. However, it should be noted that this activity would not have included the activity of vessels under 15m in length.

Nephrops and scallops and not species associated with the rocky kelp biotopes which would be targeted for seaweed harvesting and hence little of the landing value for these species is obtained from kelp beds. Potting/creeling for some shellfish and fish species (e.g. crab, lobster, wrasse) may occur within kelp beds, however, there is a risk of entanglement of these gears with the kelp and hence the value of shellfish landings from kelp beds is likely to be minimal. This will be discussed further and confirmed with fishing industry representatives and/or associations during local consultations.

With respect to the inshore fleets that operate within the Area of Search, shellfish are also the main species targeted. In the Outer Hebrides RIFG area (see Image 4.5.1), shellfish account for virtually all landings into Western Isles ports and the majority are landed by boats that are owned and crewed by local residents. In the Minches, the main species targeted are *Nephrops* (caught using trawls as well as creels), lobster, scallops and crab (brown and velvet), whilst inshore waters to the west and north provide the main fishing grounds for lobster, brown crab and crawfish. In addition to scallops harvested by dredges, a smaller volume of scallops are caught by divers in Loch Roag and to the west of Harris (Outer Hebrides IFG, undated). There is also interest in developing razor clam and cockle fisheries in the Outer Hebrides IFG area (IFG, 2018). Most whitefish and pelagic species are caught to the west of the Hebrides but are not landed into the Outer Hebrides RIFG area. There are 42 landing facilities around the Western Isles all of which are used by the Outer Hebrides fishing industry.

Within the West Coast RIFG (which includes the geographic subregions of Mull and Argyll and West Highlands and Skye), the main species targeted are also *Nephrops* (creeled and trawled), lobster, crab (brown, velvet and green) and scallops (landed by itinerant dredgers and local dive fisheries). The main ports within this district include: Kinlochbervie, Lochinver, Ullapool, Gairloch, Kyle of Lochalsh and Portree, Mallaig and Oban.



Source: Scottish Government, 2016a

Image 4.5.1 Regional Inshore Fisheries Groups (RIFGs) in Scotland

Recreational sea angling

Recreational sea angling from the shore and by boat occurs around most of the Scottish coastline. A wide range of species are caught including cod, tope, bass, rays, pollack, mackerel and spurdog. In a 2009 report it was estimated that sea angler expenditure in the regions Argyll and Lochaber, Western Isles and Northern Scotland was £22 million £9 million and £11 million respectively (although it should be noted that these regions encompass areas outside of the Area of Search). Popular launch sites for anglers within these three regions, which fall within the Area of Search included Sunart, Tobermory and Lochinver (Scottish Government, 2009).

4.5.2 Main assessment issues

Wild seaweed harvesting in the marine licence application area has the potential to affect commercial and recreational fisheries via the following impact pathways:

- Potential for fishing gear damage and disruption; and
- Fishing impacts due to fish stock impacts.
- Potential disruption of fisheries activities due to vessel movements are dealt with in Section 4.6.

The primary fisheries that may be affected by wild seaweed harvesting are seasonal pot/creel fisheries. These fisheries target prawns, lobster and crabs. Hand-collection of shellfish species may also be prevalent close to harvest areas. There is potential for seaweed harvesting to damage potting gear, or disrupt potting activities and hand-collection of shellfish. Therefore, potential effects to fishing is **scoped in** for further assessment. In order to avoid significant effects, seasonal restrictions to

seaweed harvesting may be applied as part of embedded mitigation, achieved in consultation with MS-LOT, local fisherman and relevant Regional Inshore Fisheries Groups (RIFG).

Details of the indirect impacts on commercial and recreational fisheries in relation to fish and shellfish ecology including impacts on critical habitats such as spawning, nursery and overwintering grounds are covered in Nature Conservation and Ecology (Section 4.4). These sections scoped in potential impacts to fish and shellfish due to depletion of kelp nursery habitat for further assessment. Therefore, fishing impacts due to fish stock impacts are **scoped in** for further assessment.

4.5.3 Further work required for Environmental Report

The following key elements of work will be required as part of the Environmental Report:

- Detailed review of existing available information and data. The following information sources are to be consulted:
    - ICES landings data (MMO) (if appropriate further to consultation with fishing industry regarding the level of fishing activity within kelp biotopes to be targeted for harvesting) ;
    - VMS Fishing Intensity data (MMO) (if appropriate as above);
    - Sea angling data (NMPi); and
    - Any available data from the Sea Angling Survey 2017
- Consultation with the following stakeholders to supplement the above data sets, particularly in relation to inshore fishing fleet activity:
    - Consultation with local fishermen/local fisheries associations, as well as relevant staff at the Outer Hebrides RIFG and West Coast RIFG;
    - The Scottish Fishermen's Federation (Mallaig and North West);
    - Fisheries Management Scotland;
    - West of Scotland Fish Producers Association;
- Desk-based assessment on the effects of wild seaweed harvesting on the identified impact pathways.

The assessment of indirect impact pathways will draw on the assessment for marine nature conservation and ecology in relation to potential impacts on fish and shellfish.

4.6 Commercial and recreational navigation

4.6.1 Description of the existing environment

Commercial shipping provides for the transport of goods and people within Scottish waters and internationally. Shipping routes (see Figure 4.6.1 and Figure 4.6.2) identify deeper draughted cargo vessels, tankers and passenger vessel. Routes for these types of vessels occur in deeper water with clear patterns of use through The Minch (between the Western Isles, Skye and the Scottish Mainland) with very deep draughted vessels taking a route to the west of the Western Isles. Around the islands of the Inner Hebrides and mainland Scotland (see Figure 4.6.2) shipping has an intensity of use to and from principal ports including Oban, Mallaig, Kyle of Lochalsh and Port Kishorn. Ferry traffic forms many of the higher intensity traffic routes (see Figure 4.6.1) for example; Ullapool to Stornoway, Oban to Castlebay, and the Uig, Tarbet and Lochmaddy routes.

Recreational navigation is shown in Figure 4.6.3 and Figure 4.6.4, the figure highlights that recreational use is mostly concentrated within the sea lochs and islets near the mainland and the sounds of the Inner Hebrides. Heavy recreational use is seen around the Summer Isles, the Sound of Raasay, the

Sound of Sleat and the whole area around Oban. A number of marina facilities provide services to yachts and power vessels, including larger facilities at Ullapool, Stornoway and Kyle of Lochalsh. Numerous informal anchorages exist throughout the rest of the inner and outer isles.

Within the Area of Search, there are 76 ports and harbours (see Figure 4.6.5) located close to potential harvesting areas. These are predominantly smaller jetties, piers and hard standing areas used by local communities as a base for fishing vessels, inter-island transport and recreational facilities. A number of larger ports are located within this region, these include ports such as: Mallaig, Kyle of Lochalsh, Kyleakin, Uig, Portree, Tarbert, Lochmaddy, Lochboisdale and Castlebay. Many of these larger ports also have ferry terminals providing lifeline services linking island communities with the mainland. A number of the ports and harbours are owned and operated within a port group, typically formed as one harbour authority. This includes a number of municipal ports such as those run by Comhairle nan Eilean Siar in the Western Isles and The Highland Council. A number of these ports are owned and operated as Trust ports (such as Mallaig and Lochboisdale) with other ports owned by Caledonian Maritime Assets Limited (CMAL) and run as dedicated ferry ports.

4.6.2 Main assessment issues

Wild seaweed harvesting in the marine licence application area has the potential to affect commercial and recreational navigation via the following impact pathways:

- Wild seaweed harvesting vessel accident or incident within harvesting area; and
- Wild seaweed harvesting vessel accident or incident whilst on passage between harvesting area and the harvesting vessel berth(s).

The potential risks associated with encountering unexploded ordnance (UXO) will be considered specifically under marine archaeology (see Section 4.7).

The presence of wild seaweed harvesting vessels present an additional hazard for vessels navigating in the area. There is potential for other vessels to make contact with harvesting vessels or to be involved in accidents or incidents following interaction with harvesting vessels, both in harvesting areas or whilst on passage to and from harvesting areas. It should be noted however, that interaction with commercial vessels is unlikely during harvesting operations given the need for larger commercial vessels to navigate in water with sufficient depth, on routes connecting ports and harbours. Furthermore, the vessels that will collect and transport the seaweed to the landing point are vessels that are already in service for the aquaculture sector. These vessels transport cargo to aquaculture sites and will then be used to transport harvested seaweed back to port. This arrangement is designed to minimise the increase in vessel traffic within an area. Given the importance of commercial and recreational navigation, all of the impact pathways are **scoped in** for further assessment.

4.6.3 Further work required for Environmental Report

This section sets out the key elements of work which will be required as part of the Environmental Report.

Key information on commercial navigation within the harvest area will be collected from public domain datasets, for example DfT shipping and port statistics and the most recently released MCA Automatic Identification System (AIS) data. This will identify:

- Vessel transit tracks and intensity of sea area usage;
- Vessel type; and
- Vessel voyage information (including port of origin and destination).

Further relevant information sources include:

- Military practice and exercise areas;
- Licensed marine disposal sites;
- Royal Yachting Association (RYA) indicative cruising routes and sailing areas;
- Data from the Marine Accident Investigation Branch (MAIB) on reportable ship incidents;
- Royal National Lifeboat Institute (RNLI) incident response data; and
- National 2015 AIS dataset;

Consultation will be carried out with Statutory Harbour Authorities, ferry companies and recreational boating interests adjacent to the harvest area, including (but not limited to) the following organisations:

- Mallaig Harbour Authority;
- The Highland Council;
- Comhairle nan Eilean Siar;
- Argyll & Bute Council;
- Caledonian Maritime Assets Limited (CMAL);
- Caledonian MacBrayne (CalMac); and
- RYA Scotland/Scottish Boating Alliance

It will also be necessary to carry out consultation with the following maritime regulatory organisations:

- The Maritime and Coastguard Agency (who are the competent authority in respect of navigation safety outside of Statutory Harbour Authority limits); and
- The Northern Lighthouse Board (who are the General Lighthouse Authority for Scotland and the Isle of Man with respect to fixed and floating aids to navigation).

4.7 Marine archaeology and cultural heritage

4.7.1 Description of the existing environment

Scotland's seas have historically been of international importance and as a result, a wide range of archaeological features are located along the coast and in the marine environment (HES, 2016). These include the remains of ships and aircraft lost at sea, harbours, lighthouses and other structures relating to transport and trade by sea and the remains of human settlement.

Many sites lie wholly within the marine environment; however, it is believed that there are many more unprotected sites of interest on and around the coastline. As such, Scotland's seabed and inter-tidal areas contain the remains of many important historic assets, ranging from artefacts and structures deposited on the seabed, structures built on the seabed or in intertidal areas, and submerged sites that were previously above sea level.

Protected sites

There are no protected wrecks (protected places and controlled sites) under the Protection of Military Remains Act 1986 (Designation of Vessels and Controlled Sites) Order 2012 in the proposed Area of Search. The located remains of all known vessels and aircraft losses are shown on Figure 4.7.1.

Historic Environment Scotland (HES) is directly responsible for safeguarding the Scottish historic environment, including marine and coastal features. One mechanism whereby HES can provide

protection to marine archaeological sites is through the designation of Historic Marine Protected Areas (HMPA). These areas are designated under the Marine (Scotland) Act 2010 for the purpose of preserving marine historic assets of national importance, including but not limited to significant historic shipwrecks, remains relating to important fleet anchorages, battle sites or navigational hazards (where multiple wrecks and other features exist) and submerged prehistoric landscapes (if structural or artefact-based evidence is identified on the seabed). There are five designated HMPAs in the Area of Search (Figure 4.7.2). These are:

- Drumbeg (Sutherland, Highland);
- Mingary (Ardnamurchan, Highland);
- Kinlochbervie (Sutherland, Highland);
- Dartmouth (Morvern, Highland); and
- Duart Point (Mull, Argyll and Bute).

In addition to designated heritage assets, there are a large number of undesignated/uncertain/ unknown assets. There is a significant data gap associated with these, particularly in relation to underwater heritage assets.

Prehistoric archaeology

Potential locations for the survival of prehistoric archaeological material on the seabed occur in the Hawes Bank and seabed around Coll and Tiree; around Islay, Jura, Colonsay and Oronsay; the Rum and Canna coastline; in sheltered inlets and reaches to the east of the Hebrides; in sheltered inlets around Skye; on submerged islands located between the Northern Irish coast and the South Hebridean island (DTI, 2007).

Cultural heritage

In addition to archaeological features, the cultural tradition of crofting has been carried out for hundreds of years in Scotland (Steward, 2017). Crofters play a key role in maintaining the machair[9] and other wildlife through traditional practices. These include using natural fertilizers such as seaweed, namely kelp (*Laminaria* sp.). Large quantities are washed up by the winter storms and collected fresh from the beach when the winds and tides allow (RSPB Machair LIFE+, 2014a). Seaweed is then left in piles for several weeks to decompose which concentrates the nutrients and reduces its volume for spreading. Rotten seaweed is spread on the machair during late winter/early spring before it is cultivated. Seaweed helps to bind the sandy soils and its use allows for a wide range of arable and fallow wildflowers to grow because they are not engulfed by more vigorous plants boosted by artificial fertiliser.

The use of these natural fertilisers adds bulk, improves fragile soils and increases productivity. The Crofters (Scotland) Act 1993 (as amended) gives crofters access to reasonable use of seaweed under Common Grazings regulations. This is largely confined to the gathering of beach-cast *Laminaria* sp. and other mixed species for spreading on machair land in the Western Isles (Steward, 2017). Little information is available about the extent or size of such gathering from beaches (Scottish Government *et al*., 2016). However, the extent of spreading on the machair has been estimated between 2011 and 2013 to be a total of 317 ha in the Uists and Berneray in the Western Isles (RSBP Machair LIFE+, 2014b).

[9] A rare and rich coastal grassland which occurs in Western Scotland mostly in the Western Isles.

4.7.2 Main assessment issues

Wild seaweed harvesting in the marine licence application area has the potential to affect marine archaeology and cultural heritage via the following impact pathways:

- Direct damage to the marine archaeological resource;
- Indirect damage to the marine archaeological resource;
- Risk of encountering UXO; and
- Impacts to traditions associated with crofting, farming and use of seaweeds for fertiliser and animal feed.

The harvesting head to be used is designed to be situated approximately 0.5 m above the seabed when harvesting. Therefore, significant physical disturbance of the seabed is not envisaged which reduces the risk of impacting marine archaeological features. However, removal of kelp itself could disturb the substrate holdfasts are attached to. Kelp species are unlikely to attach to softer material (such as submerged historic landscapes or wooden shipwrecks), but may attach to harder materials such as metal hulls of shipwrecks (Scottish Government *et al.*, 2016). Overall, the likelihood of disturbing archaeological resource is low (both known/designated and unknown features). Nevertheless, it is appropriate to avoid areas of known features of archaeology, as well as UXO. Therefore, impacts to marine archaeology is **scoped in** for further assessment in order to identify areas of known archaeological features and assess the potential for encountering unknown archaeological features and UXO.

Indirect damages to archaeological features may be caused by changes in physical processes (e.g. wave exposure, flow speeds, scour etc. see Section 4.2). Therefore, indirect impacts due to alterations in physical processes is **scoped in** for further assessment.

Harvesting kelp has the potential to reduce the amount of beach-cast material, which may limit the resource available to crofters. The issue of changes to beach-cast material due to harvesting is addressed in Section 4.2. Due to the negligible amount of the kelp resource that will be removed by harvesting, significant changes to the amount of beach-cast material is unlikely and holdfast disposal at sea may also somewhat remedy potential changes beach-cast material. However, impacts to crofters and associated cultural heritage are **scoped in** for further assessment.

4.7.3 Further work required for Environmental Report

This section sets out the key elements of work which will be required as part of the Environmental Report. The key objectives of the work will be:

- To provide an overview on the historic environment in the study area based on existing archaeological records and secondary sources, supported by the archaeological review of available datasets;
- To highlight known sites (e.g. HMPAs) that may be impacted by the proposal with particular reference to located marine sites and recorded shipping losses;
- To summarise the potential for the presence of hitherto unknown sites that may be impacted by wild seaweed harvesting;
- To comment on the importance of known and potential sites;
- To set out the statutory, planning and policy context relating to the historic environment in the study area; and
- To assess the effects of wild seaweed harvesting on the identified archaeological pathways.

The following data sources will be consulted / interpreted:

- Records held by: the UK Hydrographic Office, the National Records of the Historic Environment (NRHE), HES; and
- Records of shipping and aircraft casualties.

Standards statement

The methodology adopted will reflect best practice in carrying out archaeological desk based assessments, as set out by the Chartered Institute for Archaeologists (CIfA) Standard and Guidance for Historic Environment Desk-based Assessment (CIfA, 2014); and the publication Marine Aggregate Dredging and the Historic Environment (BMAPA *et al*., 2005). The latter document aims to ensure the effective and practical consideration of the historic environment in the licensing of marine aggregate extraction, and elaborates on the guidance provided in the Code of Practice for Seabed Developers produced by the Joint Nautical Archaeology Policy Committee (JNAPC, 2006). This is viewed as being the most applicable guidance available for wild seaweed harvesting.

4.8 Coast protection and flood defence

4.8.1 Description of the existing environment

In 2004, the EUROSION project estimated that 733 km of Scotland's coastline was protected by defence works and artificial beaches (EUROSION, 2004), while Scottish Natural Heritage (SNH) estimated that 307 km of Scotland's mainland coast is comprised of coastal defences (Baxter *et al*. 2011).

Figure 4.8.1 shows an overview of the types of coastal protection and flood defence schemes within the Area of Search. The figure indicates that the majority of coastline within the Area of Search comprises rocks and hard cliffs. However, throughout the Area of Search, there are also natural beaches and 'soft' (sediment) coastline (see Section 4.2), particularly around the Isle of Skye. There is only one area of a hard sea defence indicated in the figure (Tarbert, Isle of Harris) although five coast protection schemes have been implemented on the western coastlines of Barra (Craigston), South Uist (Ludag and Stoneybridge) and Benbecula (Pol na Craan and Balivanich) since 2000 (Baxter, 2011) and hard defences are likely to be present in the vicinity of ports and harbours. .

4.8.2 Main assessment issues

Wild seaweed harvesting in the marine licence application area has the potential to affect coastal protection and flood defences through the following impact pathways:

- Increased coastal flooding and damage/erosion due to increased wave height/exposure, particularly during storms.

A change in wave energy along a coastline could change the potential for increased coastal erosion, undermining coastal defence infrastructure. This may lead to flooding, increases in maintenance expenditure and/or a requirement for new coastal defence schemes. However, as noted already, it is considered unlikely that coastal processes will be affected by the seaweed harvesting as the changes in kelp bed density will be similar or less than the volume removed annually by storms and other natural events. However, in order to minimise the risk further and avoid any potential impacts of flooding and coastal erosion, harvesting will be restricted or removed further offshore where shorelines are generally agreed to be at high risk of erosion.

This topic has been **scoped in** for further assessment.

4.8.3 Further work required for the Environmental Report

In preparing the Environmental Report, further information will be collected on the location of coast and flood defence structures and locations of coastal erosion in the vicinity of proposed harvesting areas, including review of Google Earth images.

A desk-based assessment of the potential for kelp harvesting to affect coastal and flood defence structures or to exacerbate existing coastal erosion will be carried out, drawing on the findings of the coastal processes assessment.

Where the assessment identifies the potential for significant environmental effects, MBL will identify mitigation measures to avoid or minimise such effects. These could include, for example, restricting or avoiding harvesting within particular resource areas. In this way, the assessment will be used to refine the number, size and location of harvesting areas to be included within the marine licence application(s).

4.9 Air quality and GHG emissions

4.9.1 Description of the existing environment

There are no Air Quality Management Areas (AQMAs) or known sensitive receptors to air quality in the vicinity of the Area of Search. Local air quality is expected to be good due to the area's coastal setting with high levels of wind dispersal and a lack of significant sources of emissions. The principal sources of emissions on the west coast of Scotland include ports and harbours, and marine traffic.

Current sources of greenhouse gas emissions in the Area of Search are likely limited to emissions from vessels (commercial, fishing and recreational) and vehicles using local road networks. These will be very small contribution to the overall emissions of Comhairle nan Eilean Siar (Formerly Western Isles Council), Highland Council, and Argyll and Bute Council areas.

As summarised by Scottish Government *et al.* (2016) kelp habitats are relatively ineffective in acting as long-term carbon stores, and do not sequester carbon as kelp detritus is respired, consumed or exported to other habitats (Burrows *et al.*, 2014b). The majority of carbon is stored within living kelps (Scottish Government *et al.*, 2016).

4.9.2 Main assessment issues

Wild seaweed harvesting in the marine licence application area has the potential to affect air quality and GHG emissions through the following impact pathways:

- Decline in air quality due to emissions associated with vessel operations;
- GHG emissions from vessel operations during harvesting; and
- Reduced carbon storage within kelp forests.

The proposed wild seaweed harvesting will result in emissions to air from the three harvesting vessels. This is unlikely to make a significant contribution to existing emissions from vessels in Scottish inshore waters, and therefore decreases in air quality are not foreseen. In the same regard, increases in GHG emissions are unlikely to be significant. Therefore, these issue is **scoped out** of further assessment.

Harvesting of kelp will remove standing stock and reduce the amount of carbon stored in kelp beds. However, given the relatively small amount of kelp to be removed by the proposed wild seaweed

harvesting, and the leaving of small kelps *in situ*, kelp bed recovery will occur within a few years (Christie *et al*., 1998). As a result, any reduction in carbon storage will be temporary until re-harvesting. Furthermore, a decrease in the amount of seaweed decomposition in the environment may reduce the amount of carbon released back into the atmosphere (Scottish Government *et al*., 2016). Therefore, reduced carbon storage within kelp forests is **scoped out** of further assessment.

4.9.3 Further work required for the Environmental Report

No further work proposed.

4.10 Infrastructure and other marine users

4.10.1 Description of the existing environment

Subsea Cables
Subsea cables include telecommunication and power cables. Figure 4.10.1 shows there are seven subsea telecommunication cables within the Area of Search, connecting the mainland and the islands of the Inner and Outer Hebrides, as well as inter-island connections. There are a higher number of subsea power cables connecting areas of the mainland across lochs, the mainland to the Inner and Outer Hebrides and inter-island connections.

Aquaculture production sites
Marine (sea-based) aquaculture in Scotland is concentrated on the west coast of the mainland and in the Western Isles, Orkney Islands and Shetland Islands (the latter two outwith the Area of Search). Installations are normally positioned in sea lochs, voes and inlets and active marine finfish and shellfish sites are shown in Figure 4.10.2. Although there is interest and research into the viability of cultivating seaweed in Scotland, at present, there is currently no commercial scale cultivation of seaweed Freshwater sites have not been shown as it is not considered that there is any pathway via which wild seaweed harvesting would interact with the freshwater sector.

Offshore renewables
Offshore renewables include wind, tidal and wave devices which generate energy and the infrastructure through which this power is transmitted to land (i.e. export cables and inter-array cables). Figure 4.10.3 shows there are no wind, tidal or wave energy installations within the Area of Search although there are wave draft plan options and wind draft plan option areas off the west coast of the Outer Hebrides.

Recreational activities (watersports, excluding recreational boating)
Marine and coastal recreation occurs all around the Scottish coastline. Figure 4.10.4 shows the concentration of general marine and coastal recreation within the Area of Search which indicates that there is moderate to high intensity of such activities at locations around the Inner Hebrides and along the adjacent mainland coast (note this figure includes recreational activities along the coastline as well as in or on the sea)[10].

4.10.2 Main assessment issues

Wild seaweed harvesting in the marine licence application area has the potential to affect infrastructure and other users through the following impact pathways:

[10] Marine and coastal recreation includes beach games, beach combing, rock pooling, painting, kite flying, sunbathing, naturism, picnicking, yoga, paddling, walking less than 2 miles, general sightseeing, fossil hunting, beach team sports, body boarding, general swimming and snorkelling, coastal cycling, horse riding and dog walking.

- Damage to infrastructure (including aquaculture sites) from harvesting rake;
- Impacts to aquaculture sites and other marine users from disposal of holdfasts and changes in water quality;
- Disturbance to recreational activities taking place in or on the sea (e.g. water sports, diving); and
- Potential impacts of physical processes changes on marine and land-based infrastructure.

Commercial and recreational fishing activities are covered in Section 4.5, commercial and recreational navigation issues and ports and harbours are considered in Section 4.6 and coastal and flood defence issues are considered in Section 4.8.

As part of embedded mitigation measures (Section 2.5), marine infrastructure, including cables, ports/harbours, jetties, flood/coastal defences, and aquaculture sites, will be mapped in the harvest area and each harvest block. Uses of coastal waters, for example bathing waters, or water sport areas, will also be examined. This information is readily available from a number of sources. Specific harvesting regimes will then be planned in accordance with infrastructure presence and locations of other users of the marine environment, and harvesting will be restricted within a specified distance of infrastructure/activities. This embedded mitigation will avoid damage and disturbance to infrastructure and other marine users from the harvesting activity. This topic is scoped in for further assessment.

Issues for aquaculture sites may include changes in water quality as a result of harvesting activity. Recreational activities such as bathing, sea swimming and beach activities may also be impacted. Direct impacts to water quality will be assessed (see Section 4.3) and the outcomes will inform further consideration of indirect impacts on other recreational marine users. Therefore, impacts to aquaculture and recreation as a result of changes in water quality are scoped in for further assessment.

Changes to physical processes caused by seaweed harvesting has been scoped in for further assessment (see Section 4.2) therefore, indirect marine and land-based infrastructure impacts due to changes in physical processes have been **scoped in** for further assessment.

4.10.3 Further work required for the Environmental Report

The following key elements of work will be required as part of the Environmental Report:

- A desk-based review of marine infrastructure (including aquaculture sites) using NMPi data (supplemented by consultation with industry representatives (e.g. ASSG, SSPO) if adequate data is not available;

- A desk-based review of marine recreational activity data to identify any areas of activity which overlap with areas of kelp resource, using available leisure and recreation data (e.g. NMPi), supplemented by consultation with local governing body representatives for water sports if adequate data is not available;
- Desk-based assessment on the effects of wild seaweed harvesting on the identified impact pathways.

The assessment of indirect impact pathways will draw on the assessment for coastal process in relation to potential impacts on these physical processes.

Where the assessment identifies the potential for significant environmental effects, MBL will identify mitigation measures to avoid or minimise such effects. These could include, for example, restricting or avoiding harvesting within particular resource areas. In this way, the assessment will be used to refine the number, size and location of harvesting areas to be included within the marine licence application(s).

4.11 Human health

4.11.1 Description of the existing environment

The World Health Organization (WHO) defines health as a state of complete physical, mental and social wellbeing and not merely the absence of disease or infirmity. As such, human health can be considered to encompass environmental, social and economic aspects (IEMA *et al*, 2017).

The Scottish Index of Multiple Deprivation (SIMD) is a tool for identifying areas of poverty and inequality across Scotland. The index comprises multiple indicators of deprivation, which can be grouped into the following seven 'domains': income, employment, education, health, access to services, crime and housing. The SIMD provides a relative measure of deprivation across small areas in Scotland, which are ranked between 1 (the most deprived area) and 6,976 (the least deprived area) and can be used to identify areas of greater need for support and intervention.

In 2016, The Highland Council region had a decreased share of the 20% most deprived data zones in Scotland compared with SIMD 2012. There was no change in deprivation between SIMD 2016 and SIMD 2012 for the Western Isles Council region (Scottish Government, 2016b).

4.11.2 Main assessment issues

Wild seaweed harvesting in the marine licence application area has the potential to affect local communities and the economy through the following impact pathway:

- Economic diversification for coastal communities and increased job opportunities;
- Growth of Scottish economy through new industry;
- Possible changes in recreation and amenity value of coastal environments and impacts on tourism; and
- Concern of the local community on perceived environmental impacts.

Wild seaweed harvesting has the potential to provide a new source of revenue to local communities, and provide new jobs in the seaweed harvesting industry. There may also be opportunities for local fisherman to contribute to monitoring activities. A diversified economy is likely to improve the resilience of local communities, increase employment rates and incomes, and improve the quality of life for individuals.
Local communities may be concerned over the sustainability of removing natural resources from local coastal environments, and how this may affect them, which may cause stress and anxiety. Furthermore, there may be impacts associated with recreational activities or enjoyment of coastal environments through perceived or real effects on amenity value. An example of this may be the impact seaweed harvesting may have on recreational diving at sites with kelp beds. It may also impact of tourism through the perception of the seaweed harvesting industry to tourists, or through changes in amenity of coastal environments.

Socio-economic impacts are **scoped in** for further assessment. To facilitate social acceptance of the proposed wild seaweed harvesting, MBL will conduct in-depth engagement with local communities

near harvest areas (see Section 5.2). This will help MBL to understand local community perspectives at an early stage and provide the opportunity for MBL to work with stakeholders to reach sustainable solutions to pertinent issues.

4.11.3 Further work required for Environmental Report

Engagement with key stakeholders and local communities as part of pre-application (or pre-harvesting) consultation will be undertaken to help identify any issues or areas of concern and to identify opportunities to contribute to local socio-economic/wellbeing priorities. For the pre-application process, such stakeholders will include:

- Highlands and Islands Enterprise;
- Competent authorities (i.e. Local Authorities, Harbour Authorities);
- Community Councils and Development/Community Trusts; and
- Local industry representatives (e.g. for tourism, fisheries, recreational activities).

A desk based assessment of the potential impacts on human health will be carried out based on the information obtained through the engagement process and information on the potential socio-economic benefits of the project (income, employment).

4.12 Airborne noise and vibration

Noise will be generated during harvesting from harvesting vessels and operation of harvesting equipment. However, as previously described this is a low intensity operation, with vessels operating at slow speeds (*circa*. 3 knots). Moreover, given the remote coastal locations of harvest areas, receptors are unlikely to be affected. Impacts are therefore **scoped out** of further assessment. Disturbance to ecological receptors are covered in Section 4.4.

4.13 Landscape and seascape

Seaweed will be harvested using purpose built vessels (with a capacity of around 100 tonnes) and transported to Mallaig using specialist transport vessels (see Section 2.2.1). However, as previously described this is a low intensity operation with harvesting (and hence vessel operation) limited to one block within any given harvesting area per year and with different harvesting areas utilised each year. Given the broad area over which the activity will be conducted and the low intensity activity within any given area, it is unlikely that landscape and seascape receptors will be affected. Impacts are therefore **scoped out** of further assessment.

4.14 Cumulative effects

The Environmental Report will consider potential cumulative effects.

Under the Habitats Regulations, it will also be necessary to consider the in-combination effects of the proposal with other plans and/or projects specifically on features protected within European Sites.

We will agree the scope of the cumulative and in-combination assessment for wild seaweed harvesting in the marine licence application area with Marine Scotland, SNH and SEPA early on in the consultation process for the Environmental Report.

In summary, the types of projects and activities that are currently proposed for consideration in this assessment are as follows (in no particular order):

- Proposals for finfish and shellfish aquaculture installations;
- Proposals for coast protection or flood defence works;
- Proposals for offshore energy development;
- Proposals for port & harbour development; and
- Proposals for electricity or telecom cables.

4.15 Other aspects to be included in the Environmental Report

4.15.1 Regulatory and planning framework

The Environmental Report will include a review of the relevant regulatory and planning policy context for the proposals at National, Regional and Local level and will assess the extent to which the proposal complies with, or departs from any plans. The most relevant planning and strategic guidance documents to be reviewed include the following:

- National Planning Framework 3;
- Marine Policy Statement (HM Government, 2011);
- Scotland's National Marine Plan;
- Local Development Plans;
- Scotland RBMPs; and
- Local Flood Risk Management Plans.

4.15.2 Mitigation and monitoring

The findings from the Environmental Report will be used to inform the requirements for any additional mitigation measures over and above those already proposed for inclusion within the marine licence and harvesting plan(s).

Standard best practice procedures and impact reduction measures will be considered as part of the proposal to minimise the potential impact on different receiving environments. Where additional measures are needed, the significance of the residual impact (i.e. the impact remaining following the implementation of mitigation measures) will be assessed.

Detailed proposals for site specific environmental monitoring will be included in the Environmental Report, building on the proposals outlined in Section 2.6 of this Scoping Report.

The Environmental Report will also provide a detailed description of the process by which harvesting plans will be prepared and used to control harvesting activity at site level.

5 Proposed Scope and Methods of the Environmental Report

5.1 Environmental Report content

The Environmental Report will particularly need to include:

- A description of the proposal;
- An explanation of the need for the works;
- A statement on the alternative sources of seaweed, or alternative means of harvesting, considered by MBL to meet demand;
- An assessment of the likely direct and indirect effects of wild seaweed harvesting on important environmental receptors (that have been scoped in as part of this scoping phase and consultation with key stakeholders), with a focus on developing solutions that avoid, or minimise environmental effects;
- An assessment of the cumulative effects of the proposal from multiple seaweed harvesting activities in the region and other relevant plans, projects or activities; and
- A non-technical summary of the above information.

Based on the review of key assessment issues (Section 4), a summary of the issues or receptor groups that have been scoped in and out of the Environmental Report is provided in Table 5.1.1. The further work that is proposed for each of the issues scoped into the Environmental Report is summarised in the table. The relevant sections of the report included in the table provide a more detailed justification of the proposed scope of the Environmental Report.

Table 5.1.1 Summary of key assessment issues scoped in (orange) and scoped out (green) of the Environmental Report, and summary of proposed further work

Issue	Proposed Further Work
Physical Processes (Section 4.2)	Scoped in
Water and Sediment Quality (Section 4.3	Scoped in
Nature Conservation and Ecology (Section 4.4)	Scoped in (including coastal ecology)
Commercial and Recreational Fisheries (Section 4.5)	Scoped in
Commercial and Recreational Navigation (Section 4.6)	Scoped in
Marine Archaeology and Cultural Heritage (Section 4.7)	Scoped in
Coast Protection and Flood Defence (Section 4.8)	Scoped in
Air Quality and GHG emissions (Section 4.9)	No further work proposed.
Infrastructure and Other Marine Users (Section 4.10)	Scoped in
Human Health (Section 4.11)	Scoped in
Airborne Noise and Vibration (Section 4.12)	No further work proposed.
Landscape/Seascape and Visual (Section 4.13)	No further work proposed.
Cumulative effects (Section 4.14)	The potential cumulative effects of wild seaweed harvesting and other known activities, plans or projects in the area will be considered.

5.2 Consultation

Consultation is a crucial part of the marine licence application process and this will be undertaken as widely as possible to obtain additional baseline information as required and seek views of all key parties/ stakeholders at an early stage. Engagement with regional stakeholders and Community Councils will occur through attending Community Council meetings or arranging local events.

A Pre-Application Consultation Report will be prepared and submitted with the Environmental Report, consistent with the requirements of The Marine Licensing (Pre-application Consultation) (Scotland) Regulations 2013.

The consultees that have been identified include the following parties:

Statutory consultees/national bodies:

- SNH;
- SEPA;
- Maritime and Coastguard Agency;
- Northern Lighthouse Board;
- Historic Environment Scotland;
- Fisheries Management Scotland;
- Crown Estate Scotland

Key stakeholders:

- Scottish Environment Link
- Mallaig Harbour Authority;
- The Highland Council;
- Comhairle nan Eilean Siar;
- Argyll and Bute Council;
- Highlands & Islands Enterprise;
- West Coast RIFG
- Outer Hebrides RIFG
- Scottish Fisherman's Federation (SFF; Mallaig and North West)
- Association of Scottish Shellfish Growers
- Scottish Salmon Producers Organisation
- West of Scotland Fish Producers Association
- Scottish Seaweed Industry Association
- RYA Scotland/Scottish Boating Alliance
- Relevant Community Councils
- South West Mull and Iona Development Trust
- Tiree Community Development Trust
- Development Coll
- The Glendale Trust
- Barra and Vatersay Community Ltd
- Storas Uibhist
- West Harris Trust
- Coigach Community Development Company
- Morar Community Trust
- Knoydart Foundation
- Isle of Eigg Heritage Trust
- Isle of Rum Community Trust
- Isle of Canna Community Trust

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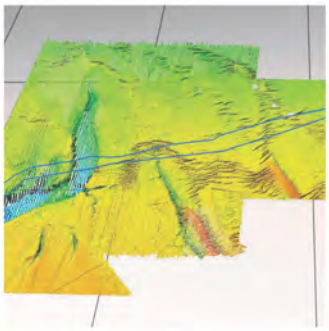
7 Abbreviations/Acronyms

AA	Appropriate Assessment
AIS	Automatic Identification System
AQMA	Air Quality Management Areas
ASSG	Association of Scottish Shellfish growers
BGS	British Geological Survey
BMAPA	British Marine Aggregate Producers Association
BPEO	Best Practicable Environmental Option
BWD	Bathing Water Directive
CalMac	Caledonian MacBrayne (CalMac)
CAR	Controlled Activity Regulations
Cefas	Centre for Environment, Fisheries and Aquaculture Science
CES	Crown Estate Scotland
CIfA	Chartered Institute for Archaeologists
CMAL	Caledonian Maritime Assets Limited
CODA	Cetacean Offshore Distribution and Abundance
cSAC	candidate Special Areas of Conservation
DfT	Department for Transport
DSP	Diarrhetic Shellfish Poisoning
DTI	Department for Trade and Industry
EAV	Equivalent Adult Value Metric
EC	European Commission
EEC	European Economic Community
EIA	Environmental Impact Assessment
EMODnet	European Marine Observation and Data Network
EMS	Electronic Monitoring System
EPS	European Protected Species
ESG	Environmental Steering Group
EU	European Union
EUROSION	European Study into Coastal Erosion at a European Scale
GES	Good Environmental Status
GHG	Greenhouse Gas
GPS	Global Positioning System
HES	Historic Environment Scotland
HIE	Highlands & Islands Enterprise
HM	Her Majesty's
HMPA	Historic Marine Protected Areas
HMWB	Heavily Modified Water Bodies
ICES	International Council for the Exploration of the Sea
IEMA	Institute of Environmental Management and Assessment
IFG	Inshore Fisheries Group
INNS	Invasive Non-Native Species
JNAPC	Joint Nautical Archaeology Policy Committee
JNCC	Joint Nature Conservation Committee
MAIB	Marine Accident Investigation Branch
MBL	Marine Biopolymers Ltd
MCA	Maritime Coastguard Agency
MHWM	Mean High Water Mark
MLWS	Mean Low Water Springs

MMO	Marine Management Organisation
MNCR	Marine Nature Conservation Review
MPA	Marine Protected Area
MSFD	Marine Strategy Framework Directive
MS-LOT	Marine Scotland Licencing Operations Team
MU	Management Unit
NCMPA	Nature Conservation Marine Protected Areas
NMPi	National Marine Plan Interactive
NRHE	National Records of the Historic Environment
PMF	Priority Marine Feature
pMPA	proposed Marine Protected Area
PSP	Paralytic Shellfish Poisoning
QUB	Queens University Belfast
Ramsar	Wetlands of international importance, designated under The Convention on Wetlands (Ramsar, Iran, 1971)
RBD	River Basin District
RBMP	River Basin Management Plan
RIFG	Regional Inshore Fisheries Groups
RNLI	Royal National Lifeboat Institution
RSPB	Royal Society for the Protection of Birds
RYA	Royal Yachting Association
SAC	Special Areas of Conservation
SACFOR	Super-abundant, Abundant, Common, Frequent, Occasional, Rare
SAMS	Scottish Association of Marine Science
SCANS-II	Small Cetaceans in the European Atlantic and North Sea
SCI	Sites of Conservation Interest
SCI	Site of Community Importance
SCOS	Special Committee On Seals
SEA	Strategic Environmental Assessment
SEPA	Scottish Environment Protection Agency
SFF	Scottish Fisherman's Federation
SIMD	Scottish Index of Multiple Deprivation
SNH	Scottish Natural Heritage
SPA	Special Areas of Protection
SRSL	SAMS Research Services Ltd
SSB	Spawning Stock Biomass
SSPO	Scottish Salmon Producers' Organisation
SSSI	Site of Special Scientific Interest
UAber	University of Aberystwyth
UK	United Kingdom
UKTAG	Partnership of the UK environment and conservation agencies
UXO	Unexploded Ordnance
VMS	Vessel Monitoring System
WEWS	Water Environment Water Services (Scotland) Act 2003
WFD	Water Framework Directive
WHO	World Health Organization

Cardinal points/directions are used unless otherwise stated.
SI units are used unless otherwise stated.

Figures


Innovative Thinking - Sustainable Solutions

ABP mer

Figures

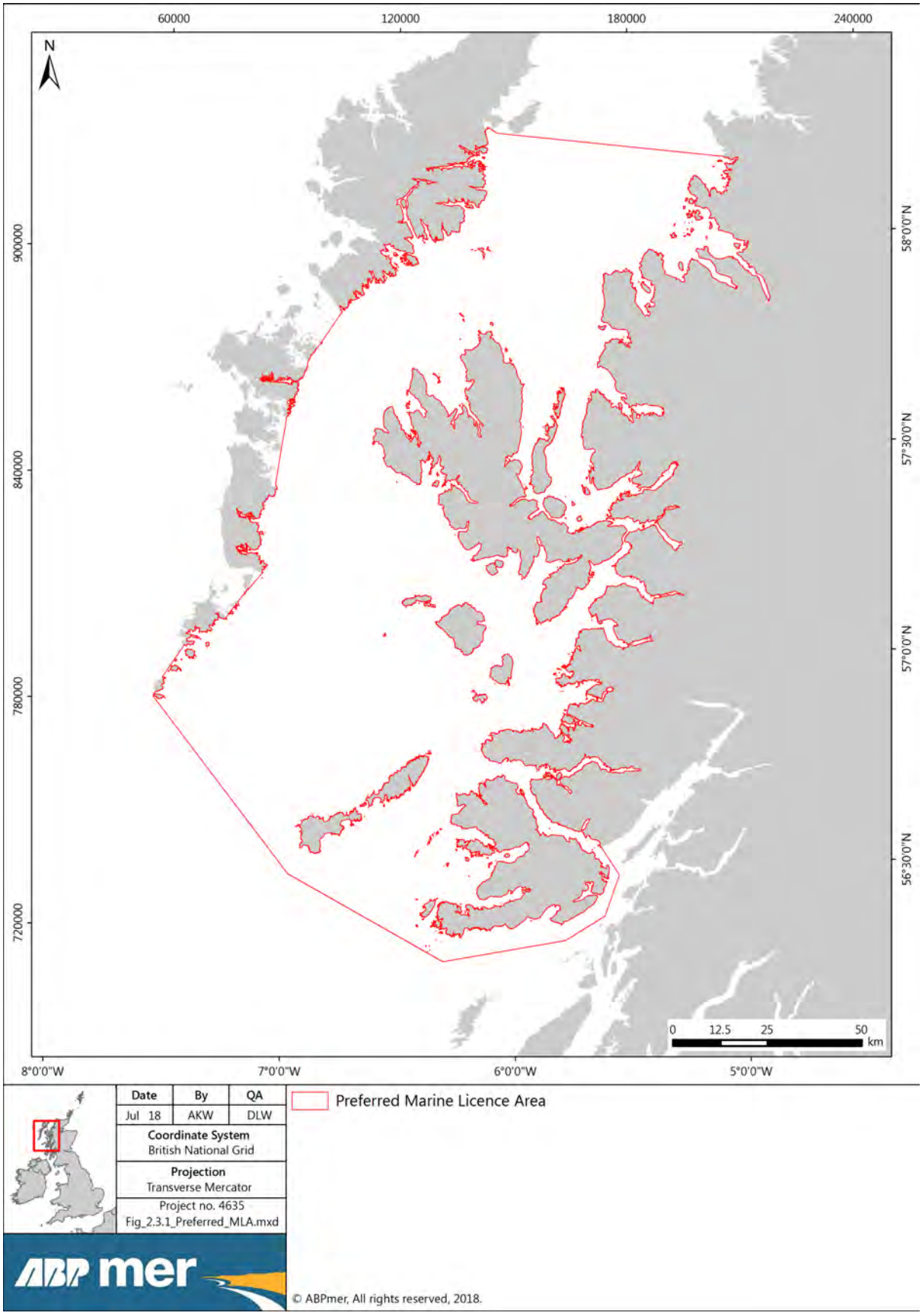


Figure 2.3.1 Area of Search

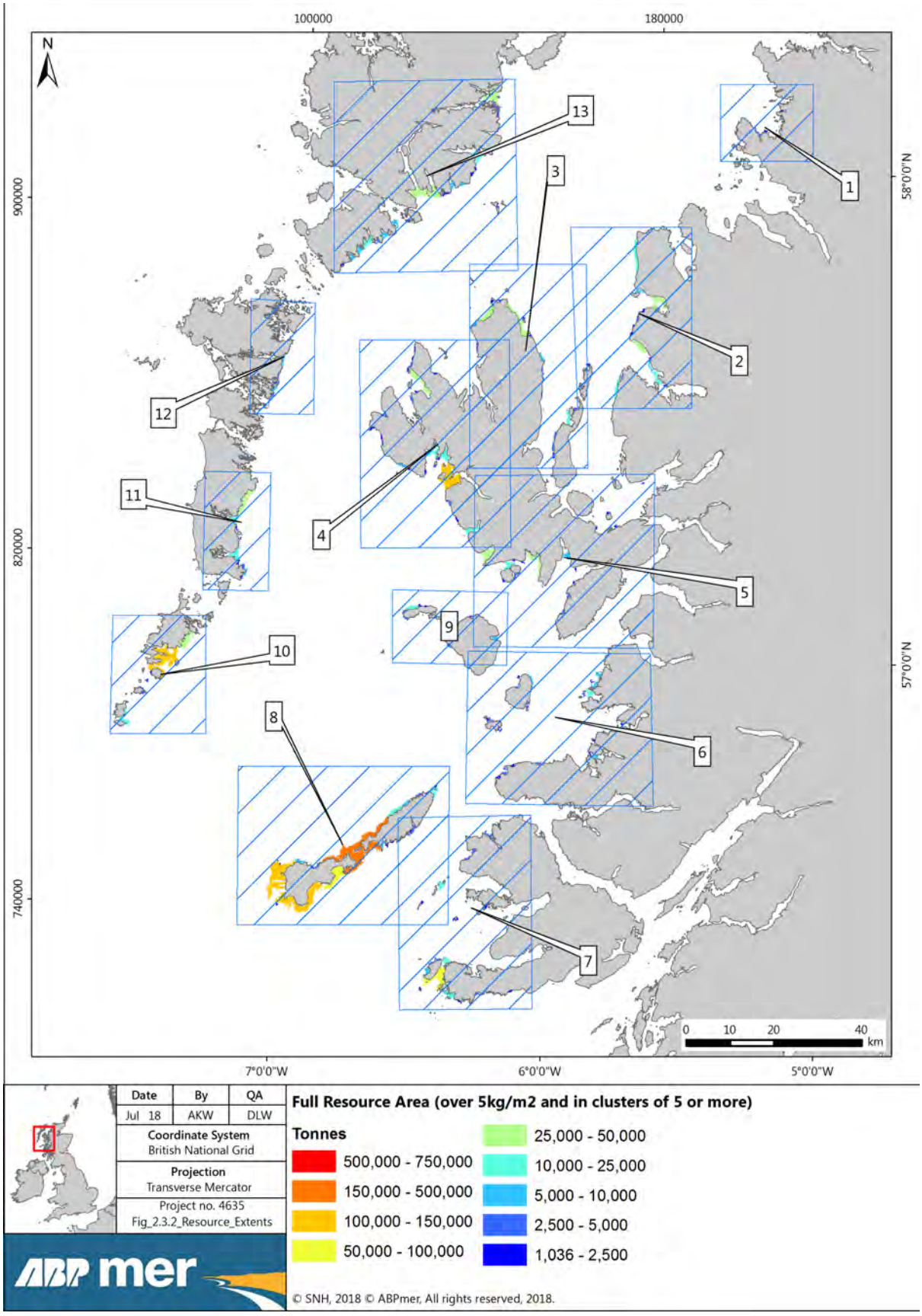
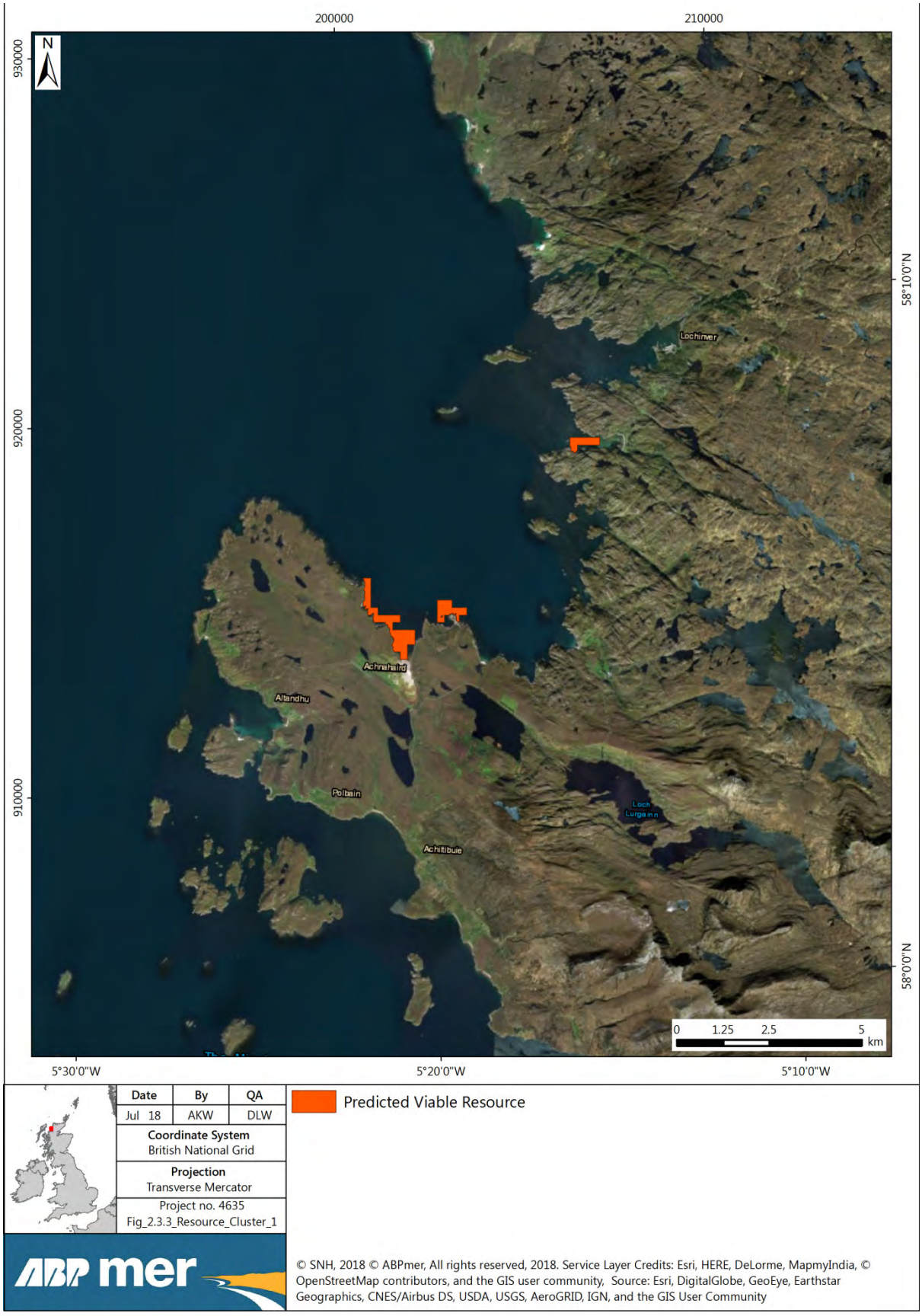


Figure 2.3.2 Potential *L. hyperborea* resource areas within Area of Search



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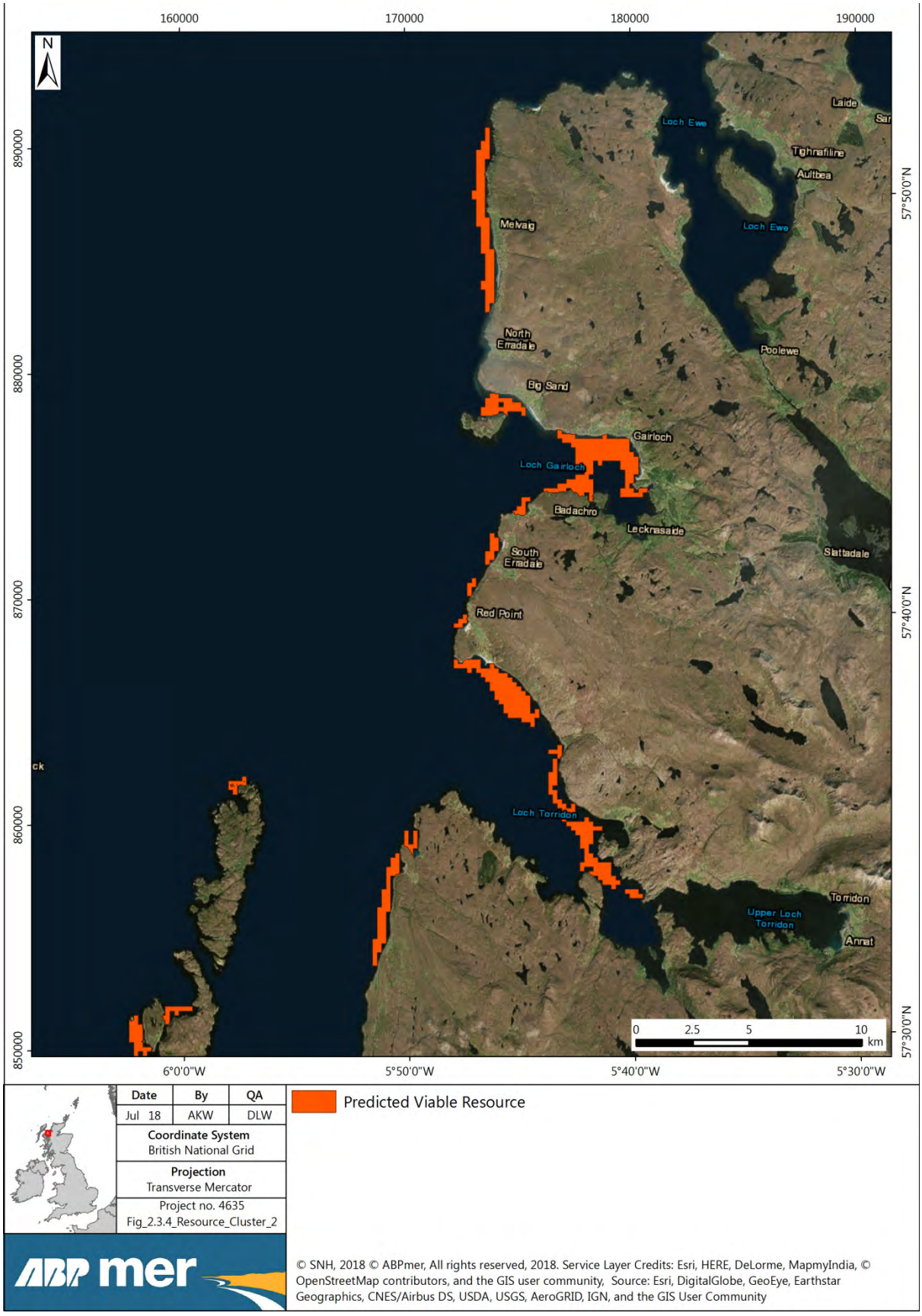

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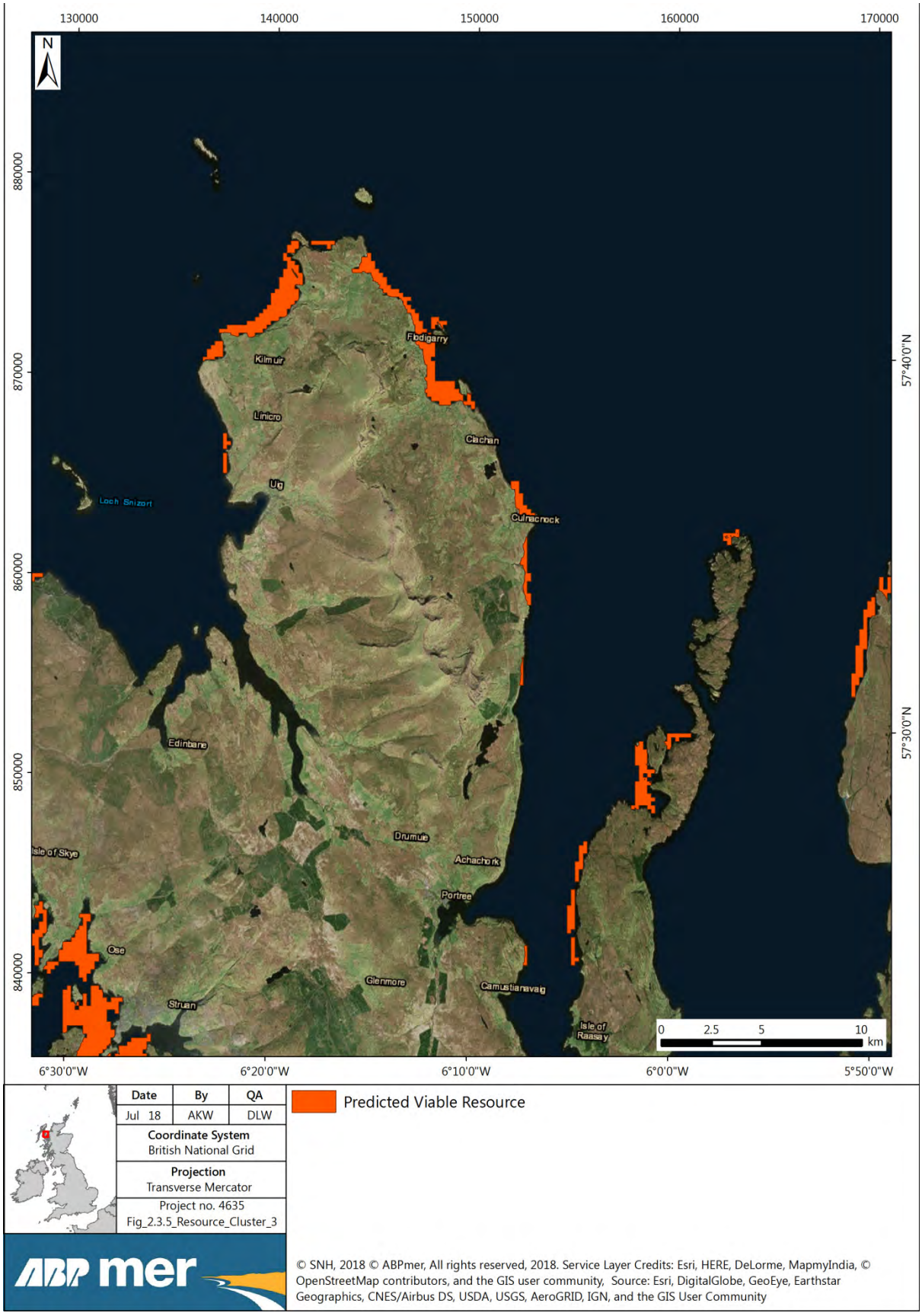
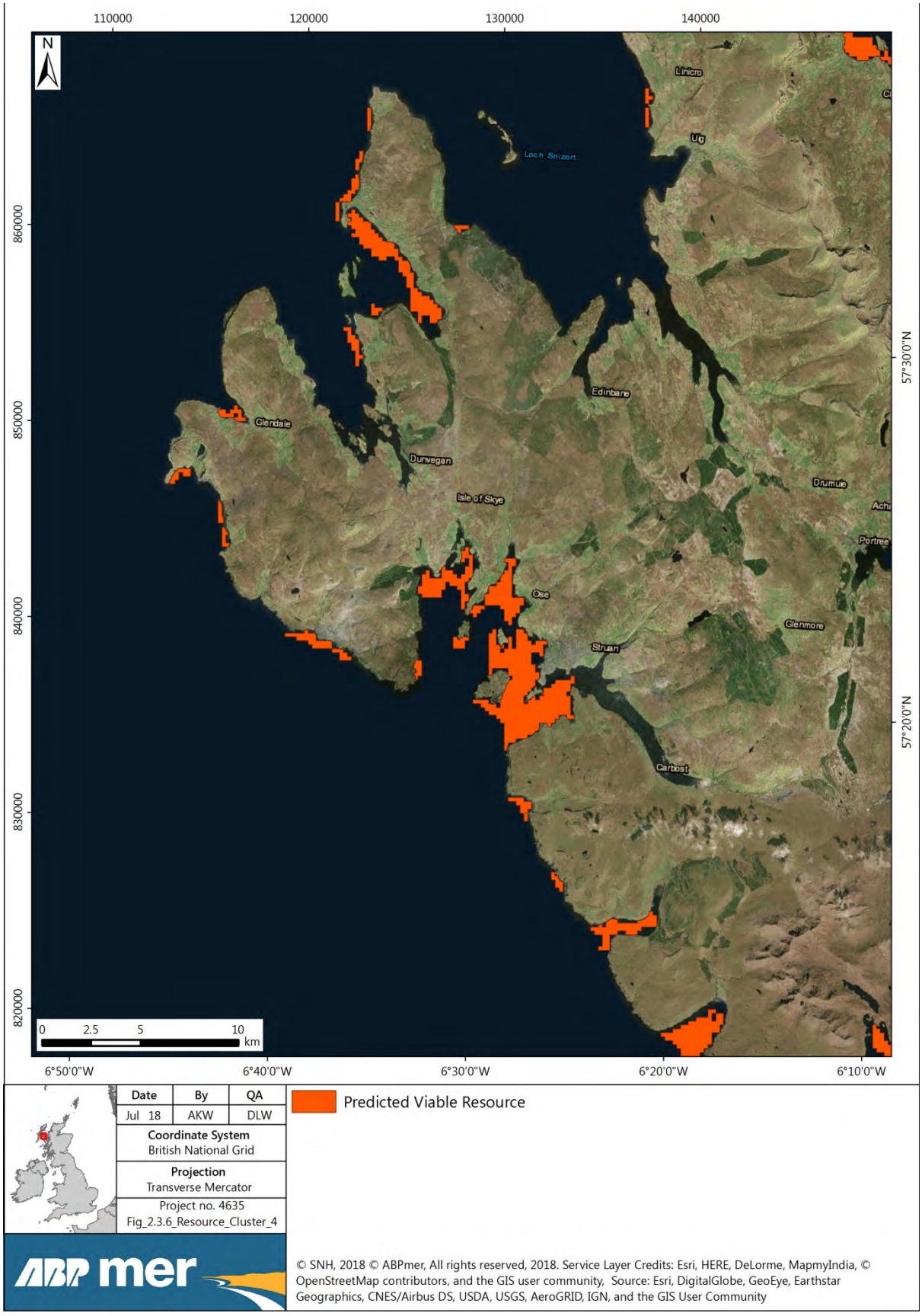


Figure 2.3.5 Resource Cluster 3



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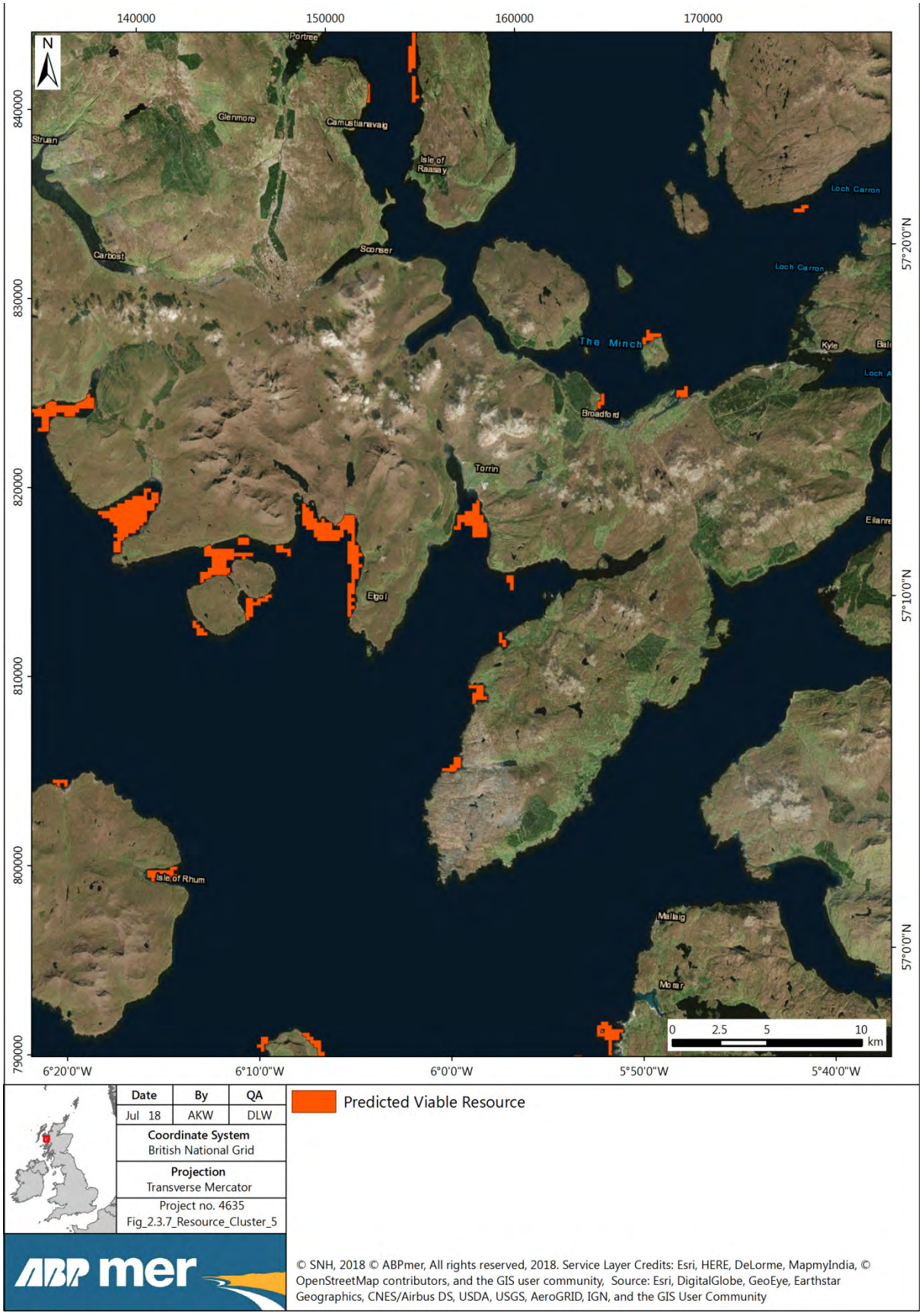

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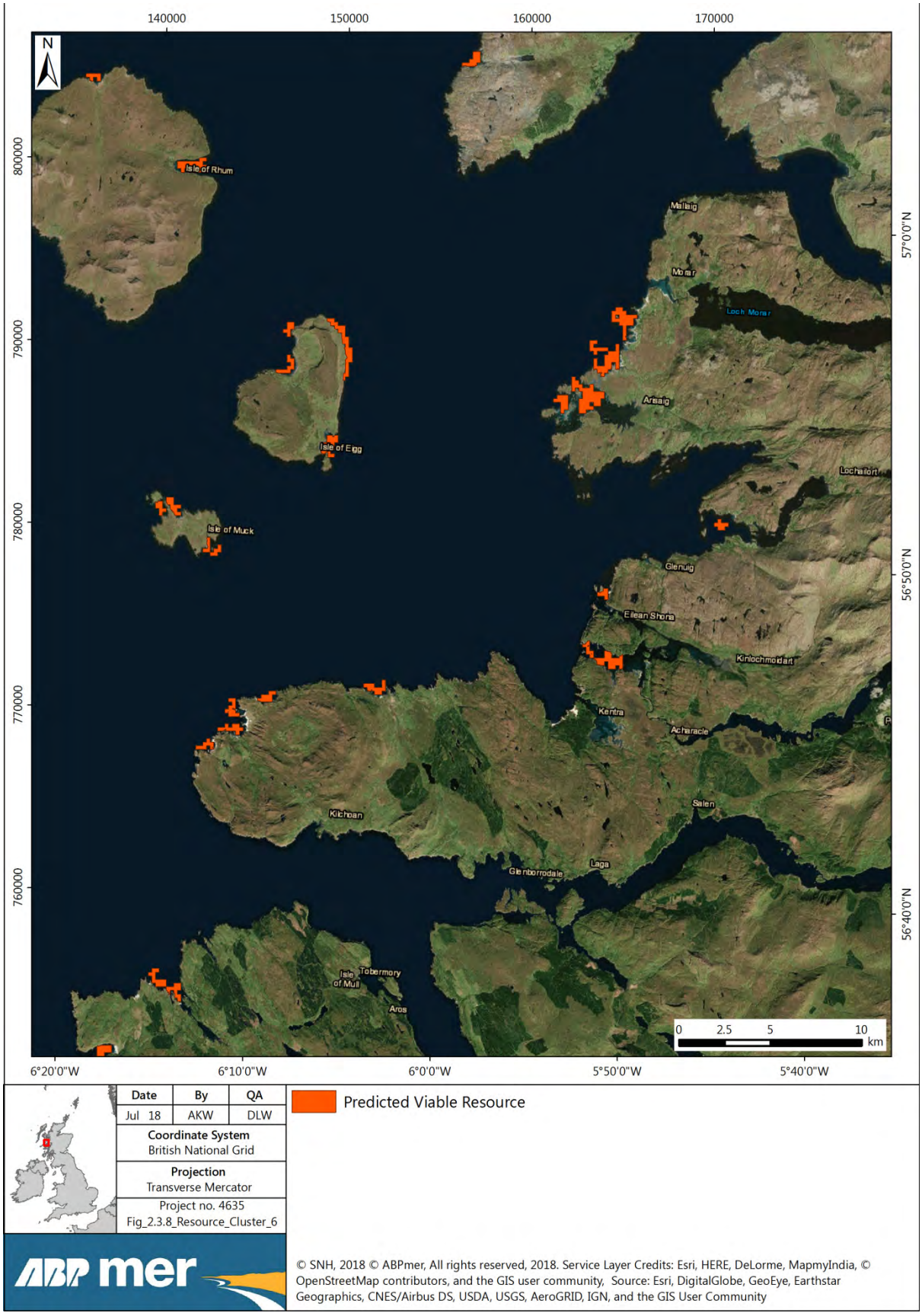

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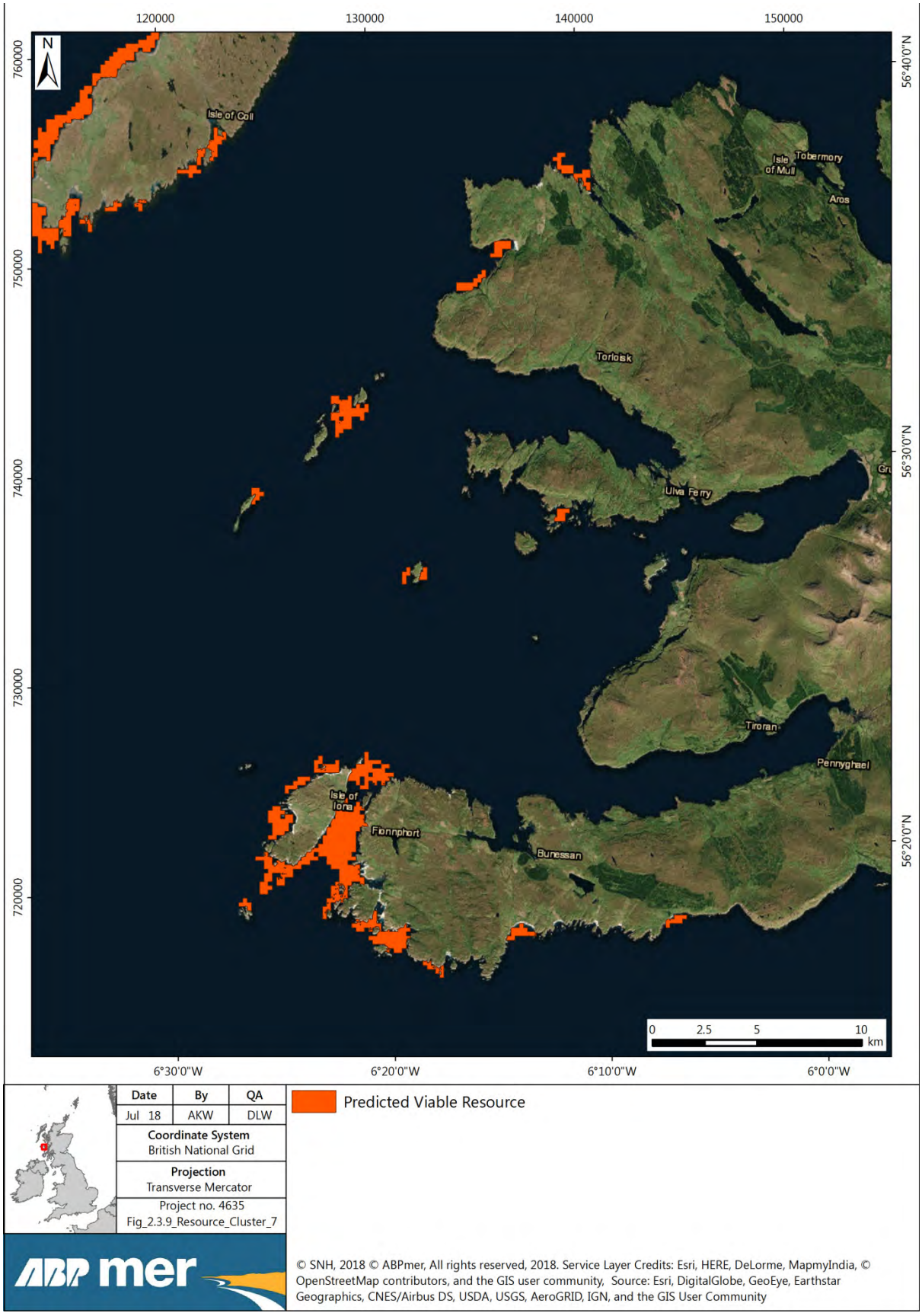

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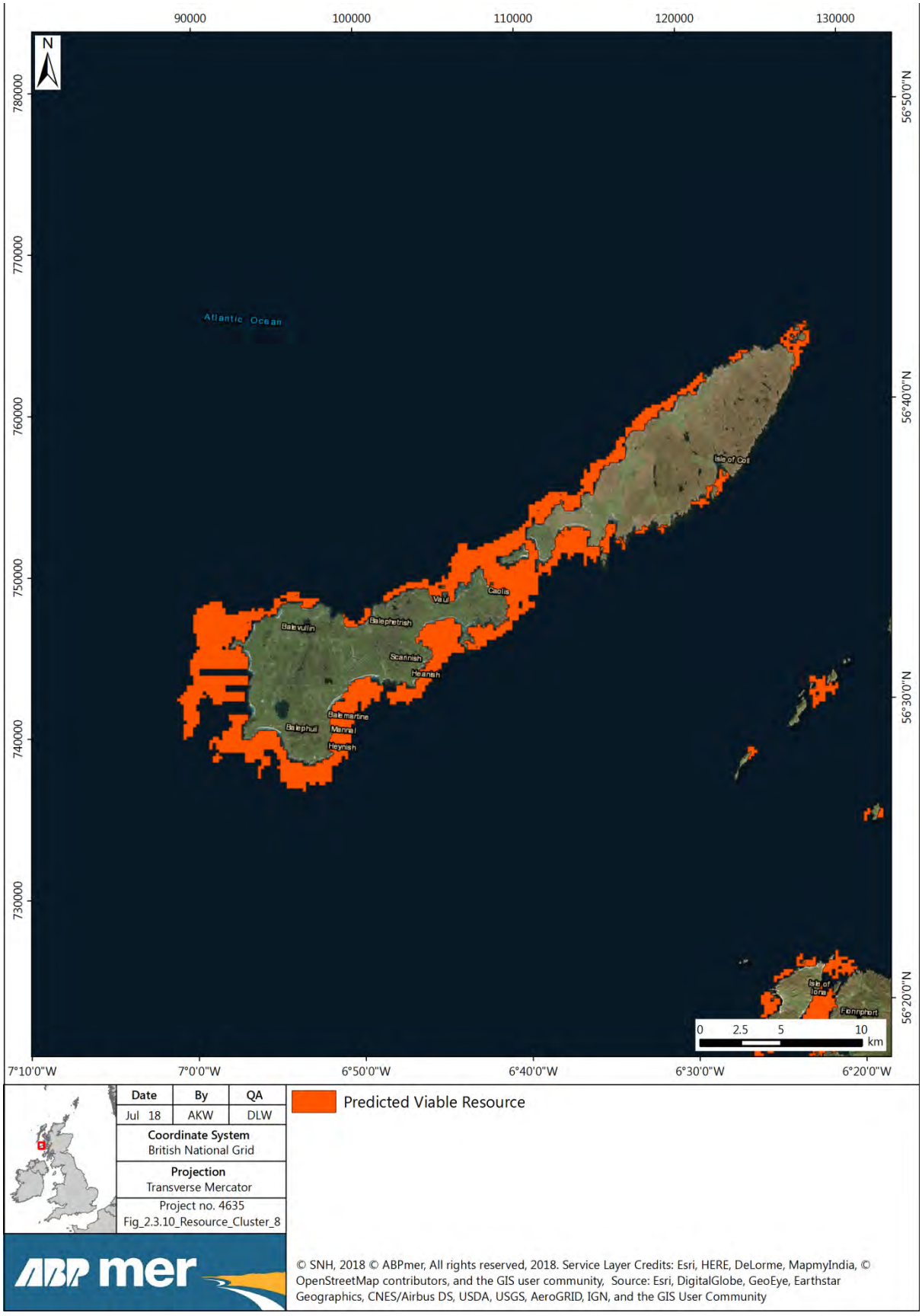


Figure 2.3.10 Resource Cluster 8

Figure 2.3.11 Resource Cluster 9

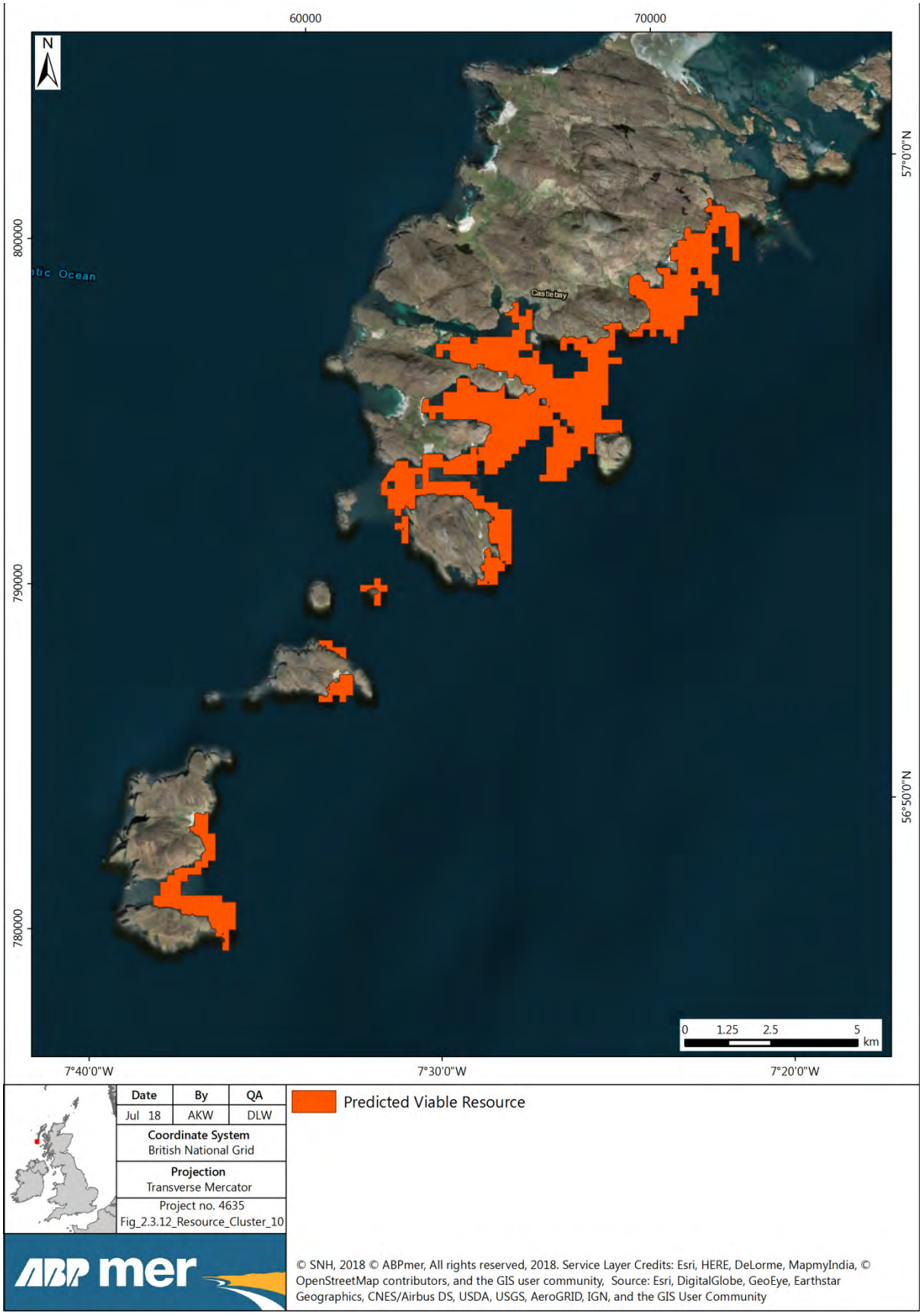
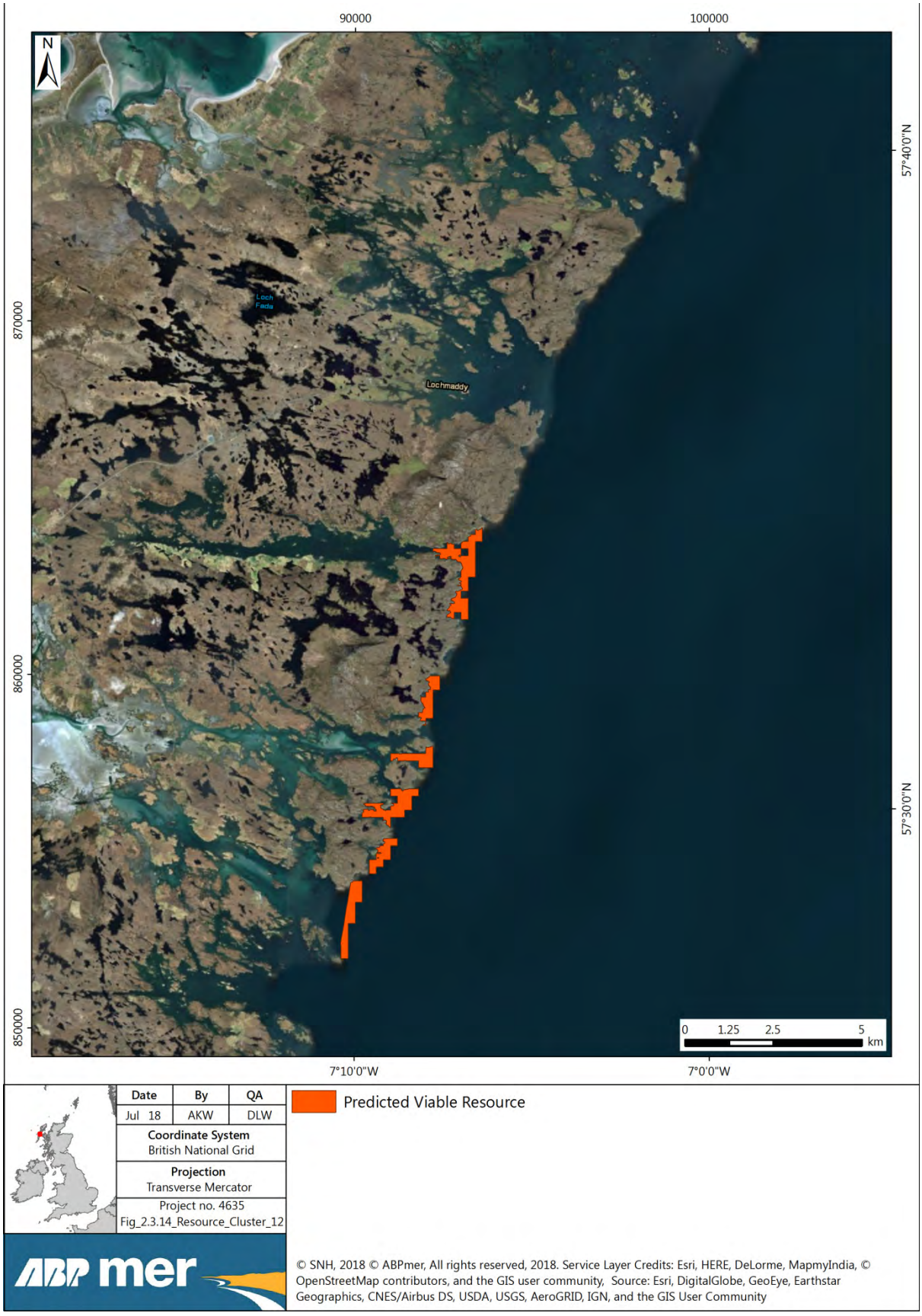


Figure 2.3.12 Resource Cluster 10

Figure 2.3.13 Resource Cluster 11



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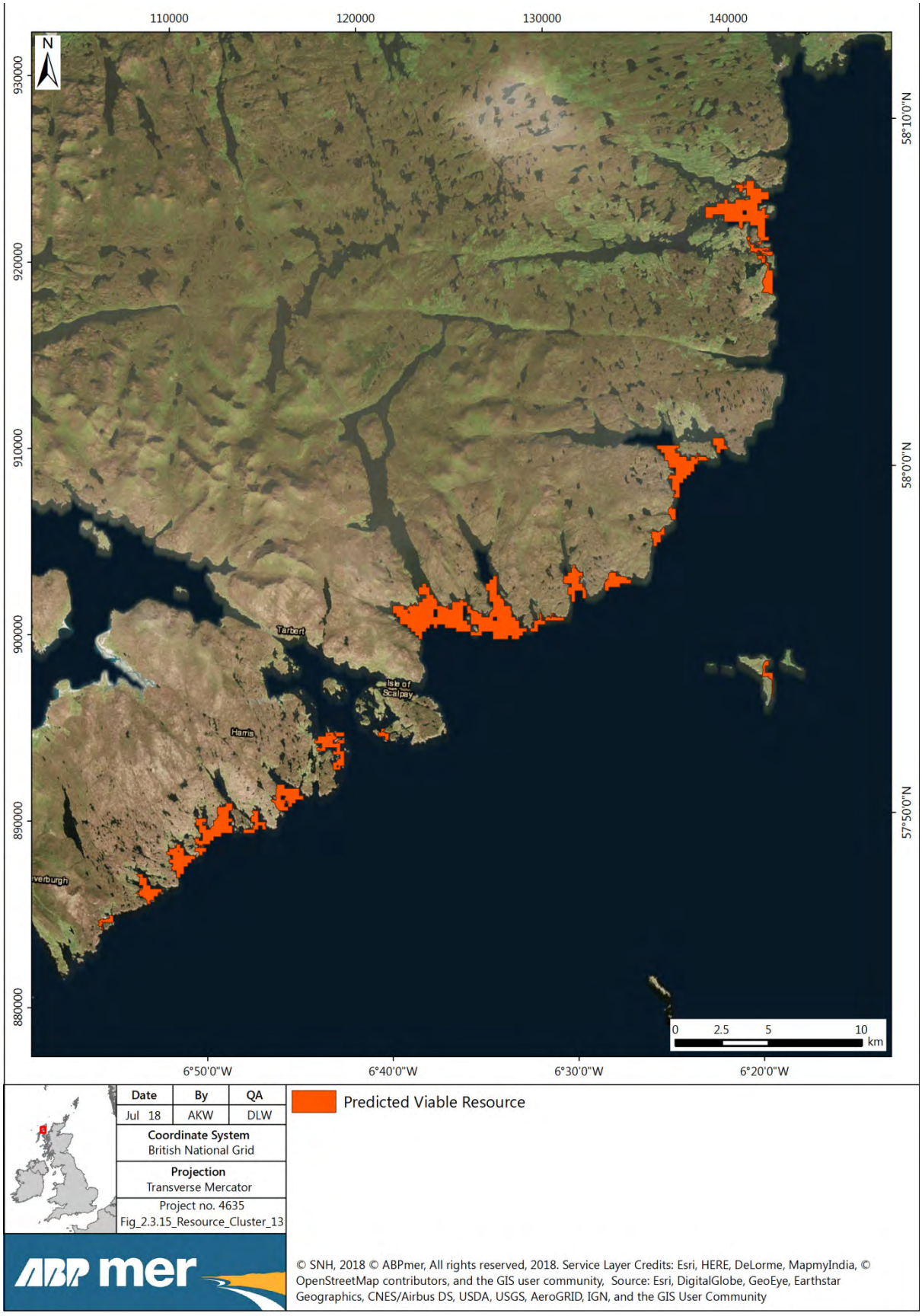

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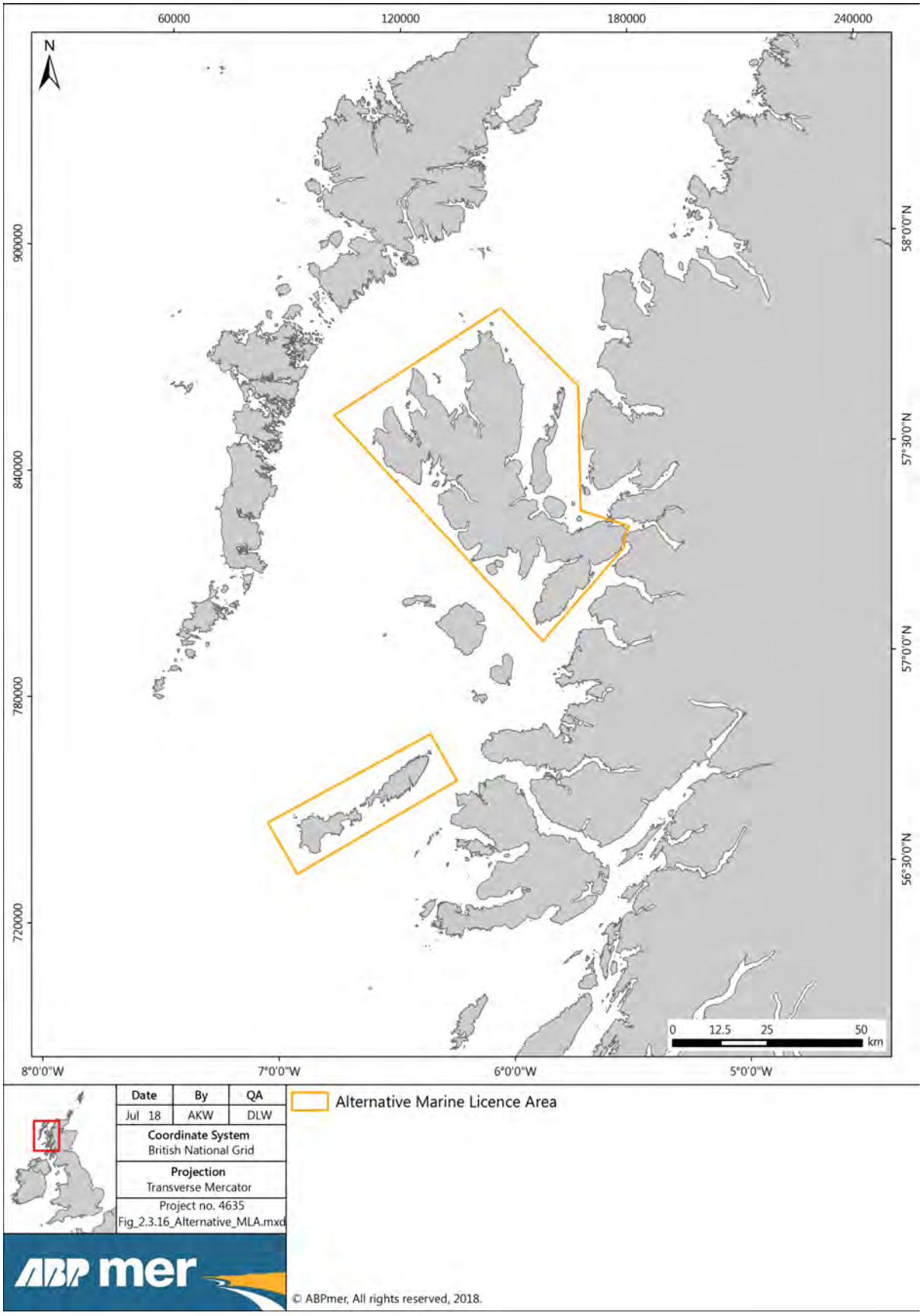


Figure 2.3.16 Alternative marine licence area

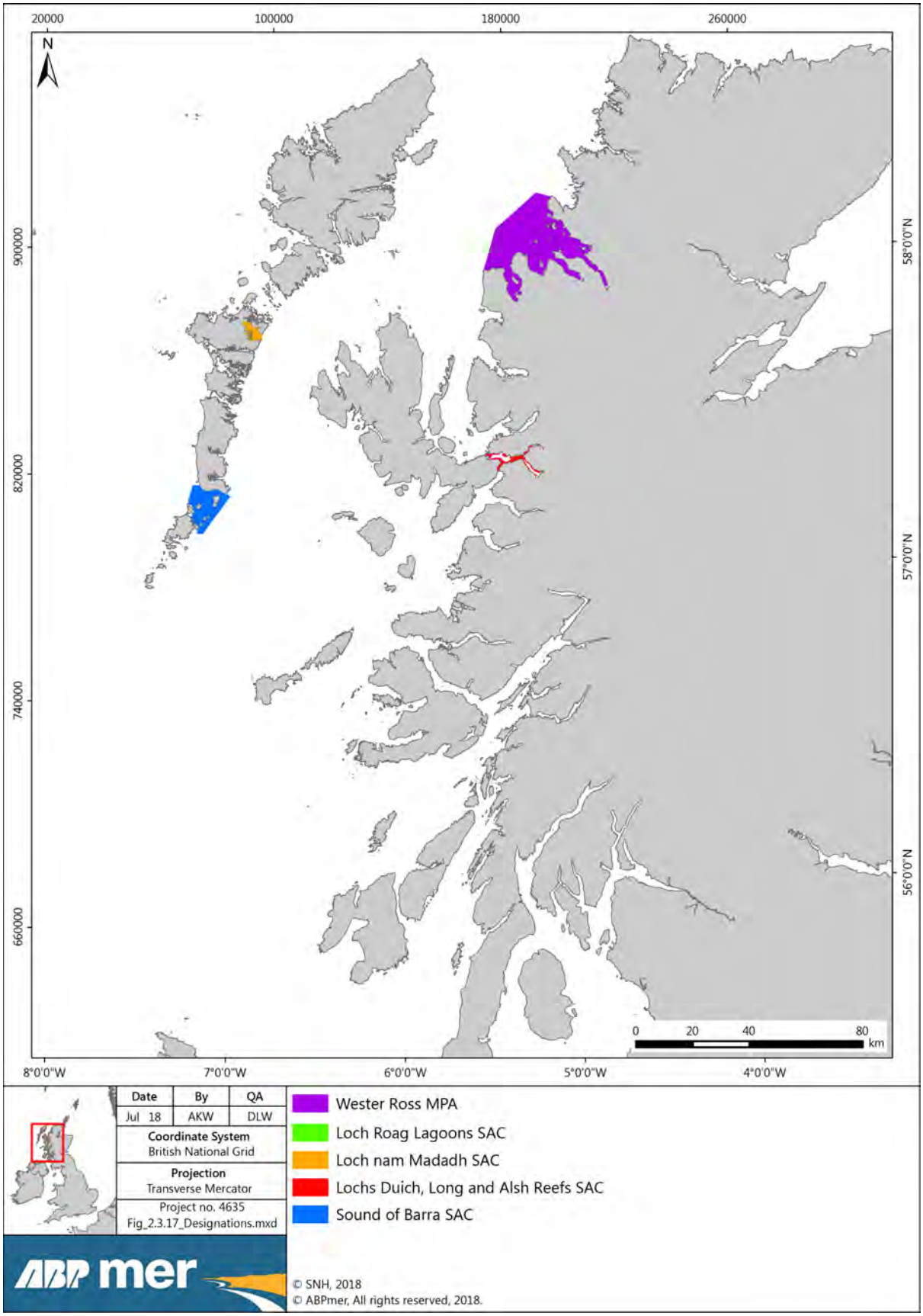


Figure 2.3.17 Special Areas of Conservation and Nature Conservation Marine Protected Areas which are designated for kelp features

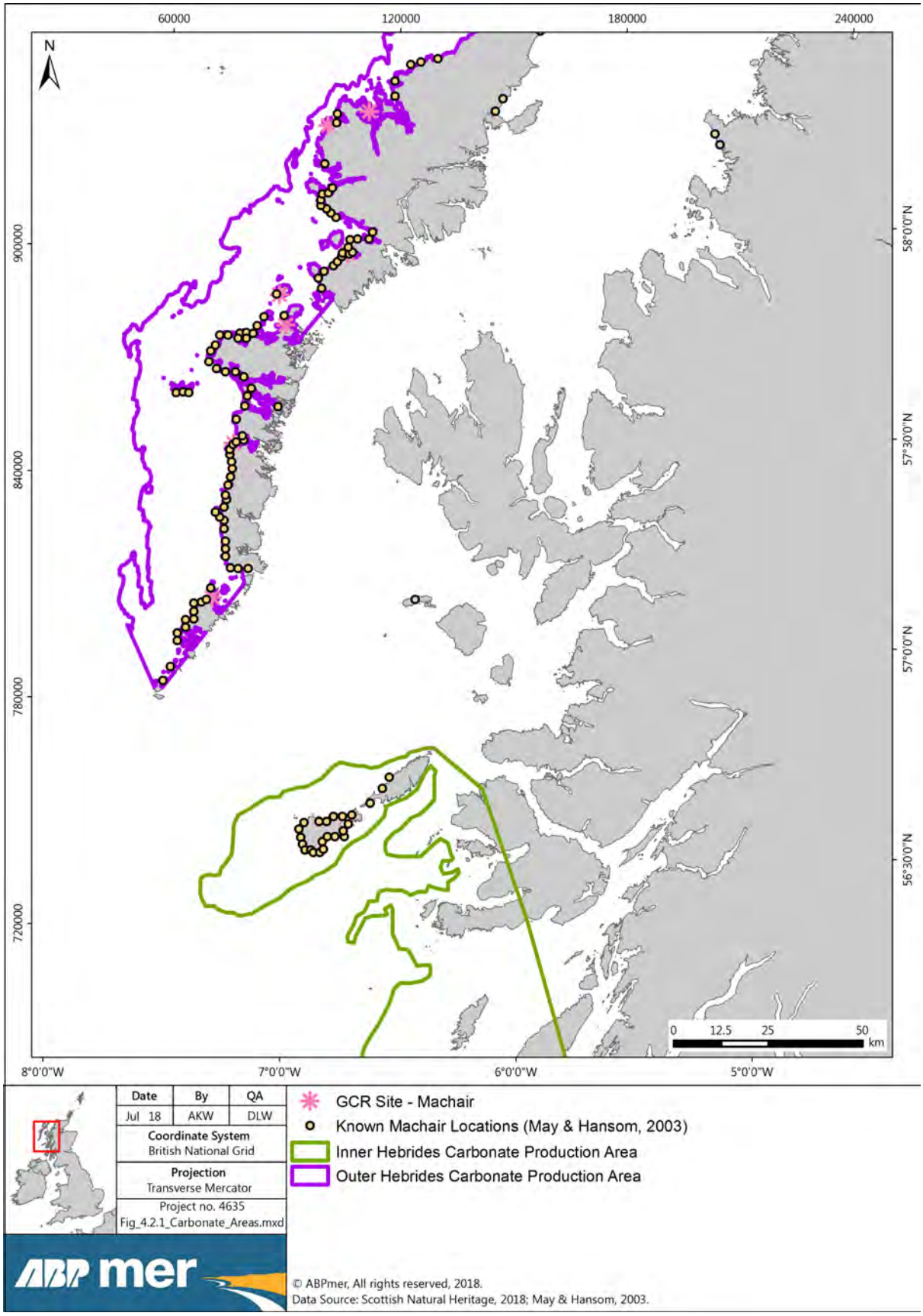


Figure 4.2.1 Carbonate production areas within Area of Search

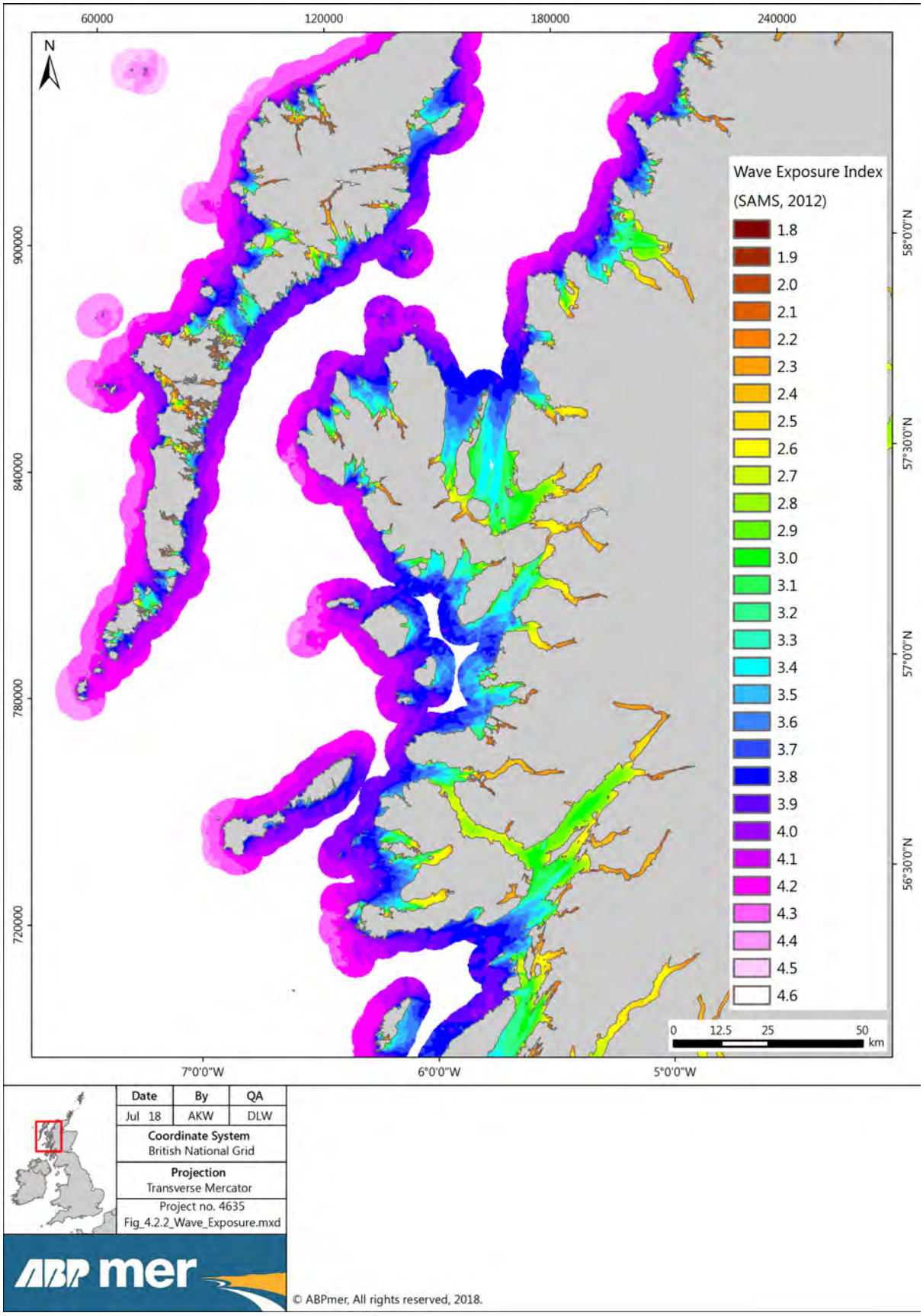


Figure 4.2.2 Wave exposure index within the Area of Search

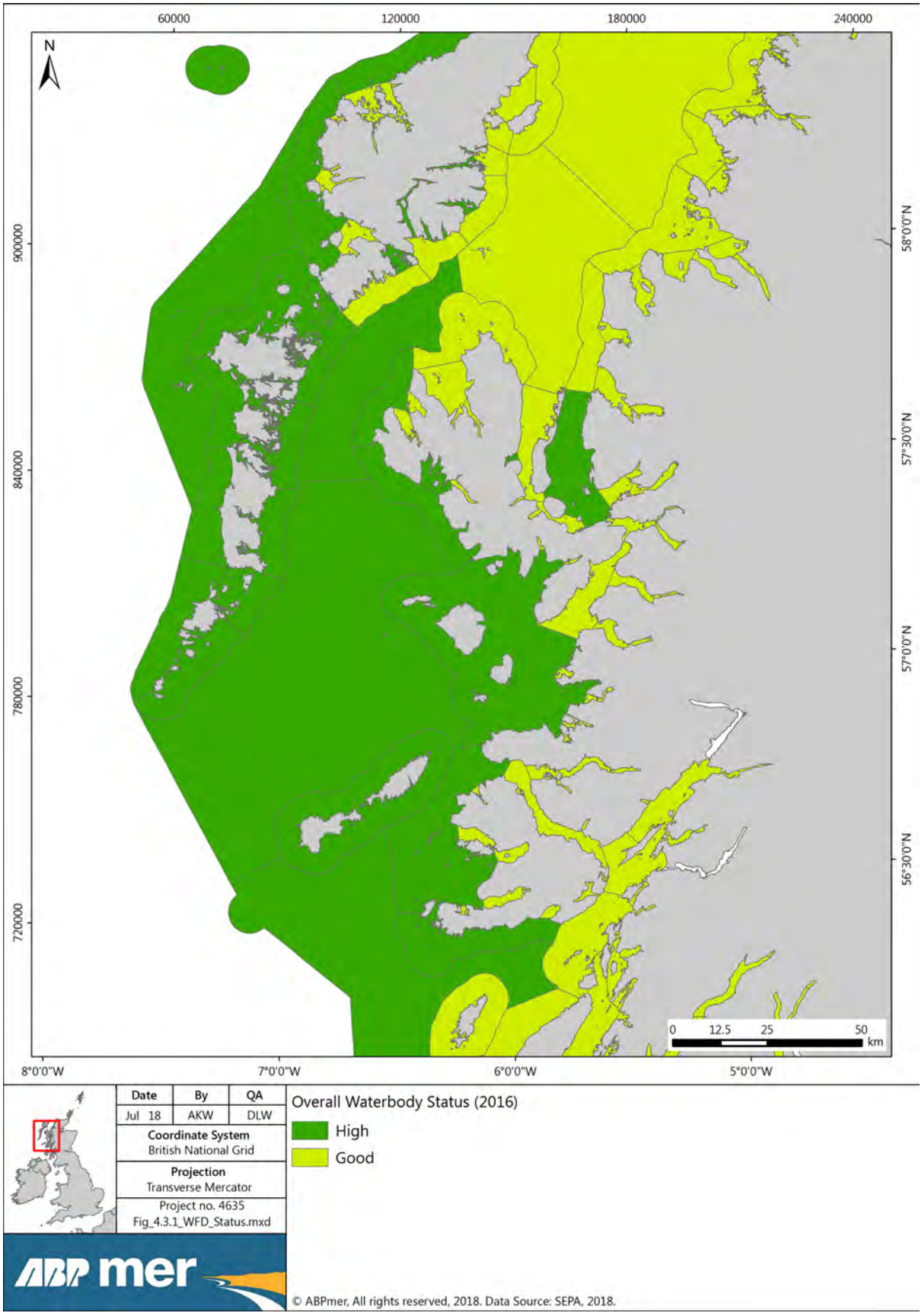


Figure 4.3.1 Overall waterbody status for WFD waterbodies within the Area of Search

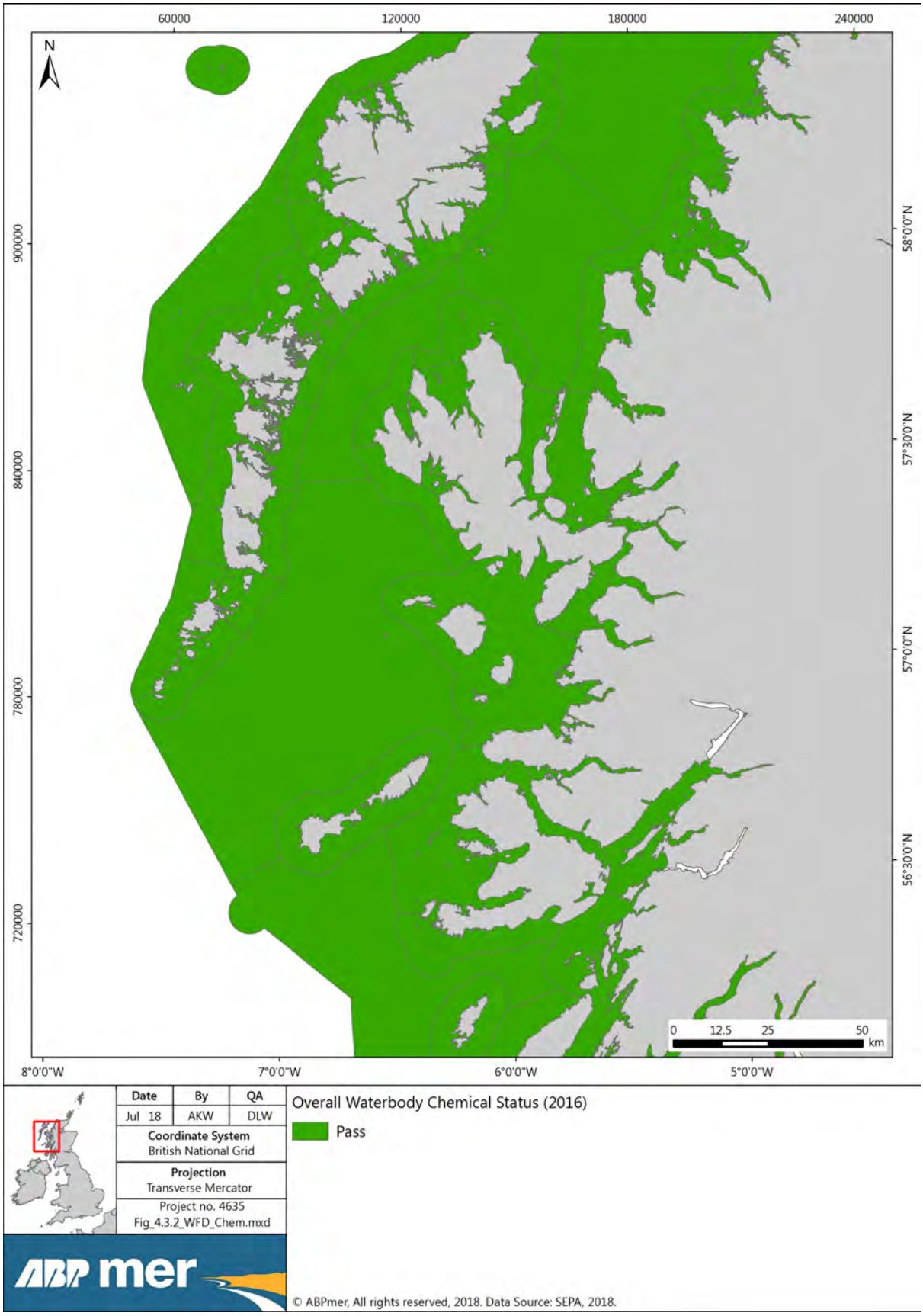


Figure 4.3.2 Overall chemical status for WFD waterbodies within the Area of Search

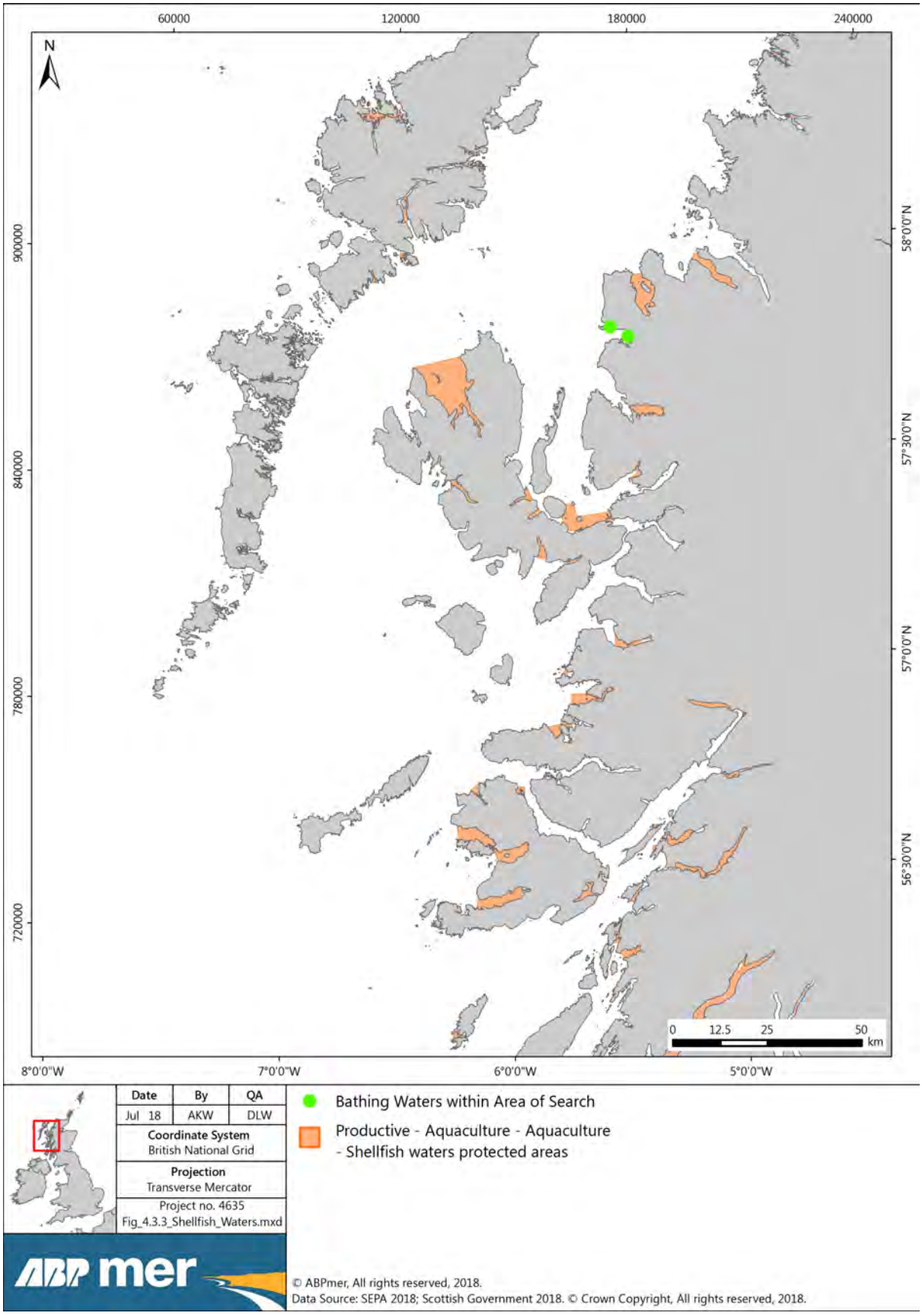


Figure 4.3.3 Bathing waters and shellfish waters within Area of Search

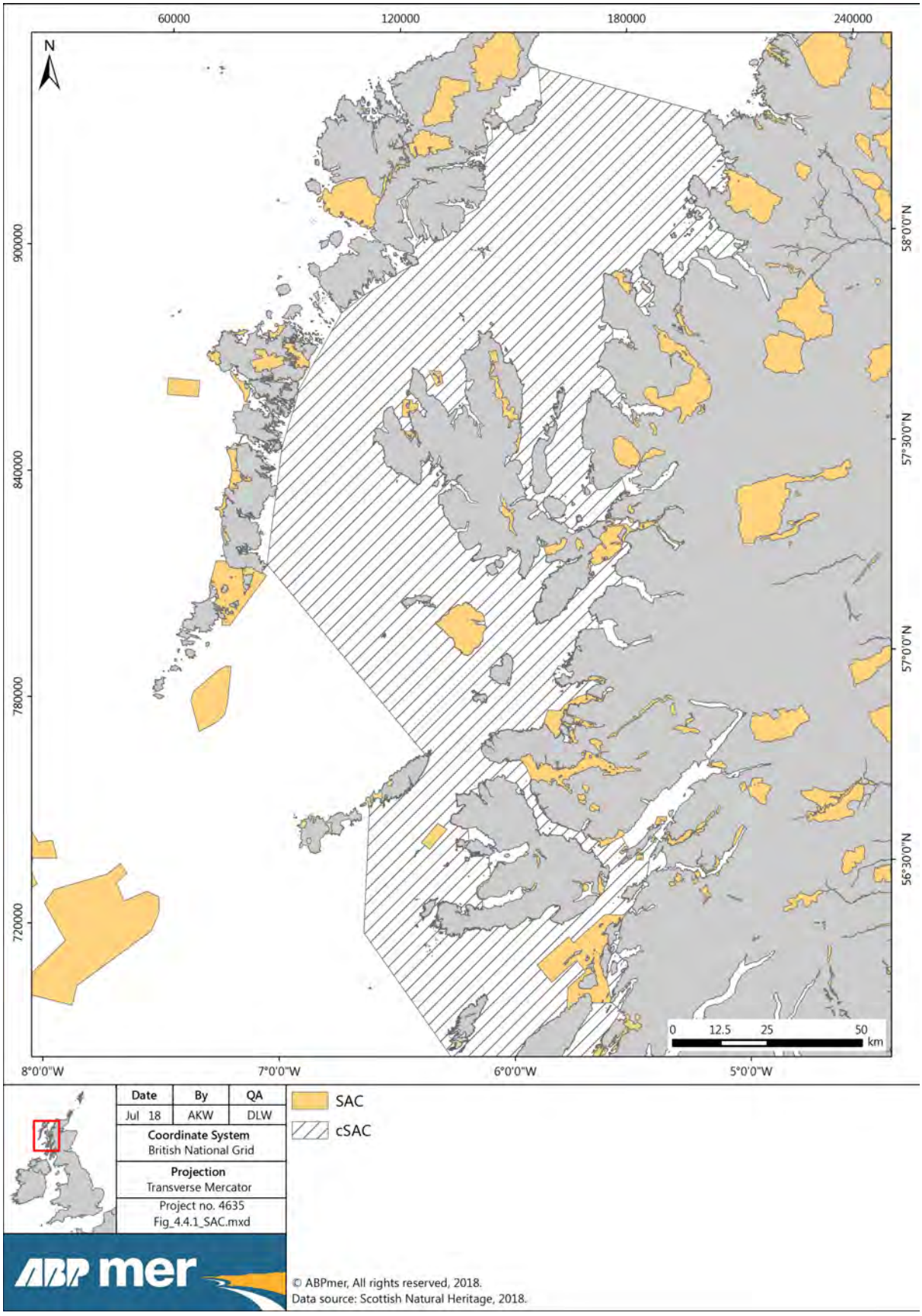


Figure 4.4.1 Special Areas of Conservation and Sites of Conservation Importance within Area of Search

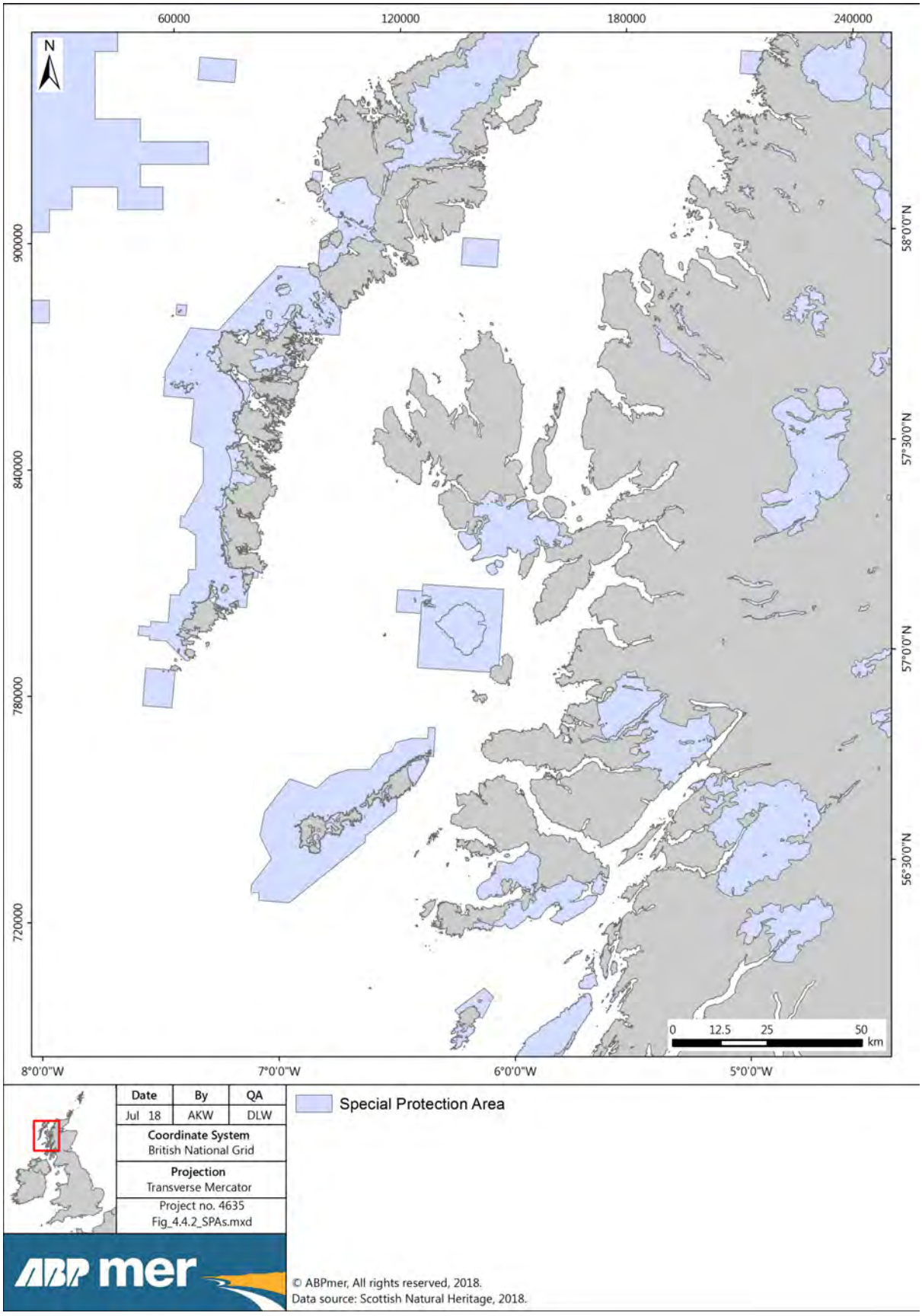


Figure 4.4.2 Special Protection Areas and proposed Special Protection Areas within Area of Search

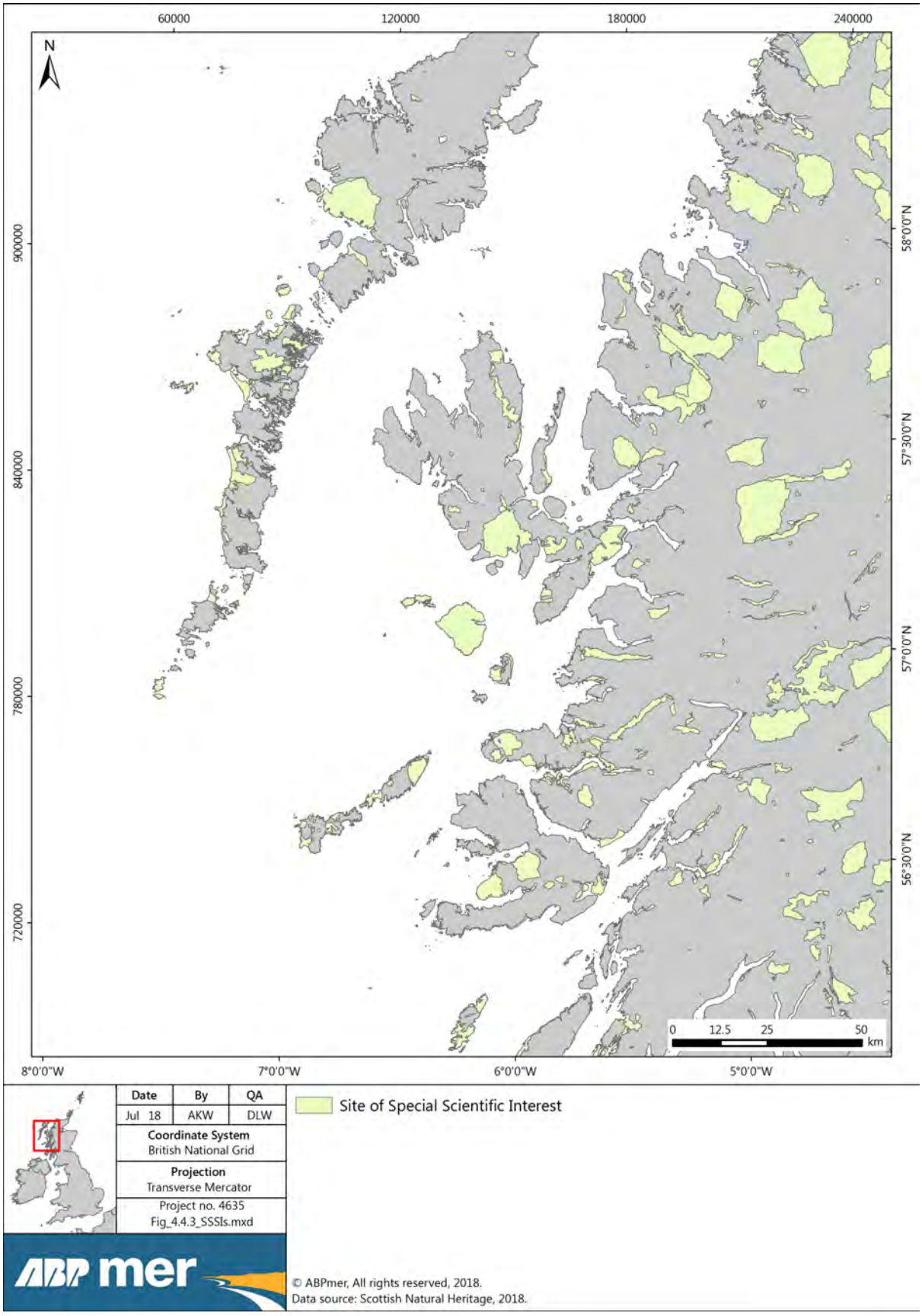


Figure 4.4.3 Sites of Special Scientific Interest within Area of Search

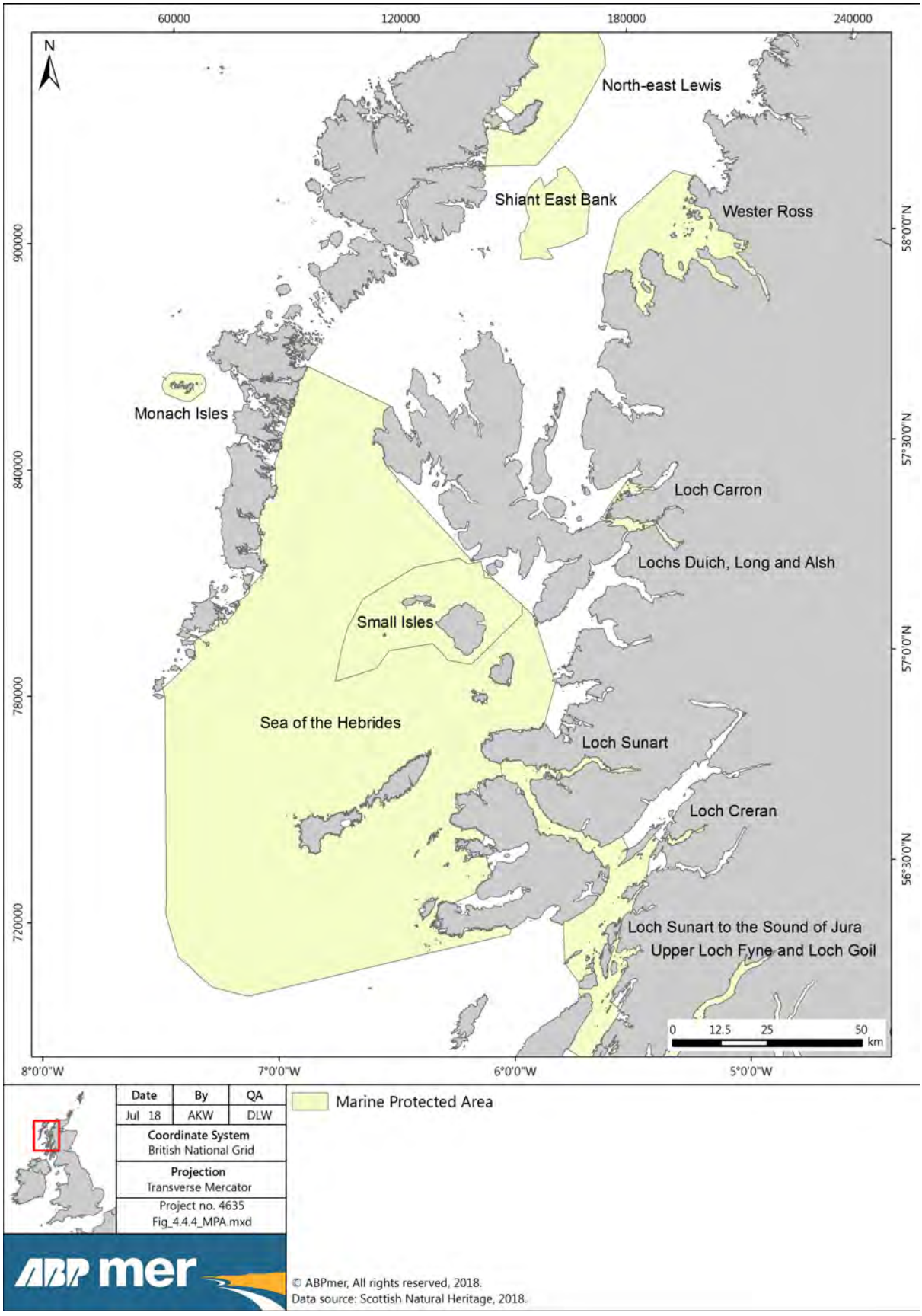


Figure 4.4.4 Nature Conservation Marine Protected Areas and proposed Marine Protected Areas within Area of Search

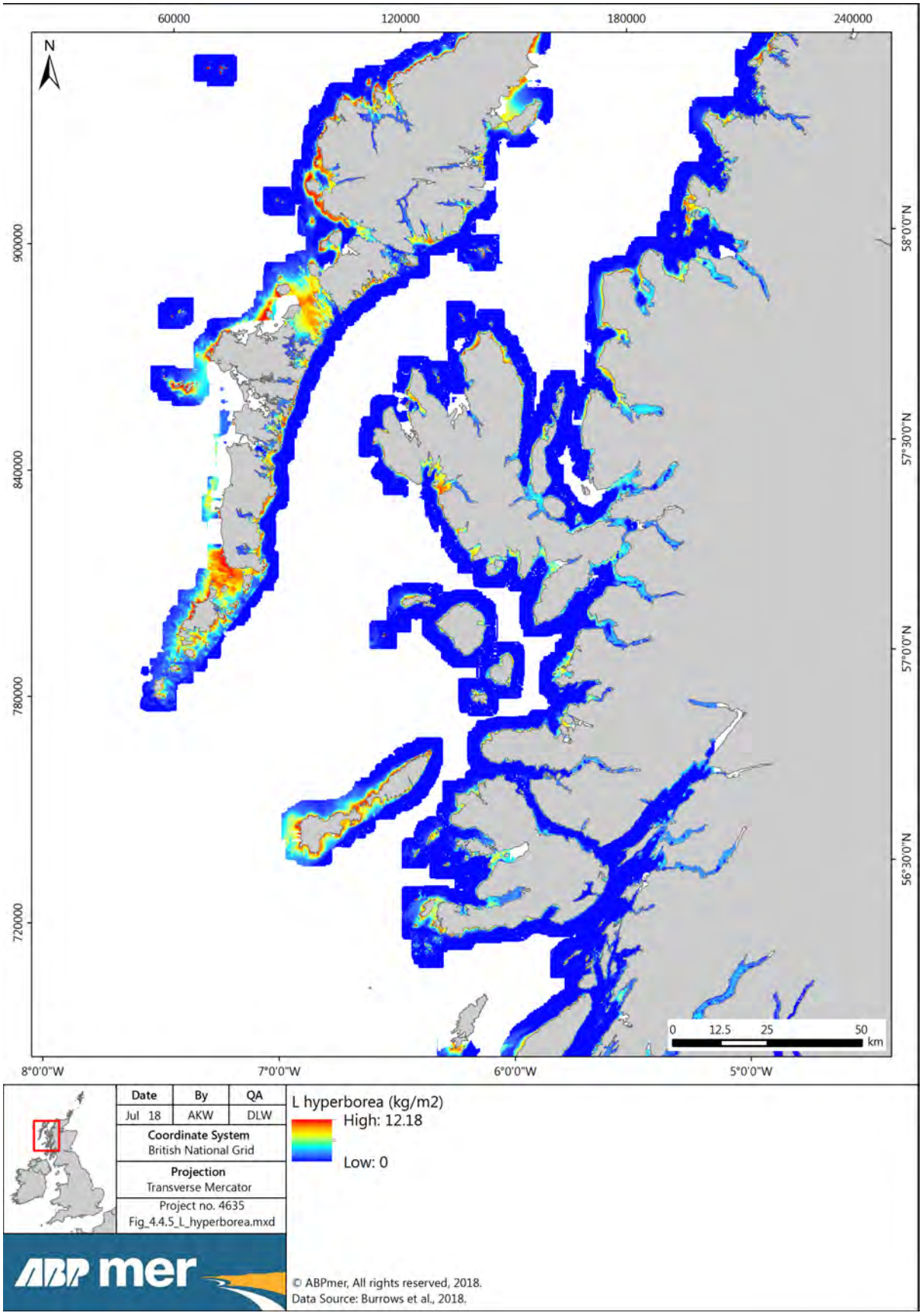


Figure 4.4.5 Modelled distribution of *L hypoborea*

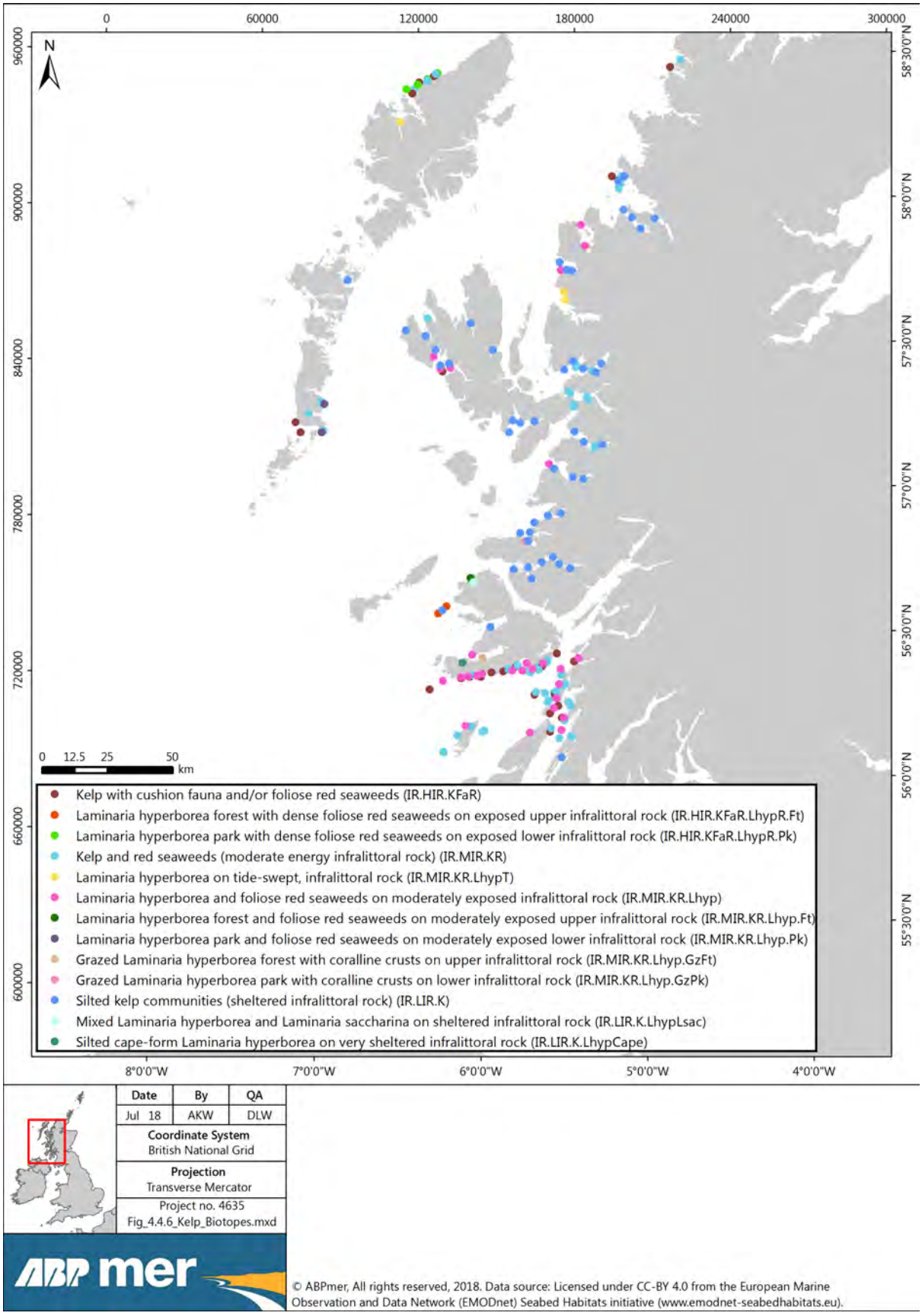


Figure 4.4.6 Kelp biotopes within Area of Search

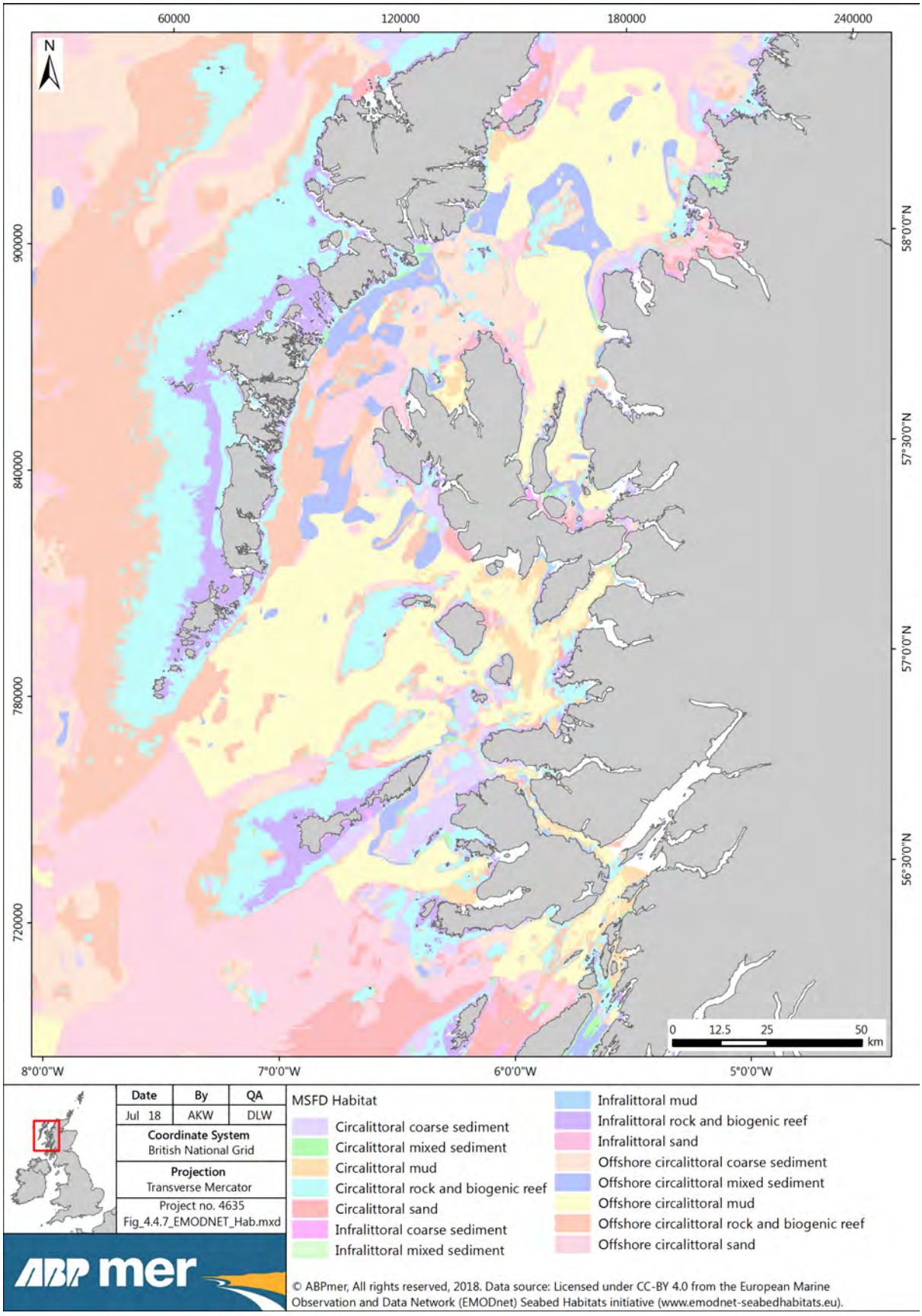


Figure 4.4.7 EMODnet habitat

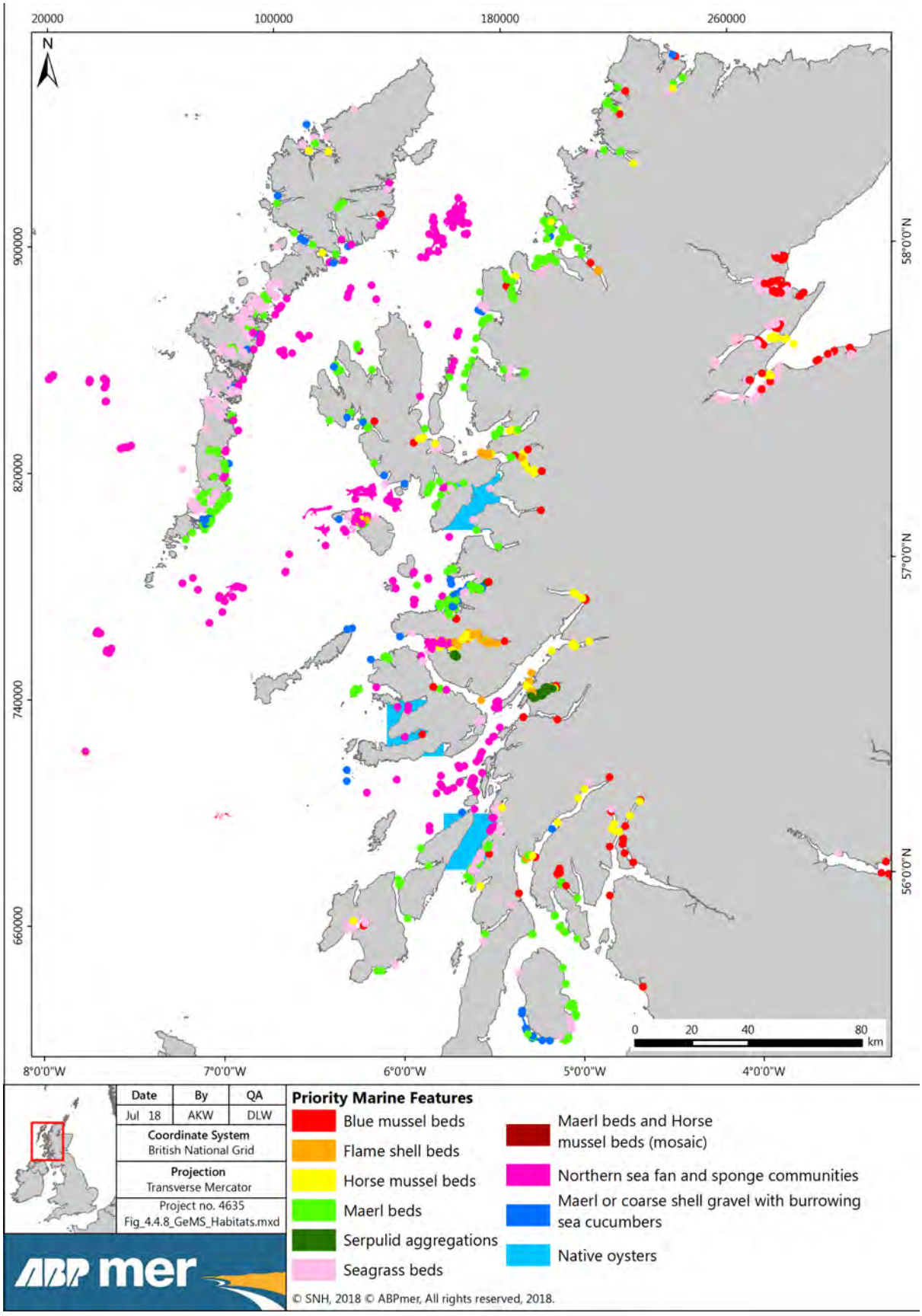


Figure 4.4.8 Distribution of inshore Priority Marine Features within the Area of Search

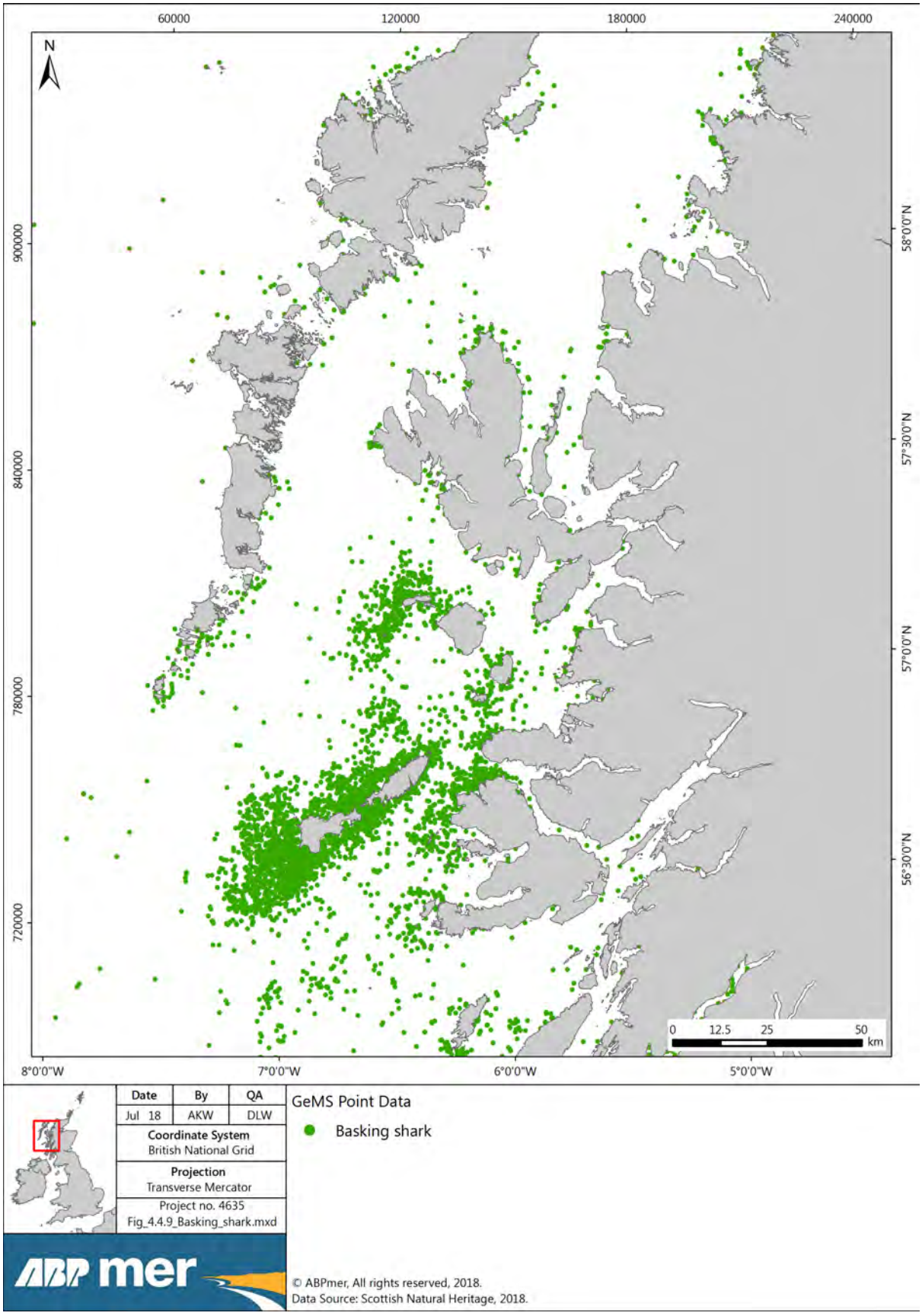


Figure 4.4.9 Distribution of basking shark within the Area of Search

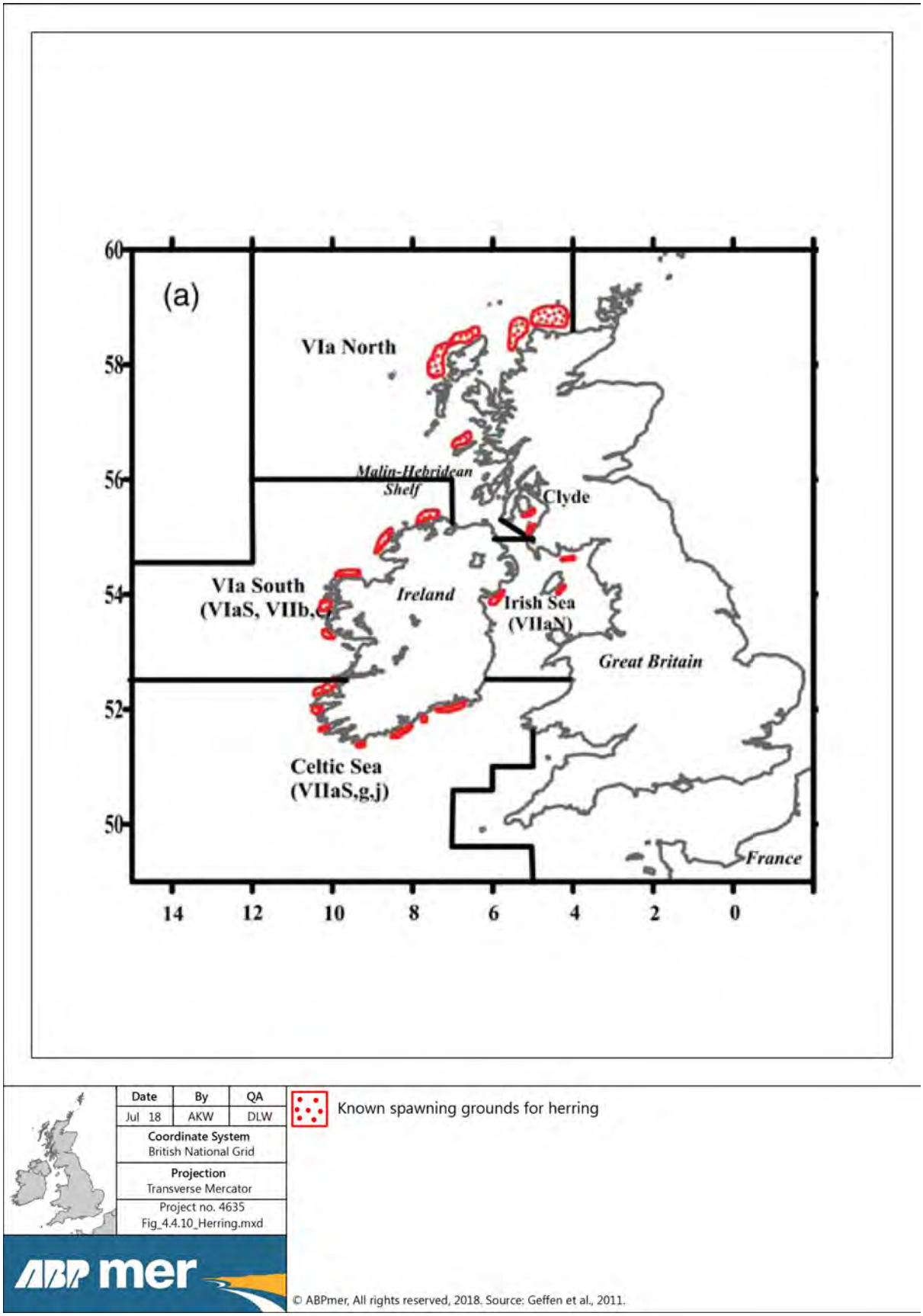


Figure 4.4.10 ICES management areas and the known spawning grounds for herring

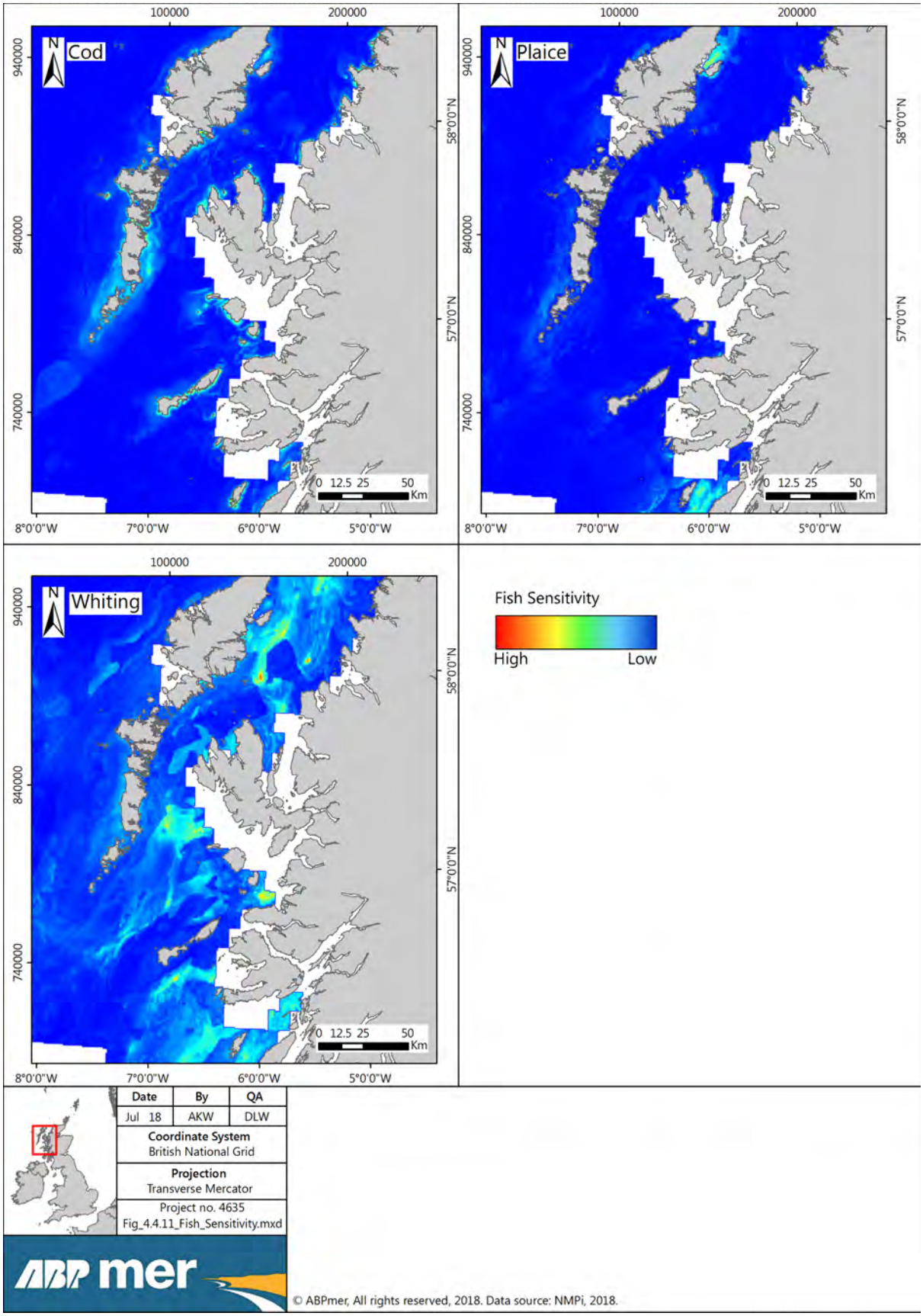


Figure 4.4.11 Fish sensitivity maps

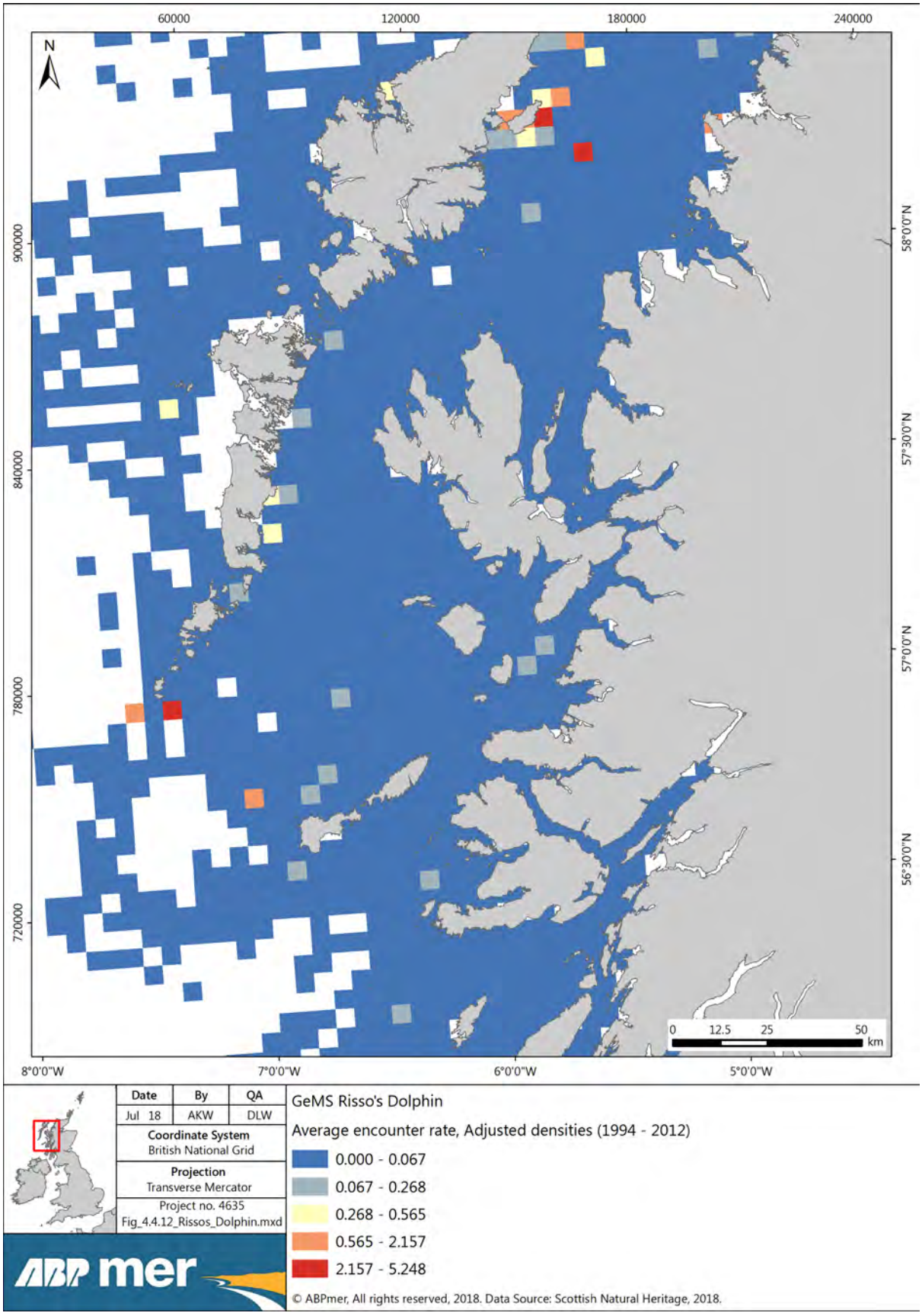


Figure 4.4.12 Distribution of Risso's dolphin within the Area of Search

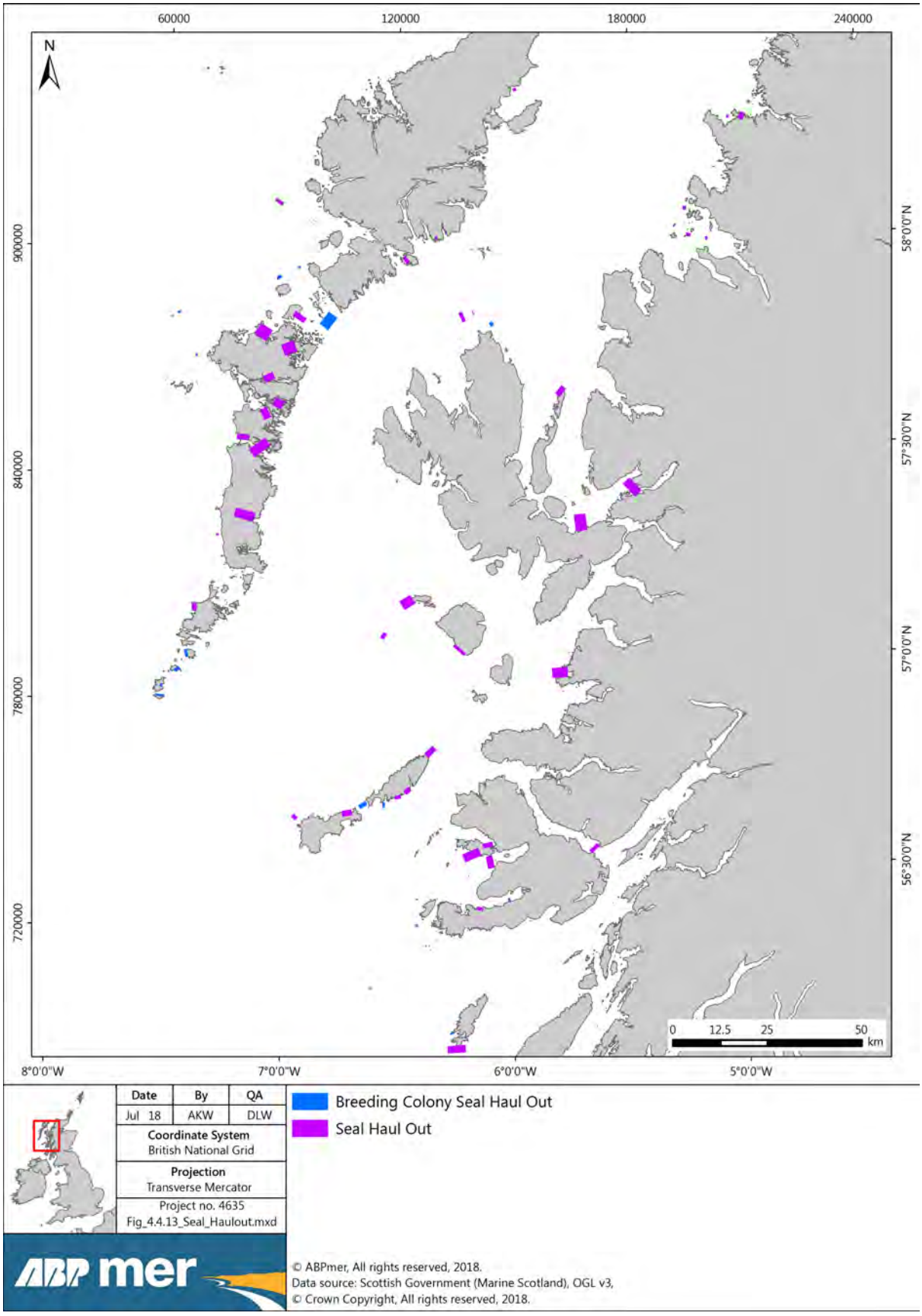


Figure 4.4.13 Distribution of haul-out sites and breeding colonies of seal within the Area of Search

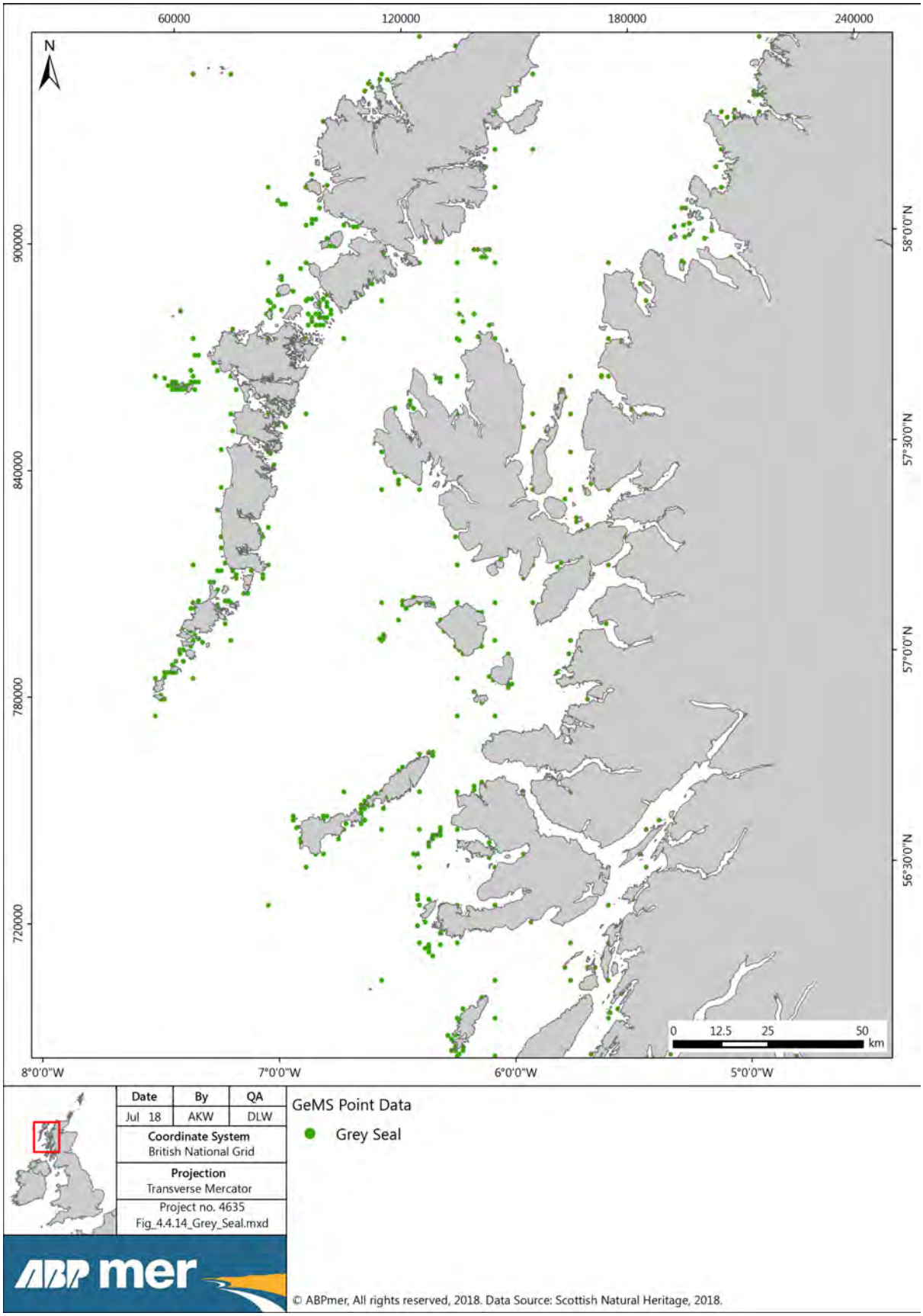


Figure 4.4.14 Distribution of grey seal and harbour seal within the Area of Search

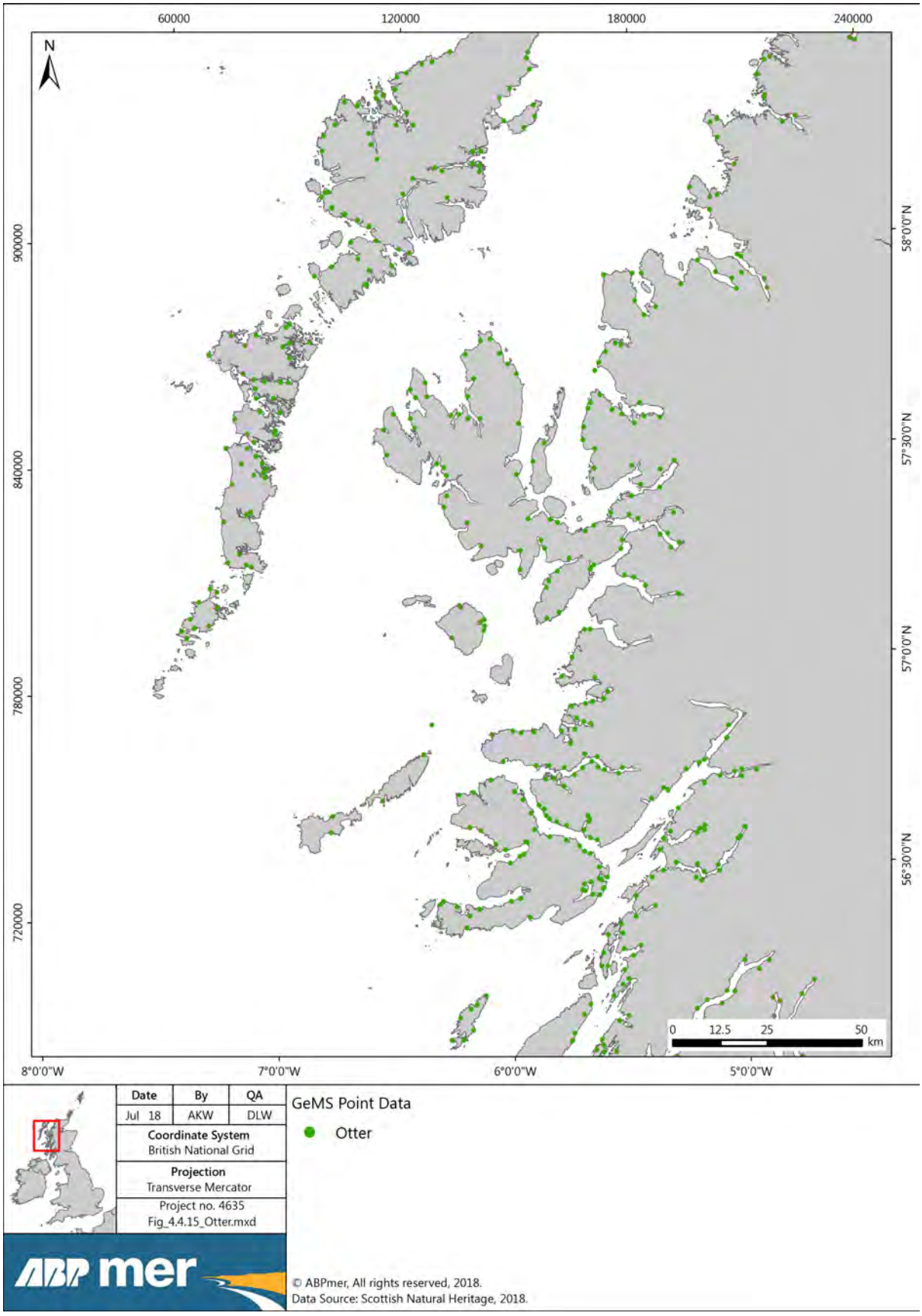


Figure 4.4.15 Distribution of otter within the Area of Search

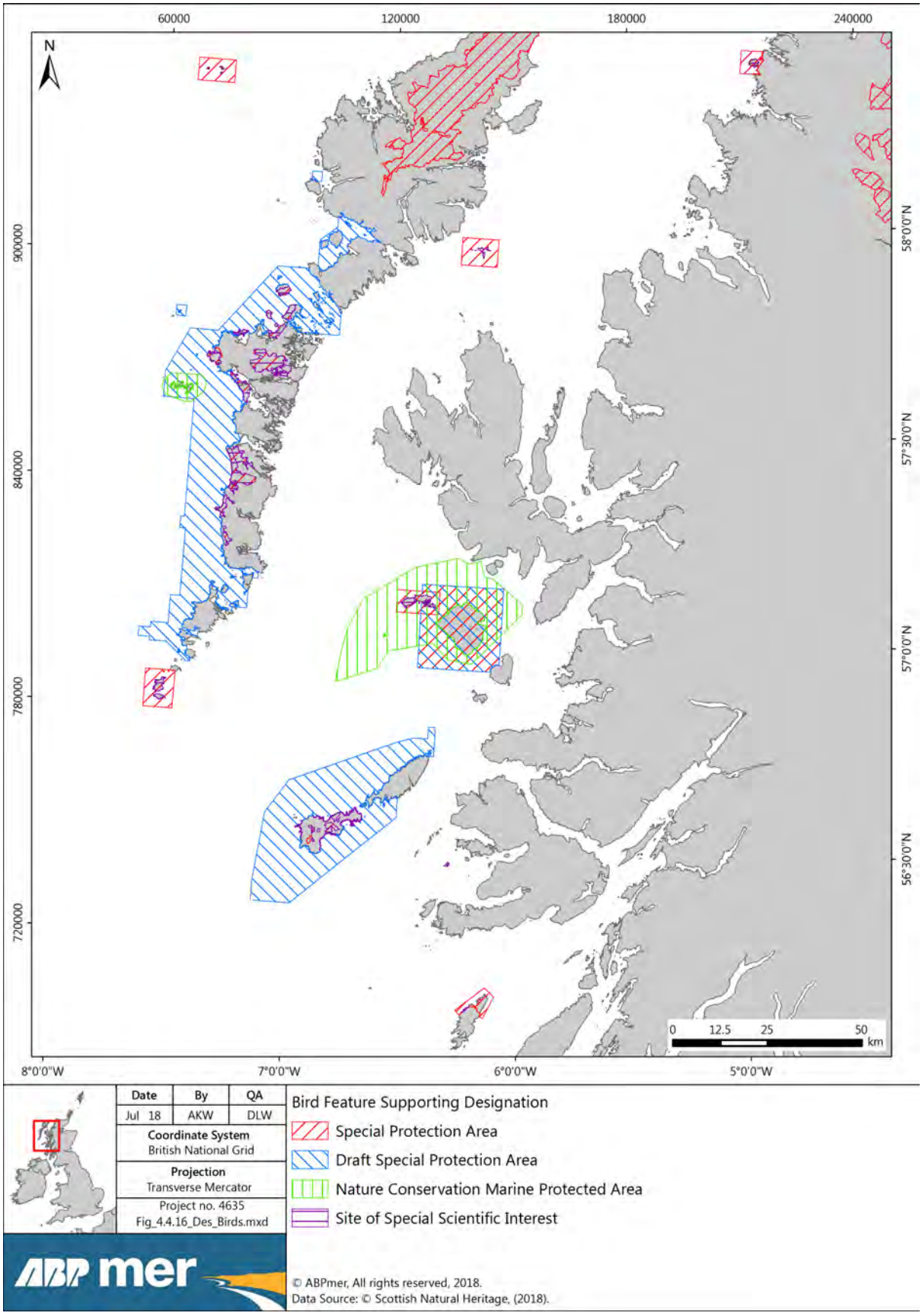


Figure 4.4.16 Designated and proposed sites supporting bird features that use coastal waters within Area of Search

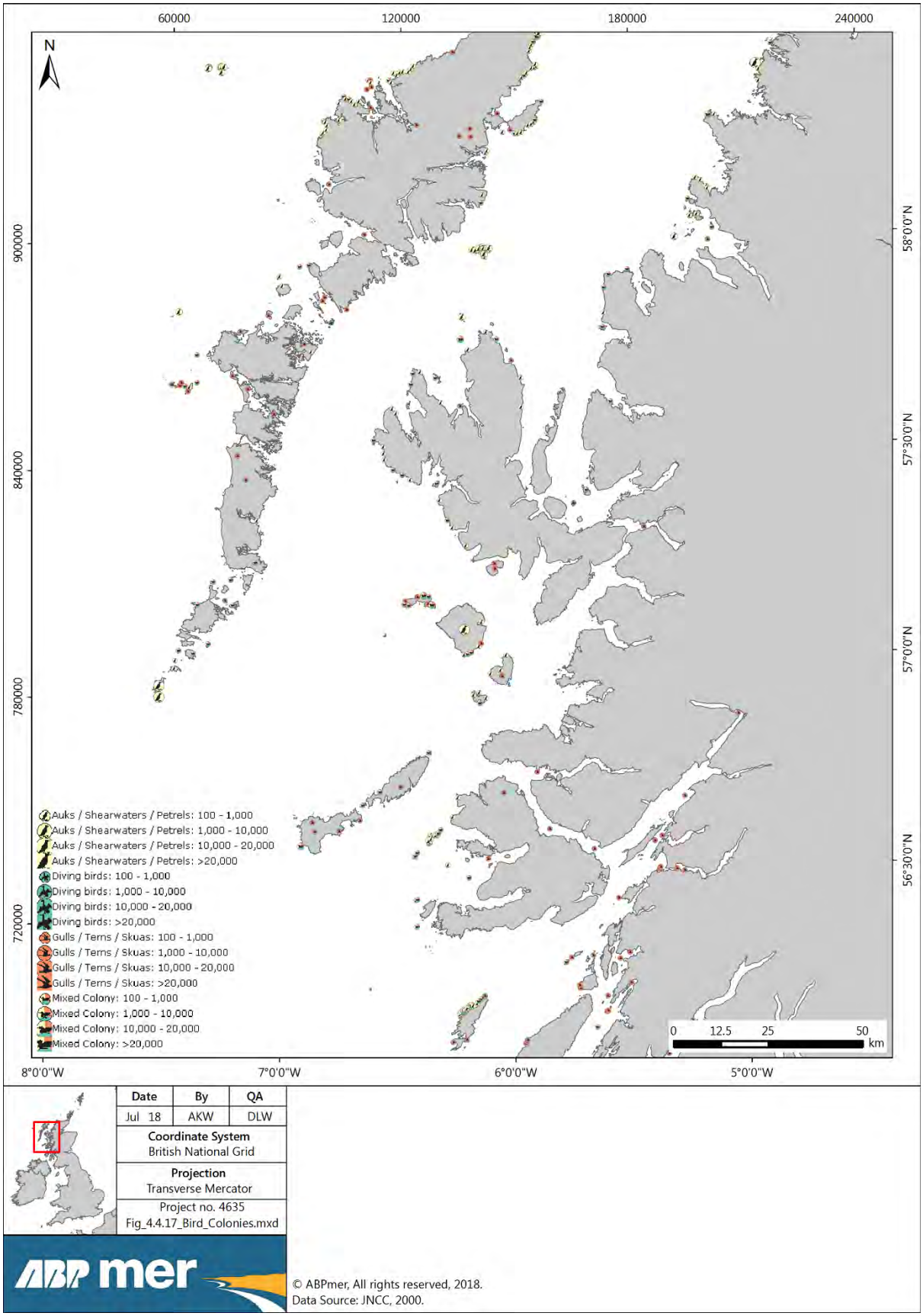


Figure 4.4.17 Breeding bird colonies within Area of Search

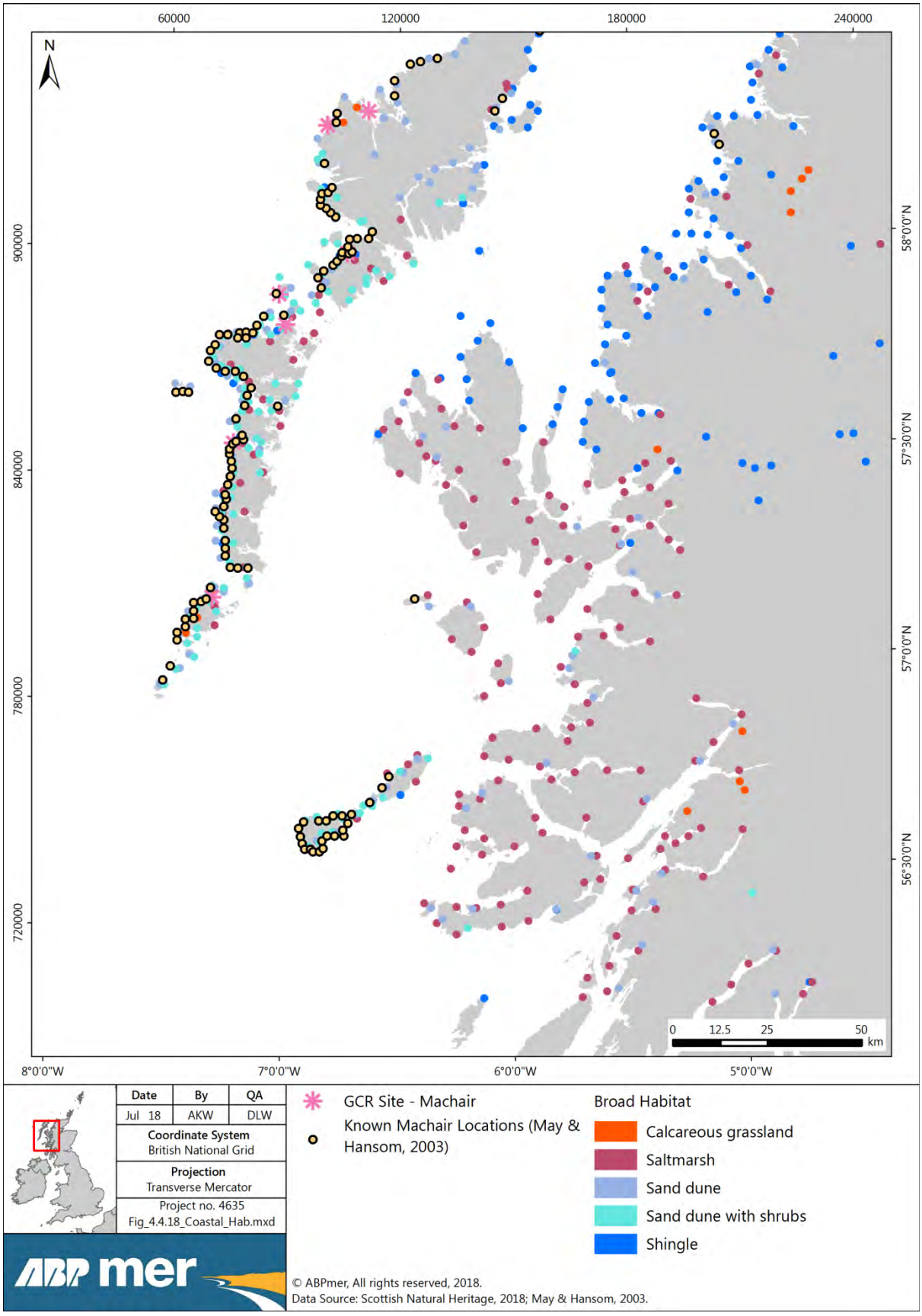


Figure 4.4.18 Coastal habitats within and adjacent to Area of Search

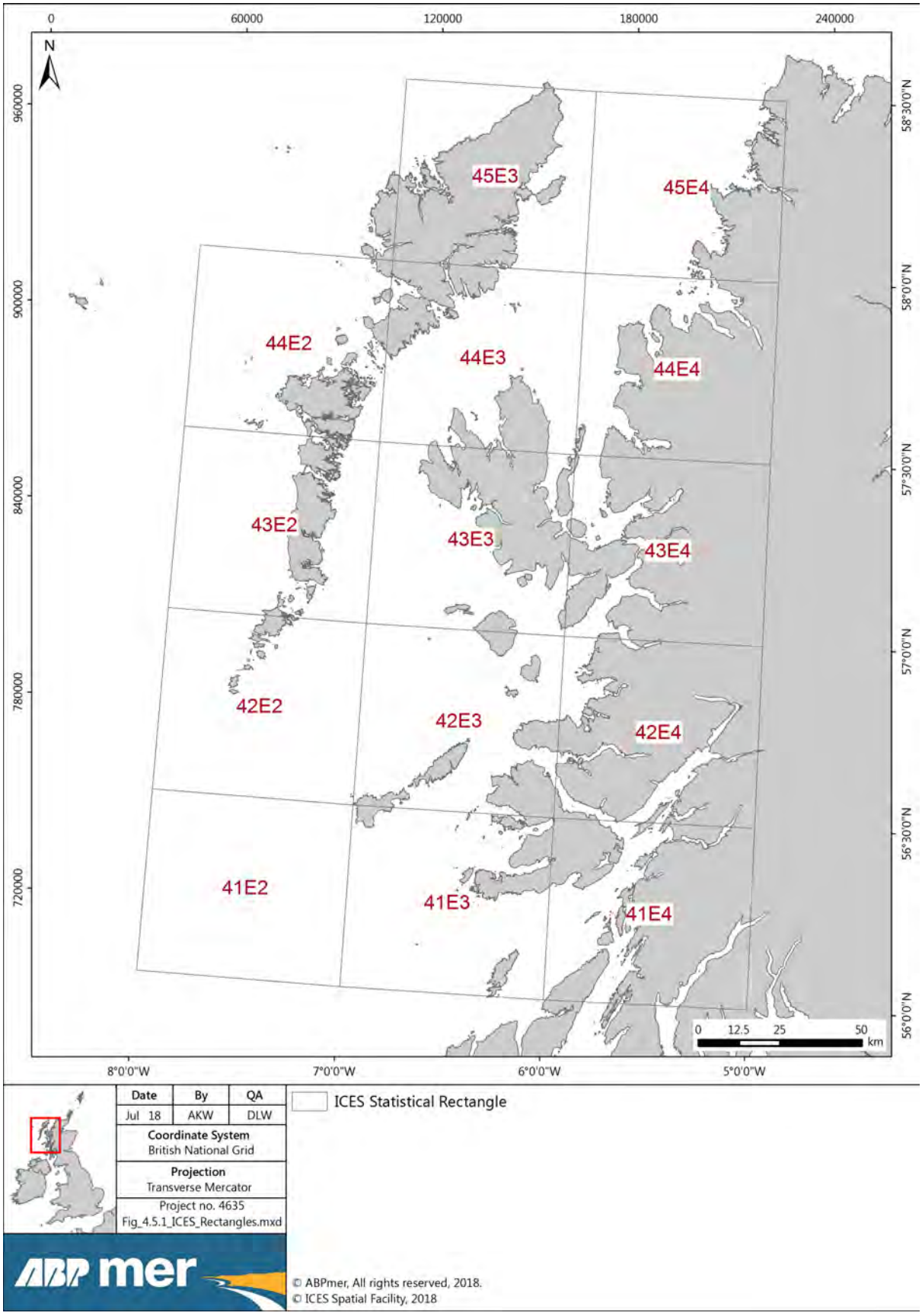


Figure 4.5.1 ICES rectangles that intersect or occur within the Area of Search

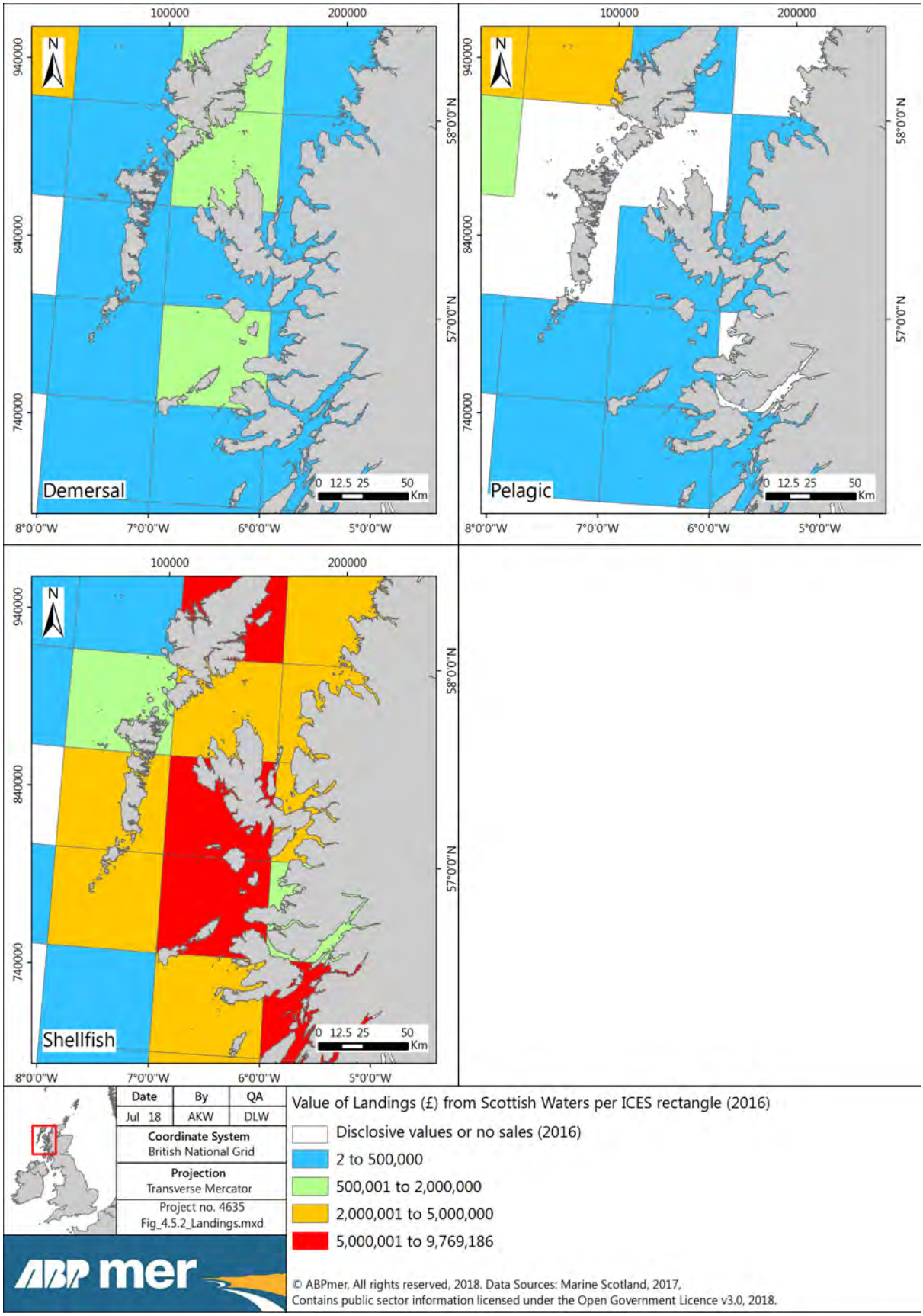


Figure 4.5.2 Value of demersal, pelagic and shellfish landings from UK vessels by ICES rectangle in 2016

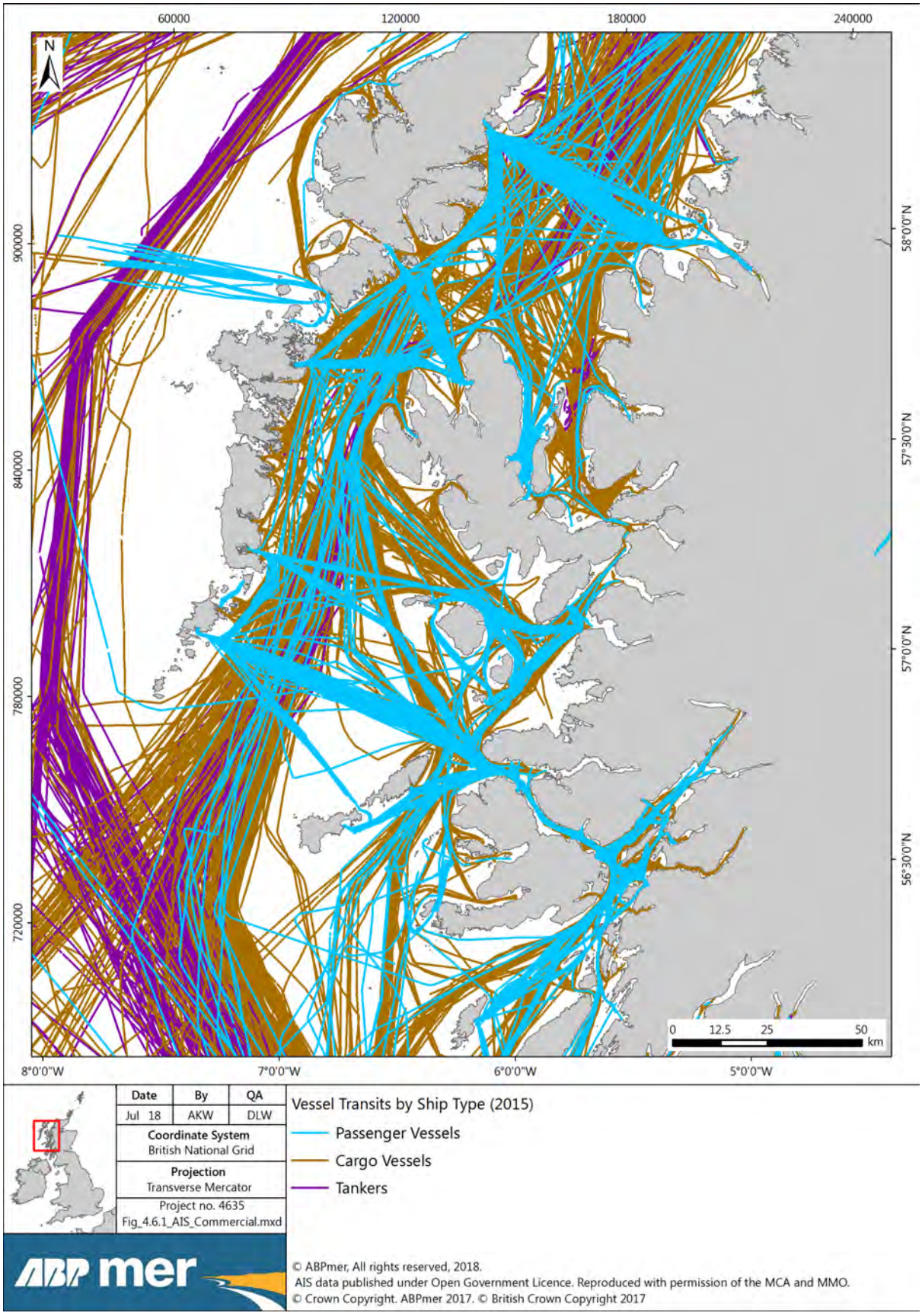


Figure 4.6.1 AIS Transits Commercial

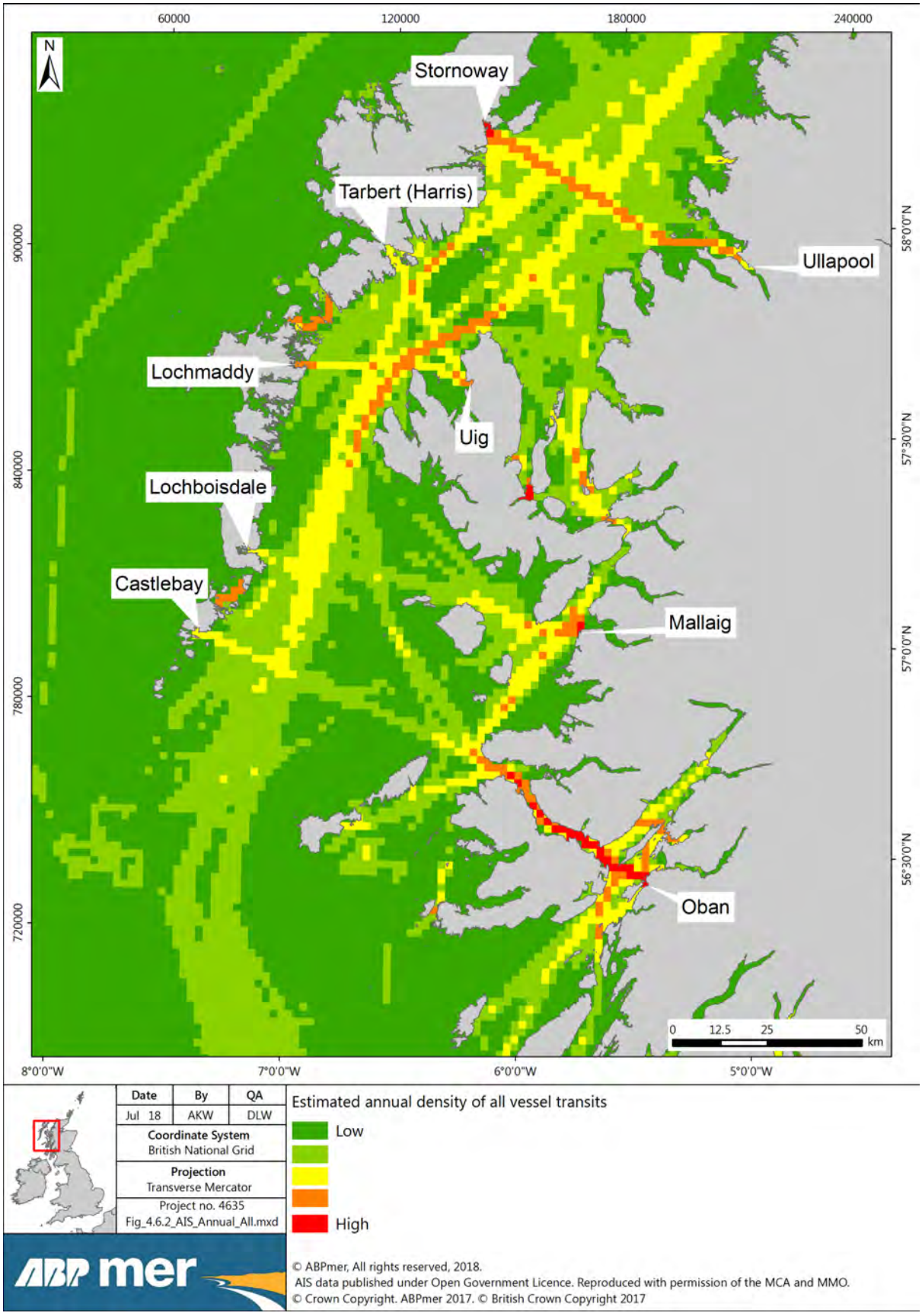


Figure 4.6.2 AIS Density

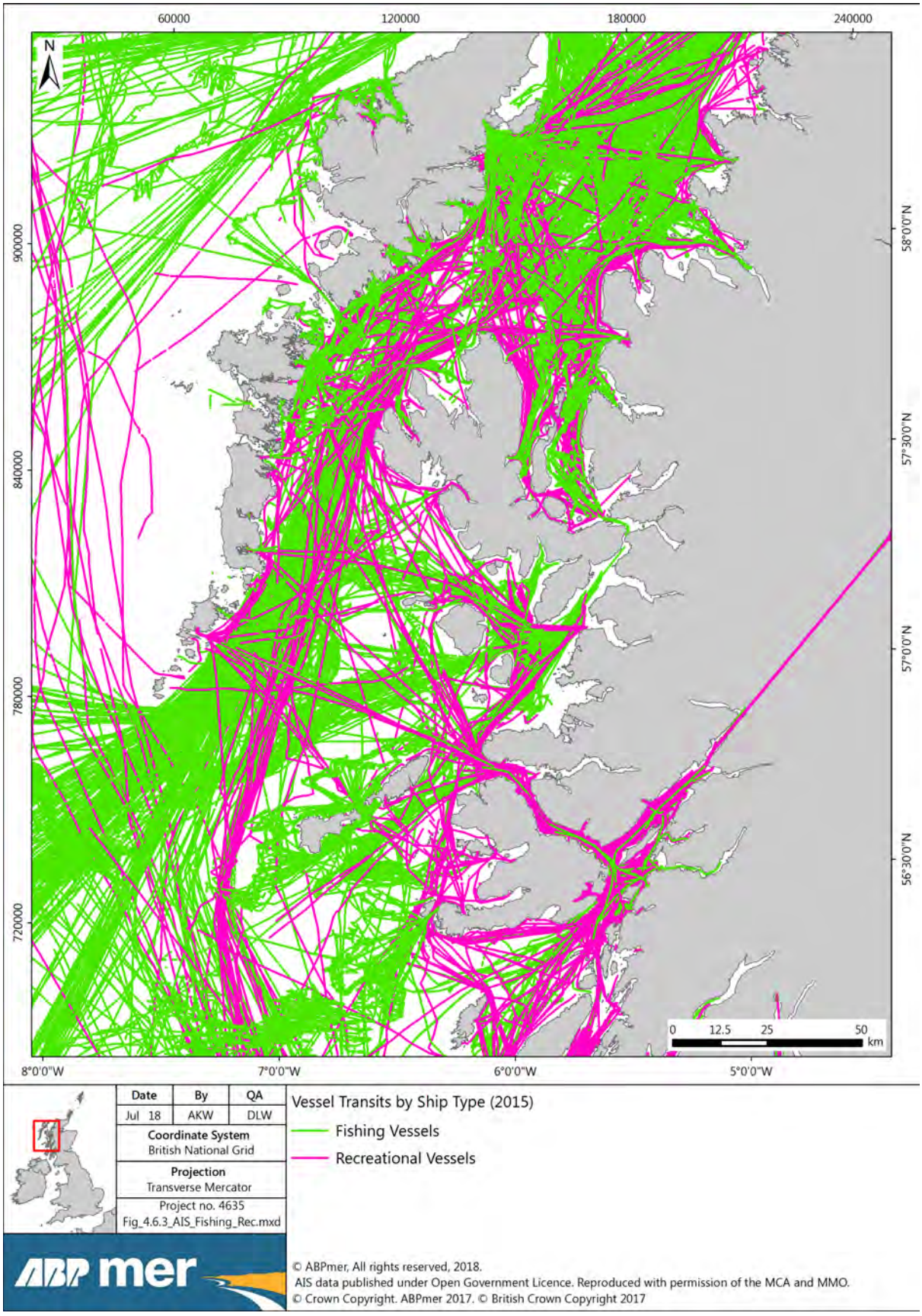


Figure 4.6.3 AIS Transits Rec/Fish

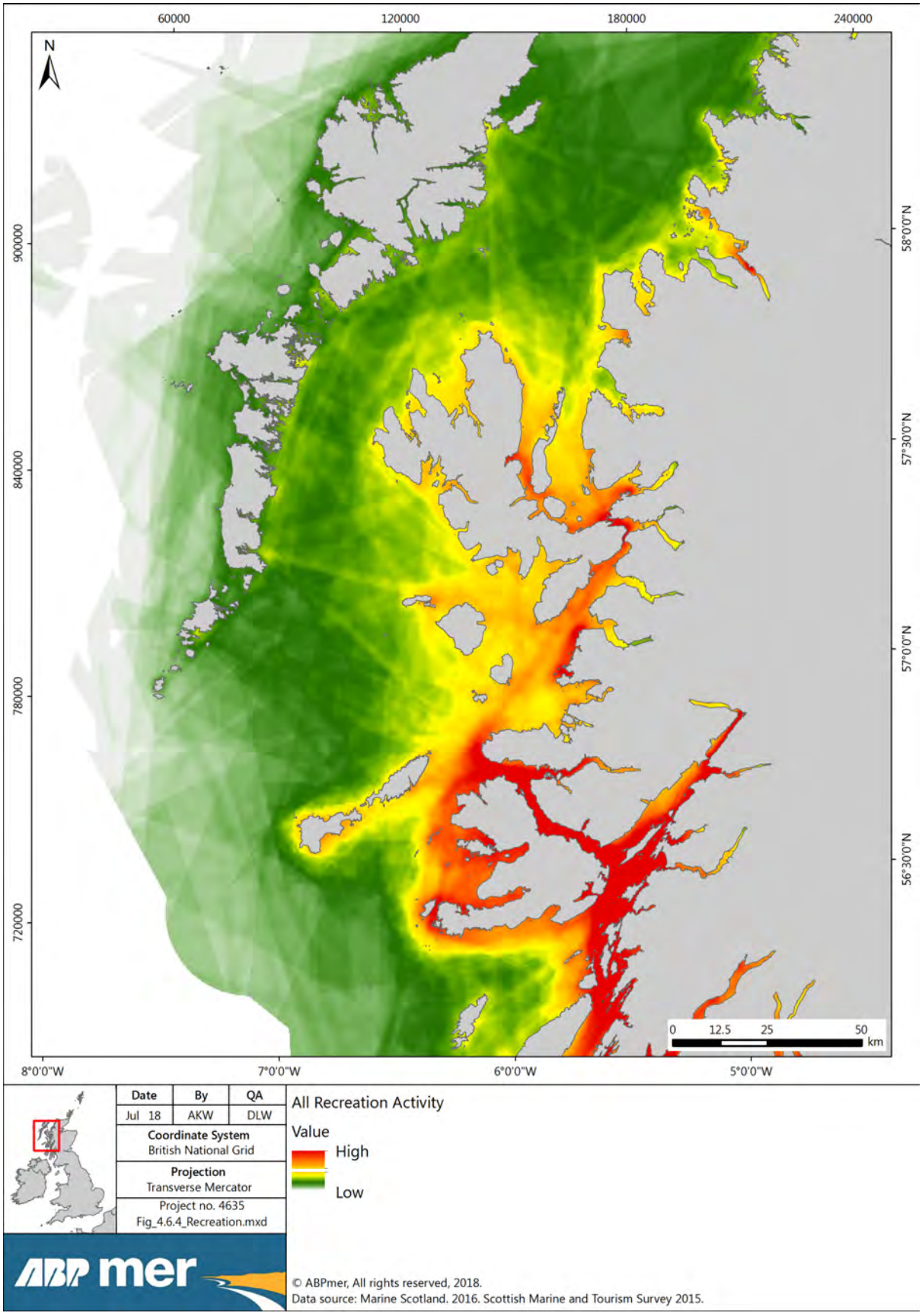


Figure 4.6.4 Map of recreational activities (from NMPi) LUC study

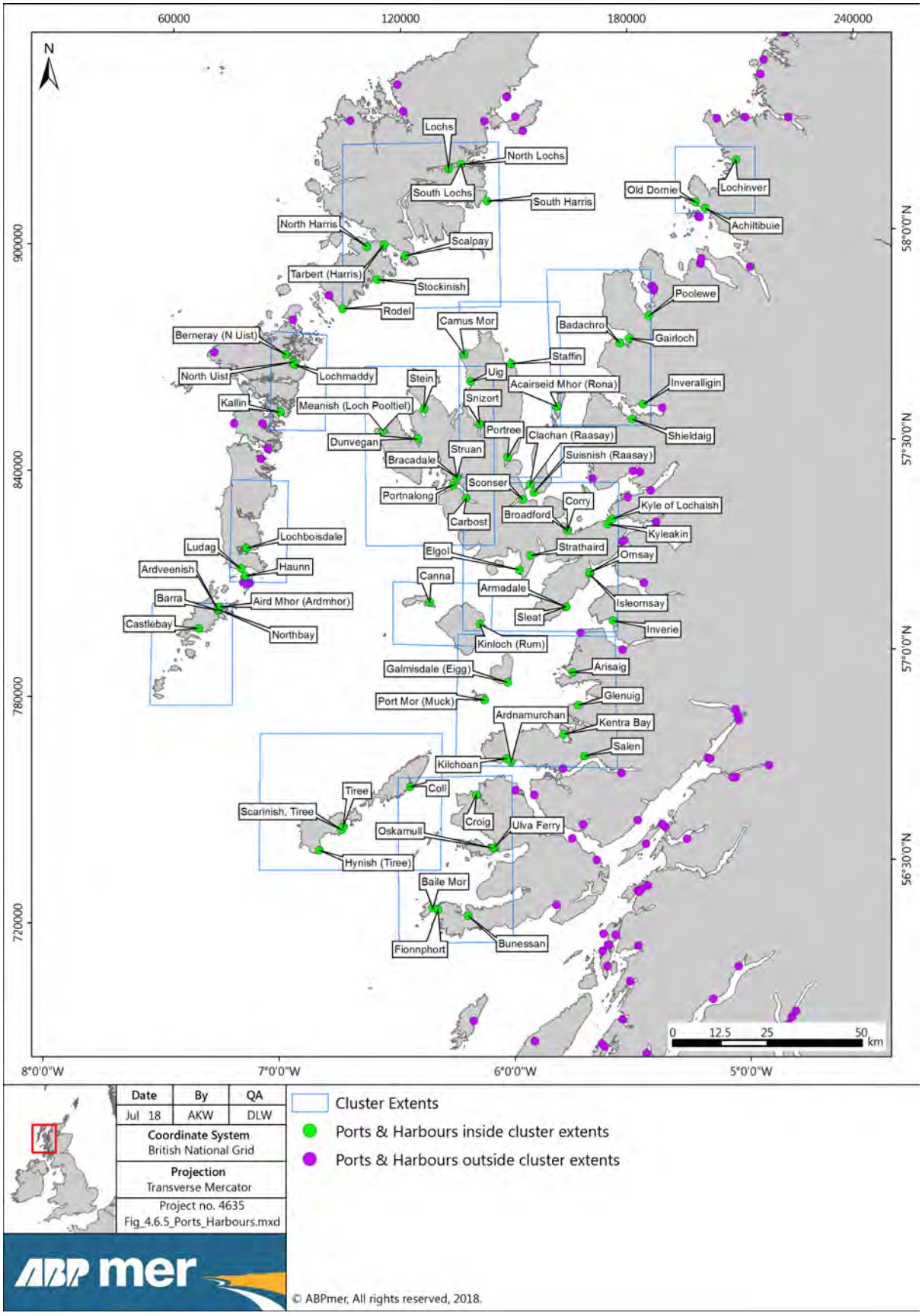


Figure 4.6.5 Ports and harbours within Area of Search

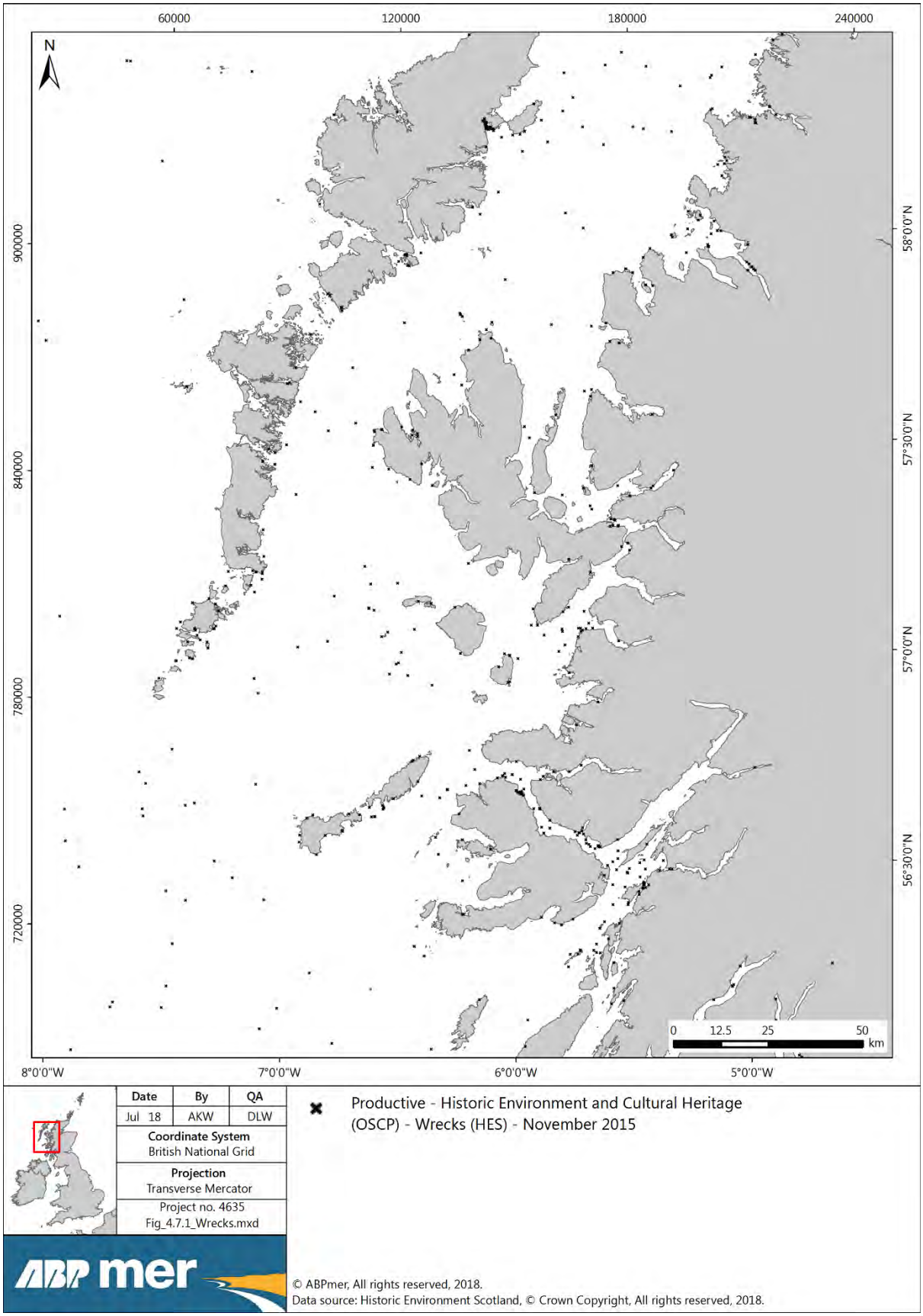


Figure 4.7.1 Location of wrecks

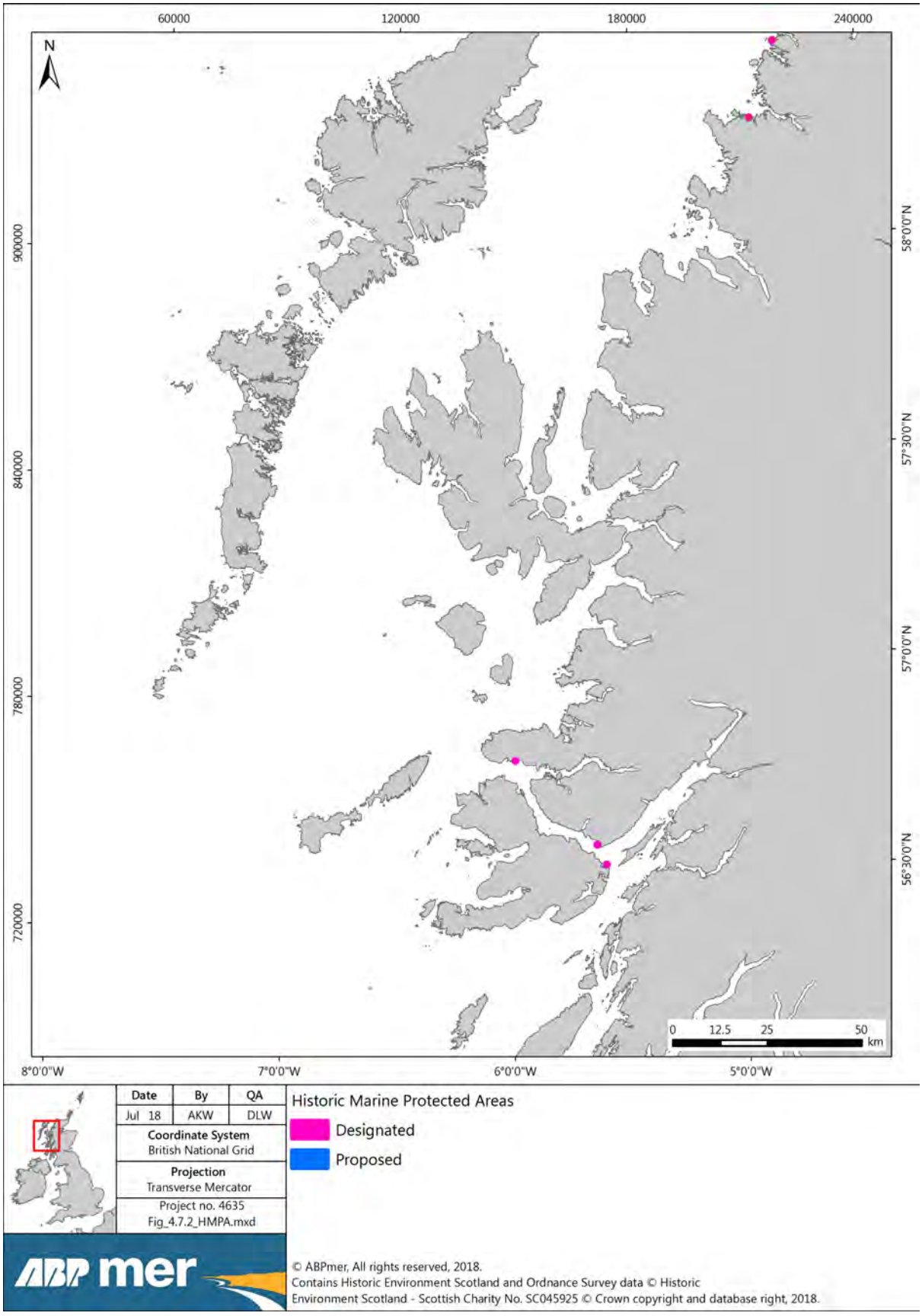


Figure 4.7.2 Location of Historic Marine Protected Areas

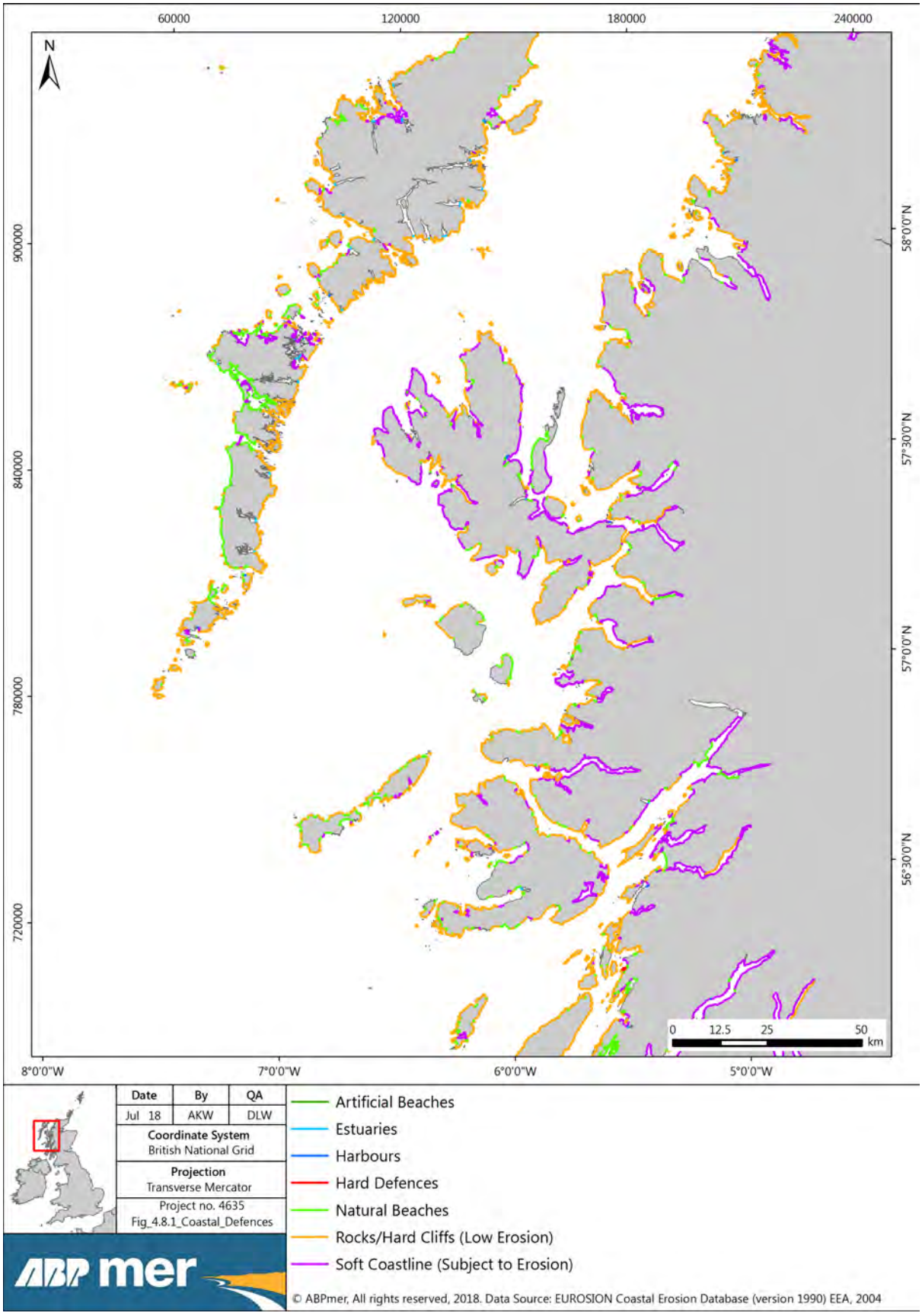


Figure 4.8.1 Coastal defence works

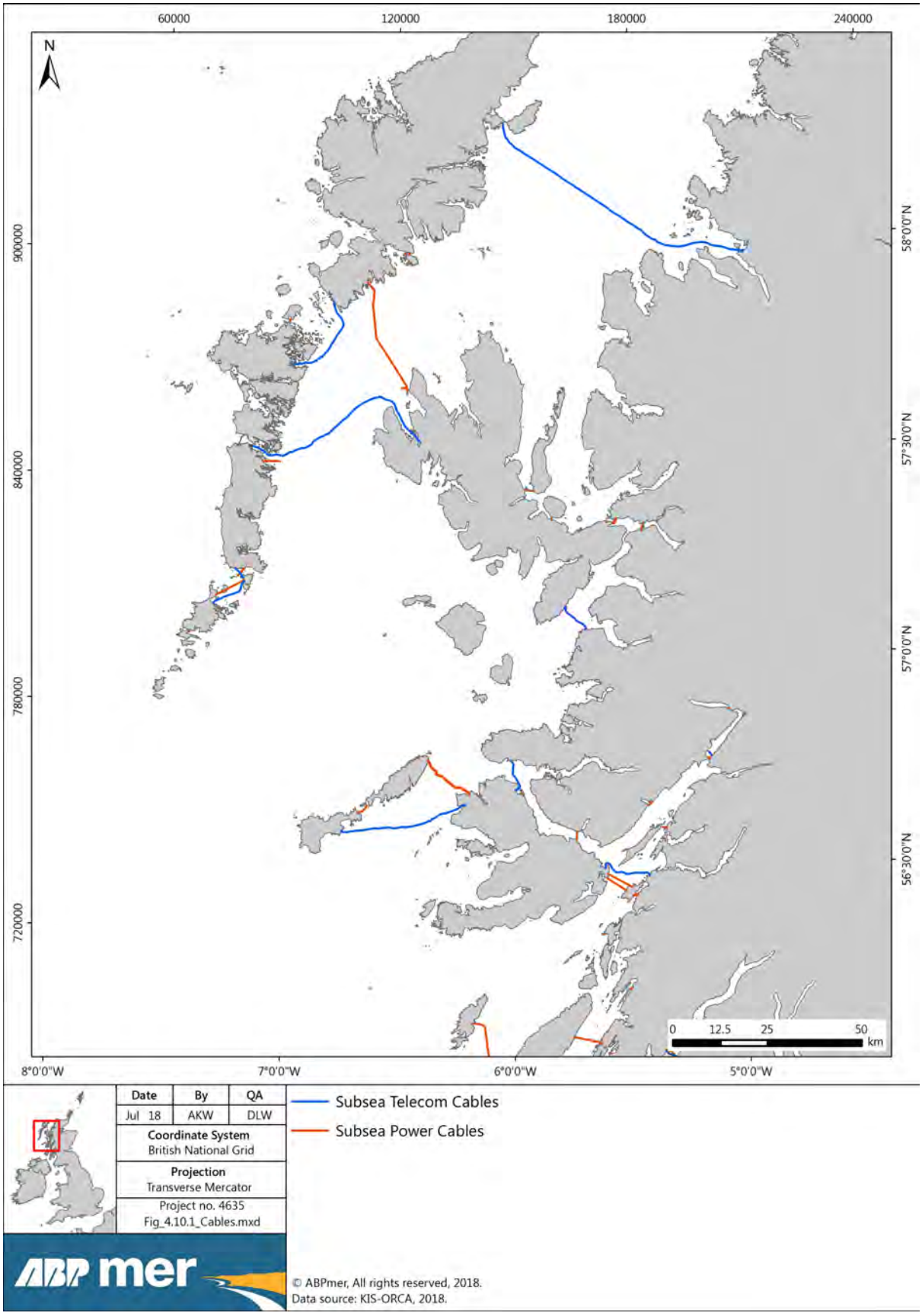


Figure 4.10.1 Location of subsea cables

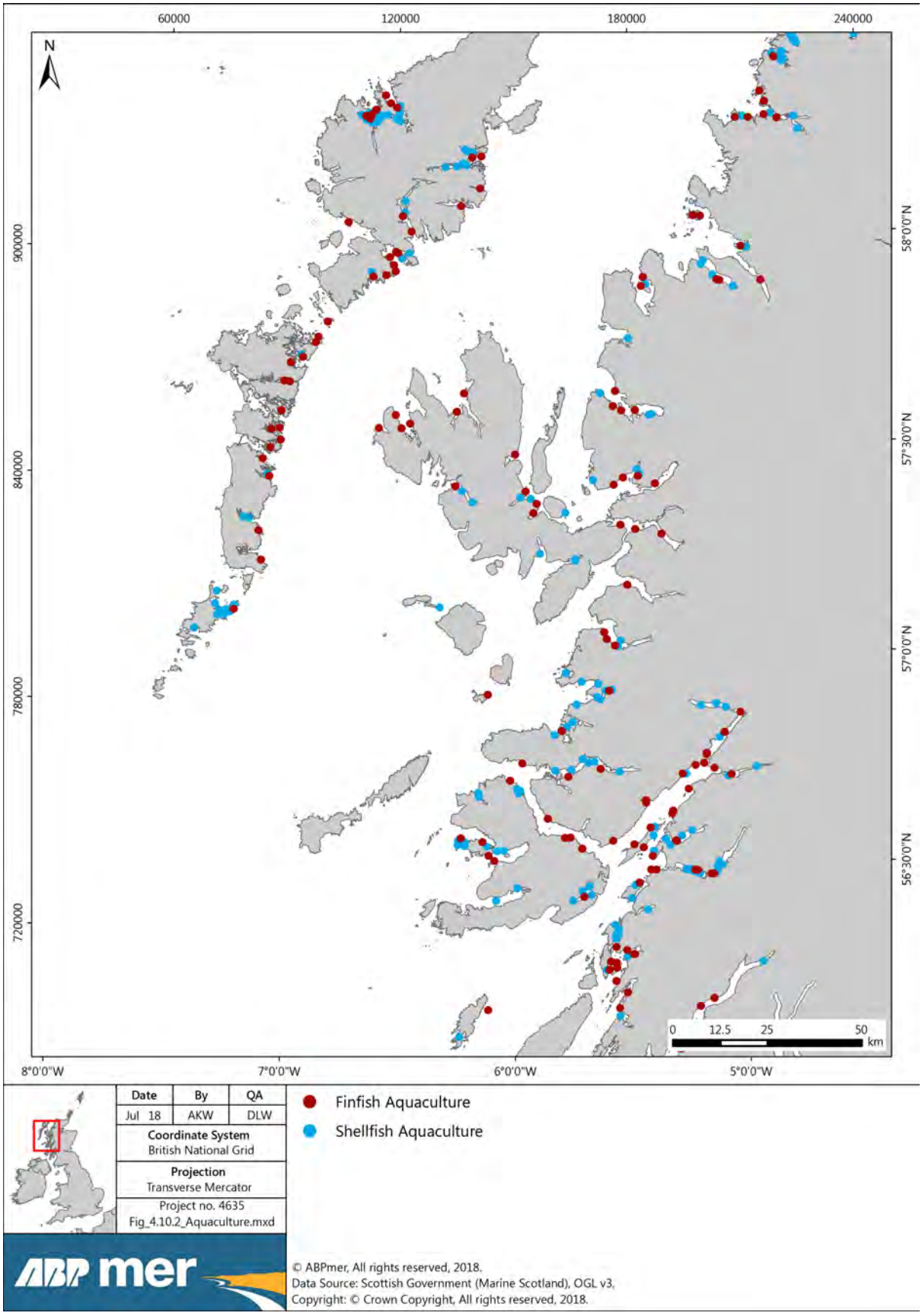


Figure 4.10.2 Location of active marine finfish and shellfish production sites

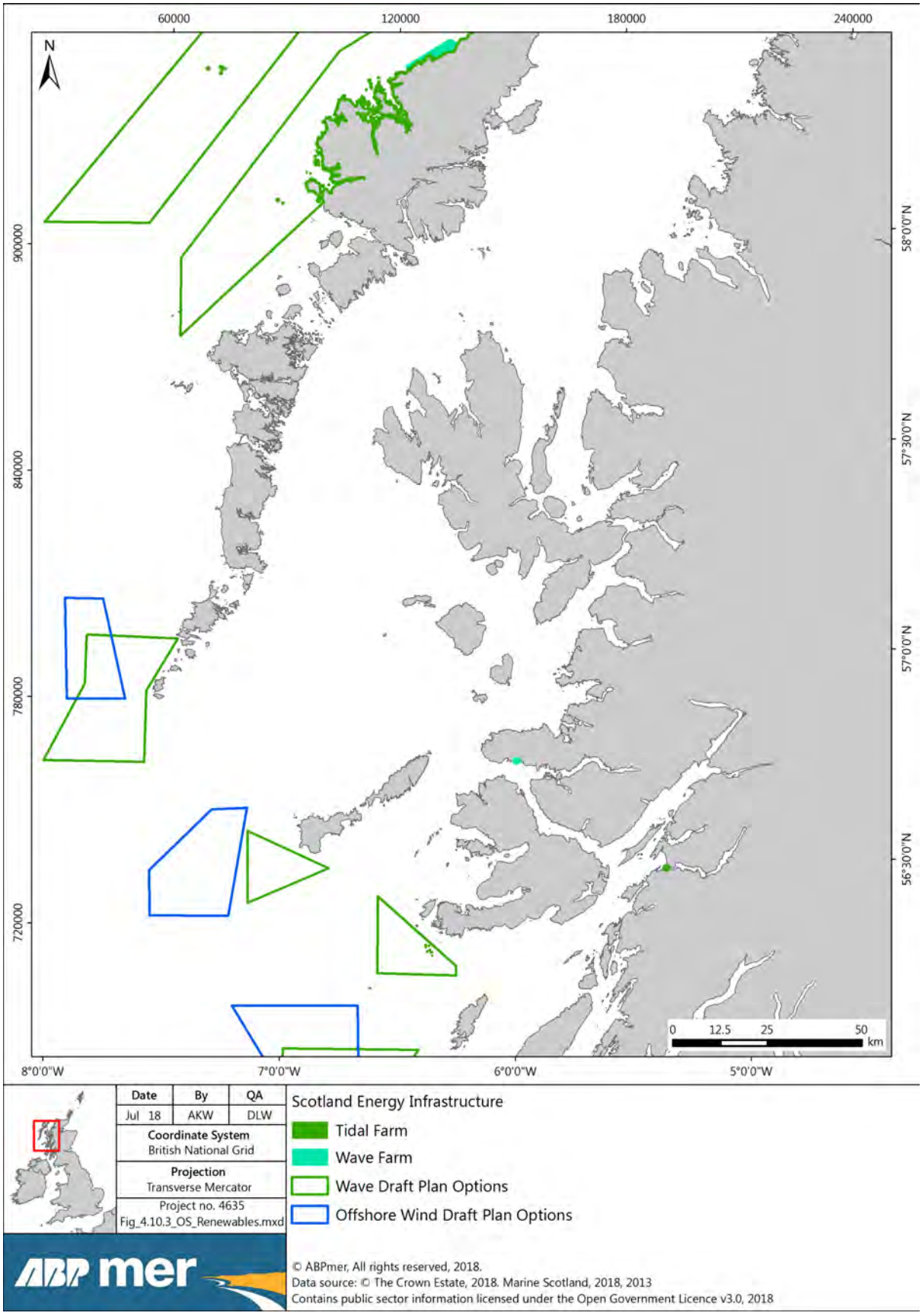


Figure 4.10.3 Energy generation activity

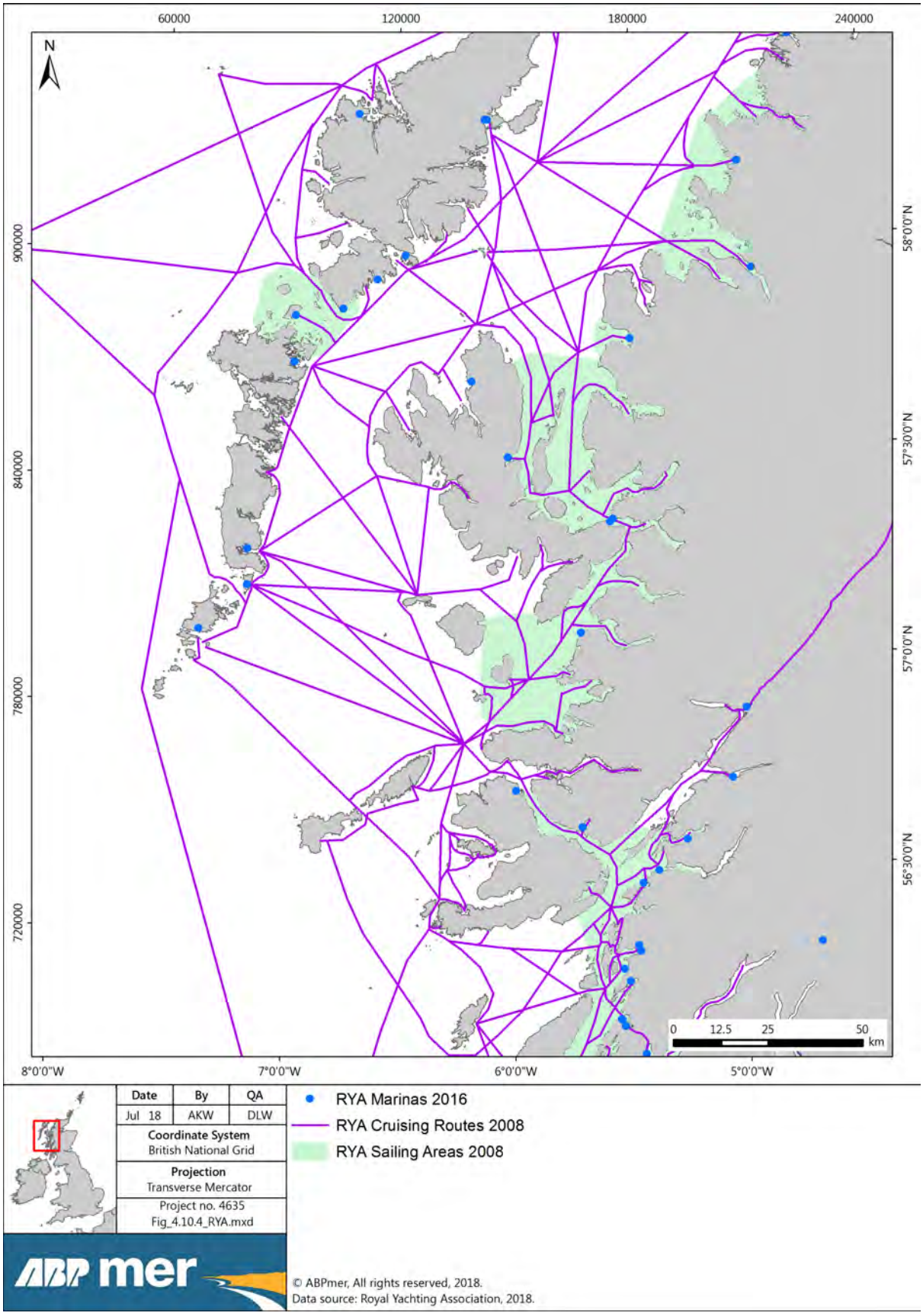
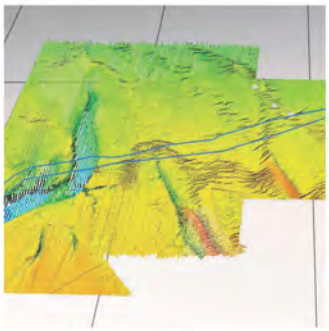
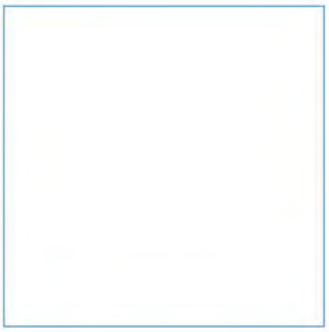
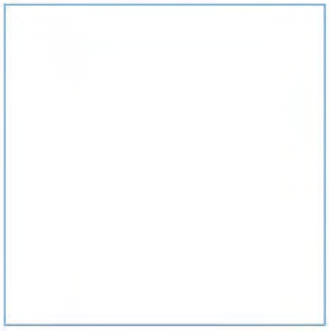
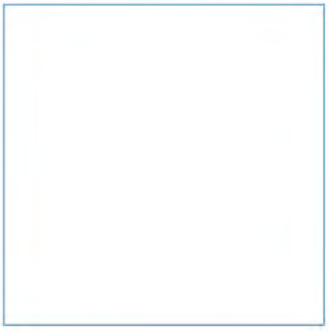


Figure 4.10.4 Marine and coastal recreation activity

Appendix



Innovative Thinking - Sustainable Solutions

ABP mer

A Nature Conservation Sites Within Area of Search

Protected site	Feature of Conservation Interest
Internationally Designated (SACs and SPAs)	
Achnahaird SAC	Annex II species primary reason: ▪ 1395 Petalwort *Petalophyllum ralfsii*
Ardmeanach SAC	Annex I habit primary reason: ▪ 6230 Species-rich *Nardus* grasslands, on silicious substrates in mountain areas (and submountain areas in Continental Europe) ▪ 6430 *Hydrophilous* tall herb fringe communities of plains and of the montane to alpine levels Annex I habitat not primary reason: ▪ 1230 Vegetated sea cliffs of the Atlantic and Baltic Coasts
Ardnamurchan Burns SAC	Annex II species primary reason: ▪ 1029 Freshwater pearl mussel *Margaritifera margaritifera*
Ascrib, Isay and Dunvegan SAC	Annex II species primary reason: ▪ Harbour seal *Phoca vitulina*
Claish Moss and Kentra Moss SAC	Annex I habit primary reason: ▪ 7130 Blanket bogs (* if active bog) Annex I habitat not primary reason: ▪ 7150 Depressions on peat substrates of the *Rhynchosporion*
Coll Machair SAC	Annex I habit primary reason: ▪ 2120 Shifting dunes along the shoreline with *Ammophila arenaria* (""white dunes"") ▪ 2130 Fixed coastal dunes with herbaceous vegetation (""grey dunes"") ▪ 21A0 Machairs Annex I habitat not primary reason: ▪ 2190 Humid dune slacks ▪ 3130 Oligotrophic to mesotrophic standing waters with vegetation of the *Littorelletea uniflorae* and/or of the *Isoëto-Nanojuncetea* Annex II species primary reason: ▪ 1833 Slender naiad *Najas flexilis*
East Mingulay Site of Community Importance (SCI)	Annex I habit primary reason: ▪ 1170 Reefs
Firth of Lorn SAC	Annex I habit primary reason: ▪ 1170 Reefs
Glen Beasdale SAC	Annex I habit primary reason: ▪ 91A0 Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles Annex II species not primary reason: ▪ 1029 Freshwater pearl mussel *Margaritifera margaritifera* ▪ 1355 Otter *Lutra lutra*
Inner Hebrides and the Minches SCI	Annex II species primary reason: ▪ 1351 Harbour porpoise *Phocoena phocoena*
Inverasdale Peatlands SAC	Annex I habit primary reason: ▪ 7130 Blanket bogs (* if active bog)

Protected site	Feature of Conservation Interest
Inverpolly SAC	Annex I habit primary reason: ▪ 3130 Oligotrophic to mesotrophic standing waters with vegetation of the *Littorelletea uniflorae* and/or of the *Isoëto-Nanojuncetea* ▪ 3160 Natural dystrophic lakes and ponds ▪ 4010 Northern Atlantic wet heaths with *Erica tetralix* ▪ 7130 Blanket bogs (* if active bog) ▪ 7140 Transition mires and quaking bogs ▪ 7150 Depressions on peat substrates of the Rhynchosporion Annex I habitat not primary reason: ▪ 4030 European dry heaths ▪ 4060 Alpine and Boreal heaths ▪ 6150 Siliceous alpine and boreal grasslands ▪ 8110 Siliceous scree of the montane to snow levels (*Androsacetalia alpinae* and *Galeopsietalia ladani*) ▪ 8220 Siliceous rocky slopes with chasmophytic vegetation ▪ 91A0 Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles Annex II species primary reason: ▪ 1355 Otter *Lutra lutra* Annex II species not primary reason: ▪ 1029 Freshwater pearl mussel *Margaritifera margaritifera*
Kinloch and Kyleakin Hills SAC	Annex I habit primary reason: ▪ 91A0 Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles Annex I habitat not primary reason: ▪ 4010 Northern Atlantic wet heaths with *Erica tetralix* ▪ 4030 European dry heaths ▪ 4060 Alpine and Boreal heaths ▪ 7130 Blanket bogs (* if active bog) ▪ 9180 *Tilio-Acerion* forests of slopes, screes and ravines Annex II species not primary reason: ▪ 1355 Otter *Lutra lutra*
Little Gruinard River SAC	Annex II species primary reason: ▪ 1106 Atlantic salmon *Salmo salar*
Loch Maree Complex SAC	Annex I habit primary reason: ▪ 3130 Oligotrophic to mesotrophic standing waters with vegetation of the *Littorelletea uniflorae* and/or of the *Isoëto-Nanojuncetea* ▪ 4030 European dry heaths ▪ 4060 Alpine and Boreal heaths ▪ 6150 Siliceous alpine and boreal grasslands ▪ 8110 Siliceous scree of the montane to snow levels (*Androsacetalia alpinae* and *Galeopsietalia ladani*) ▪ 8220 Siliceous rocky slopes with chasmophytic vegetation ▪ 91A0 Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles ▪ 91C0 Caledonian forest Annex I habitat not primary reason: ▪ 4010 Northern Atlantic wet heaths with *Erica tetralix* ▪ 6430 Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels ▪ 7130 Blanket bogs (* if active bog)

Protected site	Feature of Conservation Interest
	▪ 7150 Depressions on peat substrates of the *Rhynchosporion* ▪ 8210 Calcareous rocky slopes with chasmophytic vegetation ▪ 91D0 Bog woodland ▪ 91E0 Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion, Alnion incanae, Salicion albae*) Annex II species primary reason: ▪ 1355 Otter *Lutra lutra*
Loch Moidart and Loch Shiel Woods SAC	Annex I habit primary reason: ▪ 91A0 Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles Annex I habitat not primary reason: ▪ 1140 Mudflats and sandflats not covered by seawater at low tide ▪ 9180 *Tilio-Acerion* forests of slopes, screes and ravines ▪ 91E0 Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion, Alnion incanae, Salicion albae*) Annex II species not primary reason: ▪ 1355 Otter *Lutra lutra*
Loch nam Madadh SAC	Annex I habit primary reason: ▪ 1150 Coastal lagoons ▪ 1160 Large shallow inlets and bays Annex I habitat not primary reason: ▪ 1110 Sandbanks which are slightly covered by sea water all the time ▪ 1140 Mudflats and sandflats not covered by seawater at low tide ▪ 1170 Reefs Annex II species primary reason: ▪ 1355 Otter *Lutra lutra*
Lochs Duich, Long and Alsh Reefs SAC	Annex I habit primary reason: ▪ 1170 Reefs
Mingarry Burn SAC	Annex II species primary reason: ▪ 1029 Freshwater pearl mussel *Margaritifera margaritifera*
Morvern Woods SAC	Annex I habit primary reason: ▪ 9180 *Tilio-Acerion* forests of slopes, screes and ravines ▪ 91A0 Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles Annex II species not primary reason: ▪ 1355 Otter *Lutra lutra*
Mull Oakwoods SAC	Annex I habit primary reason: ▪ 91A0 Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles Annex II species not primary reason: ▪ 1355 Otter *Lutra lutra*
Obain Loch Euphoirt SAC	Annex I habit primary reason: ▪ 1150 Coastal lagoons
Rigg - Bile SAC	Annex I habit primary reason: ▪ 1230 Vegetated sea cliffs of the Atlantic and Baltic Coasts Annex I habitat not primary reason: ▪ 9180 *Tilio-Acerion* forests of slopes, screes and ravines

Protected site	Feature of Conservation Interest
Rum SAC	Annex I habit primary reason: ▪ 3130 Oligotrophic to mesotrophic standing waters with vegetation of the *Littorelletea uniflorae* and/or of the *Isoëto-Nanojuncetea* ▪ 3160 Natural dystrophic lakes and ponds ▪ 4010 Northern Atlantic wet heaths with *Erica tetralix* ▪ 4030 European dry heaths ▪ 6130 Calaminarian grasslands of the *Violetalia calaminariae* ▪ 6230 Species-rich *Nardus* grasslands, on silicious substrates in mountain areas (and submountain areas in Continental Europe) ▪ 8120 Calcareous and calcshist screes of the montane to alpine levels (*Thlaspietea rotundifolii*) Annex I habitat not primary reason: ▪ 1230 Vegetated sea cliffs of the Atlantic and Baltic Coasts ▪ 4060 Alpine and Boreal heaths ▪ 6430 Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels ▪ 7130 Blanket bogs (* if active bog) ▪ 7150 Depressions on peat substrates of the *Rhynchosporion* ▪ 7230 Alkaline fens ▪ 8110 Siliceous scree of the montane to snow levels (*Androsacetalia alpinae* and *Galeopsietalia ladani*) ▪ 8210 Calcareous rocky slopes with chasmophytic vegetation ▪ 8220 Siliceous rocky slopes with chasmophytic vegetation Annex II species primary reason: ▪ 1355 Otter *Lutra lutra*
Sound of Arisaig (Loch Ailort to Loch Ceann Traigh) SAC	Annex I habit primary reason: ▪ 1110 Sandbanks which are slightly covered by sea water all the time
Sound of Barra SCI	Annex I habit primary reason: ▪ 1110 Sandbanks which are slightly covered by sea water all the time ▪ 1170 Reefs Annex II species not primary reason: ▪ 1365 Harbour seal *Phoca vitulina*
Strath SAC	Annex I habit primary reason: ▪ 3140 Hard oligo-mesotrophic waters with benthic vegetation of *Chara* spp. ▪ 6170 Alpine and subalpine calcareous grasslands ▪ 8210 Calcareous rocky slopes with chasmophytic vegetation ▪ 8240 Limestone pavements Annex I habitat not primary reason: ▪ 4010 Northern Atlantic wet heaths with *Erica tetralix* ▪ 7220 Petrifying springs with tufa formation (*Cratoneurion*) ▪ 7230 Alkaline fens ▪ 9180 *Tilio-Acerion* forests of slopes, screes and ravines
Sunart SAC	Annex I habit primary reason: ▪ 91A0 Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles Annex I habitat not primary reason: ▪ 1170 Reefs ▪ 4010 Northern Atlantic wet heaths with *Erica tetralix*

Protected site	Feature of Conservation Interest
	▪ 4030 European dry heaths ▪ 9180 *Tilio-Acerion* forests of slopes, screes and ravines Annex II species primary reason: ▪ 1355 Otter *Lutra lutra*
Tiree Machair SAC	Annex I habit primary reason: ▪ 2120 Shifting dunes along the shoreline with *Ammophila arenaria* (""white dunes"") ▪ 2130 Fixed coastal dunes with herbaceous vegetation (""grey dunes"") ▪ 21A0 Machairs ▪ 3150 Natural eutrophic lakes with *Magnopotamion* or *Hydrocharition* - type vegetation Annex I habitat not primary reason: ▪ 2110 Embryonic shifting dunes ▪ 2190 Humid dune slacks
Treshnish Isles SAC	Annex II species primary reason: ▪ 1364 Grey seal *Halichoerus grypus*
Canna and Sanday SPA	Regularly supports at least 20,000 seabirds: ▪ During the breeding season, the area regularly supports 21,000 individual seabirds including: Puffin *Fratercula arctica*, Guillemot *Uria aalge*, Kittiwake *Rissa tridactyla*, Herring Gull *Larus argentatus*, Shag *Phalacrocorax aristotelis*
Cnuic agus Cladach Mhuile SPA	Annex I species (during the breeding season): ▪ Golden Eagle *Aquila chrysaetos*, 9 pairs representing at least 2.3% of the breeding population in Great Britain (1992)
Coll SPA	Annex I species (over winter): ▪ Barnacle Goose *Branta leucopsis*, 1,029 individuals representing at least 3.8% of the wintering population in Great Britain (winter peak means) ▪ Greenland White-fronted Goose *Anser albifrons flavirostris*, 789 individuals representing at least 5.6% of the wintering population in Great Britain (winter peak means)
Coll (corncrake) SPA	Annex I species (during the breeding season): ▪ Corncrake *Crex crex*, 24 individuals representing at least 5.0% of the breeding population in Great Britain (1993-1997)
Cuillins SPA	Annex I species (during the breeding season): ▪ Golden Eagle *Aquila chrysaetos*, 11 pairs representing at least 2.8% of the breeding population in Great Britain (1992)
Glas Eileanan SPA	Annex I species (during the breeding season): ▪ Common Tern *Sterna hirundo*, 530 pairs representing at least 4.3% of the breeding population in Great Britain
Mingulay and Berneray SPA	Migratory species (during the breeding season): ▪ Razorbill *Alca torda*, 11,323 pairs representing at least 2.0% of the breeding population (Count as at 1985) Regularly supports at least 20,000 seabirds: ▪ During the breeding season, the area regularly supports 110,000 individual seabirds including: Puffin *Fratercula arctica*, Guillemot *Uria aalge*, Kittiwake *Rissa tridactyla*, Shag *Phalacrocorax aristotelis*, Fulmar *Fulmarus glacialis*, Razorbill *Alca torda*

Protected site	Feature of Conservation Interest
Mointeach Scadabhaigh SPA	Annex I species (during the breeding season): ▪ Black-throated Diver *Gavia arctica*, 3 pairs representing at least 1.9% of the breeding population in Great Britain (Count, as at 1993) ▪ Red-throated Diver *Gavia stellata*, 48 pairs representing at least 5.1% of the breeding population in Great Britain (Count, as at 1994)
Priest Island SPA	Annex I species (during the breeding season): ▪ Storm Petrel *Hydrobates pelagicus*, 2,200 pairs representing at least 2.6% of the breeding population in Great Britain (Count, as at 1995)
Rum SPA	Annex I species (during the breeding season): ▪ Golden Eagle *Aquila chrysaetos*, 4 pairs representing at least 1.0% of the breeding population in Great Britain (Count, as at 1992.) ▪ Red-throated Diver *Gavia stellata*, 11 pairs representing at least 1.2% of the breeding population in Great Britain (5-year mean, 1992-1996) Migratory species (during the breeding season): ▪ Manx Shearwater *Puffinus puffinus*, 61,000 pairs representing at least 23.0% of the breeding population (Count, as at 1995) Regularly supports at least 20,000 seabirds: ▪ During the breeding season, the area regularly supports 130,000 individual seabirds (Count, as at 1992) including: Guillemot *Uria aalge*, Kittiwake *Rissa tridactyla*, Manx Shearwater *Puffinus puffinus*.
Shiant Isles SPA	Annex I species (over winter): ▪ Barnacle Goose *Branta leucopsis*, 172 individuals representing at least 0.6% of the wintering population in Great Britain (Three count mean, 1994, 1995 & 1997) Migratory species (during the breeding season): ▪ Puffin *Fratercula arctica*, 76,100 pairs representing at least 8.4% of the breeding population (Count, as at 1970) ▪ Razorbill *Alca torda*, 7,337 pairs representing at least 1.3% of the breeding population (Count as at 1986) ▪ Shag *Phalacrocorax aristotelis*, 1,780 pairs representing at least 1.4% of the breeding Northern Europe population (Count, as at 1986) Regularly supports at least 20,000 seabirds: ▪ During the breeding season, the area regularly supports 200,000 individual seabirds including: Guillemot *Uria aalge*, Kittiwake *Rissa tridactyla*, Fulmar *Fulmarus glacialis*, Puffin *Fratercula arctica*, Razorbill *Alca torda*, Shag *Phalacrocorax aristotelis*.
Sleibhtean agus Cladach Thiriodh (Tiree Wetlands and Coast) SPA	Annex I species (over winter): ▪ Barnacle Goose *Branta leucopsis*, 959 individuals representing at least 3.6% of the wintering population in Great Britain (winter peak mean) ▪ Greenland White-fronted Goose *Anser albifrons flavirostris*, 783 individuals representing at least 5.6% of the wintering population in Great Britain (winter peak mean) Migratory species (during the breeding season): ▪ Dunlin *Calidris alpina schinzii*, 125 pairs representing at least 1.1%

Protected site	Feature of Conservation Interest
	of the breeding Baltic/UK/Ireland population (1994/5) ▪ Oystercatcher *Haematopus ostralegus*, 160 pairs representing <0.1% of the breeding Europe & Northern/Western Africa population (1994/5) ▪ Redshank *Tringa totanus*, 140 pairs representing at least 0.2% of the breeding Eastern Atlantic - wintering population (1994/95) ▪ Ringed Plover *Charadrius hiaticula*, 160 pairs representing at least 1.0% of the breeding Europe/Northern Africa - wintering population (1998) Migratory species (over winter): ▪ Turnstone *Arenaria interpres*, 700 individuals representing at least 1.0% of the wintering Western Palearctic - wintering population (mean 1995, 1998, & 1999 special surveys)
Treshnish Isles SPA	Annex I species (during the breeding season): ▪ Storm Petrel *Hydrobates pelagicus*, 5,040 pairs representing at least 5.9% of the breeding population in Great Britain (Count, as at 1996) Annex I species (over winter): ▪ Barnacle Goose *Branta leucopsis*, 82 individuals representing at least 0.3% of the wintering population in Great Britain (Three count mean, 1994, 1955 & 1997)
Coll and Tiree SPA (proposed)	Annex I species (over winter): ▪ Great Northern Diver *Gavia immer*, 452 individuals representing 18.1% of population in Great Britain Migratory species (over winter): ▪ Common Eider *Somateria mollissima*, 1,465 individuals representing 2.4% of the population in Great Britain
Rum SPA (proposed)	Proposed additional marine feature to the Rum SPA Annex I species (during the breeding season): ▪ Red-throated Diver *Gavia stellata*, 18 pairs representing 1.4% of the population in Great Britain
West Coast of the Outer Hebrides SPA (proposed)	Annex I species (during the breeding season): ▪ Great Northern Diver *Gavia immer*, 1298 individuals representing 52% of population in Great Britain ▪ Red-throated Diver *Gavia stellata*, 58 pairs representing 4.5% of the population in Great Britain Annex I species (non-breeding): ▪ Black-throated Diver *Gavia artica*, 43 individuals representing 7.2% of the population in Great Britain ▪ Slavonia Grebe *Podiceps auritus*, 51 individuals representing 4.6% of the population in Great Britain Migratory species (non-breeding): ▪ Common Eider *Somateria mollissima*, 5,079 individuals representing 8.5% of the population in Great Britain ▪ Long-tailed Duck *Clangula hyemalis*, 821 individuals representing 7.5% of the population in Great Britain ▪ Red-breasted Merganser *Mergus serrator*, 239 individuals representing 2.8% of the population in Great Britain

Protected site	Feature of Conservation Interest
Site of Special Scientific Interest (SSSI)	
Achnahaird SSSI	Designated features: ▪ Bryophyte assemblage (Favourable)
Aird Thuirinis - Port na Long SSSI	Designated features: ▪ Moine (Favourable)
Allt Cracaig Coast SSSI	Designated features: ▪ Moine (Unfavourable)
Ard Hill SSSI	Designated features: ▪ Moine (Favourable)
Ardalanish Bay SSSI	Designated features: ▪ Caledonian Igneous (Favourable) ▪ Moine (Favourable)
Ardmeanach SSSI	Designated features: ▪ Cenomanian – Maastrichtian (Favourable) ▪ Hettangian, Sinemurian, Pliensbachian (Favourable) ▪ Quaternary of Scotland (Favourable) ▪ Tertiary Igneous (Favourable) ▪ Maritime cliff (Favourable) ▪ Montane assemblage (Favourable) ▪ Slender Scotch burnet moth (*Zygaena loti*) (Favourable) ▪ Subalpine calcareous grassland (Unfavourable) ▪ Vascular plant assemblage (Favourable)
Ardnamurchan SSSI	Designated features: ▪ Tertiary Igneous (Favourable)
Ardtun Leaf Beds SSSI	Designated features: ▪ Tertiary Igneous (Favourable) ▪ Palaeoentomology (Favourable) ▪ Tertiary Palaeobotany (Favourable)
Ardura - Auchnacraig SSSI	Designated features: ▪ Marsh fritillary (*Euphydryas aurinia*) (Favourable) ▪ Saltmarsh (Favourable) ▪ Upland oak woodland (Favourable) ▪ Tertiary Igneous (Favourable)
Aultbea SSSI	Designated features: ▪ Torridonian (Favourable)
Avernish SSSI	Designated features: ▪ Moine (Favourable)
Bagh Tharsgabhaig SSSI	Designated features: ▪ Moine (Favourable)
Ben More - Scarisdale SSSI	Designated features: ▪ Mineralogy of Scotland (Favourable) ▪ Quaternary of Scotland(Favourable) ▪ Tertiary Igneous (Favourable) ▪ Upland oak woodland (Recovering)
Boirearaig to Carn Dearg SSSI	Designated features: ▪ Hettangian, Sinemurian, Pliensbachian (Favourable)
Cailleach Head SSSI	Designated features: ▪ Torridonian (Favourable)
Calgary Dunes SSSI	Designated features: ▪ Machair (Favourable)

Protected site	Feature of Conservation Interest
Camas Mor, Muck SSSI	Designated features: ▪ Tertiary Igneous (Favourable)
Canna and Sanday SSSI	Designated features: ▪ Machair (Favourable) ▪ Maritime cliff (Unfavourable) ▪ Moth assemblage (Favourable) ▪ Seabird colony, breeding (Unfavourable) ▪ Shag (*Phalacrocorax aristotelis*), breeding (Unfavourable) ▪ Tertiary Igneous (Favourable)
Ceann a' Mhara to Loch a' Phuill SSSI	Designated features: ▪ Eutrophic loch (Favourable) ▪ Machair (Favourable) ▪ Sand dunes (Favourable)
Ceann Loch Eishort SSSI	Designated features: ▪ Torridonian (Favourable)
Coille Dalavil SSSI	Designated features: ▪ Blanket bog (Favourable) ▪ Dragonfly assemblage (Favourable) ▪ Flood-plain fen (Favourable) ▪ Lichen assemblage (Favourable) ▪ Upland oak woodland (Unfavourable)
Coille Dhubh SSSI	Designated features: ▪ Upland oak woodland (Unfavourable)
Coille Thogabhaig SSSI	Designated features: ▪ Beetles (Favourable) ▪ Bryophyte assemblage (Unfavourable) ▪ Cambrian – Tremadoc (Favourable) ▪ Lichen assemblage (Unfavourable) ▪ Moine (Favourable) ▪ Rocky slopes (includes inland cliff, rocky outcrops, chasmophytic vegetation) (Favourable) ▪ Upland mixed ash woodland (Favourable)
Crossapol and Gunna SSSI	Designated features: ▪ Greenland Barnacle goose (*Branta leucopsis*), non-breeding (Favourable) ▪ Greenland white-fronted goose (*Anser albifrons flavirostris*), non-breeding (Favourable) ▪ Machair (Favourable) ▪ Sand dunes (Favourable)
Cuillins SSSI	Designated features: ▪ Alkaline fen (Favourable) ▪ Blanket bog (Favourable) ▪ Bryophyte assemblage (Favourable) ▪ Flood-plain fen (Favourable) ▪ Open water transition fen (Favourable) ▪ Quaternary of Scotland (Favourable) ▪ Subalpine dry heath (Favourable) ▪ Tall herb ledge (Favourable) ▪ Tertiary Igneous (Favourable) ▪ Upland birch woodland (Unfavourable) ▪ Vascular plant assemblage (Favourable)

Protected site	Feature of Conservation Interest
Drimnin to Killundine Woods SSSI	Designated features: ▪ Upland mixed ash woodland (Unfavourable) ▪ Upland oak woodland (Unfavourable)
Druimindarroch SSSI	Designated features: ▪ Moine (Favourable)
Eigg - An Sgurr and Gleann Charadail SSSI	Designated features: ▪ Maritime cliff (Favourable) ▪ Scrub (Favourable) ▪ Subalpine dry heath (Unfavourable) ▪ Tertiary Igneous (Favourable)
Eigg - Laig to Kildonnan SSSI	Designated features: ▪ Bathonian (Favourable) ▪ Jurassic - Cretaceous Reptilia (Favourable) ▪ Lichen assemblage (Favourable) ▪ Maritime cliff (Recovering) ▪ Scrub (Favourable)
Eilean Chlamail - Camas nan Ceann SSSI	Designated features: ▪ Moine (Favourable)
Elgol Coast SSSI	Designated features: ▪ Bathonian (Favourable) ▪ Callovian (Favourable) ▪ Mesozoic Mammalia (Favourable) ▪ Oxfordian (Favourable)
Garbh Shlios SSSI	Designated features: ▪ Upland oak woodland (Unfavourable)
Geary Ravine SSSI	Designated features: ▪ Tall herb ledge (Favourable) ▪ Upland mixed ash woodland (Favourable)
Glas Eileanan SSSI	Designated features: ▪ Common tern (*Sterna hirundo*), breeding (Unfavourable)
Glen Beasdale SSSI	Designated features: ▪ Upland oak woodland (Favourable)
Gribun Shore and Crags SSSI	Designated features: ▪ Cenomanian – Maastrichtian (Favourable) ▪ Maritime cliff (Favourable) ▪ Permian - Triassic (red beds) (Favourable) ▪ Rocky slopes (includes inland cliff, rocky outcrops, chasmophytic vegetation) (Unfavourable) ▪ Subalpine calcareous grassland (Unfavourable)
Hough Bay and Balevullin Machair SSSI	Designated features: ▪ Machair (Favourable) ▪ Machair loch (Favourable) ▪ Sand dunes (Favourable) ▪ Subalpine dry heath (Favourable)
Inninmore Bay SSSI	Designated features: ▪ Upland mixed ash woodland (Unfavourable) ▪ Upper Carboniferous [Namurian (part) - Westphalian] (Favourable)
Inverasdale Peatlands SSSI	Designated features: ▪ Blanket bog (Favourable)

Protected site	Feature of Conservation Interest
Inverpolly SSSI	Designated features: ▪ Beetle (*Otiorhynchus auropunctatus*) (Favourable) ▪ Blanket bog (Favourable) ▪ Breeding bird assemblage (Favourable) ▪ Moths (Favourable) ▪ Norwegian mugwort (*Artemisia norvegica*) (Favourable) ▪ Oligotrophic loch (Favourable) ▪ Quaternary of Scotland (Favourable) ▪ Upland assemblage (Favourable) ▪ Upland birch woodland (Unfavourable)
Kentra Bay and Moss SSSI	Designated features: ▪ Blanket bog (Unfavourable) ▪ Bryophyte assemblage (Unfavourable) ▪ Lichen assemblage (Unfavourable) ▪ Maritime cliff (Favourable) ▪ Mudflats (Favourable) ▪ Saltmarsh (Unfavourable) ▪ Upland oak woodland (Unfavourable) ▪ Vascular plant assemblage (Favourable)
Kinloch and Kyleakin Hills (Monadh Chaol Acainn is Cheann Loch) SSSI	Designated features: ▪ Alpine heath (Favourable) ▪ Blanket bog (Favourable) ▪ Bryophyte assemblage (Favourable) ▪ Lichen assemblage (Unfavourable) ▪ Otter (*Lutra lutra*) (Favourable) ▪ Subalpine dry heath (Favourable) ▪ Subalpine wet heath (Recovering) ▪ Torridonian (Favourable) ▪ Upland oak woodland (Unfavourable)
Lagganulva Wood SSSI	Designated features: ▪ Tertiary Igneous (Favourable) ▪ Upland oak woodland (Unfavourable)
Loch an Duin SSSI	Designated features: ▪ Brackish water cockle (*Cerastoderma glaucum*) (Favourable) ▪ Breeding bird assemblage (Favourable) ▪ Coastal Geomorphology of Scotland (Favourable) ▪ Otter (*Lutra lutra*) (Favourable) ▪ Saline lagoon (Favourable) ▪ Tidal rapids (Favourable)
Loch Moidart SSSI	Designated features: ▪ Beetle (*Schizotus pectinicornis*) (Favourable) ▪ Moine (Favourable) ▪ Mudflats (Favourable) ▪ Saltmarsh (Favourable) ▪ Upland oak woodland (Unfavourable)
Loch Obisary SSSI	Designated features: ▪ Saline lagoon (Favourable)
Meall a' Mhaoil SSSI	Designated features: ▪ Tertiary Igneous (Favourable)

Protected site	Feature of Conservation Interest
Mingulay and Berneray SSSI	Designated features: ▪ Fulmar (*Fulmarus glacialis*), breeding (Favourable) ▪ Guillemot (*Uria aalge*), breeding (Favourable) ▪ Kittiwake (*Rissa tridactyla*), breeding (Favourable) ▪ Razorbill (*Alca torda*), breeding (Favourable) ▪ Seabird colony, breeding (Favourable)
Mointeach Scadabhaigh SSSI	Designated features: ▪ Black-throated diver (*Gavia arctica*), breeding (Favourable) ▪ Blanket bog (Favourable) ▪ Breeding bird assemblage (Favourable) ▪ Dystrophic and oligotrophic lochs (Favourable) ▪ Red-throated diver (*Gavia stellata*), breeding (Favourable)
North East Coll Lochs and Moors SSSI	Designated features: ▪ Blanket bog (Favourable) ▪ Breeding bird assemblage (Favourable) ▪ Greenland white-fronted goose (*Anser albifrons flavirostris*), non-breeding (Favourable) ▪ Lichen assemblage (Favourable) ▪ Machair (Favourable) ▪ Vascular plant assemblage (Favourable)
Ob Lusa to Ardnish SSSI	Designated features: ▪ Hettangian, Sinemurian, Pliensbachian (Favourable)
Obain Loch Euphoirt SSSI	Designated features: ▪ Foxtail stonewort (*Lamprothamnium papulosum*) (Favourable) ▪ Saline lagoon (Favourable)
Priest Island SSSI	Designated features: ▪ Maritime cliff (Favourable) ▪ Storm petrel (*Hydrobates pelagicus*), breeding (Favourable)
Raasay SSSI	Designated features: ▪ Aalenian – Bajocian (Favourable) ▪ Dystrophic and oligotrophic lochs (Favourable) ▪ Hettangian, Sinemurian, Pliensbachian (Favourable) ▪ Mass movement (Favourable) ▪ Upland assemblage (Unfavourable) ▪ Upland oak woodland (Unfavourable) ▪ Vascular plant assemblage (Favourable)
Rigg - Bile SSSI	Designated features: ▪ Aalenian – Bajocian (Favourable) ▪ Maritime cliff (Favourable) ▪ Mesozoic Palaeobotany (Favourable) ▪ Tertiary Igneous (Favourable) ▪ Toarcian (Favourable) ▪ Upland mixed ash woodland (Favourable)
Rubh' an Eireannaich SSSI	Designated features: ▪ Tertiary Igneous (Favourable)
Rubha Camas na Cailinn SSSI	Designated features: ▪ Moine (Favourable)
Rubha Dunan SSSI	Designated features: ▪ Hydromorphological mire range (Favourable) ▪ Torridonian (Favourable)

Protected site	Feature of Conservation Interest
Rubha Hunish SSSI	Designated features: ▪ Maritime cliff (Favourable) ▪ Tertiary Igneous (Favourable)
Rum SSSI	Designated features: ▪ Bryophyte assemblage ▪ Invertebrate assemblage ▪ Manx shearwater (*Puffinus puffinus*), breeding ▪ Maritime cliff ▪ Quaternary of Scotland ▪ Tertiary Igneous ▪ Upland assemblage ▪ Vascular plant assemblage
Shiant Islands SSSI	Designated features: ▪ Fulmar (*Fulmarus glacialis*), breeding (Unfavourable) ▪ Greenland Barnacle goose (*Branta leucopsis*), non-breeding (Favourable) ▪ Guillemot (*Uria aalge*), breeding (Unfavourable) ▪ Puffin (*Fratercula arctica*), breeding (Favourable) ▪ Razorbill (*Alca torda*), breeding (Favourable) ▪ Seabird colony, breeding (Unfavourable) ▪ Shag (*Phalacrocorax aristotelis*), breeding (Unfavourable) ▪ Tertiary Igneous (Favourable)
Sleibhtean agus Cladach Thiriodh SSSI	Designated features: ▪ Breeding bird assemblage (Favourable) ▪ Dunlin (*Calidris alpina schinzii*), breeding (Favourable) ▪ Greenland Barnacle goose (*Branta leucopsis*), non-breeding (Favourable) ▪ Greenland white-fronted goose (*Anser albifrons flavirostris*), non-breeding (Favourable) ▪ Machair (Favourable) ▪ Oligotrophic loch (Favourable) ▪ Oystercatcher (*Haematopus ostralegus*), breeding (Favourable) ▪ Purple sandpiper (*Calidris maritima*), non-breeding (Favourable) ▪ Redshank (*Tringa totanus*), breeding (Favourable) ▪ Ringed plover (*Charadrius hiaticula*), breeding (Unfavourable) ▪ Ringed plover (*Charadrius hiaticula*), non-breeding (Favourable) ▪ Sand dunes (Favourable) ▪ Sanderling (*Calidris alba*), non-breeding (Favourable) ▪ Turnstone (*Arenaria interpres*), non-breeding (Favourable)
Slumbay Island SSSI	Designated features: ▪ Moine (Favourable)
Sound of Mull Cliffs SSSI	Designated features: ▪ Upland mixed ash woodland (Favourable)
South Mull Coast SSSI	Designated features: ▪ Maritime cliff (Favourable) ▪ Mineralogy of Scotland (Favourable) ▪ Tertiary Igneous (Favourable)
Staffa SSSI	Designated features: ▪ Fulmar (*Fulmarus glacialis*), breeding (Unfavourable) ▪ Maritime cliff (Favourable)

Protected site	Feature of Conservation Interest
	▪ Puffin (*Fratercula arctica)*, breeding (Favourable) ▪ Shag (*Phalacrocorax aristotelis*), breeding (Favourable)
Strath SSSI	Designated features: ▪ Base-rich loch (Favourable) ▪ Mineralogy of Scotland (Recovering) ▪ Molluscs (Favourable) ▪ Tertiary Igneous (Favourable) ▪ Upland assemblage (Favourable) ▪ Upland birch woodland (Unfavourable) ▪ Vascular plant assemblage (Favourable)
Sunart SSSI	Designated features: ▪ Bryophyte assemblage (Unfavourable) ▪ Caledonian Igneous (Favourable) ▪ Chequered skipper (*Carterocephalus palaemon*) (Favourable) ▪ Dragonfly assemblage (Favourable) ▪ Eelgrass beds (Favourable) ▪ Egg wrack (*Ascophyllum nodosum ecad mackaii*) (Favourable) ▪ Lichen assemblage (Unfavourable) ▪ Moine (Favourable) ▪ Moths (Favourable) ▪ Otter (*Lutra lutra*) (Favourable) ▪ Rocky shore (Favourable) ▪ Saltmarsh (Favourable) ▪ Tertiary Igneous (Favourable) ▪ Upland assemblage (Unfavourable) ▪ Upland oak woodland (Unfavourable) ▪ Vascular plant assemblage (Favourable)
Talisker SSSI	Designated features: ▪ Burnet moth (*Zygaena lonicerae jocelynae*) (Favourable) ▪ Calcareous scree (Favourable) ▪ Rocky slopes (includes inland cliff, rocky outcrops, chasmophytic vegetation) (Favourable) ▪ Tall herb ledge (Favourable) ▪ Tertiary Igneous (Favourable)
Totamore Dunes and Loch Ballyhaugh SSSI	Designated features: ▪ Machair (Favourable) ▪ Machair loch (Favourable) ▪ Open water transition fen (Favourable) ▪ Sand dunes (Favourable) ▪ Vascular plant assemblage (Favourable)
Treshnish Isles SSSI	Designated features: ▪ Greenland Barnacle goose (*Branta leucopsis*), non-breeding (Unfavourable) ▪ Grey seal (*Halichoerus grypus*) (Favourable) ▪ Maritime cliff (Favourable) ▪ Quaternary of Scotland (Favourable) ▪ Seabird colony, breeding (Favourable)
Trotternish Ridge SSSI	Designated features: ▪ Bathonian (Favourable) ▪ Bryophyte assemblage (Unfavourable) ▪ Callovian (Favourable)

Protected site	Feature of Conservation Interest
	▪ Kimmeridgian (Favourable) ▪ Mass movement (Favourable) ▪ Mineralogy of Scotland (Favourable) ▪ Oxfordian (Favourable) ▪ Tertiary Igneous (Favourable) ▪ Upland assemblage (Unfavourable) ▪ Vascular plant assemblage (Favourable)
Valtos SSSI	Designated features: ▪ Bathonian (Favourable)
Nature Conservation Marine Protected Areas	
Loch Carron NCMPA	Protected features (biodiversity): ▪ flame shell beds
Loch Sunart NCMPA	Protected features (biodiversity): ▪ flame shell beds ▪ northern feather star aggregations on mixed substrata ▪ *serpulid* aggregations
Lochs Duich, Long and Alsh NCMPA	Protected features (biodiversity): ▪ burrowed mud ▪ flame shell beds
Wester Ross NCMPA	Protected features (biodiversity): ▪ burrowed mud ▪ circalittoral muddy sand communities ▪ flame shell beds ▪ kelp and seaweed communities on sublittoral sediment ▪ maerl beds ▪ maerl or coarse shell gravel with burrowing sea cucumbers ▪ northern feather star aggregations on mixed substrata Protected features (geodiversity): ▪ marine geomorphology of the Scottish shelf seabed – banks of unknown substrate ▪ Quaternary of Scotland – glaciated channels/troughs, megascale glacial lineations, moraines ▪ seabed fluid and gas seep – pockmarks ▪ submarine mass movement – slide scars
Loch Sunart to the Sound of Jura NCMPA	Protected features (biodiversity): ▪ common skate Protected features (geodiversity): ▪ Quaternary of Scotland – glaciated channels/troughs
Small Isles NCMPA	Protected features (biodiversity): ▪ black guillemot ▪ burrowed mud ▪ circalittoral sand and mud communities ▪ fan mussel aggregations ▪ horse mussel beds ▪ northern feather star aggregations on mixed substrata ▪ northern sea fan and sponge communities ▪ shelf deeps ▪ white cluster anemones Protected features (geodiversity): ▪ Quaternary of Scotland – glaciated channels/troughs, glacial lineations, meltwater channels, moraines, streamlined bedforms

Protected site	Feature of Conservation Interest
Shiant East Bank proposed NCMPA	Protected features (biodiversity): ▪ Circalittoral sands and mixed sediment communities ▪ Northern sea fan and sponge communities ▪ Shelf banks and mounds Protected features (geodiversity): ▪ Quaternary of Scotland - glacial lineations, drumlins, iceberg ▪ scours
Sea of the Hebrides proposed NCMPA	Protected features (biodiversity): ▪ Basking shark ▪ Fronts ▪ Minke whale Protected features (geodiversity): ▪ Marine Geomorphology of the Scottish Shelf Seabed (components to be confirmed)
North-east Lewis proposed NCMPA	Protected features (biodiversity): ▪ Risso's dolphin ▪ Sandeels Protected features (geodiversity): ▪ Quaternary of Scotland - glaciated channel/troughs, landscape of areal glacial scour, megascale glacial lineations ▪ Marine Geomorphology of the Scottish Shelf Seabed - longitudinal bedform field

Contact Us

ABPmer

Quayside Suite,
Medina Chambers
Town Quay, Southampton
SO14 2AQ

T +44 (0) 23 8071 1840
F +44 (0) 23 8071 1841
E enquiries@abpmer.co.uk

www.abpmer.co.uk