Marine Protected Area Assessment Methodology

Marine Resources (Government of Jersey)

December 2023

SoJ Assembly, March 2022: 'The Minister for the Environment will create a Marine Spatial Plan to organise human and marine resources and activities in Jersey's territorial waters and, in particular, *to develop a network of marine protected areas which will be consistent with overall environmental, economic and social objectives.* This work will inform the policies of the next iteration of the Island Plan and support coordinated development and decision making on all aspects affecting the marine environment.'

1.0 - Introduction

In Ministerial Plans, published in October 2023, as part of the Government Plan 2023–2026, the Minister for the Environment sets out, as a priority, 'developing a marine spatial plan to ensure the sustainable management of the Island's marine environment'. The need for a MSP was endorsed by the States of Jersey Assembly in several key policy debates and clearly highlighted in the Bridging Island Plan (Strategic Proposal 3) and the Carbon Neutral Roadmap (Enabling Policy 5). Marine spatial planning is also included in the Economic Framework for the Marine Environment 2022. A stated objective of the MSP is to 'develop a network of marine protected areas which will be consistent with overall environmental, economic and social objectives'.

The approach taken by the Jersey Marine Spatial Plan (JMSP) towards the request to develop a marine protected area (MPA) network for Jersey follows the recommendations given in the UK government's 2020 *Benyon Review* (Benyon, 2019). This sought to define the need, opportunities and challenges associated with MPAs and options associated with their selection and management. The *Benyon Review* provides 25 recommendations relating to the definition, functioning, identification and creation of MPAs and the actions and management measures required to deliver long term environmental and socioeconomic benefits. The *Benyon Review* has guided the UK's selection and designation of highly marine protected areas (HMPAs) within its inshore and offshore seas. A high emphasis was placed on Recommendation 12 which states that the government 'should identify sites for HPMA designation using the principles of ecological importance; naturalness, sensitivity and potential to recover, and ecosystem services. Social and economic principles are a secondary filter'. This led to the selection of pilot HMPA being based on 'ecological, social and economic criteria, to provide maximum biodiversity benefits while seeking to also maximise associated benefits and minimise impacts to sea users.' The approach taken by the JMSP towards its site selection is in line with the Benyon Review recommendations and the general approach adopted by the UK government.

This report is also mindful of the findings of the 2021 Dasgupta Report into the economics of biodiversity which identifies the high reliance that human society has on Nature and degree to which economies and livelihoods are embedded within Nature, not external to it (Dasgupta, 2021). A key conclusion is that the current demand for the services and goods that Nature produces far exceeds the capacity to provide them. The report identifies embedded systemic institutional failures which have failed to ensure that human demands on Nature do not exceed its ability to supply them. This applies to the marine environment where an effect of long-term unsustainable activities can be the degradation of ecosystems to a point where they can no longer contribute or benefit to future socioeconomic or welfare services. The historical and recent documented collapse of fish and shellfish stocks across the globe, including locally, suggest that such considerations are not theoretical but are a tangible and ongoing issue.

The creation of highly managed MPAs has been shown through multiple studies to facilitate ecosystem recovery and protection which, in turn, have potential social and economic benefits. While the primary aim of most MPAs is to protect or enhance biodiveristy, other benefits can include increased tourism, educational, research and recreational activities. The recovery of ecosystems also benefits commercial and recreational fisheries through increased stock density and biomass within managed sites but also via spillover and boundary effects. The disadvantage of managed MPA areas is that they often require the displacement of identified disruptive or destructive seabed activities and this may impact existing fisheries within identified areas. In this respect the potential impact of MPAs on fishing and other maritime industries must be acknowledged and documented to support marine uses and to ensure that problems do not result from moving pressures to other marine areas.

Jersey's existing MPA network occupies 6.5% of the island's territorial sea and would be classed by the *Benyon Review* as an HMPA through its whole site management approach and mitigation of identified disruptive activities in line with the requirements of the OSPAR Convention (Annex V). The current network has evolved in a piecemeal fashion until 2018 when several individual sites were drawn together as an internationally recognised MPA network through OSPAR. The most recently designated MPA areas are two offshore reefs, Les Écréhous and Les Minquiers, which were created in 2017. A three-year study on the socioeconomic and biological evolution of these two MPAs suggests that commercial species' life histories and habitat requirements need to be included within management plans to take account of their reliance on multiple habitats (Blampied, 2022). In relation of Jersey's fishing economy, which is dominated by shellfish species, improved spatial management is needed to improve connectivity of protected areas to support the various life stages of commercial species. These findings are in line with other studies into the derived benefits of spatial management across the socioeconomic spectrum but especially in relation to fisheries (see, for example, the OSPAR Intermediate Assessment, 2017).

The principle of enhancing marine productivity and biodiversity through spatial management features in multiple Government of Jersey strategies, plans and multilateral environmental agreements and this report does not seek to rehearse existing evidence demonstrating the high value that a biologically diverse and productive marine environment has to society. Nor does it seek to review the wealth of evidence around the value of setting aside sea areas with high levels of protection to maximise the biomass, abundance and diversity of species therein. In doing so, the natural capital benefits derived from ecosystem services are enhanced. For a summary in relation to this, readers should consult, among others, Lester and Halpern (2008), Lester *et al.* (2009), Stewart *et al.* (2009), Sciberras *et al.* (2015), Sala and Giakoumi (2018), Benyon (2019) and Blampied (2022).

This report summarises the approach, evidence and results of the identification of an MPA network within Jersey waters as required by the JMSP's key objectives. This includes an examination of potential impacts and benefits in relation to the recommended site boundaries. The approach taken by the JMSP towards the identification of its MPAs is in line with the recommendations within the *Benyon Review* and therefore also that of the UK government.

1.1 – The Jersey MPA Network

In March 2022 the Bridging Island Plan (Strategic Proposal 3) and the States of Jersey Assembly required the creation of an MSP that could 'develop a network of marine protected areas which will be consistent with overall environmental, economic and social objectives.' Achieving this requires understanding the definition and purpose of a MPA network and the Government of Jersey's environmental, economic and social objectives and principles. The assessment and design process behind the identification of an MPA network for Jersey's waters must take these factors into account.

In line with the *Benyon Review*'s recommendations, an effective MPA design must possess an appropriate level of protection (supported by legislation/regulation) required to achieve stated aim(s), be representative of regional ecology/biogeography and possess a size and coherence sufficient to deliver measurable benefits in relation to its objectives. Additional to this is a recognition that the success and effectiveness of MPAs will be enhanced by stakeholder participation, enforcement and strong leadership. MPA networks that fail to meet their objectives often do so because of a lack of monitoring or enforcement and because conflicting interests have been prioritised over management recommendations (e.g. Giakoumi *et al.* 2018). These factors need to be considered when designing an MPA network.

To date approximately 6.5% of Jersey's territorial seas are recognised as MPAs under the OSPAR Convention. These areas were established successively between 2001 and 2017 to protect the then known extent of sensitive seabed habitats, such as seagrass and maerl, from potentially destructive fishing activities (Chambers *et al.* 2019; Blampied, 2022). Additionally, and at the request of local stakeholders, a small No Take Zone of 2 km^2 was established in 2022 on Jersey's south coast to provide an experimental study area for local and visiting NGOs, schools and other organisations.

The legislation and policy review undertaken in association with the JMSP summarises the international agreements, legislation and policy frameworks that are associated Jersey's maritime area (Terra Mare, 2022). These include commitments made by Jersey in relation to the natural environment, biodiversity, climate change, infrastructure and several areas of marine management such as: the Common Strategic Policy; Government Plan; Integrated coastal zone management strategy; Economic Framework for the Marine Environment; Bridging Island Plan; Paris Agreement on Climate Change; Carbon Neutral Strategy/Roadmap; Ramsar Convention; ASCOBANS, Bern/Bonn Convention; Convention on Biological Diversity; Wildlife (Jersey) Law 2021; Wildlife (Areas of Special Protection) (Jersey) Order 2022; States of Jersey Biodiversity Strategy; EU–UK Trade and Cooperation Agreement; Sea Fisheries (Jersey) Law 1994; Aquatic Resources (Jersey) Law 2014. For further details, see the relevant entry in *The JMSP Legislation and Policy Review (Terra Mare, 2022)*.

The definition of an MPA has been interpreted differently by different organisations, governments and management authorities. The IUCN, for example, defines protected areas as being 'a clearly defined geographical space, recognised, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values.' When registering its MPAs with OSPAR and the World Database on Protected Areas in 2017, the Government of Jersey adhered to the objective and principles in Annex V of the OSPAR Convention, to which the island is a contracting party. This requires the identification of seabed habitats recognised under the OSPAR Convention as being threatened and then assessing their properties, services and functions against any activities that might impact or degrade them. Management measures must then be built around establishing the long-term conservation of valued habitats including their ecosystem services and cultural values.

This approach is consistent with the *Benyon Review*'s definition of a highly protected marine areas (HPMA) which requires a whole site approach (Solandt, 2020) in which all habitats and species within an MPA boundary are protected from actual or potentially destructive human activity. The HPMA definition within the *Benyon Review* is distinct from its description of an MPA which in most countries do not follow the whole site approach and will therefore allow some or all extractive or depositional activities to continue.

Jersey's 2017 approach to MPA designation using a whole site approach was unanimously voted through the States Assembly and the requirement to develop an MPA network as part of the JMSP will be consistent with the aims and objectives of Jersey's current MPA sites. Although mindful of a need to be consistent with the *Benyon Review*'s recommendations, the island's current MPA network was established in accordance with Annex V of the OSPAR Convention. When seeking to develop an MPA network, the JMSP has adhered to the recommendations of the *Benyon Review* and the requirements of Annex V of the OSPAR Convention while also being guided by the island's environmental, economic and social objectives. As a contracting party to the OSPAR Convention, Jersey's MPA Network should conform to the following objectives:

- to protect, conserve and restore species, habitats and ecological processes which have been adversely affected by human activities;

- to prevent degradation of, and damage to, species, habitats and ecological processes, following the precautionary principle; and

- to protect and conserve areas that best represent the range of species, habitats and ecological processes in the maritime area.

It should, however, be noted that the JMSP is not beholden to, nor driven by, the island's commitment to the "30 by 30" (30% MPA coverage by 2030) agreed at the COP15 summit in December 2022. The 30 by 30 target does form part of the OSPAR Convention and the Convention on Biological Diversity to which Jersey is a signatory. The target requires that 'by 2030 at least 30 per cent of marine and coastal areas, especially areas of particular importance for biodiversity and ecosystem functions and services, are effectively conserved and managed through ecologically representative, well-connected and equitably governed systems of protected areas.' However, the JMSP approach towards the development of an MPA network is based on an evidence-based assessment. Therefore, while JMSP is aware of the '30 by 30' target and Jersey's commitment to achieving this, it is not bound by it.

1.2 - The MPA Assessment Framework

The development of a successful and workable MPA network requires balancing ecological, social and management principles within a definable geographical area to achieve stated aims and objectives (see above). This process must be transparent and make provision for the identification and inclusion of stakeholders though a consultative process and the utilisation of evidence derived from robust data gathering and research.

The assessment associated with the JMSP's objective of developing a MPA network is based on GIS data held within the project's evidence base. It also draws on the analyses and conclusions from other JSMP assessments concerning the marine environment and activities. The assessment is driven by the instruction that the JMSP should develop a network of marine protected areas consistent with overall environmental, economic and social objectives. It is also guided by the outcome of workshop consultations which offered support for MPAs while also raising the need to ensure that impact on the fishing economy is minimised. Section 1.1 outlines the need for MPAs to be consistent with existing approaches including those that were used to establish the existing MPA network sites in line with objectives and principles outlined in the OSPAR Convention.

With these objectives in mind, this assessment has used a Conservation Planning approach that is in line with other marine spatial plans associated with island archipelagos such as those for Bermuda, Seychelles, the Shetlands and Orkney. These use multiple criteria to identify key spatial characteristics which can be used to assess the value of individual sea areas. This evaluation has been undertaken using GIS software often using datasets that have been processed to provide an evaluation at the resolution of 1 km^2. Summary details on these datasets are given below and more detail may be obtained from other JMSP reports concerning ecosystem services, marine activities and habitat sensitivity. Only those sea areas with the highest values have been considered for MPA candidacy. The process operates across several stages, all of which are covered in detail in this report and are summarised below:

Part One – Core Features

Key parameters which relate to existing defined areas or to agreements and strategies of direct relevance to the JMSP. Core features are considered to be:

- Spatial designations. Inclusion is defined by the boundary of a sea area.

- OSPAR threatened habitats. Defined using a scoring system based on percentage of OSPAR habitats within each 1 km^2 square.

- Blue carbon. Defined using a scoring system based on percentage of BC1 (production) and BC2 (permanent burial/sequestration) areas within each 1 km^2 square.

Part Two – Secondary Features

Other parameters that help highlight/identify areas for possible MPA inclusion. These features are scored using the percentage of the parameter within each 1 km^2.

- Habitat complexity/diversity/connectivity. Scored on the number of habitat groups (>10% coverage) within each 1 km^2 square.

- Seabed depth. Scored on the percentage of seabed shallower than 15 metres within each 1 km^2 square.

- Ecosystem Services. Scored by taking the combined ES score for each habitat group, multiplying it by the percentage area within each 1 km^2 square and then adding up the total.

MPA Network Design

The design of the MPA network follows a standard Conservation Planning quantitative approach towards decision-making in relation to a defined environmental planning objective (Moilanen *et al.* 2009; Groves and Game, 2015). Spatial attributes are used to identify priority areas from which expert opinion may be used to facilitate a MPA network design. This produces a draft outline of the MPA area which can then be adjusted and its effectiveness/impact tested against other criteria.

Effectiveness and Impact

The draft MPA network derived from the design process needs to be effective in relation to the objectives and targets outlined in Section 1.1. The sea areas resultant from the MPA design process has been assessed against stakeholder feedback, biodiversity targets and, for comparative purposes, the marine assessment criteria associated with EU, UK and OSPAR. An impact assessment is also included which utilises available evidence in relation to fishing and other activities as outlined in the (Marine Resources, 2023e) .

It should be noted that the proposed MPA Network outlined in this report is for inclusion in the draft version of the JMSP which will be released for public consultation. Any changes to the MPA Network design resultant from the consultation process will necessitate a re-evaluation of the effectiveness and impact in relation to the sites. For this reason, this report may need to be updated in relation to the final JMSP and so should be considered to be interim.

2.0 - MPA Assessment: Part One – Core Features

Part one of the assessment sought to identify seabed areas that may be considered to have a high value in relation to Jersey's strategies, agreements and commitments. These are considered to be:

- Spatial areas defined by a boundary that have been ascribed an importance in relation to the aims and objectives (2.1.1 to 2.1.4 below). Inclusion is defined by the boundary of the spatial area.

- OSPAR threatened habitats (2.2.0 below). Defined using a scoring system based on percentage of OSPAR habitats within each square.

- Climate change: blue carbon (2.3.0 below). Defined using a scoring system based on percentage of BC1 (production) and BC2 (sequestration) habitats within each square.

An assessment of Jersey's marine area in relation to these features is given below. The combined outcome of the Part One assessment is summarised in Section 2.4.0.

2.1.1 - Existing MPA and NTZ Areas

The JMSP does not seek to reduce the coverage or boundary of Jersey's existing MPA and NTZ network. These areas will be included without further assessment within the scope of the JMSP MPA network.

2.1.2 – Ramsar Sites

Jersey has 187 km^2 of marine area designated as Wetlands of International Importance under the Ramsar Convention. The designation covered four separate sites one of which is coastal (the Jersey South-east Ramsar Site) and the other three offshore reefs (Les Ecrehous, Les Minquiers and Les Pierres de Lecq). Designation occurred in 2000 and 2004 and was based on a demonstrable value of the sites in respect of their biodiversity, key habitats and high functionality across several environmental, oceanographic and socioeconomic sectors. All sites have management plans which are overseen by a combination of the Government of Jersey and the Ramsar Management Authority (a stakeholder led and organised group). Reporting on the condition and management of the sites is undertaken to the Ramsar Convention annually.

Ramsar sites are internationally recognised for their ecological importance and, while the existing Jersey MPA network does overlap with some of the Ramsar sites, the boundaries are not coincident leaving some Ramsar areas outside the Jersey MPA network. Given that Jersey's Ramsar areas have been recognised as Wetlands of International Importance and are managed and promoted for the high natural capital value, all designated Ramsar areas should be part of a future MPA network for Jersey.

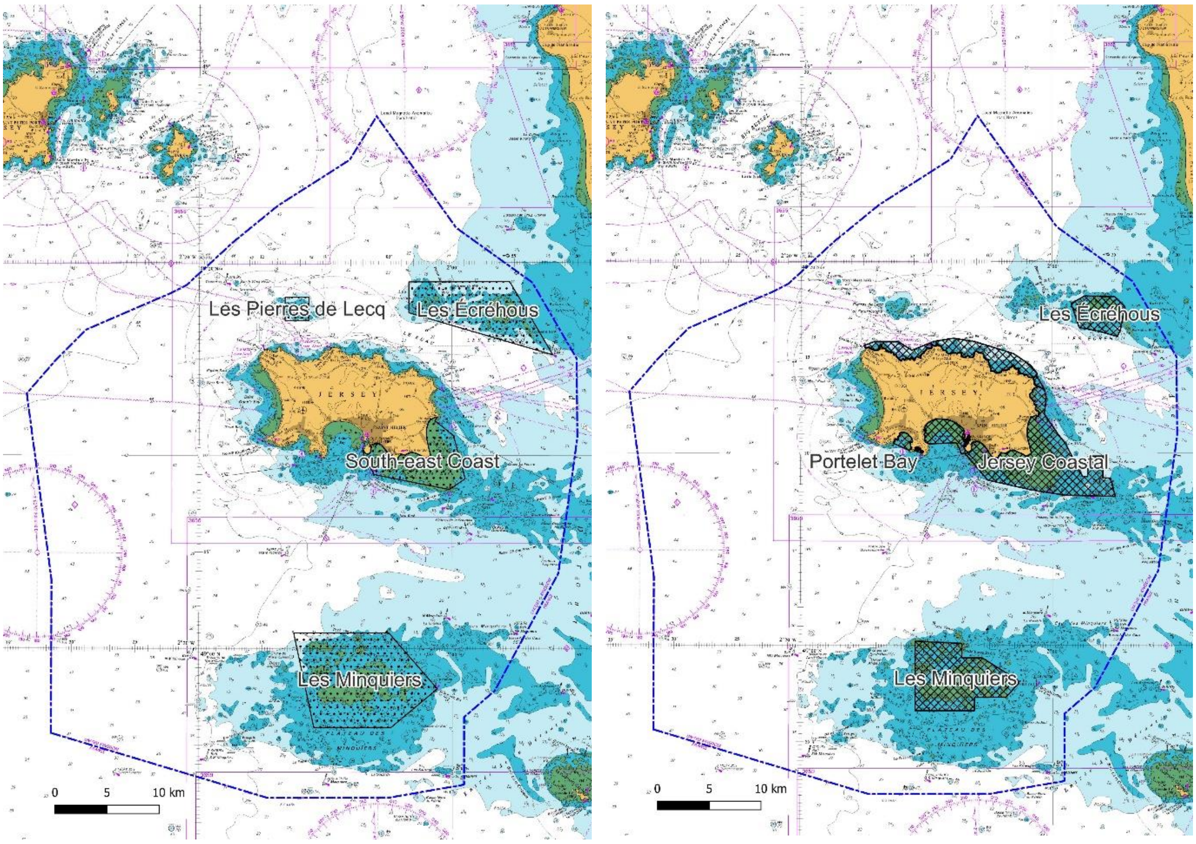

Figure 2.1.1.1 – The location of: (left) Jersey's designated Ramsar (wetlands of international importance) sites; (right) Jersey's current designated MPA/NTZ sites.

2.1.3 – Jersey's Intertidal and Nearshore Zone

Jersey's entire intertidal area, from High Water Mean Spring (HWMS) to Chart Datum plus Ramsar sites, is included within the Bridging Island Plan's (BIP) Protected Coast Zone where it is afforded the highest level of protection within Jersey's planning framework. The BIP notes that:

'Inclusion [inside the Protected Coastal Zone] of the intertidal zone and shallow water around the offshore reefs explicitly recognises that Jersey's character is significantly influenced by the visual relationship of the sea and the land; and the view and perception of it from the sea, bays and beaches, as well as from the land. The island's coastline and its seascapes are highly sensitive and are at risk of having their key characteristics fundamentally altered by inappropriate or insensitive landward or marine development. This plan, therefore, recognises the critical need to comprehensively identify and protect the character of the best of the island's landscapes and seascapes, and their setting, and to explicitly consider the impact of development upon it as an integral part of the planning process.' (*Bridging Island Plan*: p. 76)

The high level of importance afforded to the intertidal area by the BIP has been echoed in multiple studies of Jersey's intertidal areas such as the studies by Portsmouth University, PML, Société Jersiaise and Government of Jersey. Additional to its natural environment qualities, the Jersey intertidal area has a high socioeconomic value across a broad range of areas including tourism, leisure, recreational and commercial fisheries, aquaculture, transport, heritage, etc.

As an island, the intertidal area is core to Jersey's culture, identity and economy all of which derives from its biological, ecological and landscape properties. It bis suggested that Jersey's intertidal areas should be included within an MPA and that a buffer area of one nautical mile (1852 metres) is created from the low water mark (Figure 2.1.3.1).

This buffer area covers the transitional area between the intertidal and subtidal and encompasses complex, highly productive and sensitive shallow marine habitats dominated by plants (seagrass and algae), burrowing organisms and niche habitats associated with the life cycle of key and commercial species (e.g. ormers, bass, lobsters, brown crabs and whelks). Intertidal and shallow subtidal areas have been surveyed (see Appendix II) and present a high degree of spatial and biological complexity whose importance requires recognition within an MPA network.

Additionally, the buffer area encompasses that part of Jersey's sea area that is most heavily used for a range of commercial, recreational and industrial activities (see Marine Activities Report, Marine Resources, 2023e). This includes maritime traffic, watersports, nature watching, tourism, fishing (recreational and commercial) and a range of heritage, educational and cultural activities.

The combined area of the intertidal (32 km^2) and buffer area (181 km^2) is 213 km^2 or 8.6% of Jersey's territorial seas. Of this, 36.8% (78.4 km^2) is already designated as a MPA. Inclusion of Jersey's intertidal with a one nautical mile buffer in the MPA ensures that those areas that are of greatest biological, ecological and socioeconomic value to the Bailiwick of Jersey are included in a framework that can provide protection and the opportunity for coherent management and conflict reduction. This is in line with the European Habitats Directive, UK Biodiversity Action Plan and Jersey Biodiversity Strategy, all of which highlight the importance of intertidal areas and habitats/features in the shallow marine that exhibit a topographic or ecological complexity (e.g. sandbanks, reefs, etc.). (For a description and evaluation of intertidal and shallow marine habitats see Marine Resources, 2023c.)

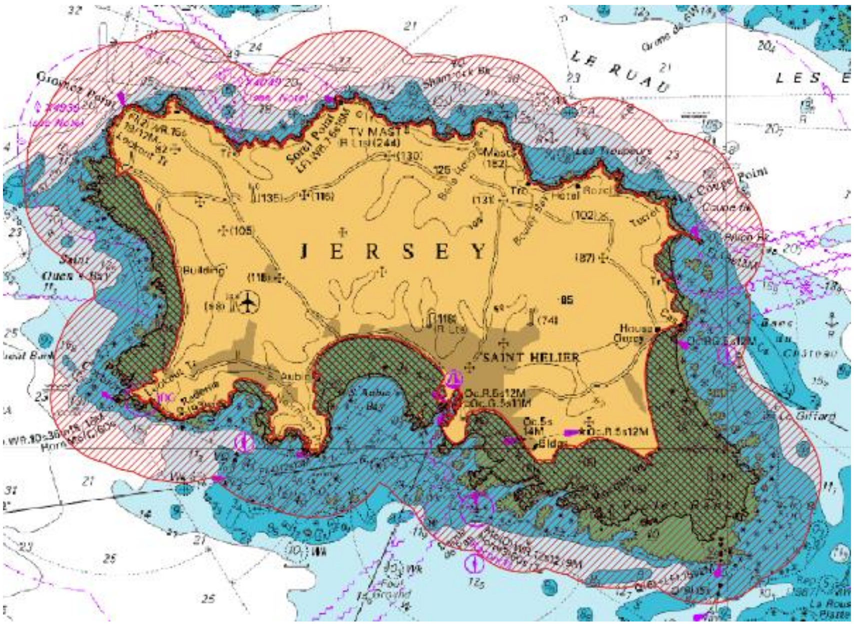

Figure 2.1.3.1 - Jersey's intertidal area (black hatched) with the one nautical mile nearshore buffer area (red hatched).

2.1.4 – Drying Rocks

The location of drying rocks (i.e. rocks away from the main intertidal zone which are subaerially exposed during the tidal cycle) has been defined from aerial photographs and Admiralty charts. The drying part of these features is usually the tallest part of a topographic feature that may have an irregular shape and/or a complex subtidal structure.

Drying rocks represent the visible, intertidal part of what are often more complex topographic subtidal structure which are, or connect to, subtidal reefs, shoals, channels and sandbanks. Disruption to the flow of tidal currents by rocks and other raised features can generate complex habitats (such as mixes of sediment seaweed and biogenic habitats) which are extensively utilised by fish, shellfish and a range of encrusting organisms. Areas of drying rock are also associated with kelp forests, nursery habitats and protected species such as sea fans and cup corals; as such they can be important locations for commercial fishing metiers such as potting and angling but also tourism (such as RIB tours) and watersports (diving, kayaking, recreational fishing).

Using Admiralty charts and aerial photography, 347 drying rocks were identified in Jersey's territorial seas. (The complexity of the nearshore areas means that intertidal rocks and those within the one nautical mile buffer areas identified in Section 2.1.3 were not counted.) Of these, 98 are located within existing MPA areas and a further 129 rocks within Ramsar sites. This leaves 113 drying rocks to which a 0.5 NM buffer could be applied; two of these are adjacent and form Les Grunes Vaudin (south of Noirmont Point) with the remainder located in clusters associated with Les Minquiers and Les Anquettes reefs.

Drying rocks possess properties and functions that are of high biological and socioeconomic importance. They are also indicative of topographic features (reefs, shoals and sandbanks) whose complexity and value are recognised in the European Habitats Directive, UK Biodiversity Action Plan and Jersey Biodiversity Strategy. It is proposed to put a 0.5 NM buffer around the highest point of a rock or islet. It is recommended that the 0.5 NM buffer areas associated with drying rocks should be included within the Jersey MPA network wherever it is practical.

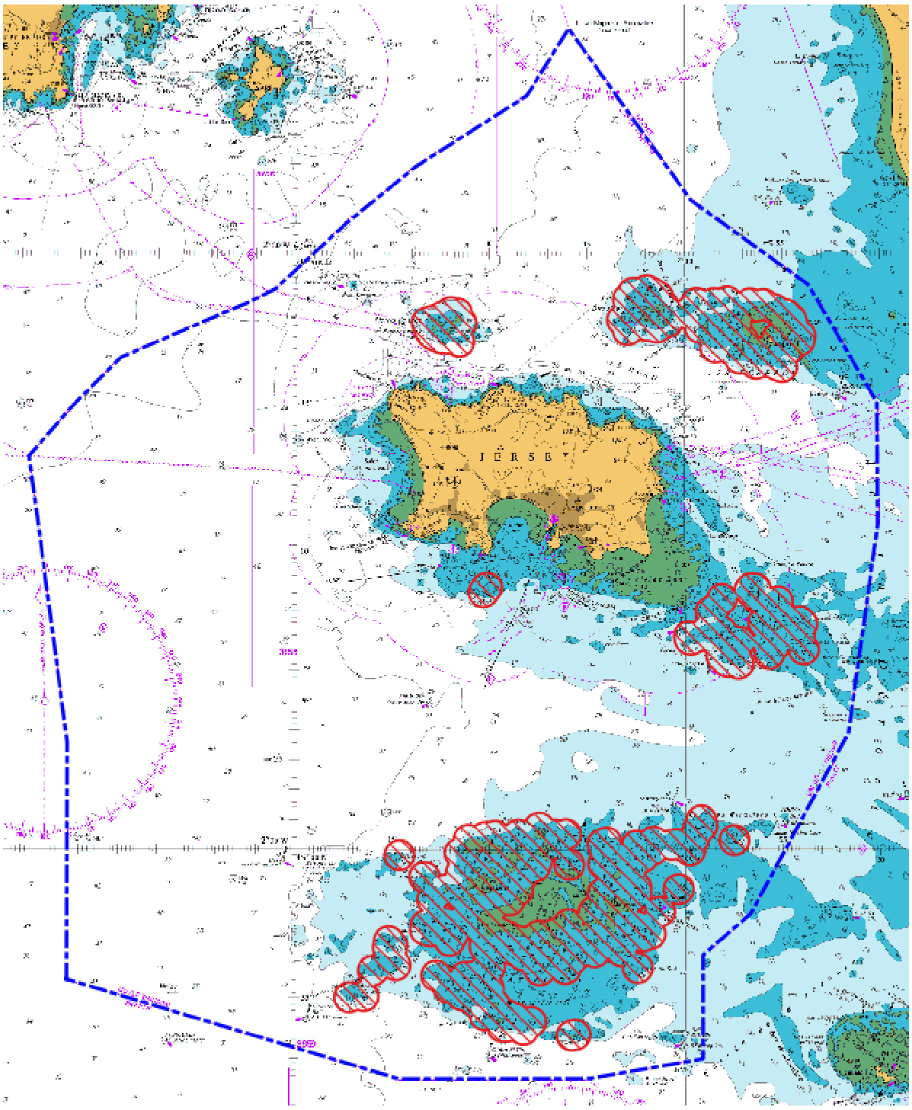

Figure 2.1.4.1 – The outline of a 0.5 nautical mile buffer around drying rocks further than one nautical from Jersey's intertidal chart datum. Where the buffer area overlap, they have been merged.

2.2.0 – Threatened Habitats (OSPAR)

Jersey is a signatory to Annex V of the OSPAR Convention which concerns the protection and conservation of marine ecosystems, habitats and biological diversity. This requires participating parties to protect their maritime areas against the 'adverse effects of human activities', conserve marine ecosystems, restore marine areas which have been adversely affected and develop strategies plans or programmes for the conservation and sustainable use of biological diversity.

Of particular importance are those habitats and species listed by OSPAR as being threatened or declining. In relation to Jersey's known marine habitats, this means kelp forest, seagrass meadows and maerl. A GIS assessment for OSPAR listed threatened habitats was undertaken using a 1 km^2 polygon grid and the Jersey seabed habitat map classified into the 14 habitat groups outlined in (Marine Resources, 2023b) (Figure 2.2.0.1). The percentage of seabed classified as an OSPAR threatened habitat within each 1 km^2 polygon was calculated. Individual 1 km^2 squares where the coverage of OSPAR habitats exceeded 30% of the total were highlighted for potential inclusion within the Jersey MPA network.

The assessment identified 327 polygons (i.e. 327 km^2) which contain a seabed coverage with >30% OSPAR listed threatened habitats. Of these 157 polygons (approximately 157 km^2) are outside an existing MPA or Ramsar area; 52 (approximately 157 km^2) polygons are outside a MPA, Ramsar, intertidal or drying rock buffer area.

A further habitat, *Sabellaria spinulosa* (ross worm), is listed by OSPAR as threatened; surveying work by Hommeril (1967) located sizeable seabed areas with a high density of *S. spinulosa* to the north and north-west of Les Écréhous (Figure 2.2.0.2). However, ross worm habitats are highly susceptible to physical disruption by a range of activities (principally trawling and dredging) and recent survey work in these areas has not been able to determine with certainty whether ross worm habitats still exist in Jersey's marine waters. For these reasons, only areas with known extents of kelp forest, seagrass meadows and maerl have been assessed for inclusion within the Jersey MPA Network. See also Hommeril's 1967 survey which indicates considerable densities of maerl in the sedimentary basin area to the east of Jersey (Figure 2.2.0.2). This area has been resurveyed since 2010 (see Appendix II) and the results included in the Jersey marine habitat map. (see Appendix II)

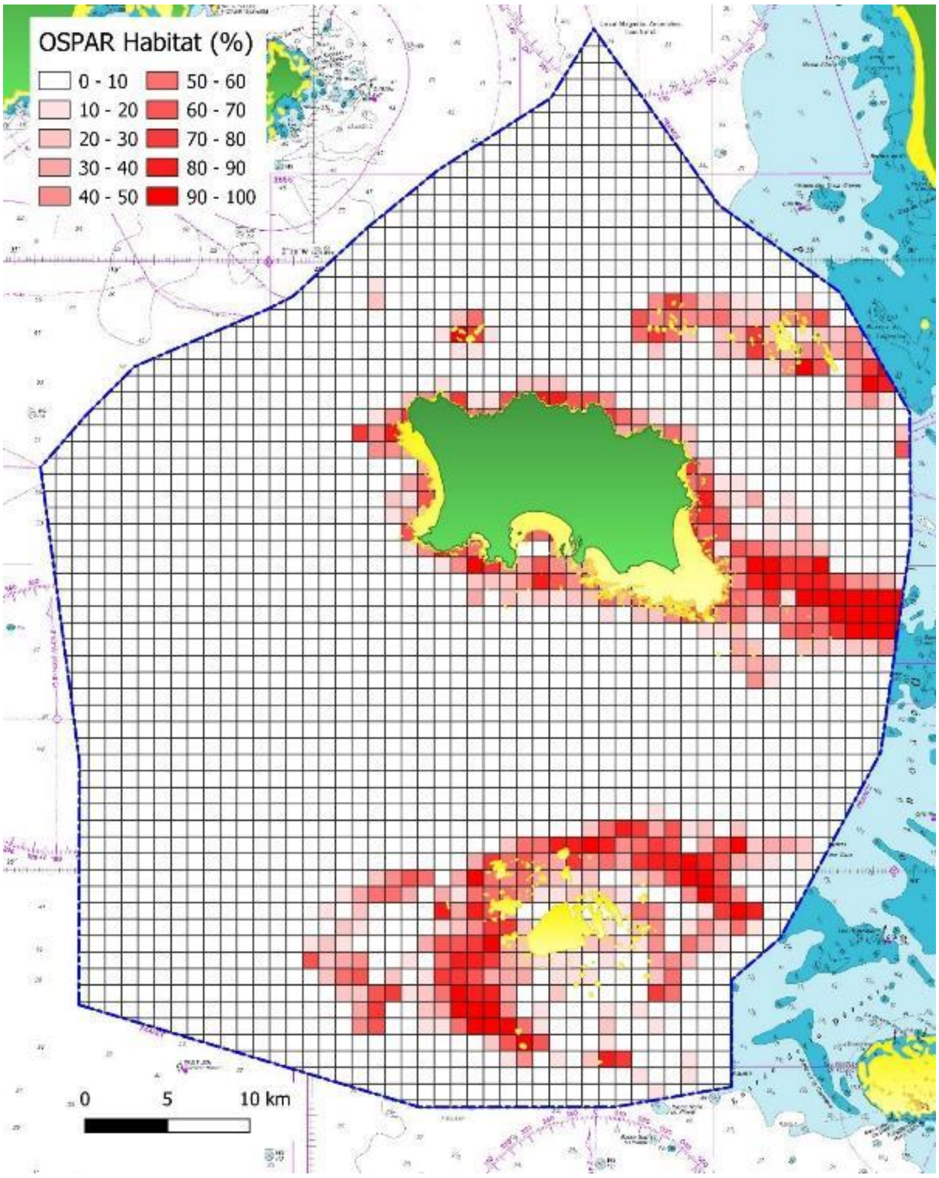

Figure 2.2.0.1 - The assessment grid of the percentage of seabed area containing OSPAR threatened habitats.

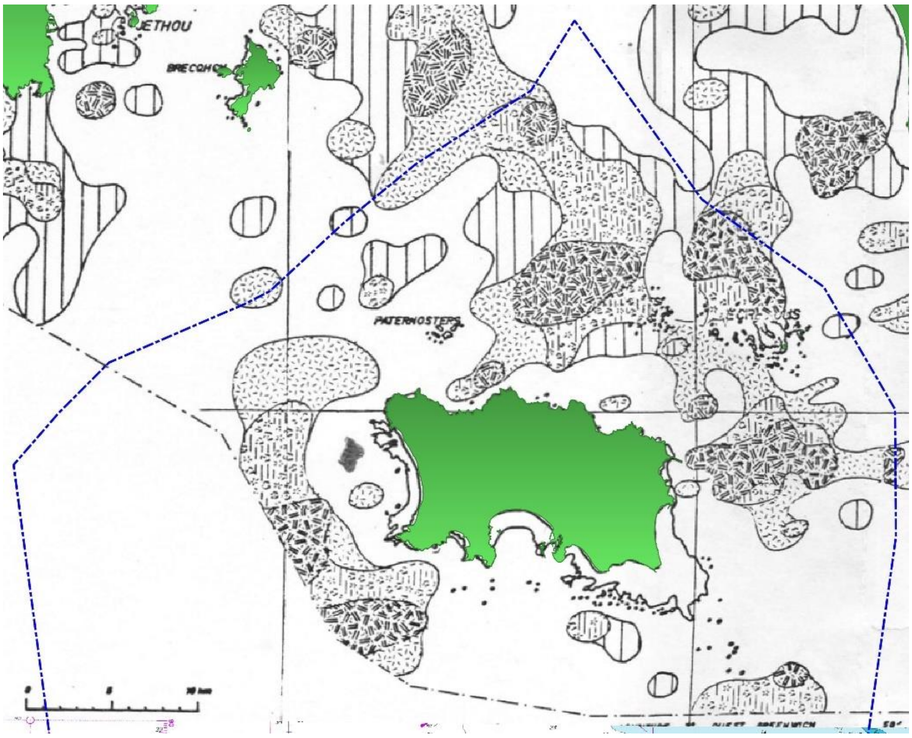

Figure 2.2.0.2 - The seabed density (ranging from rare to abundant) of Sabellaria spinulosa (Ross worm) in Jersey waters as surveyed by Hommeril (1967) and superimposed on a modern chart. The present density of Ross worm in these areas has yet to be determined.

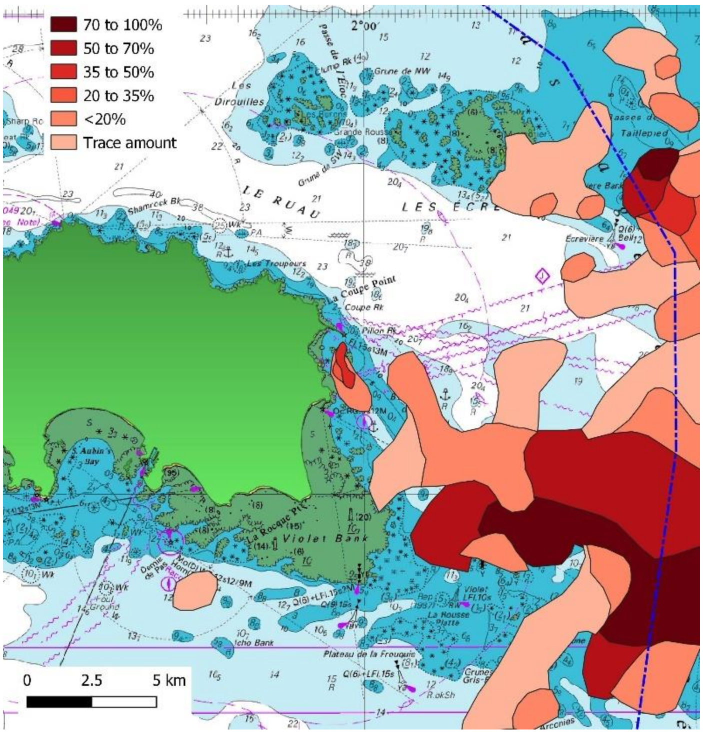

Figure 2.2.0.2 – The coverage of maerl on seabed areas to the east of Jersey as surveyed by Hommeril (1967) and afterwards digitised. These areas have been resurveyed since 2010 the results from which are included in the Jersey marine habitat map (see Appendix II).

2.3.0 – Climate Change (Blue Carbon)

The Delivery Plan (2022 to 2025) within the Jersey *Carbon Neutral Roadmap* (CNR) includes a requirement to support blue carbon projects and to 'recognise that tackling the climate emergency by using nature-based solutions that also address the biodiversity crisis provides multiple benefits for our land, air and sea'. In reference to the marine environment, the CNR requires that the GoJ will develop a Marine Spatial Plan by the end of 2023. This is to provide the regulatory and consenting frameworks needed to manage marine activity in support of blue carbon sequestration and which, with international partners, can promote the recognition of marine sequestration in greenhouse gas inventories' (*Carbon Neutral Roadmap*).

A desktop survey of Jersey's blue carbon functioning and potential was published in 2022 in the *Blue Carbon Resources* report (available on GoJ website). This presented the results of an assessment (using biological, environmental and geological evidence) of the stored weight of carbon in Jersey's marine environment. Results suggest that Jersey's offshore marine habitats are productive, complex and biodiverse and can be classified into four blue carbon classes based on their properties, processes and functioning. The four classes are: BC1 (areas of high productivity and standing stock for organic carbon); BC2 (high diversity and burial rates offer the potential for the burial and permanent removal of organic carbon); BC3 (mixed potential but always with a high inorganic carbon content) and; BC4 (low overall value).

The areas of key importance in relation to the CNR are classes BC1 and BC2 as these represent areas of potential high organic production (generally areas rich in seaweed such as kelp forest) or permanent burial (shallow marine sedimentary areas). Reference to the CNR identified these areas as having an important role in the mitigation of greenhouse gases associated with climate change and so should be identified for inclusion within the Jersey MPA Network.

The blue carbon assessment for this report was based on the percentage of seabed classified as BC1 and BC2 within each 1 km^2 polygon grid in the GIS model (see methodology in 2.2.0). An overall inclusion target of at least 30% of the total BC1 and BC2 coverage has been set for Jersey's MPA network. This assessment identified 809 polygons (809 km^2) as having a seabed coverage of >30% of BC1 or BC2 areas (Figure 2.3.0.1). Of these, 546 polygons (approximately 546 km^2) lie outside existing Ramsar or MPA areas and 370 polygons (approximately 370 km^2) outside areas already covered by the intertidal buffer area or drying rocks. Although it is recognised that these areas are potentially important in the context of local commitments to biodiversity and climate change, it is recommended that identified blue carbon areas for potential inclusion within the MPA network should be assessed in conjunction with other features. This is because the study of blue carbon resources is at an early stage and the value (in terms of blue carbon potential) remains ongoing.

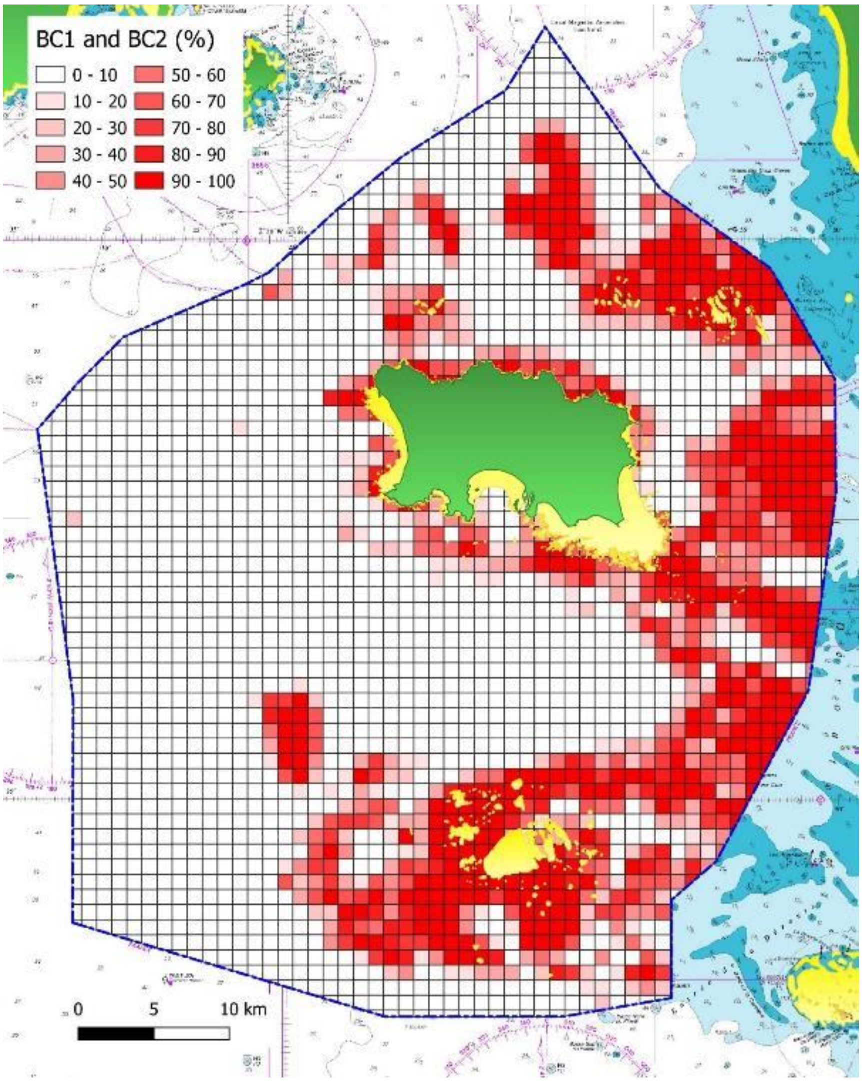

Figure 2.3.0.1 - An assessment grid showing the percentage of seabed area containing areas classified as BC1 (highly productive) and BC2 (burial potential) in relation to organic carbon. For further details see the Government of Jersey's Blue Carbon Resources report.

2.4.0 - Part One Assessment Results

An assessment of the high value features identified in Part One (Section 2.0) of this report indicates of those areas which are may be considered core to the spatial design of an expanded Jersey MPA network. The results are displayed in Figure *2.4.0.1* and consist of the following parts:

Boundary-based designation

This identifies potentially important areas based on their spatial extent. Within this existing MPAs/NTZ (Section 2.1.1), Ramsar areas (Section 2.1.2) and Jersey's intertidal and nearshore 1NM buffer area (Section 2.1.3) are considered to be a very high priority for inclusion in the MPA network. In addition, area drying rock features with a 0.5NM buffer (Section 2.1.4) which, while having a high recommendation for inclusion, could be subject to adjustment for a variety of reasons (e.g. to prevent complex MPA boundaries, etc.).

Grid-based Assessment

Seabed areas which may form complex or uneven distribution patterns or borders have been assessed using their area coverage within a 1 km^2 GIS polygon grid. These include OSPAR listed threatened habitats (Section 2.2.0) and blue carbon BC1 and BC2 areas (Section 2.3.0). Only polygons where the coverage is >30% have been identified for potential inclusion within an MPA network.

Part One Combined Assessment

There is a much overlap between the important spatial areas identified in Part One of this assessment with some areas having an importance in all the assessed characteristics while others might only have been identified in just one or two categories. To assist with the conservation planning process, the results were combined to assist with identifying the relative importance of individual sea areas. This is on the presumption that areas which are recognised as important in several separate areas have a greater relative value than those with fewer recognitions.

To achieve this, the percentage cover figures obtained for the threatened habitat and blue carbon assessments were rounded to the nearest multiple of ten and then divided by ten to give a figure between zero and ten (e.g. 22 will be rounded to 20 which gives a figure of 2). For each 1 km^2 polygon the figures for the two assessments were then added together to give a combined score of between zero and twenty. The boundary-based assessment results were superimposed on this to provide a combined assessment of the Part One analysis.

The assessed parameters in Part One are focused on existing protection, spatial definition, biodiversity, key habitats and blue carbon. The association between these and the intertidal, shallow subtidal and complex topography mean the results from this assessment place a high emphasis on shallow water areas in close association with Jersey's coastline and offshore reefs. It also picks up the potential value of some offshore sediment areas including the actively accreting basins to the east and south-east of Jersey and sandbank features north-east of Les Dirouilles and Les Minquiers.

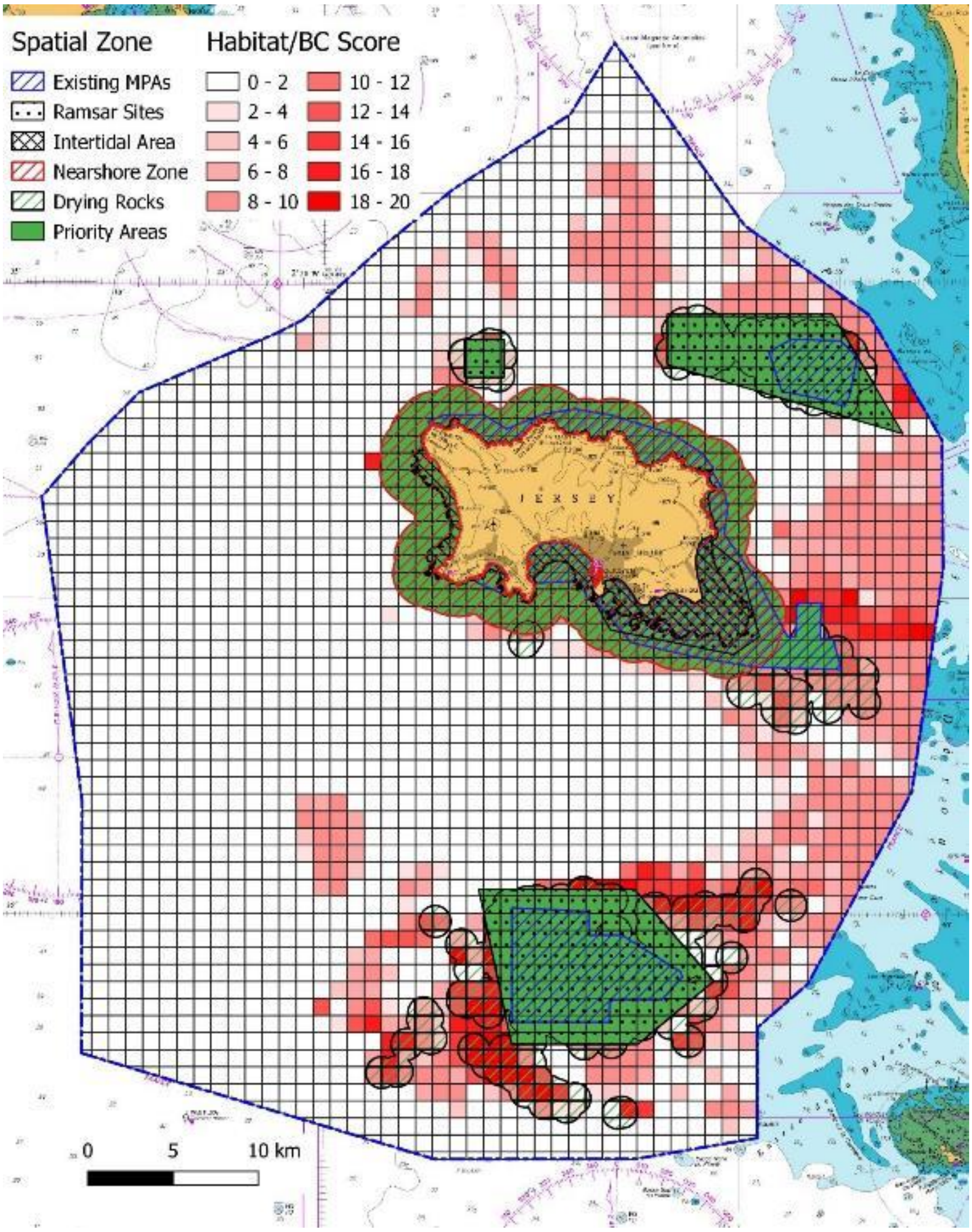

Figure 2.4.0.1 - The results from the Part One MPA assessment displaying the spatially assessed areas and combined scores for OSPAR threatened habitats and blue carbon (BC1 and BC2) coverage within the 1 km² assessment grid.

3.0 – MPA Assessment: Part Two – Secondary Features

The assessments from Part One (Section 2.0) used parameters that take into account spatially defined areas and Jersey's commitments to international environmental and climate change conventions. This has defined areas containing large areas of seabed that are of potentially high value in relation to these parameters. This secondary assessment uses additional parameters which can assist with identifying seabed areas that may be of sufficiently high value to merit inclusion within a Jersey MPA network.

This section contains the results from three assessments using parameters which can be used to infer characteristics that may be indicative of ecological or socioeconomic value. The first of these is ecosystem service function (based on Marine Resources, 2023b) which relates the ascribed value of habitat groups to human society in relation to their beneficial services and functions. The second looks at the diversity of habitat groups within defined areas as their variety and complexity offers an indication of the species and genetic diversity within living ecosystems. The third assessment is a simple analysis of seabed depth, this being a good indicator of biodiversity and resilience as shallower areas will usually have greater access to sunlight, nutrients and various oceanographic processes than deeper water ones.

The analysis for Part Two uses the 1 km^2 polygon grid in conjunction with scores derived from the assessments. The main objective is to combine the overall results of Parts One and Two to identify areas of seabed that will benefit most from inclusion within an MPA network. This process will also identify other seabed areas that have a general low value in relation to the parameters assessed or which have sufficient value to warrant further investigation.

3.1.0 – Ecosystem Service Functioning

Ecosystem services (ES) are the supporting, regulating, provisioning and cultural services supplied by the habitats that produce benefits that are essential to human well-being. This recognises that human society and wellbeing is dependent on the maintenance of key processes and services associated with the natural environment. Degrading the ES functionality of habitats, especially for immediate gain, may have longer term impacts whose eventual cost far outweighs any short-term advantage. For example, the overuse of cheap artificial fertilisers on land may eventually lead to eutrophication in rivers and bays that disrupts other economies (such as fishing and tourism) which is expensive to resolve. Understanding the ES potential of natural habitats assists with longer term environmental management and planning. For more information see Marine Resources, 2023b.

The ES scoring used in this assessment was taken from a study of marine Habitat Groups prepared for the JMSP (Marine Resources, 2023b). Using a standardised literature survey, the study looked at six supporting, six regulating, four provisioning and four cultural services; collectively these represent the key ES properties associated with Jersey's marine environment. For each Habitat Group the individual services were given a score of zero (negligible or unknown value), one (low value) or two (high value). The sum of these scores was used in this assessment to represent the relative ES value of each habitat group.

An index was created from the summed ES values which could express the ES value of individual 1 km^2 polygon areas within Jersey's territorial seas. This was achieved by taking the ES value for each habitat group and multiplying it by the percentage of seabed that the habitat group occupies within each 1 km^2 area. This produced a score ranging between 413 and 2851. This was normalised to produce a score between one and ten by taking the ES score, subtracting the minimum value (413) and then dividing the result by the range of values (2438). The result was multiplied by ten and rounded to the nearest whole number to produce a score between one and ten.

The results in Tables 3.1.0.1 and Tables 3.1.0.2 reveal that just under 50% of the polygons had an ES Index Score of three or lower. A further 40% of polygons had a score of between four and six and just 11% a score that was seven or greater.

Habitat Group	**Supporting Services**	**Regulating services**	**Provisioning services**	**Cultural services**	**Total**
Rock: barnacle communities	**6**	**2**	**0**	**6**	**14**
Rock: seaweed communities	**12**	**5**	**6**	**8**	**31**
Rockpools	**11**	**1**	**3**	**8**	**23**
Kelp Forest	**11**	**3**	**5**	**6**	**25**
Sediment: sparse fauna	**5**	**2**	**1**	**4**	**12**
Sediment: robust fauna	**5**	**3**	**1**	**4**	**13**
Sediment: rich fauna	**8**	**6**	**2**	**4**	**20**
Sediment: seaweed	**11**	**5**	**4**	**8**	**28**
Hard ground: stable	**10**	**3**	**3**	**7**	**23**
Hard ground: unstable	**5**	**0**	**1**	**1**	**7**
sandmason worms	**9**	**5**	**1**	**6**	**21**
Seagrass	**12**	**9**	**5**	**8**	**34**
Maerl beds	**11**	**4**	**4**	**6**	**25**
Slipper limpets	**5**	**2**	**1**	**2**	**10**

Table 3.1.0.1 – Ecosystem service scoring associated with habitat groups. Source: (Marine Resources, 2023b) .

Ecosystem Service Index Score	Number of Polygons	Percentage (cumulative)
1	765	30.7% (30.7%)
2	163	6.5% (37.2%)
3	282	11.3% (48.6%)
4	682	27.4% (76.0%)
5	149	5.9% (82.0%)
6	164	6.5% (88.6%)
7	149	5.9% (94.6%)
8	98	3.9% (98.5%)
9	33	1.2% (99.8%)
10	4	0.2% (100%)

Table 3.1.0.2 – The number (and percentage) of grid squares in relation to ecosystem service scoring after normalisation to create and index on a scale of one to ten. An index position of one indicates a low ecosystem service score and ten the highest.

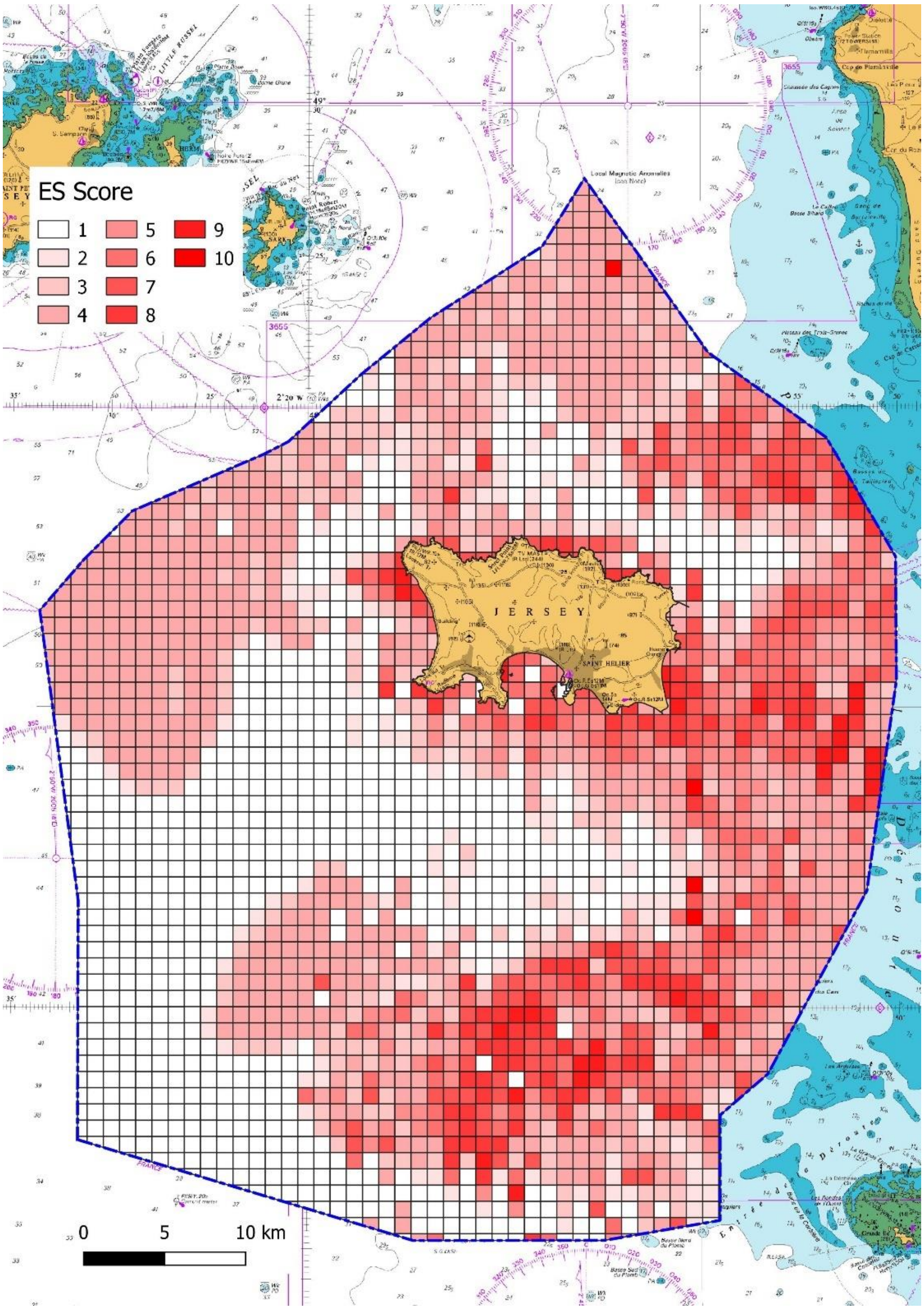

Figure 3.1.0.1 – The indexed results from an ecosystem service score analysis of seabed areas within the 1 km² assessment grid.

3.2.0 – Marine Biodiversity

Since the late nineteenth century Jersey's marine environment (and that of the Normano-Breton Gulf as a whole) has been recognised as being an area of exceptional diversity for species and habitats (e.g. see reviews in Le Hir *et al.*, 1986; Chambers *et al.*, 2016; Le Mao *et al.*, 2019; Blampied, 2022). The conservation and enhancement of biodiversity should be a core function within an MPA network as it maintains the integrity and resilience of the marine environment by enhancing ecosystem functioning to assist with mitigation against the negative effects of climate change, pollution, physical degradation and overexploitation. In this respect, areas containing a greater complexity and diversity of habitats can withstand or compensate for individual threats and pressures better than areas with a low diversity of habitats and species (Marine Resources, 2023c).

The JMSP seeks to measure marine biodiversity by measuring the number of habitat groups ((Marine Resources, 2023b)) found within each 1 km^2 of Jersey's marine environment. This is achieved by counting each habitat group which occupied 10% or more of each 1 km^2 polygon on the GIS model. This gives a range of between one and seven habitat groups; this number is used as an index to marine biodiversity within polygon. Therefore, an index score of one is low and a score of seven is high.

The results of the analysis are provided in Table 3.2.0.1 and Figure 1. Almost 50% of the polygons contained only one habitat group and 91% fewer than three habitat groups. Just 0.2% of polygons had the maximum figure of seven habitat groups. The spatial distribution of results suggests that deeper water areas to the west, south-west and north of Jersey have a reduced number of habitats in comparison to shallower, rocky areas to the south and east of the area. The highest diversity of all is associated with offshore reef areas such as les Ecrehous, Les Minquiers and the rocky areas to the south and south-east of Jersey.

Number of Habitat Groups	Number of Polygons	Percentage (cumulative)
1	1242	49.8% (49.8%)
2	720	28.9% (78.8%)
3	306	12.3% (91.0%)
4	138	5.5% (96.6%)
5	57	2.3% (98.9%)
6	22	0.8% (99.8%)
7	4	0.2% (100%)

Table 3.2.0.1 - *The number (and percentage) of grid squares in relation to the number of habitat groups (with a coverage of at least 10%) inside each 1* km^2 *square.*

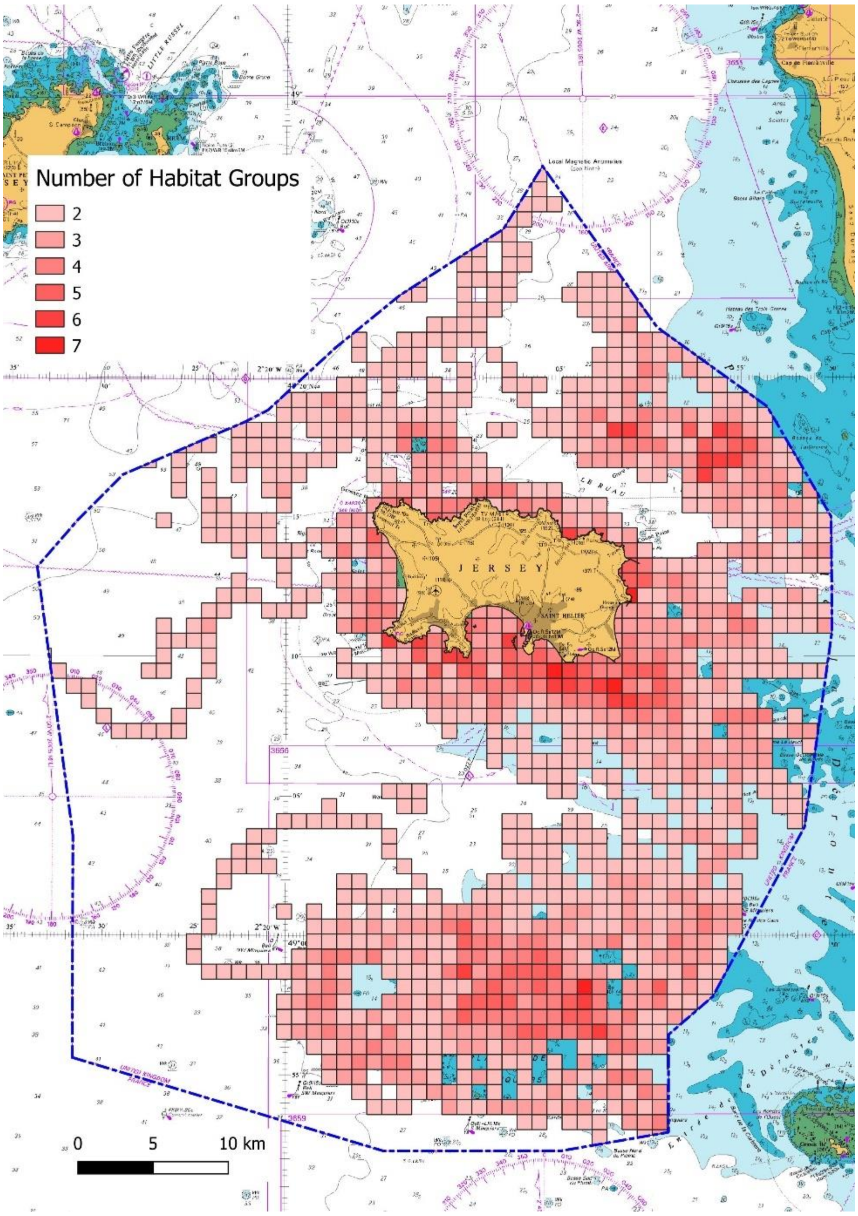

Figure 3.2.0.1 – The number of habitat groups (with at least 10% coverage) inside each 1 km^2. Squares containing a single habitat (i.e. a score of one) are not shown.

3.3.0 – Seabed depth

The depth of water at sea is linked to habitat biodiversity, ecosystem services and blue carbon functioning. Even allowing for turbidity and other processes, intertidal and infralittoral (up to *circa* 20 to 25 metres below chart datum) areas will have greater access to light and nutrients than deeper water ones. They will also have greater topographic variability, sediment accumulation and niches than deeper water areas due to tidal currents, historic sea level rise and wave energy. For these, and other reasons, species density and diversity will usually be greater in shallower water or intertidal areas than in offshore deeper water areas.

Within Jersey's territorial seas the seabed is generally shallow with no areas exceeding 60 metres below chart datum; even so, the concentration of algae in areas shallower than 20 metres means that the depth gradient applies in local waters also. This was recognised in 2010 when areas around the island's north coast were protected using the 20-metre isobath to create the MPA boundary.

It is already suggested (Section 1.3) that intertidal areas should be automatically included within the MPA network. For this report, it is suggested that areas which have a high percentage of shallow water depth should be assessed for possible inclusion within the Jersey MPA network with the assessment threshold set at 15 metres below chart datum (i.e. seabed areas shallower than this could be assessed for inclusion within the MPA network). This threshold represents the approximate depth at which macroalgae, such as kelp, starts to become less dense (see Kerambrun, 1984).

The assessment is based on the percentage of seabed <15 metres below chart datum that occupies each 1 km^2 polygon grid in the GIS model. This dataset will be used to generate a score of between one and ten is derived by rounding the percentage number to the nearest ten and then dividing by 10; e.g. a square score with 67% of seabed <15 metres would be rounded up to 70 and then this would score seven.

The results (Table 3.3.0.1; Figure 3.3.0.1) suggest that the seabed around Jersey is sharply divided around the 15-metre depth threshold. Nearly 60% of the polygons had under 10% of seabed that was <15 metres while 30% had over 90% that was shallower than 15 metres. This leaves approximately 10% of polygons where the percentage of seabed was between 10 and 90%. The spatial distribution of these seabed areas reveals this sharp division with the deeper water areas (coverage <10%) being sharply divided from the shallower coastal waters and areas around the offshore reefs.

Percentage seabed <15m	Number of Polygons	Percentage (cumulative)
0 – 10	1456	58.5% (58.5%)
10 - 20	51	2.1% (60.6%)
20 – 30	24	1% (61.6%)
30 – 40	34	1.4% (63%)
40 – 50	38	1.5% (64.5%)
50 – 60	30	1.2% (65.7%)
60 – 70	24	1% (66.7%)
70 – 80	32	1.3% (68%)
80 – 90	50	2% (69.9%)
90 - 100	748	30.1% (100%)

Table 3.3.0.1 - The number (and percentage) of 1 km^2 grid squares (polygons) in relation to the percentage of seabed shallower than 15 metres that they contain.

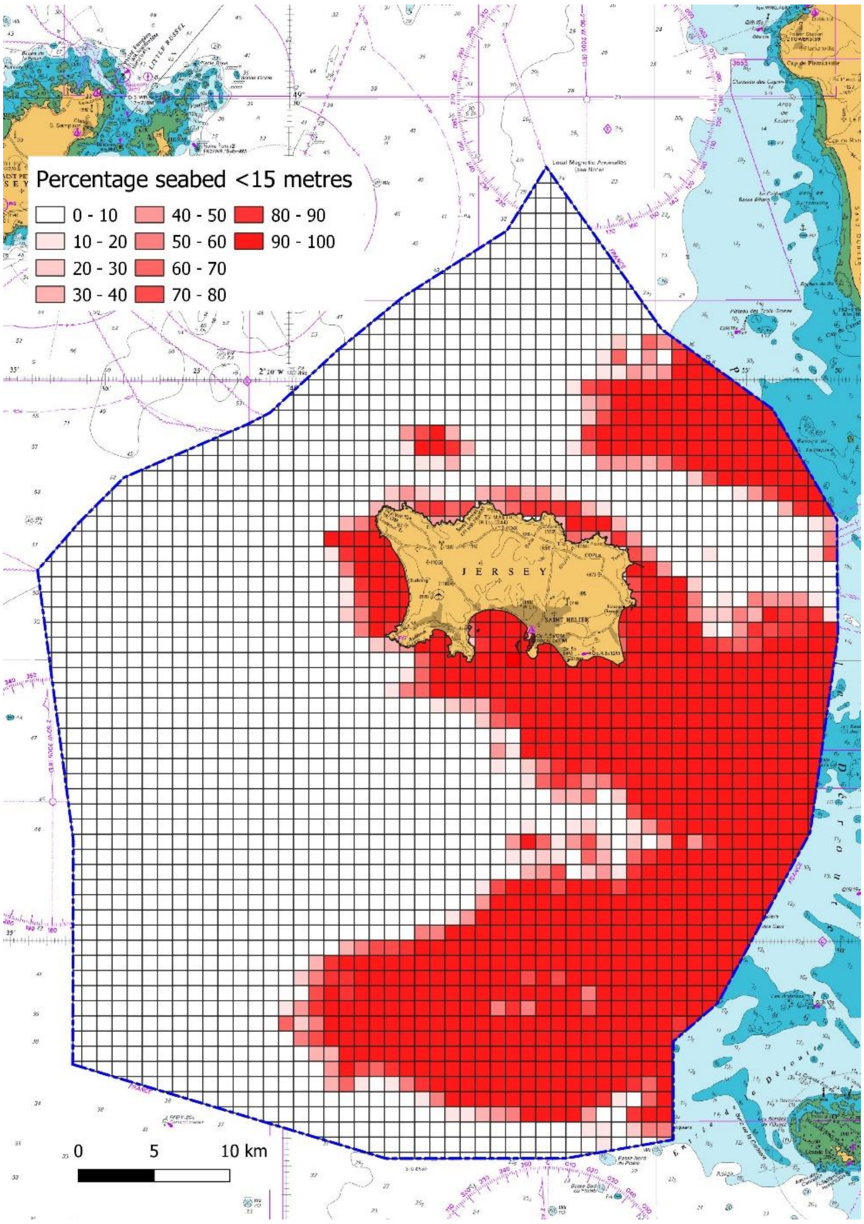

Figure 3.3.0.1 - *The percentage of seabed shallower than 15 metres below chart datum inside each 1 km² square.*

3.4.0 – Part Two Assessment Results

An assessment of the supplementary features identified in Part Two (Section 3.0) of this report has been used to identify areas for potential inclusion within an MPA network based on their ecosystem service value, habitat biodiversity and seabed depth. These features are good indicators of overall seabed value that can be used in combination with the Part One results to assist with designing an MPA network.

The results are displayed in Figure 3.4.0.1 and follow the same 1 km^2 GIS polygon grid assessment methodology as the threatened habitats (2.2.0) and blue carbon (2.3.0) in the Part One Assessment. Unlike Part One, no threshold values have been used; instead, each polygon has a score derived from the parameter being assessed. For ecosystem services and seabed depth, the score is between one and ten; for habitat biodiversity the score is between one and seven. This gives a maximum possible score of 27 although in practice the polygons scored between one and 25.

The results in Table 3.4.0.1 show that just of half (53%) of polygons have a score that is less than five while just over a quarter (28%) have a score of 15 or more. The remaining 19% score between five and 15. The spatial distribution of results (Figure 3.4.0.1) follows that of Part One in that the higher scoring areas are concentrated around Jersey's coast, the offshore reefs and adjacent shallow marine areas. This is a reflection of the use of habitat complexity and ecosystem service scores, which tend to be higher in areas adjacent to the coast or reefs, and water depth.

Part Two Score	Number of Polygons	Percentage (cumulative)
1 - 5	1331	53.5% (53.5%)
5 - 10	226	9.1% (62.6%)
10 -15	235	9.4% (72%)
15 - 20	552	22.2% (94.2%)
20 - 25	145	5.8% (100%)

Table 3.4.0.1 – The number (and percentage) of 1 km^2 grid squares (polygons) in relation to their score for the Part Two assessment.

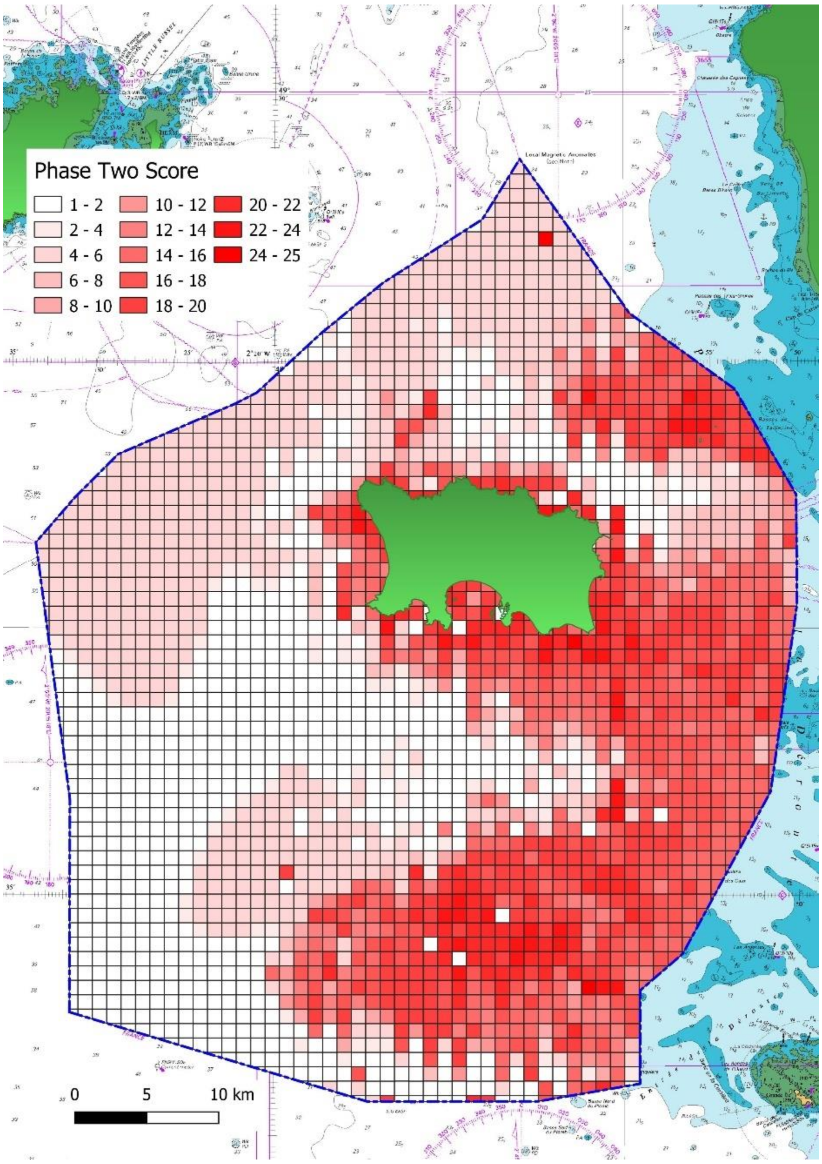

Figure 3.4.0.1 – Part Two scores (binned) based on an assessment at 1 km² resolution.

4.0 - MPA Assessment: Spatial Prioritisation

The assessments undertaken for Parts One and Two above have identified seabed areas which exhibit important features relating to biodiversity, ecosystem service functioning, blue carbon or which fall within the boundaries of zones defined as spatially significant.

The design of a Jersey MPA network through the JMSP must take into account the following OSPAR objectives:

- to protect, conserve and restore species, habitats and ecological processes which have been adversely affected by human activities (the principle of restoration);

- to prevent degradation of, and damage to, species, habitats and ecological processes, following the precautionary principle (the principle of persistence); and

- to protect and conserve areas that best represent the range of species, habitats and ecological processes in the maritime area (the principle of representation).

The assessment processes undertaken have identified priority areas that meet these objectives and principles. The prioritisation process seeks to identify areas that are most likely represent the range of ecosystem types and species occurring in Jersey's marine environment and which have the best chance of persisting into the future.

4.1.0 – Multi-criteria Assessment Results

The results from Parts One and Two can be assessed to identify those areas which score highly in terms of existing spatial management, OSPAR habitats, blue carbon, habitat complexity, seabed depth and ES functioning. From this it is possible to suggest the boundaries for an MPA network.

To avoid weighting the result, both the Phase One or Phase Two scores were normalised to give a score of between 0 and 50 using the following equation:

$$(((X – Min(range))/(Max(range)-Min(range))*100)/2$$

The Phase One and Phase Two scores were added together to give a potential assessment score of between 0 and 100 for each 1 km2 square, although in practice the range was actually between 0 and 93. Additionally, any part of any square that falls within an existing MPA/NTZ (Section 2.1.1), Ramsar site (Section 2.1.2) or the Jersey intertidal/nearshore zone (Section 2.1.3) was given a score of 100 in line with their high priority status as outlined in Sections 2.1.1 to 2.1.3.

The actual range of scores (0 to 93) was divided into three equal parts to give four classes based on the combined score with an additional class added to cater for high priority areas given a score of 100:

Low Priority (score 0 to 31): the polygon is excluded from the MPA network assessment.

Medium Priority (score 31 to 62): Further assessment required to determine whether the polygon should be included or excluded in the MPA network.

High Priority (score 62 to 93): The polygon should be given a high priority for inclusion in the Jersey MPA network.

Very High Priority (score = 100): The polygon (or part of the polygon) falls within the spatial areas defined in Sections 2.1.1, 2.1.2 and 2.1.3. These areas are considered core to the MPA network based on their spatial boundaries.

Figure 4.1.0.1 indicates that areas with a high or very high priority are generally adjacent to spatially defined areas (such as existing MPAs and Ramsar sites) and that Medium Priority areas are often adjacent to high priority areas. Low priority areas occupy the majority of the seabed within Jersey's territorial seas and are found mostly to the west, southwest and north of Jersey.

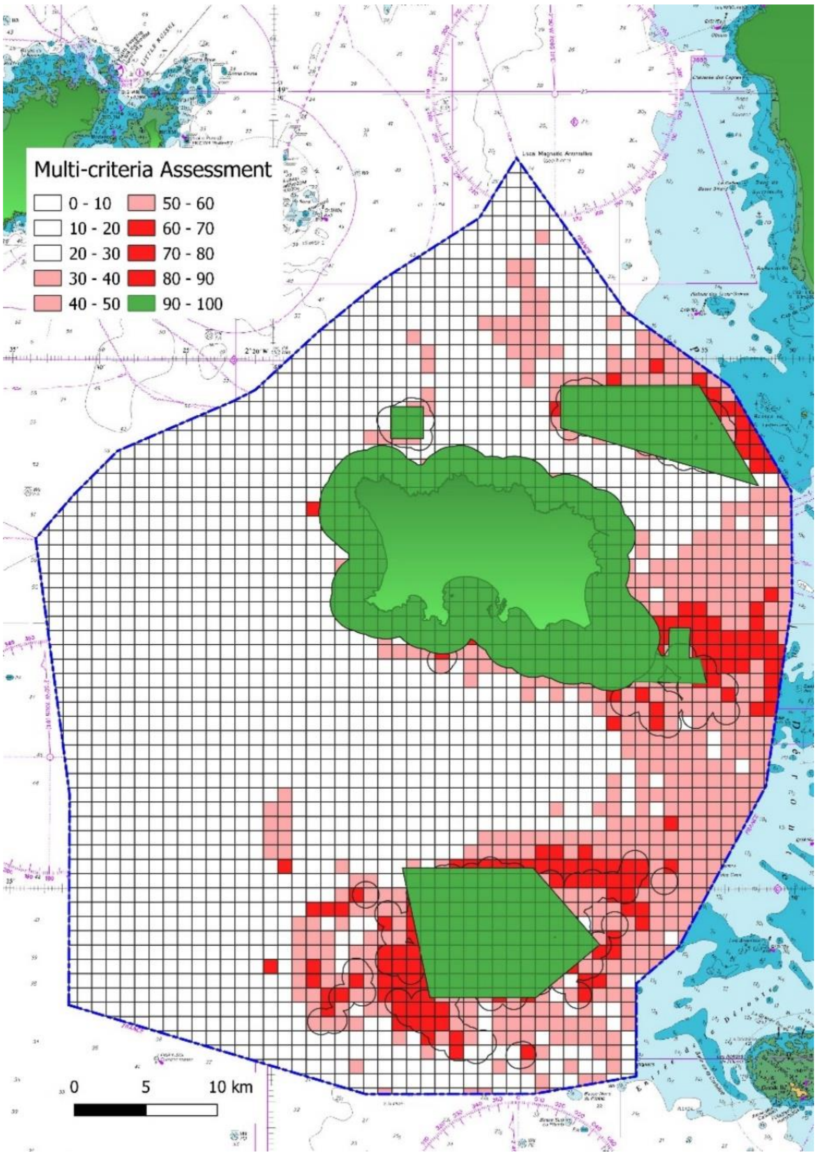

Figure 4.1.0.1 –Multi-criteria assessment scores combined (each normalised to 50 to give a possible score of 100). White = Low priority, Pink = Medium priority, Red = High priority, Green = Very high priority.

4.2.0 – Spatial Connectivity

Spatial connectivity represents an important feature within conservation planning. On land the fragmentation of habitats will lower the biodiversity, resilience and resistance of individual sites through the destruction of wildlife corridors, genetic diversity and the ability of species to repopulate following disturbance. The same principal operates within the sea where a good level of connectivity within and between managed areas will preserve key functions such as the movement of individuals, food and other resources (organic carbon, larvae, etc.) between habitats, populations, communities or ecosystems. The inclusion of spatial connectivity when assessing areas for their conservation potential will improve their resilience, resistance and sensitivity to disturbance, promote biodiversity and improve their ecosystem services.

Many metrics and methods have been used to evaluate the connectivity of areas in relation to the assessment and development of protected areas. This includes techniques that utilise spatial adjacency and ecological connectivity expressed through conservation planning algorithms and software such as Marxan. For this study, connectivity was assessedusing the 1km^2 polygon grid and the multi-criteria assessment results described in Section 4.1.0. A value was given to each polygon based on the sum of the multi-criteria assessment scores (0 to 100) of polygons directly connected to it. Depending on a polygon's location, the number of connecting squares could be between 3 and 10. The summed value was then divided by the number of connected polygons to give a figure between 0 and 100. This value represents the average multi-criteria assessment score of polygons adjacent to individual polygons and is an indication of the assessed localised worth of each polygon. This offers a means of assessing the value of individual polygons in relation to their regional context. This will for example, moderate the scores of isolated high scoring polygons which adjacent to low scoring areas and vice versa. In areas with medium and high scoring polygons, understanding their value in a wider localised context can assist with decision-making

Areas to which contain a concentration of high or very high priority scoring polygons generally score highly. In this respect those areas which were identified in Section 4.1.0. as a low, high or very high priority for MPA inclusion remain little different. It is, however, within the medium scoring areas that the connectivity scores diverge from those of Section 4.1.0. Of the 618 polygons identified as medium scoring in Section 4.1, there are 231 (37%) with a connectivity score greater than 50 (i.e. the upper 50% by score). These indicate areas where ecological connectivity is liable to play a role in the maintenance of localised populations, communities or ecosystems. Conversely, those areas scoring below 50 (i.e. the lower 50% by score) are generally isolated or contain predominantly low scoring or mixed value polygons.

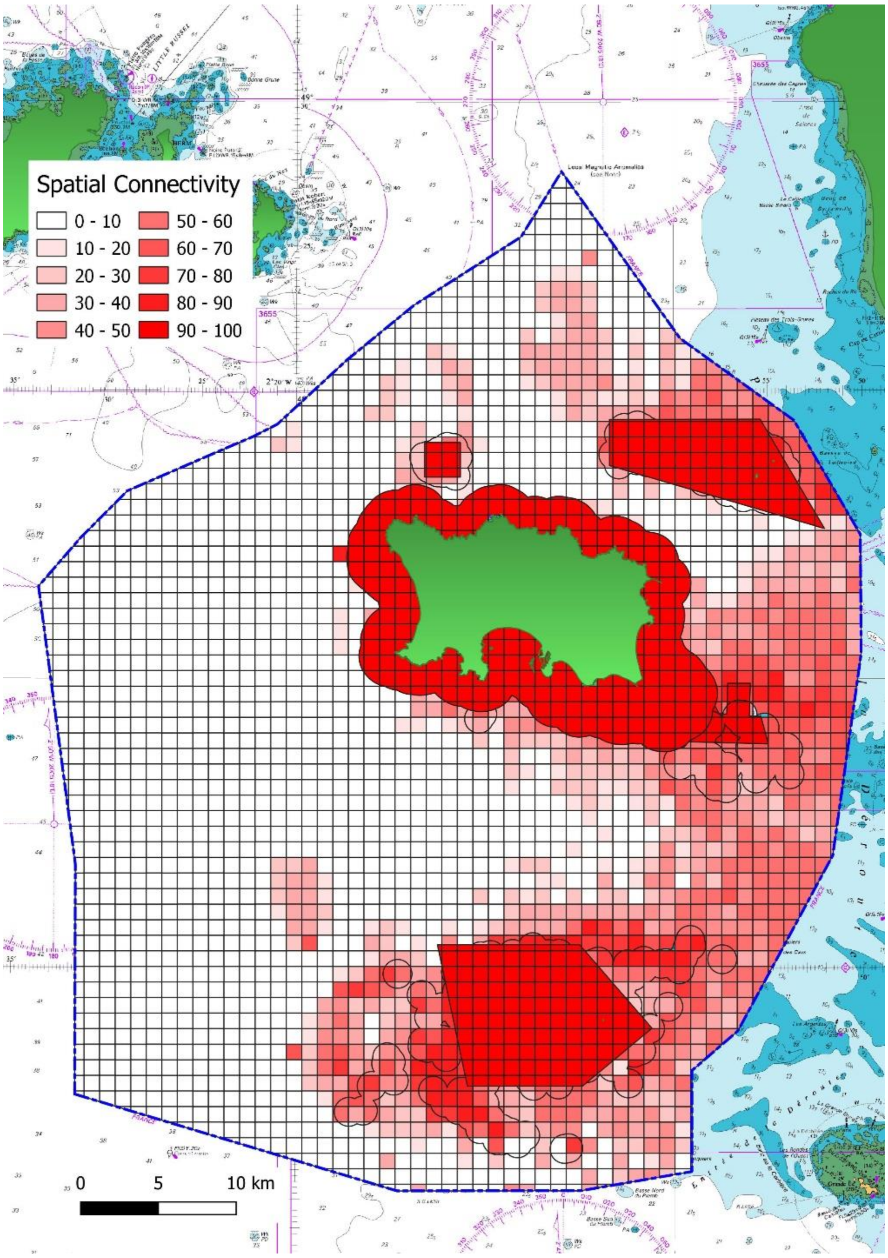

Figure 4.2.0.1 – The spatial connectivity score for individual 1 km² square areas where the value represents the average multi-criteria assessment score of polygons adjacent to a polygon providing an indication of the assessed localised worth of each polygon. See Section 4.2.0.

5.0 – The Jersey MPA Network

The assessment process described in Sections 2.0 and 3.0 offer an indication of the ecological value of individual 1 km^2 areas within Jersey's territorial seas. A combined score for individual polygons from Sections 2.0 and 3.0 is provided in Section 4.1 and the wider spatial value of each polygon is given in Section 4.2. These results highlight areas in which general environmental and ecosystem functioning are high or low with the higher value areas being prioritised for inclusion with a potential MPA network and the lower values one excluded from it. Areas with 'medium' scores that fall between high and low require assessing in relation to the MPA network objectives and the relationship between neighbouring polygons.

An MPA network has been created which focuses primarily on threatened habitats and the offshore reefs but which include a sufficient representation of most habitat groups to ensure resilience. The network focuses on areas identified as high scoring but also encompasses lower scoring features which exhibited some of the following:

- scored highly across multiple parameters

- has a high coverage (>30% seabed area) of threatened habitats

- has proximity/connectivity to existing spatially defined features such as MPAs and Ramsar sites

- has proximity/connectivity to high value grid squares

- has proximity/connectivity to shallow water reef areas

A lower priority was given to features:

- which score highly in just one or two parameters

- with a low coverage of threatened habitats

- that are isolated with a low proximity/connectivity to high value grid squares

When designing the borders of the MPA areas, attention was paid to the boundaries of existing spatially defined areas (Ramsar sites and MPAs) and, where possible, to construct the MPA outline using visible markers such as navigation buoys/beacons and rocks. This use of visible markers is to assist with identifying the position of MPA boundaries when at sea but also to minimise the number of points used to construct an MPA. The exception to this is the one nautical mile area away from Jersey's coastline which used the low water mark as a baseline.

5.1.0 – MPA Design

The MPA network proposed in this report is displayed in Figure 5.1.0.1. Eight potential MPA sites have been identified (and named) ranging in area from 1 to 272 km^2. Collectively the network occupies 607 km^2 (26%) of Jersey's territorial seas leaving 74% of the seabed outside the network. Four of the proposed MPA sites, Les Écréhous, Les Minquiers, Les Anquettes and Jersey Coast are expansions of existing MPA areas. One proposed MPA site, Les Pierres de Lecq (Paternosters) is based on an existing Ramsar site. The remaining three proposed MPA sites (Les Sauvages, West Rank and Banc des Ormes) are small areas constructed to conserve isolated topographic seabed features. Basic physical statistics for each of the proposed sites is given in Tables 5.1.0.1 to 5.1.0.3.

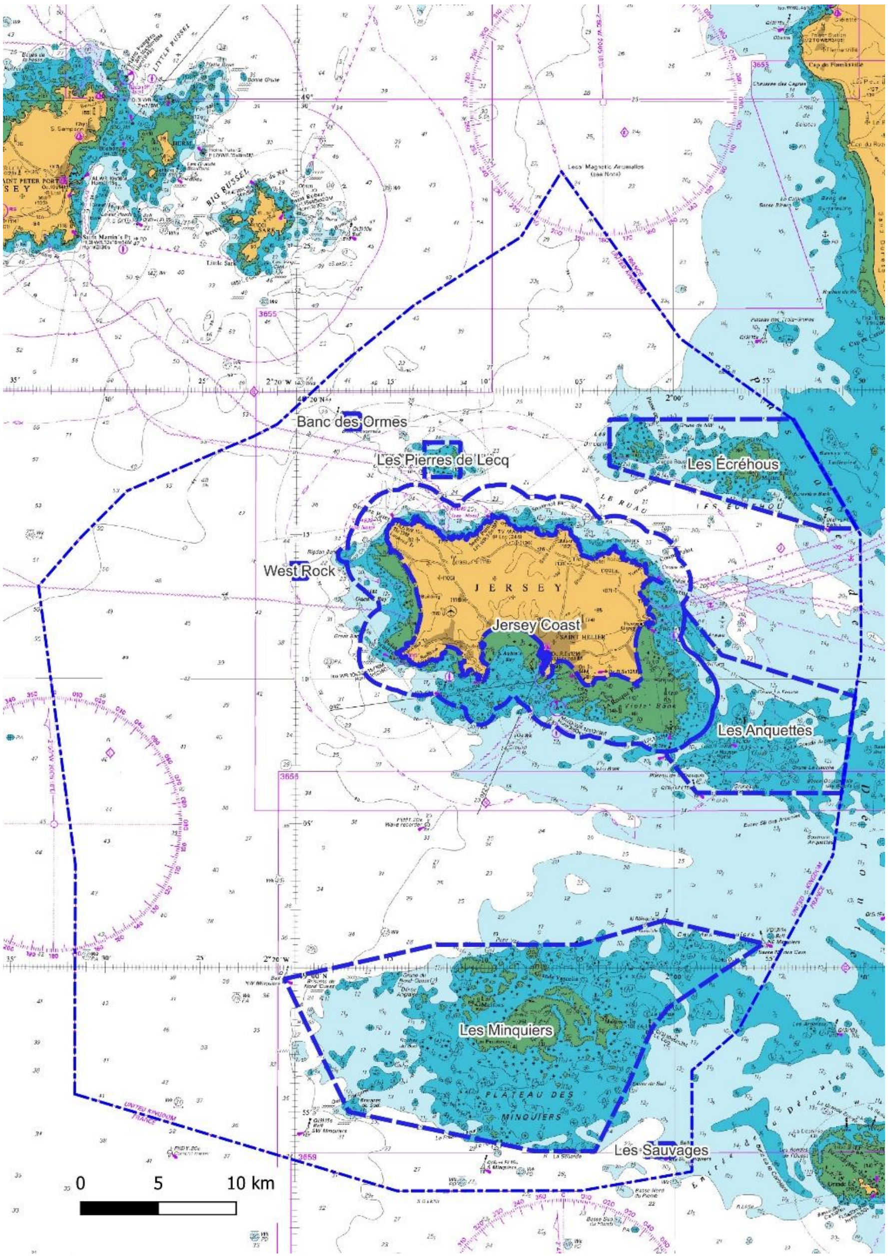

Figure 5.1.0.1 – The proposed JMSP MPA Network based on the assessment process outlined in Sections 2.0 to 4.0. Each MPA area has been given name to assist with the assessment process.

MPA Name	Site Area (km^2)	Territorial Sea (%)
Les Écréhous	69.421	2.97
Les Minquiers	272.079	11.65
Les Pierres de Lecq	5.124	0.22
Les Anquettes	78.482	3.36
Jersey Coast	178.366	7.64
Les Sauvages	1.506	0.06
West Rock	1	0.04
Banc des Ormes	1	0.04
Total Area	606.978	25.98

Table 5.1.0.1 – The area (km^2) and percentage of Jersey's territorial sea of the proposed MPA sites in Figure 5.1.0.1.

MPA Name	Mean Depth	Median Depth	Max Depth	Max Height	Depth Range
Les Écréhous	-11.4	-12	-29.1	17.2	46.3
Les Minquiers	-7.5	-7.3	-35	21	56
Les Pierres de Lecq	-13.8	-12.4	-32.4	-1.1	31.3
Les Anquettes	-11.3	-11.7	-22.1	-0.9	21.2
Jersey Coast	-9.2	-10.5	-41.9	30	71.6
Les Sauvages	-11.8	-11.3	-23	-1.8	21.2
West Rock	-30.4	-29.8	-42.1	-18.3	23.8
Banc des Ormes	-27.2	-25.2	-37.9	-22	15.9

Table 5.1.0.2 – The depth statistics (in metres relative to chart datum) for the proposed MPA sites in Figure 5.1.0.1. Units are in metres in relation to chart datum.

MPA Name	Intertidal (%)	Subtidal (%)
Les Écréhous	2.2	97.8
Les Minquiers	1.9	98.1
Les Pierres de Lecq	0	100
Les Anquettes	0.1	99.9
Jersey Coast	21	79
Les Sauvages	0	100
West Rock	0	100
Banc des Ormes	0	100

Table 5.1.0.3 – The percentage of each proposed MPA sites in Figure 5.1.0.1 that is intertidal and subtidal.

5.2.0 – Stakeholder Feedback

In early spring 2023 The Government of Jersey Marine Resources Team held a series of five workshops with stakeholder groups identified as key to the deployment of the island's Marine Spatial Plan (MSP). Invitees ranged from Jersey's Youth Parliament and other interested islanders through to commercial and third sector operators who utilise marine resources for the delivery of their operations. Additionally, many sports, social, and academic interests were represented at the meetings.

At the workshop the stakeholder groups were invited to highlight key current and future issues, both 'what is done well' and 'what could be done better' using note cards and a large chart of the island's waters. Participants also had access to a set of 'layer' charts that depicted different elements of the island's marine system ranging from shipping routes and power cables to marine benthic habitats and current management zones.

The data from the workshops was taken and used to shape the development of the Marine Spatial Plan. An exercise was carried out to highlight the key issues raised identifying comments relating to a specific area or group of linked subjects. Note was made of each comment and if it was positive or negative in angle on that subject. From 406 workshop responses received there were 466 identifiable points relating to 54 individual subject areas. These are summarised in Table 5.2.0.1.

Table 5.2.0.1 ranks the subject areas raised by the number of comments (positive and negative) associated with it. A great many of these subjects relate (directly or indirectly) to marine conservation and usually have comments that are favourable or unfavourable. For example, the most frequently commented on subject was the creation of MPAs where 49 comments that were favourable and one against. However, another subject area centred on the preservation of fishing grounds with 17 in favour and none against. Other subject areas touch on the need to conserve sensitive habitats (18 for; 3 against), the delivery of 30x30 (7 for; 1 against) and several around ensuring that fisheries and aquaculture are suitable supported. A number of the subject areas raised fall outside the remit of the JMSP, especially those relating to direct fisheries management or matters that are wholly land-based.

In relation to the JMSP's objective of developing a network of MPAs, there is a clear support expressed for this direction of travel within the workshops. This echoes a 2022 survey finding from 2,400 islanders where 85% were in favour of a marine park (which is not necessarily an MPA) and 91% in favour of better management of towed fishing gears. However, this must be tempered against the workshop findings where a significant number of participants expressed opposition or reservations towards either restrictive fisheries management or the concept of conservation areas. These results suggest that the MPA assessment process undertaken for the JMSP is in line with the States of Jersey's request for a MPA network but also something retains wider public support. This must be balanced against the needs of the fishing industry to ensure that any economic impact is quantified, minimised and, where possible, mitigated.

Subject Area	For	Against	Total
Create Marine Protected Areas with management restrictions	49	1	50
Transition towards sustainable Fishing	14	15	29
The need for a Jersey windfarm	23	1	24
Protect and restore high value habitats	18	3	21
Protect nesting, feeding and resting bird locations	17	3	20
Increase education/engagement	19	0	19
Recognise traditional commercial and recreational fishing grounds within the MSP	17	0	17
Manage marine litter and pollution	10	5	15
Manage the location of nets and pots	15	0	15
Manage historical and prehistoric sites within the marine environment.	14	0	14
Manage certain bays for safer watersports	13	1	14
make provision for further no take zones	11	2	13
Increase data collection and access for the marine environment	12	0	12
Protect offshore cables from damage	11	0	11
Investigate the possibility of a tidal barrage	10	1	11
Manage visitor numbers/impact on wild spaces	11	0	11
Promote sustainable tourism	9	0	9
Manage sea defences for sea level rises	9	0	9
Reduce the discharge of sewage into the sea	9	0	9
Enhance fisheries management/enforcement	2	6	8
Deliver 30% MPA coverage by 2030	7	1	8
Support the aquaculture industry	7	0	7
Manage the coastal zone better especially in relation to development and reclamation	7	0	7
Promote sustainable or low carbon shipping/ferries.	7	0	7
Manage dogs on beaches to avoid wildlife disturbance	7	0	7
Increase access to the intertidal and marine areas	4	2	6
Better support for the fishing industry	6	0	6
Place a higher value on wildlife and the marine environment	6	0	6
Better management of low water fishing activities	4	1	5
Develop the blue economy to a greater extent	5	0	5
Greater protection of marine mammals	5	0	5
Ensure the MSP adheres to accepted standards	5	0	5
Education for recreational boating	5	0	5
Enhance regional cooperation/coordination	5	0	5
Preserve and protect coastal and marine views	5	0	5
Manage French fishing vessels better	5	0	5
Develop a tuna fishery	5	0	5
Look at phytoculture possibilities	4	0	4
Diversify the marine economy	4	0	4
Expand no parlour pot zones	4	0	4
Develop marinas at Gorey/St Catherine	3	0	3
Enforce the ban on fishing gear in harbour areas	3	0	3
Explore offsetting possibilities for land-based businesses	1	1	2
Create artificial reefs to enhance biodiversity	2	0	2
Build a bridge/tunnel to France/Guernsey	2	0	2
Greater provision for cruise ships	2	0	2

Develop hydrogen energy storage	2	0	2
Manage of marine noise for wildlife	2	0	2
Better control lost fishing gear	2	0	2
Introduce recreational fishing permits	1	0	1
Lobster hatchery should be established.	1	0	1
Jersey to be a hub for sustainable finance	1	0	1

Table 5.2.0.1 – Combined and collated responses from the consultation workshops undertaken in March 2023 across key stakeholder groups.

5.3 – Biodiversity Targets

Biodiversity targets relate to the proportion of each habitat group type that, across the long-term, needs to be left in a natural or near natural state in order to maintain a representative sample of the habitats, species and genetic diversity that are associated with it. When used as part of conservation planning, the targets are goals against which to assess the health of the wider marine environment as such are recognised through the Convention on Biological Diversity (Aichi Biodiversity Targets) and the IUCN Red List of Ecosystems.

5.3.1 – Habitat Representation

Conservation planning for marine ecosystems often use flat targets of 20 to 30% to remain in line with the IUCN Red List of Ecosystems which assigns Critically Endangered status to ecosystems that have lost more than 70% to 80% of their geographic distribution over 50 years. For the JMSP the threshold for this has been set at 30% for each of the Habitat Groups listed below which means that the overall MPA area should contain at least 30% of that habitat group. However, this approach is pragmatic rather than absolute in recognition that the actual percentage included needs to be flexible as some habitat groups have a high conservation status and/or may be just a few kilometres in extent while others may cover hundreds of kilometres of seabed areas.

The percentage of each habitat group inside and outside the MPA network is given in Table 5.3.1.1 This indicates that the 30% target has been achieved for all but two of the habitats (Sediment: robust fauna; Hard ground) both of which cover large areas of offshore seabed and so are adequately represented by total area inside the network by geographic area. Some habitats, such as intertidal rocks, Sandmason worms, seagrass and sediment with seaweeds have 100% inclusion while the OSPAR threatened habitats of kelp forest and maerl beds have more than 80% inclusion. The proposed MPA network therefore offers a high degree of habitat representation; the breakdown of habitats for the MPA site is given in Tables 5.3.1.2 to 5.3.1.9.

Habitat Group	% Inside MPA network	% Outside MPA network	Total Area (km^2)
Rock: barnacle communities	99.9	0.1	4.8
Rock: seaweed communities	100	0	18.9
Rockpools	100	0	2.9
Kelp Forest	89	11	146.2
Sediment: sparse fauna	56.7	43.3	213.4
Sediment: robust fauna	16.8	83.2	798
Sediment: rich fauna	31.2	68.8	143.2

Sediment: seaweed	100	0	18.5
Hard ground	5.4	94.6	888.6
Sandmason worms	99.4	0.6	22.1
Seagrass	100	0	4.1
Maerl beds	86.7	13.3	56.9
Slipper limpets	40.5	59.5	15.2

Table 5.3.1.1 – The percentage of each habitat group within the MPA network together with its total area in 1 km².

Habitat Group Name	Area (km²)
Rock: barnacle communities	1
Rock: seaweed communities	4
Rockpools	0.8
Kelp Forest	82.2
Sediment: sparse fauna	72.2
Sediment: robust fauna	59.2
Sediment: rich fauna	15.3
Sediment: seaweed	16.6
Hard ground: stable	0.1
Hard ground: unstable	15.5
Sandmason worms	0.5
Seagrass	0.1
Maerl beds	4.6
Slipper limpets	0

Table 5.3.1.2 – A breakdown of habitat groups within the proposed Les Minquiers MPA site. This is expressed in area (km²).

Habitat Group Name	Area (km²)
Rock: barnacle communities	1
Rock: seaweed communities	1.9
Rockpools	0.4
Kelp Forest	15.3
Sediment: sparse fauna	7.9
Sediment: robust fauna	17.4
Sediment: rich fauna	11.5
Sediment: seaweed	1
Hard ground: stable	0
Hard ground: unstable	4.4
Sandmason worms	0.1
Seagrass	0
Maerl beds	8.4
Slipper limpets	0.1

Table 5.3.1.3 – A breakdown of habitat groups within the proposed Les Écréhous MPA site. This is expressed in area (km²).

Habitat Group Name	Area (km²)
Rock: barnacle communities	2.7
Rock: seaweed communities	12.9
Rockpools	1.8
Kelp Forest	25
Sediment: sparse fauna	27.6
Sediment: robust fauna	30.6
Sediment: rich fauna	14.8
Sediment: seaweed	0.9
Hard ground: stable	0
Hard ground: unstable	27.8
Sandmason worms	19.8
Seagrass	4
Maerl beds	6.5
Slipper limpets	3.7

Table 5.3.1.4 – A breakdown of habitat groups within the proposed Jersey Coast MPA site. This is expressed in area (km²).

Habitat Group Name	Area (km²)
Rock: barnacle communities	0
Rock: seaweed communities	0
Rockpools	0
Kelp Forest	4
Sediment: sparse fauna	12.5
Sediment: robust fauna	25.2
Sediment: rich fauna	2.8
Sediment: seaweed	0
Hard ground: stable	0
Hard ground: unstable	0
Sandmason worms	1.6
Seagrass	0
Maerl beds	29.8
Slipper limpets	2.4

Table 5.3.1.5 – A breakdown of habitat groups within the proposed Les Anquettes MPA site. This is expressed in area (km²).

Habitat Group Name	Area (km²)
Rock: barnacle communities	0.1
Rock: seaweed communities	0.1

Rockpools	0
Kelp Forest	2.9
Sediment: sparse fauna	0.8
Sediment: robust fauna	1
Sediment: rich fauna	0
Sediment: seaweed	0
Hard ground: stable	0
Hard ground: unstable	0.1
Sandmason worms	0
Seagrass	0
Maerl beds	0
Slipper limpets	0

Table 5.3.1.6 – A breakdown of habitat groups within the proposed Les Pierres de Lecq MPA site. This is expressed in area (km^2).

Habitat Group Name	**Area (km^2)**
Rock: barnacle communities	0
Rock: seaweed communities	0
Rockpools	0
Kelp Forest	0.2
Sediment: sparse fauna	0
Sediment: robust fauna	1.1
Sediment: rich fauna	0
Sediment: seaweed	0
Hard ground: stable	0
Hard ground: unstable	0.2
Sandmason worms	0
Seagrass	0
Maerl beds	0
Slipper limpets	0

Table 5.3.1.7 – A breakdown of habitat groups within the proposed Les Sauvages MPA site. This is expressed in area (km^2).

Habitat Group Name	**Area (km^2)**
Rock: barnacle communities	0
Rock: seaweed communities	0
Rockpools	0
Kelp Forest	0.1
Sediment: sparse fauna	0
Sediment: robust fauna	0.1
Sediment: rich fauna	0
Sediment: seaweed	0
Hard ground: stable	0

Hard ground: unstable	0.8
Sandmason worms	0
Seagrass	0
Maerl beds	0
Slipper limpets	0

Table 5.3.1.8 – A breakdown of habitat groups within the proposed West Rock MPA site. This is expressed in area (km²).

Habitat Group Name	**Area (km²)**
Rock: barnacle communities	0
Rock: seaweed communities	0
Rockpools	0
Kelp Forest	0.4
Sediment: sparse fauna	0
Sediment: robust fauna	0.1
Sediment: rich fauna	0
Sediment: seaweed	0
Hard ground: stable	0
Hard ground: unstable	0.4
Sandmason worms	0
Seagrass	0
Maerl beds	0
Slipper limpets	0

Table 5.3.1.9 – A breakdown of habitat groups within the proposed Banc des Ormes MPA site. This is expressed in area (km²).

5.3.2 – Marine Species

Jersey's territorial seas and the surrounding waters of the Norman-Breton Gulf were identified as being notably diverse during Victorian times and attracted naturalists and collectors from across Europe (Le Mao *et al.* 2019). Recent (post-2000) recording has produced over 24,000 records collected through surveying by government, NGOs and individual university projects. A further 70,000+ records exist from sources that pre-date 2000; these records have not been included in this analysis. The number of species recorded recently from Jersey waters stands at 972 the status of which is discussed in the Sensitive Species report (Marine Resources, 2023d).

The results from a high-level analysis of species recorded inside and outside of the proposed MPA network sites is shown in Tables 5.3.2.1 to 5.3.2.4. This initial analysis indicates that MPA sites retain a high diversity of species across a range of phyla with the larger sites (Jersey Coast, Les Anquettes, Les Écréhous, Les Minquiers) containing a notable number of protected species records, especially for marine mammals. This corresponds to hydrophone data which suggest that some areas (Jersey's north coast, Les Pierres de Lecq and Les Minquiers) are subject to seasonal aggregations (perhaps for mating purposes) by porpoises and dolphins.

While this basic analysis provides an overview of species diversity, a fuller analysis of species records is recommended in order to look at diversity in relation to site parameters, habitat complexity and recording history. It is recommended that such an analysis is undertaken once the boundaries of the MPA network have been finalised following the consultation period.

MPA Site Name	Number of records	Number of species
Outside MPAs	2177	284
Jersey Coast	16310	789
Les Anquettes	131	63
Les Écréhous	2726	333
Les Minquiers	3326	367
Les Pierres de Lecq	186	107
Les Sauvages	291	142

Table 5.3.2.1 – The number of species records (post-2000) and species from inside and outside of the proposed MPA sites.

Phylum	Outside MPAs	Jersey Coast	Les Anquettes	Les Écréhous	Les Minquiers	Les Pierres de Lecq	Les Sauvages
FORAMINIFERA	1	4	0	0	18	1	0
PORIFERA	13	36	2	21	23	18	26
CNIDARIA	20	45	4	27	15	14	15
PLATYHELMINTHES	0	1	0	1	1	1	1
ACOELOMORPHA	0	1	0	0	1	0	0
NEMERTEA	0	3	0	0	1	0	0
PRIAPULIDA	0	1	0	0	0	0	0
ENTOPROCTA	0	1	0	0	0	0	0
SIPUNCULA	0	2	0	0	2	0	0
ANNELIDA	14	83	1	23	16	4	5
CHELICERATA	0	2	0	1	1	0	0
MYRIAPODA	0	1	0	1	0	0	0
CRUSTACEA	44	126	11	38	39	1	10
HEXAPODA	0	2	0	1	1	0	0
MOLLUSCA	34	121	10	42	54	12	13
BRACHIOPODA	0	0	0	0	0	0	1
BRYOZOA	8	31	4	11	11	4	11
ECHINODERMATA	20	19	2	8	7	2	7
HEMICHORDATA	0	0	0	1	0	0	0
CHORDATA	90	113	18	49	48	31	35
BACILLARIOPHYTA	8	14	3	5	10	0	4
OCHROPHYTA	13	43	2	26	35	7	6
GRACILICUTES	0	3	0	1	1	0	0
RHODOPHYTA	10	102	4	60	62	12	7
CHLOROPHYCOTA	5	25	1	12	16	0	1
ANGIOSPERMS	1	3	1	1	1	0	0

ASCOMYCOTA	3	7	0	4	4	0	0

Table 5.3.2.2 – The number of species per phylum recently (post-2000) recorded from individual proposed MPA sites.

Species Name	**Vulgar Name**	**OMPA**	**JC**	**LA**	**LE**	**LM**	**PDL**	**LS**
Eunicella verrucosa	pink sea fan	9	29	2	3	8	4	10
Leptopsammia pruvoti	sunset cup coral	0	0	0	0	0	1	4
Mactra glauca	five-shilling shell	0	15	0	2	2	0	0
Lamna nasus	porbeagle shark	0	3	0	0	0	0	0
Cetorhinus maximus	basking shark	2	0	0	0	0	0	0
Squalus acanthias	spurdog	0	1	0	0	0	0	0
Alosa alosa	allis shad	0	1	0	0	0	0	0
Hippocampus hippocampus	short-snouted seahorse	1	3	0	0	0	0	0
Cyclopterus lumpus	lumpsucker	0	7	0	0	0	0	0
Thunnus thynnus	blue-fin tuna	1	0	0	0	0	0	0
Mola mola	sunfish	4	10	0	1	1	0	1
Caretta caretta	common loggerhead turtle	0	1	0	0	0	0	0
Dermochelys coriacea	leatherback turtle	2	0	0	0	0	0	0
Phoca vitulina	harbour seal	0	2	0	1	0	0	0
Halichoerus grypus	grey seal	15	104	3	136	55	0	0
Delphinus delphis	common dolphin	13	16	0	0	2	0	0
Tursiops truncatus	bottle-nosed dolphin	418	1253	220	312	135	0	1
Lagenorhynchus acutus	Atlantic white-sided dolphin	0	1	0	0	0	0	0
Lagenorhynchus albirostris	white-beaked dolphin	0	1	0	0	0	0	0
Grampus griseus	Risso's dolphin	2	5	0	0	0	0	0
Globicephala melaena	long-finned pilot whale	9	10	0	1	1	0	0
Phocoena phocoena	harbour porpoise	5	6	0	2	0	0	0
Total Number of Records		12	18	3	8	7	2	4

Table 5.3.2.3 – The number of records relating to species protected to the Jersey Wildlife Law from individual proposed MPA sites. The column indicate are abbreviations of the site names used in Table 5.3.2.2.

Phylum	**Species Name**	**Outside MPAs**	**Jersey Coast**	**Les Anquettes**	**Les Écréhous**	**Les Minquiers**	**Pierres de Lecq**	**Les Sauvages**
ANNELIDA	*Janua brasiliensis*	0	2	0	0	0	0	0
CRUSTACEA	*Elminius modestus*	2	11	0	1	0	0	0
CRUSTACEA	*Balanus amphitrite*	0	1	0	0	0	0	0
CRUSTACEA	*Hemigrapsus sanguineus*	0	13	0	0	0	0	0

MOLLUSCA	*Potamopyrgus antipodarum*	1	3	0	0	0	0	0
MOLLUSCA	*Crepidula fornicata*	17	330	21	31	7	1	0
MOLLUSCA	*Urosalpinx cinerea*	1	1	0	0	0	0	0
MOLLUSCA	*Crassostrea gigas*	3	199	0	27	5	0	0
MOLLUSCA	*Tapes philippinarum*	0	30	0	3	0	0	0
BRYOZOA	*Bugula neritina*	0	2	0	0	0	0	0
BRYOZOA	*Bugula stolonifera*	0	1	0	0	0	0	0
BRYOZOA	*Tricellaria inopinata*	1	1	0	0	0	0	0
BRYOZOA	*Watersipora subtorquata*	0	78	0	0	0	0	0
CHORDATA	*Perophora japonica*	0	2	0	0	0	1	0
CHORDATA	*Corella eumyota*	0	1	0	0	0	0	0
CHORDATA	*Styela clava*	13	54	2	8	1	0	2
CHORDATA	*Botrylloides violaceus*	0	6	0	0	0	0	0
BACILLARIOPHYTA	*Coscinodiscus wailesii*	0	1	0	0	0	0	0
OCHROPHYTA	*Undaria pinnatifida*	0	47	0	0	0	0	0
OCHROPHYTA	*Sargassum muticum*	10	568	1	63	108	3	0
RHODOPHYTA	*Asparagopsis armata*	0	14	0	6	2	0	0
RHODOPHYTA	*Bonnemaisonia hamifera*	0	1	0	0	0	0	0
RHODOPHYTA	*Grateloupia subpectinata*	0	143	0	5	2	0	0
RHODOPHYTA	*Grateloupia turuturu*	0	24	0	0	1	0	0
RHODOPHYTA	*Polyopes lancifolius*	0	4	0	0	0	0	0
RHODOPHYTA	*Caulacanthus ustulatus*	0	3	0	0	0	0	0
RHODOPHYTA	*Solieria chordalis*	0	6	0	0	0	0	0
RHODOPHYTA	*Gracilaria vermiculophylla*	0	2	0	0	0	0	0
RHODOPHYTA	*Antithamnionella ternifolia*	0	1	0	0	0	0	0
RHODOPHYTA	*Heterosiphonia japonica*	0	2	0	0	0	0	0
RHODOPHYTA	*Polysiphonia harveyi*	2	11	0	1	2	0	1
CHLOROPHYCOTA	*Codium fragile fragile*	0	50	0	0	1	2	0
Total Number of Records		9	32	3	9	9	4	2

Table 5.3.2.4 – The number of records relating to species identified as being non-native from individual proposed MPA sites.

5.4.0 - European Habitat Schemes

For comparative purposes, this section contains a list of habitats and features identified as important in EU, UK and Jersey environment strategies. These habitats/features are often a combination of topography and natural environment and so not always well-defined. The JNCC have related individual biotopes to the Annex 1 and HPI definitions, but they are broad.

5.4.1 - EU Habitats Directive/Jersey Biodiversity Strategy

The 1992 European Council Directive on the Conservation of Natural Habitats and of Wild Fauna and Flora is more commonly called the EU Habitats Directive. Its purpose is the conservation of flora and fauna species through the establishment of protected areas across the EU as part of what is called the Natura 2000 network. Annex I of the Habitats Directive lists specific habitats which are viewed as internationally important and which member states are obliged to assess and report on regularly.

The Bailiwick of Jersey has never been an EU member state and so the Habitats Directive did not apply in local waters. However, the feature definitions in Annex I were incorporated into the 2000 Jersey Biodiversity Strategy including the below marine habitats:

- Sandbanks which are slightly covered by sea water all the time

- Mudflats and sandflats not covered by seawater at low tide

- Large shallow inlets and bays

- Reefs

Using the biotope definitions assigned to Habitats Directive features by the JNCC, Figure 5.3.1 shows the extent of three of these habitats (the one not included is large shallow inlets and bays) within Jersey waters. Table 5.4.1.1 shows the percentage (by area) of each Annex I habitat within the proposed MPA sites. These figures are offered as a basic assessment of the MPA network's relationship to the EU habitats Directive and Jersey Biodiversity Strategy. This assessment suggests that a high percentage of each site is occupied by Annex I habitats including those with large geographic coverage such as Les Minquiers, Les Écréhous and Jersey .

MPA Site Name	Reefs	Sand Flats Exposed	Sand Flats Covered	Site Total
Les Écréhous	28.3	0	21.9	50.2
Les Minquiers	36.3	0.3	6.4	43
Les Pierres de Lecq	63.9	0	16.7	80.6
Les Anquettes	5.4	0	43.5	48.9
Jersey Coast	21.7	10.2	29.8	61.7
Les Sauvages	15.7	0	14.3	30
West Rock	14	0	72.7	86.7
Banc des Ormes	40.8	0	59.2	100

Table 5.4.1.1 – The percentage (by area) of features within the EU Habitats Directive inside each MPA site.

Associated with this are marine habitats listed as vulnerable or critically endangered under the European Red List of Habitats. For Jersey's seas this includes seagrass (critically endangered), maerl beds (vulnerable) and infralittoral coarse sediment and rock biotopes. The percentage of each proposed MPA site occupied by each critically endangered or vulnerable habitat is given in Table 5.4.1.2.

MPA Site Name	Critical Habitats	Vulnerable Habitats	Total Site
Les Écréhous	0	22.4	22.4
Les Minquiers	0.1	6.4	6.5
Les Pierres de Lecq	0	15.7	15.7
Les Anquettes	0	44	44
Jersey Coast	1	27.9	28.9
Les Sauvages	0	14.3	14.3
West Rock	0	71.4	71.4
Banc des Ormes	0	55.1	55.1

Table 5.4.1.2 – The percentage (by area) of habitat classed as critical or vulnerable within the EU Habitats Directive inside each MPA site.

5.4.2 – OSPAR Threatened Habitats

The relevance of the OSPAR Convention to Jersey is outlined in Section 2.2.0. Under Annex V the Convention lists three Jersey habitats as threatened (see Section 2.2.0). The percentage of each proposed MPA site occupied by each critically endangered or vulnerable habitat is given in Table 5.4.2.1.

MPA Site Name	Seagrass (*Z. noltei*)	Kelp (*L. hyperborea*)	Kelp (*L. digitata*)	Maerl	Seagrass (*Z. marina*)	Total
Les Écréhous	0	20.5	2	12.4	0	34.9
Les Minquiers	0	25	5.9	1.7	0.1	32.7
Les Pierres de Lecq	0	58.4	0	0	0	58.4
Les Anquettes	0	5.2	0	38.7	0	43.9
Jersey Coast	1.4	11.5	0	3.5	0.9	17.3
Les Sauvages	0	1.7	13.2	0	0	14.9
West Rock	0	12.8	0	0	0	12.8
Banc des Ormes	0	44.6	0	0	0	44.6

Table 5.4.2.1 – The percentage (by area) of habitat listed as threatened within OSPAR Convention inside each MPA site.

5.4.3 - UK Biodiversity Action Plan

The following features (habitats) are included as high priority habitats in the UK Biodiversity Action Plan. These are illustrated in Figure 5.3.1 but overlap with the EU Habitats Directive (Annex I) features and so are listed here without further analysis.

- Intertidal boulder communities
- Intertidal mudflats
- Seagrass beds
- Sheltered muddy gravels
- Fragile sponge and anthozoan communities on subtidal rocky habitats
- *Sabellaria spinulosa* (Ross worm) reefs
- Tide-swept channels
- Maerl beds
- Subtidal sands and gravels

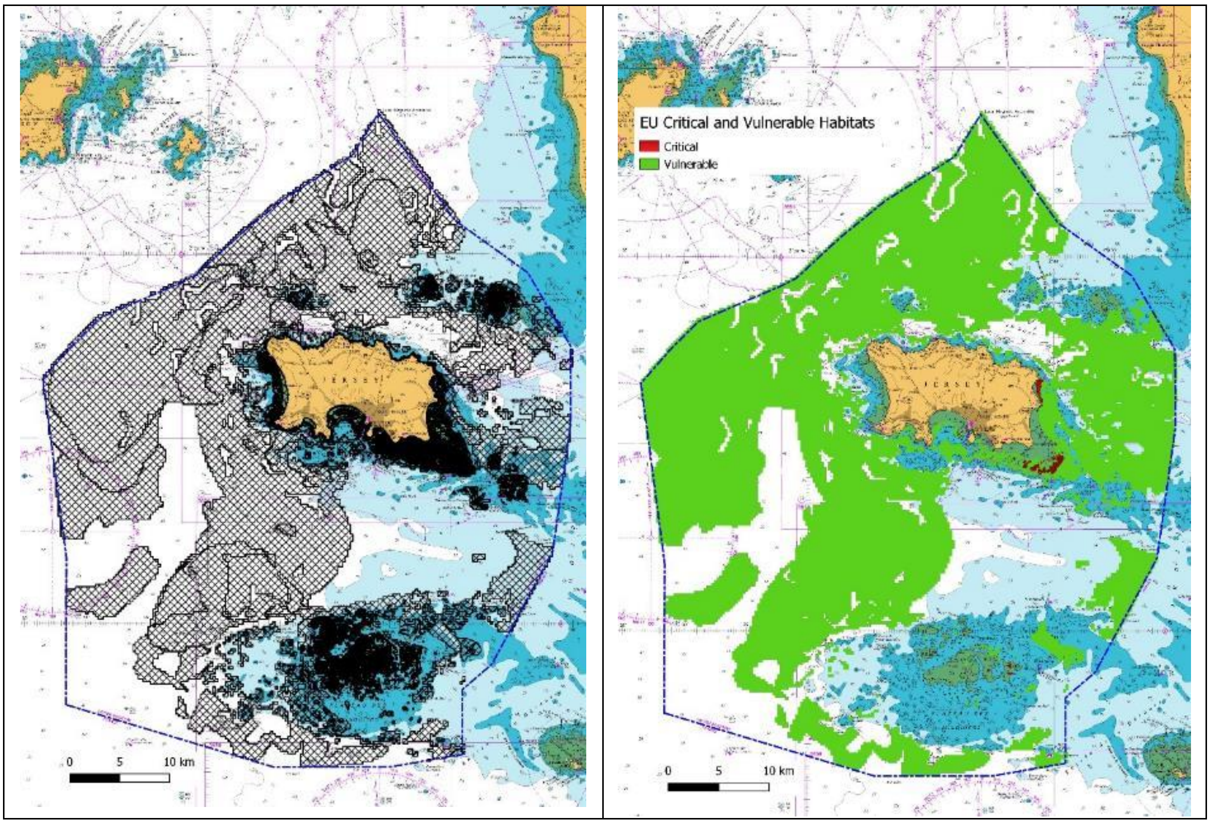

Figure 5.3.1 – Seabed areas that are listed within: (left) UK BAP (Annex I); (right) EU Habitats Directive/Jersey Biodiversity Strategy.

5.5 – Further Work

The assessment process undertaken in Sections 2.0 to 4.0 identified areas of seabed which scored moderately but, for reasons stated in Section 5.1 were not included within the proposed MPA network. It is suggested that these areas are prioritised for any future research/survey work. These areas are shown in Figure 5.5.1 and are focused on the shallow marine sedimentary basins located along the eastern edge of Jersey's territorial seas. The habitats and species within these areas have, in most instances, been recently surveyed (Appendix II) but other properties, such as blue carbon resources, may require further work.

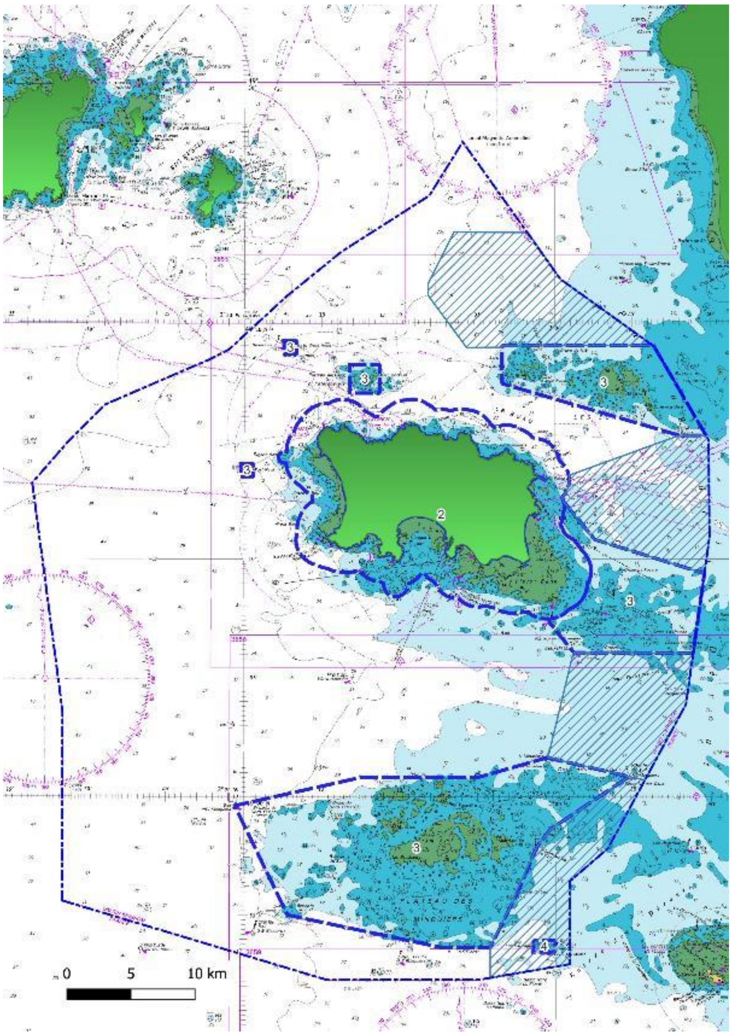

Figure 5.5.1 – The proposed MPA network with seabed areas (hatched) with characteristics that may warrant future research or survey work.

6.0 – Initial Impact Assessment

The designation of an expanded MPA network as outlined in by the JMSP will present a mixture of challenges and opportunities to sea users. It is therefore important that an understanding is developed of the social and economic effects presented by the network as a whole and at the level of individual sites. This section looks at some of the challenges and opportunities associated with the proposed MPA network especially in relation to fishing activity which, in Jersey waters where other extractive and depositional activities are at a very low level, is the sector most likely to interact with the proposed areas. The analysis and results below are based on the boundaries outlined in Section 5.1 of this report which have yet to go through a consultation process and so could be subject to change. The figures and conclusions offered here are therefore provision and it is recommended that any impact analysis is updated and, if necessary, expanded once the JMSP has been finalised.

6.1 – Fishing Activity

Analysis of fishing activity within the boundaries of the eight proposed MPAs was undertaken using the VMS dataset described in the Maritime Activities report (Marine Resources, 2023e) and via an analysis of logbook and spatial data associated with non-VMS enabled vessels. These analyses and results indicate the nature and levels of fishing activity occurring within the proposed MPA areas. This defines the key fishing metiers associated with each site, levels of access and the number of vessels across the proposed MPA network. Further site-specific detail may be found in Section 6.1.2. Although comprehensive, this analysis has been undertaken on the MPA sites in their proposed form. Once the final JMSP has been released it is recommended that the impact assessment process is repeated and expanded so that the effects of any management, including economic impact, may be determined at the level of individual vessels.

This impact analysis has not considered recreational fishing activities as no records could be found of mobile gear being used by non-commercial vessels in Jersey waters. The prohibition of static fishing gear, such as lines, pots and nets, is proposed for Les Sauvages as these have been observed to damage corals, sponges and other delicate marine life. The level of recreational fishing activity at Les Sauvages is unknown although inspection records held by Marine Resources and the survey by de Gruchy (2015) suggests this is not a site where Jersey recreational vessels habitually fish, if at all. Any fishing at Les Sauvages by French recreational vessels may need to be subject to a separate investigation.

6.1.1 - Spatial Impact: An Overview

The potential impact that the proposed MPA network may be judged on a spatial level by comparing the metier fishing areas identified in the Marine Activities Assessment report (Marine Resources, 2023e) with the proposed MPA Network boundaries. This simple visual comparison does not take into account the number of vessels nor fishing days (see Sections 6.1.2 and 6.1.3 below); nor does it attempt to model the economic impact. It does, however, provide an understanding as to the spatial extent of key metiers within the proposed MPA areas.

Figures 6.1.1.1 and 6.1.1.2 show the degree of overlap between fishing metiers and the proposed MPA areas. Metiers based on static gear (pots, nets, lines and diving) are considered to have a low impact on the marine environment and their continued use within the proposed MPA sites is recommended. Mobile gear metiers (scallop/clam dredging and trawling) have a moderate to high impact on the marine environment but especially on the habitats identified for inclusion within the MPA sites. This means that, with the exception of Les Sauvages, the spatial activity defined for pots, fish (lines and hook), diving and crustacean netting in Figure 6.1.1.1 will not be affected by the proposed MPA network. However, some dredging and trawling activity (Figure 6.1.1.2) will be affected especially in some inshore areas and on the fringes of reefs. The degree to which mobile gear activities could be impacted is offered in Sections 6.1.2 and 6.1.3. This suggests that the visual comparison offered in Figures 6.1.1.1 and 6.1.1.2 masks a more complex picture in which the number of vessels and fishing days within each site varies considerably. More detail may be found in Sections 6.1.2 and 6.1.3.

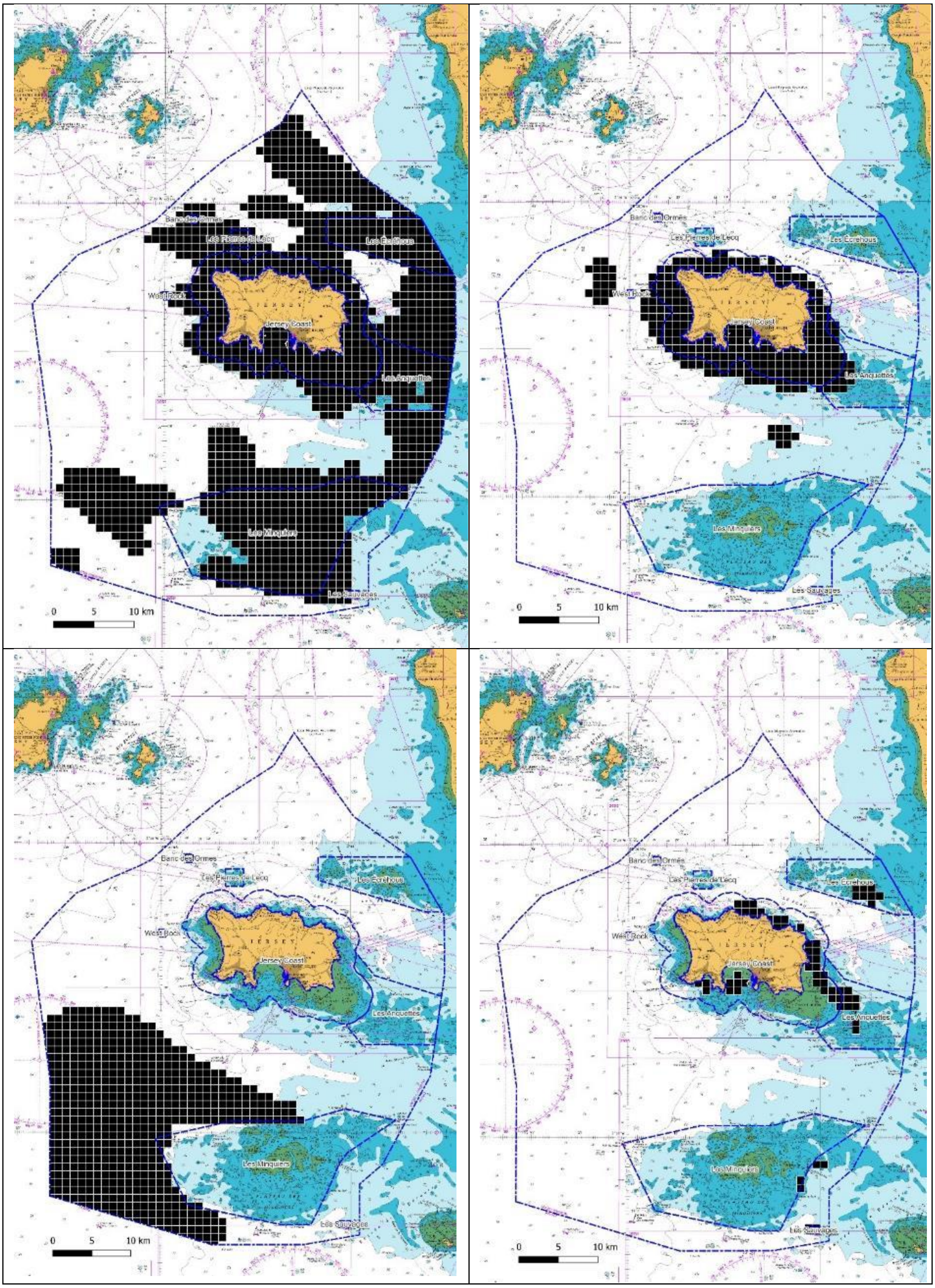

Figure 6.1.1.1 – A spatial outline of static fishing activity by metier (see (Marine Resources, 2023e) for further details). *TL: Potting activity; TR: Line and net fishing; BL: Benthic netting for crustaceans; BR: Diving for scallops.*

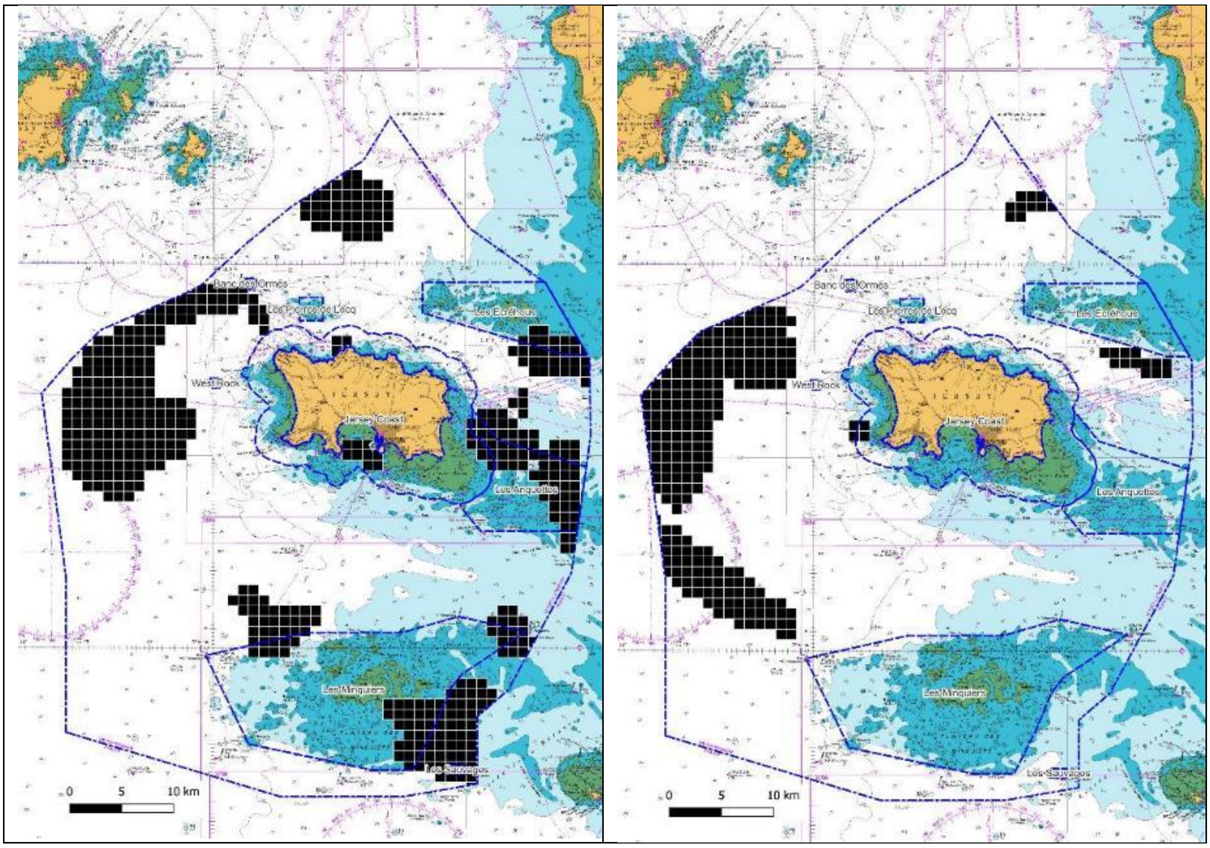

Figure 6.1.1.2 – A spatial outline of mobile fishing activity by metier (see (Marine Resources, 2023e) for further details). *(left): Dredging activity; (right): Trawling activity.*

6.1.2 - VMS Enabled Vessels

The VMS dataset analysis described in the Maritime Activity Assessment (Marine Resources, 2023e) provides detailed information concerning fishing activity outside Jersey's exclusive fishing area. This dataset concerns only French licenced fishing vessels and only covers the 12 months between 1 February 2022 and 31 January 2023 which represents the first full operational year of the post-Brexit licencing and fishing permit framework. This analysis is offered as an indication of activity levels within the MPA sites as they are proposed in the draft JMSP document. It is recommended that a fuller vessel by vessel impact assessment should be undertaken following the final JMSP release.

The analysis of VMS data focuses on days attributable to mobile and static gear; this is because on most sites mobile gear has been identified as an activity that is incompatible with the objectives of the MPAs. In practice the mobile gear activity is almost exclusively dredging with only a few days' trawling recorded in Les Écréhous. Similarly, the static gear used is predominantly pots, mostly for crustaceans but also whelks in some areas. With the exception of Les Sauvages, which has been proposed as a No Take Zone, restrictions on static gear does not form part of the proposed MPA network.

Table *6.1.2.1* shows the number of fishing days attributable to VMS enabled vessels within the proposed MPA sites broken down into vessels using mobile and static fishing gear. For all sites the number of static gear fishing days exceeds that of mobile gear and there is a general relationship between the total number of fishing days and the area of the site. The sites with the highest overall level of usage are Les Minquiers (919 days); Les Écréhous (570 days) and Les Anquettes (518 days); only two other sites recorded and fishing activity: Les Sauvages (68 days) and Banc des Ormes (1 day). This pattern is reflected in the level of activity exhibited by mobile and static gear with the biggest sites by area having more fishing days than smaller sites. At all sites there are more static gear days than for mobile gear with the ratio between the gears varying between 2.1 (Les Anquettes) and 7.5 (Les Sauvages).

MPA Site Name	MPA Fishing Days	Mobile Fishing Gear	Static Fishing Gear	Ratio
Les Écréhous	570	83	487	5.8
Les Minquiers	919	239	680	2.8
Les Pierres de Lecq*	0	0	0	0
Les Anquettes	518	169	349	2.1
Jersey Coast*	0	0	0	0
Les Sauvages	68	8	60	7.5
West Rock*	0	0	0	0
Banc des Ormes	1	0	1	0

*Table 6.1.2.1 - The number of VMS enabled fishing days associated with each of the proposed MPA sites. Note that the fishing days are site specific individual sites which means that a vessel fishing across two sites in a single day will generate a fishing day in each site. The ratio reflects static gear days in relation to mobile gear. * = MPA is wholly within the Jersey exclusive fishing zone where French vessels have no access. The ratio explains the frequency relationship between the mobile and static fishing, for example, a ratio of 1:5 means for one day of mobile fishing there were 5 days of static fishing.*

Table *6.1.2.2* shows the number of fishing days attributable to VMS enabled vessels within the proposed MPA sites broken down into vessels using mobile and static fishing gear. The number of vessels using each site shows a similar pattern to that fishing days in that the larger sites have more fishing vessels recorded from them than the smaller ones. The ratio between static and mobile gear vessels varies between 1.3 (Les Anquettes and Les Minquiers) and 2.6 (Les Écréhous).

MPA Site Name	Total No. Vessels	Mobile Gear	Static Gear	Ratio
Les Écréhous	21	6	16	2.6
Les Minquiers	31	14	18	1.3
Les Pierres de Lecq*	0	0	0	0
Les Anquettes	33	14	19	1.3
Jersey Coast*	0	0	0	0
Les Sauvages	9	3	6	2
West Rock*	0	0	0	0
Banc des Ormes	1	0	1	0

*Table 6.1.2.2 - The number of VMS enabled fishing vessels associated with each of the proposed MPA sites. Note that the vessel numbers are site specific individual sites which means that a vessel fishing across two sites in a single day will be counted in each site. * = MPA is wholly within the Jersey exclusive*

*fishing zone where vessels have no access. The ratio reflects static gear vessels in relation to mobile gear ones. * = MPA is wholly within the Jersey exclusive fishing zone where French vessels have no access.*

Table *6.1.2.3* shows the number of proposed MPA sites fished by vessels over the course of the year. This suggests that most vessels, but especially static gear ones, visit only one site. A small number of vessels fish across two sites and just two mobile gear vessels fish at three. The number of static gear vessels fishing at one site suggests that there may be a higher site dependency for static gear vessels than mobile gear ones.

Number of Sites	Mobile Gear	Static Gear
1	17	34
2	7	13
3	2	0

Table 6.1.2.3 – The number of MPA sites fished by individual vessels during the course of the year.

Table 6.1.2.4 shows the number of fishing days (banded) accumulated by mobile and static gear vessels within the collective proposed MPA areas. For both mobile and static gear there appears to be a low level of access (<11 fishing days) by over half the vessels with few vessels accessing the sites for more than 100 days.

Fishing Days	Mobile Gear	Static Gear
0 to 10	15 (57.7%)	24 (51%)
11 to 50	8 (30.7%)	11 (23.4%)
51 to 100	2 (7.6%)	9 (19.1%)
101 to 150	1 (3.8%)	1 (2.1%)
151 to 200	0	1 (2.1%)
201+	0	1 (2.1%)

Table 6.1.2.4 – The number of fishing days (banded) accumulated by vessels fishing in MPA sites across the analysis year.

This analysis provides basic information concerning access to the proposed MPA sites by VMS enabled vessels across the single year that was analysed. This suggests that there is a link between the proposed site area and the level of access, that static gear vessels have a higher level of usage and dependency than mobile gear ones and that a majority of vessels accessing the MPA areas fish a relatively small number of days. This analysis is offered as an early-stage indication of the degree to which some fishing metiers (principally mobile fishing gear) could be affected by the proposed MPAs as they stand. It is recommended that a fuller vessel by vessel impact assessment should be undertaken following the final JMSP release.

6.1.3 - Untracked Vessels

The Jersey commercial fishing fleet (with one exception) is currently not compelled to use any form of tracking (VMS, AIS, etc.) although they are required to complete and return logsheets for each day's fishing activity they undertake recording catch and effort details within six defined zones. This creates a situation where the government has access to precise catch and activity data but at a low spatial resolution. Capturing the level of fishing effort associated with the proposed MPA sites is not as precise for untracked commercial vessels fishing as it is for VMS enabled ones.

Table 6.1.3.1 displays the number of fishing days by metier associated with each of the six statutory reporting zones. This was calculated using logbook data by taking the maximum annual fishing days for each vessel (by metier) for the period 2017 to 2022. This shows the relative distribution of fishing activity within Jersey waters but does not indicate the levels of activity within the proposed MPA network sites. This does, however, suggest that there is a high reliance by most static gear metiers on zone 27E7JE and on 27E7JE and 27E7BG by scallop dredgers. Trawling and crustacean netting seem to be metiers with a low number of fishing days by untracked vessels within Jersey waters.

Permit	**26E7BG**	**26E8BG**	**27E7BG**	**27E7JE**	**27E8BG**	**27E8JE**
Scallop Diving	54	34	24	247	255	208
Scallop/Clam Dredging	59	31	206	187	47	110
Line Fishing	13	7	226	740	103	46
Crustacean Netting	1	0	72	38	0	1
Fish Netting	4	3	21	371	3	3
Crustacean Potting	633	66	722	955	331	367
Whelk Potting	76	2	290	481	229	162
Trawling	6	0	28	65	0	3

Table 6.1.3.1 – The maximum number of fishing days (best year per vessel) in each reporting zone between 2017 and 2022. Note: the fishing days have been calculated by metier which means a single vessel operating two different metiers on a single day will generate a fishing day for each metier.

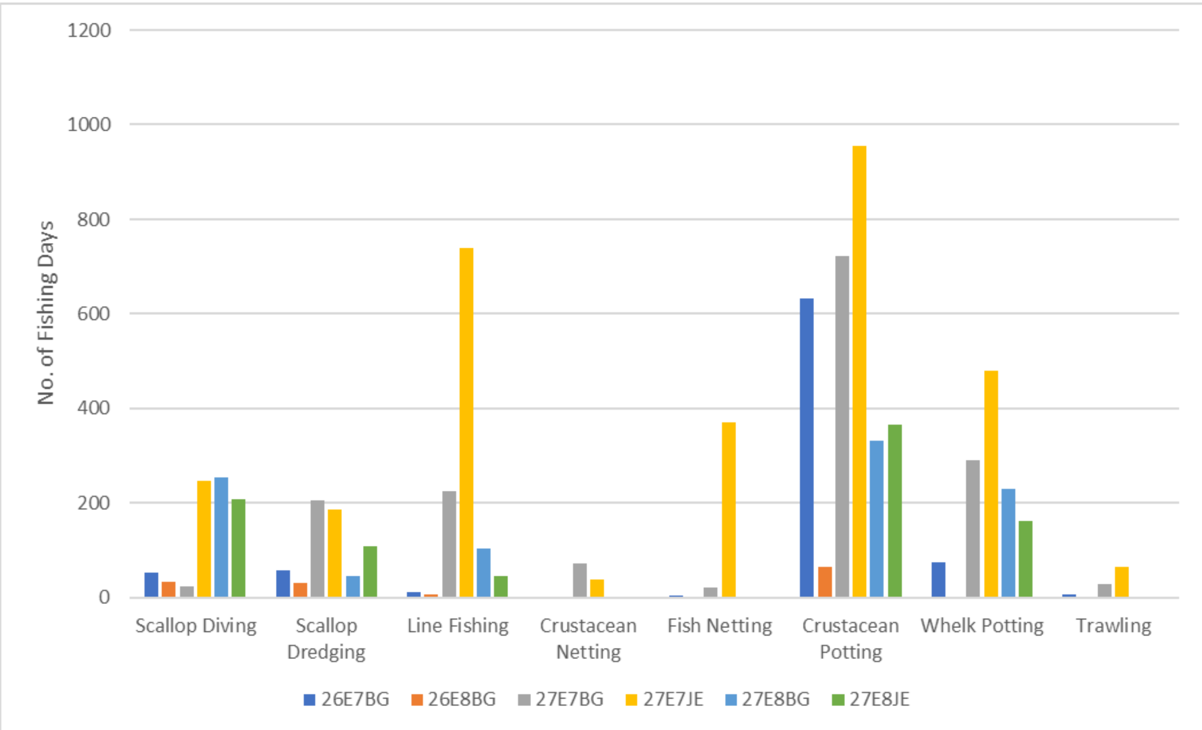

Figure 6.1.3.1 - The maximum number of fishing days (best year per vessel) in each reporting zone between 2017 and 2022. (See Table 6.1.3.1.)

Table 6.1.3.2 shows the number of vessels fishing (by metier) within the six reporting zones covering Jersey waters. This was extracted from the same analysis used to generate the fishing days in Table 6.1.3.1. The results reflect the fishing activity with static gear metiers dominating within the 27E7JE where 67 vessels fished which is nearly three times the number of any other zone, while mobile fishing gear reached a maximum of six and four vessels within zones 27E7BG and 27E7JE. Collectively this suggests that there is a high reliance on the Jersey exclusive area (27E7JE and 27E8JE) by static gear vessels and a concentration of activity with zones 27E7JE and 27E7BG by mobile gear vessels.

Fishing Activity	26E7BG	26E8BG	27E7BG	27E7JE	27E8BG	27E8JE
Scallop Diving	2	3	2	11	6	6
Scallop/Clam Dredging	3	1	6	4	3	3
Line Fishing	3	1	6	30	7	4
Crustacean Netting	1	0	2	4	0	1
Fish Netting	1	1	2	19	1	1
Crustacean Potting	17	5	23	67	10	13
Whelk Potting	1	1	6	11	5	4
Trawling	1	0	2	4	0	1

Table 6.1.3.2 – The maximum number of vessels fishing in each reporting zone between 2017 and 2022.

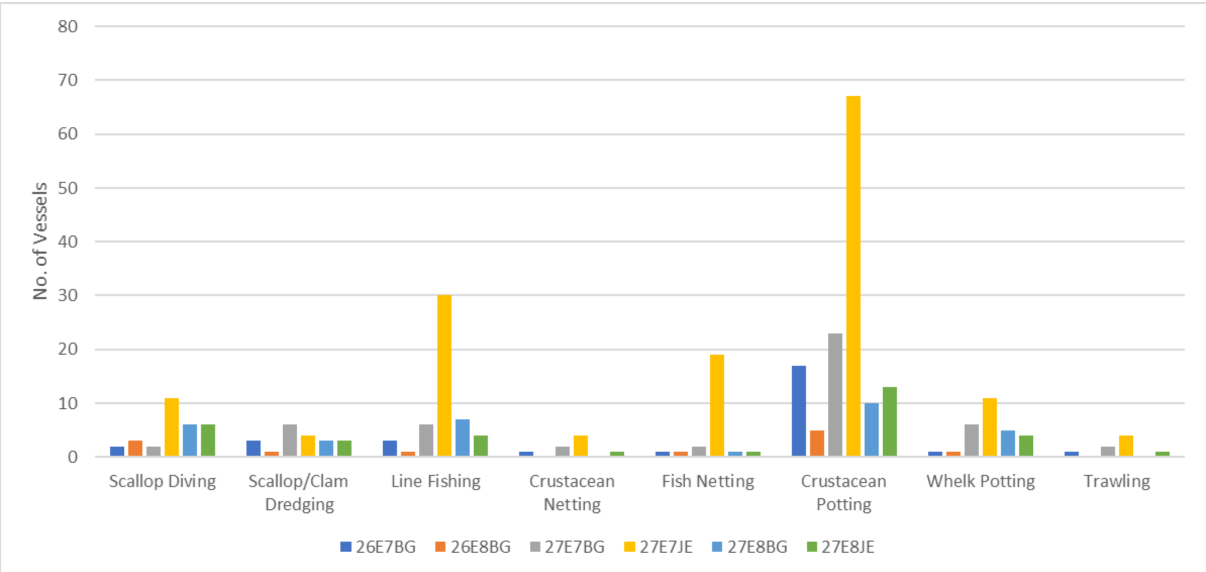

Figure 6.1.3.2 – The maximum number of vessels fishing in each reporting zone between 2017 and 2022 (see Table 6.1.3.2).

An attempt was made to define the levels of activity associated with untracked vessels within the proposed MPA areas by processing logsheet data from 2017 to 2022 to extract the highest annual figure (based on catch weight) associated with each vessel's use of static gear (pots, nets, hook and line, diving) and mobile gear (dredging, trawling) for each of the six statutory reporting zones within Jersey waters. This was mapped onto the fishing areas identified in the Maritime Fishing Activity Assessment (Marine Resources, 2023e). and apportioned to each proposed MPA based on the area that the defined fishing areas occupy within it. This methodology is presented with several caveats as it relies on spatial apportionment and is therefore imprecise especially when compared with satellite or other tracking data. The results are presented in Table 6.1.3.3 but these should be treated with caution as there is a likelihood of over or under estimation. At Les Pierres de Lecq, for example, the number of fishing days appears extremely low whereas at Les Sauvages it may be too high. When the final JMSP is released, it is recommended that an analysis of site usage is undertaken at the level of individual vessels that may be impacted.

Given the above caution, the figures displayed in Table 6.1.3.3 should be taken as indicative of relative levels of fishing activity for mobile and static fishing metiers with the proposed MPA network sites (see above). In relative terms, the greatest impact on mobile gear vessels is liable to be within the proposed Jersey Coast and Les Anquettes MPA sites where the number of fishing days from up to four vessels (Table 6.1.3.3) is indicated as being high. Of particular relevance may be St Aubin's Bay which falls within the Jersey Coast MPA is a regularly used by scallop dredgers operating from St Helier. Exact site usage within Les Anquettes is more difficult to determine from this analysis although vessels operating from Gorey and St Helier will fish frequently in the seabed areas to the north of the Anquettes beacons.

The lack (or effective lack) of any mobile gear activity in West Rock, Banc des Ormes, Les Pierres de Lecq and Les Sauvages may be an accurate reflection of the small size of the MPA areas in combination with their rocky topography and lack of sediment. Les Écréhous and Les Minquiers already have defined MPA areas; these sites are predominantly used by static gear vessels (especially potters) but mobile gear fishing does occur on the south-east and north-west parts of these two sites respectively.

Site Name	**MPA Fishing Days**	**Mobile Fishing Gear**	**Static Fishing Gear**	**Ratio**
Les Écréhous	325	6	319	53.2
Les Minquiers	448	13	435	33.5
Les Pierres de Lecq	9	0	9	NA
Les Anquettes	309	25	284	11.4
Jersey Coast	1098	86	1012	11.8
Les Sauvages	10	1	9	9
West Rock	2	0	2	NA
Banc des Ormes	2	0	2	NA

Table 6.1.3.3 - The number of fishing days (maximum vessel year between 2016 and 2022) associated with each of the proposed MPA sites. Note that the fishing days are site specific individual sites which means that a vessel fishing across sites in two separate reporting areas a single day will generate a fishing day in each site. The ratio reflects static gear days in relation to mobile gear.

During the consultation workshops in March 2023 the issue of fishing activity and weather was raised on several occasions, it being requested that wind speed needs to be considered as part of the impact assessment process. In respect of this, Table 6.1.3.4 presents the results of analysing fishing days (by metier, taken from logsheets) in relation to weather data (Jersey Met: maximum average hourly wind speed during 24 hours). The results are presented as the percentage of fishing days undertaken in relation to the maximum wind speed (expressed using thew Beaufort scale) between 2017 and 2022. This suggests that with all metiers around two-thirds of fishing occurred when wind speeds were between Force 1 and 3 with between 20 and 30% occurring during Force 4. Only a small percentage of fishing occurs above a Force 4 and none at all above Force 6. These results are likely to reflect the difficulty and dangers of fishing in poor weather especially for the smaller inshore vessels that are predominantly used by the Jersey fleet.

Permit	**F1**	**F2**	**F3**	**F4**	**F5**	**F6**	**Total Days**
Scallop Diving	1.2	27.6	48.6	20.4	2	0.2	1,944
Scallop/Clam Dredging	1.2	27.4	46.3	22.1	2.4	0.7	1,521
Line Fishing	1	30.2	49.1	17.9	1.7	0.2	2,542
Crustacean Netting	0	25.6	46.7	26.7	0.6	0.6	180
Fish Netting	0.4	21	38.8	31.4	7.3	1	932
Crustacean Potting	1.2	20.9	41.5	29.7	5.7	1.1	7,566
Whelk Potting	1.3	21.7	42.4	28	5.4	1.2	2,864
Trawling	1.9	22.1	42.1	28.7	4.4	0.9	321

Table 6.1.3.4 – Percentage of fishing days within each metier undertaken in relation to wind speed between 2016 and 2022 using the Beaufort scale. The fishing days were taken from logbook data. wind speed represents the maximum average hourly wind speed per 24-hour day. The total number of days assessed is provided. (Data: Jersey Met).

6.2 – Other Activities

Jersey's territorial sea has no recent history of extraction or mining for aggregates, fossil fuels, etc., while activities such as aquaculture, undersea cabling and infrastructure are subject to a licencing process that includes provision for environmental and other impact analyses. These are covered in the relevant sections of the JMSP. Other maritime activities, such as watersports, tourism, shipping, boating, etc., have a low level of impact on the seabed. Potential conflicts associated with moorings and anchoring, particularly in areas with seagrass, are covered in the relevant sections of the JMSP.

The benefits defined from the creation of MPAs are summarised in the Benyon Review (Chapter 4) and in the study of Les Écréhous and Les Minquiers by Blampied (2022). They include commercial, recreational and cultural benefits relating to fisheries, tourism, recreation, education as well as to climate change resilience, human health and local and international credibility. Some of these benefits derive from new opportunities (such as ecolabelling), others from conflict reduction (increased capacity, stock improvements) and evolving economies (blue carbon, ecotourism).

Appendix I – Proposed MPAs' Species List

Below is a list of marine species recorded from within the MPA Network sites together with the number of reports associated with each. For further discussions on local and regional biodiversity see Chambers *et al.* (2016, 2022) and Le Mao *et al.* (2019).

Phylum	Species Name	Jersey Coast	Les Anquettes	Les Écréhous	Les Minquiers	Pierres de Lecq	Les Sauvages
FORAMINIFERA	*Halyphysema tumanowiczii*	1	0	0	0	1	0
FORAMINIFERA	*Lagena melo*	0	0	0	1	0	0
FORAMINIFERA	*Lagena striata*	1	0	0	0	0	0
FORAMINIFERA	*Lagena sulcata*	0	0	0	1	0	0
FORAMINIFERA	*Procerolagena clavata*	0	0	0	1	0	0
FORAMINIFERA	*Fissurina lucida*	0	0	0	1	0	0
FORAMINIFERA	*Globulina myristiformis*	0	0	0	1	0	0
FORAMINIFERA	*Pyrgo depressa*	0	0	0	1	0	0
FORAMINIFERA	*Miliolina subrotunda*	0	0	0	1	0	0
FORAMINIFERA	*Sigmoilina secans*	0	0	0	1	0	0
FORAMINIFERA	*Adelosina bicornis*	0	0	0	1	0	0
FORAMINIFERA	*Quinqueloculina cliarensis*	0	0	0	1	0	0
FORAMINIFERA	*Miliolina oblonga*	0	0	0	1	0	0
FORAMINIFERA	*Spiroloculina excavata*	0	0	0	1	0	0
FORAMINIFERA	*Asterigerinata mamilla*	1	0	0	1	0	0
FORAMINIFERA	*Glabratella millettii*	0	0	0	1	0	0
FORAMINIFERA	*Elphidium crispum*	0	0	0	1	0	0
FORAMINIFERA	*Elphidium gerthi*	0	0	0	1	0	0
FORAMINIFERA	*Elphidium williamsoni*	1	0	0	1	0	0
FORAMINIFERA	*Ammonia batava*	0	0	0	1	0	0
PORIFERA	*Clathrina coriacea*	4	0	1	0	1	0
PORIFERA	*Guancha lacunosa*	3	0	1	0	1	0
PORIFERA	*Scypha ciliata*	20	0	3	2	3	3
PORIFERA	*Grantia compressa*	13	0	0	2	0	0
PORIFERA	*Aphroceras ensata*	9	0	0	0	0	0
PORIFERA	*Baeria nivea*	0	0	0	0	1	0
PORIFERA	*Oscarella lobularis*	6	0	1	1	0	0
PORIFERA	*Pachymatisma johnstonia*	19	0	3	7	4	6
PORIFERA	*Dercitus bucklandi*	2	0	0	0	1	1
PORIFERA	*Tethya citrina*	49	0	5	3	1	3
PORIFERA	*Polymastia boletiformis*	20	0	3	3	1	3
PORIFERA	*Polymastia mamillaris*	20	0	2	1	1	3
PORIFERA	*Suberites ficus*	0	0	0	0	0	1
PORIFERA	*Terpios gelatinosa*	49	0	3	3	0	1
PORIFERA	*Adreus fascicularis*	4	0	1	1	0	1
PORIFERA	*Stelligera rigida*	4	0	0	1	1	2
PORIFERA	*Stelligera stuposa*	2	0	0	0	0	2
PORIFERA	*Cliona celata*	10	0	8	3	0	3
PORIFERA	*Axinella damicornis*	0	0	0	0	0	2
PORIFERA	*Axinella dissimilis*	28	0	5	4	4	6
PORIFERA	*Ciocalypta penicillus*	6	0	1	3	0	2
PORIFERA	*Halichondria panicea*	139	0	28	19	1	2
PORIFERA	*Hymeniacidon perleve*	125	0	6	12	0	0
PORIFERA	*Amphilectus fucorum*	13	1	3	2	1	2
PORIFERA	*Ulosa digitata*	0	0	0	1	1	1
PORIFERA	*Desmacidon fruticosum*	1	0	0	0	0	0

PORIFERA	*Hymedesmia paupertas*	0	0	0	0	0	1
PORIFERA	*Hemimycale columella*	22	0	4	2	3	3
PORIFERA	*Phorbas fictitius*	0	0	0	0	0	1
PORIFERA	*Phorbas plumosum*	2	0	0	1	1	0
PORIFERA	*Myxilla incrustans*	1	0	0	0	0	0
PORIFERA	*Ophlitaspongia papilla*	10	0	0	1	0	0
PORIFERA	*Raspailia hispida*	1	0	0	0	0	2
PORIFERA	*Raspailia ramosa*	23	0	6	0	2	4
PORIFERA	*Tethyspira spinosa*	0	0	0	0	0	1
PORIFERA	*Haliclona angulata*	1	0	0	0	0	0
PORIFERA	*Haliclona cinerea*	1	0	0	0	0	0
PORIFERA	*Haliclona fistulosa*	1	0	0	0	0	0
PORIFERA	*Haliclona oculata*	6	0	0	0	0	0
PORIFERA	*Haliclona simulans*	1	0	0	1	0	0
PORIFERA	*Haliclona viscosa*	2	0	1	0	0	0
PORIFERA	*Aplysilla rosea*	0	1	0	0	0	0
PORIFERA	*Aplysilla sulfurea*	0	0	0	0	0	1
PORIFERA	*Dysidea fragilis*	28	0	3	4	4	3
PORIFERA	*Halisarca dujardini*	29	0	1	7	0	0
CNIDARIA	*Craterolophus convolvulus*	1	0	0	0	0	0
CNIDARIA	*Lucernariopsis campanulata*	1	0	0	0	0	0
CNIDARIA	*Pelagia noctiluca*	2	0	0	0	0	0
CNIDARIA	*Chrysaora hysoscella*	2	0	0	0	0	0
CNIDARIA	*Aurelia aurita*	1	0	0	1	0	0
CNIDARIA	*Rhizostoma octopus*	4	0	2	2	0	0
CNIDARIA	*Corymorpha nutans*	1	0	0	0	0	0
CNIDARIA	*Tubularia indivisa*	2	0	0	0	1	0
CNIDARIA	*Sarsia eximia*	1	0	0	0	0	0
CNIDARIA	*Candelabrum cocksii*	1	0	0	0	0	0
CNIDARIA	*Hydractinia echinata*	2	0	0	0	0	0
CNIDARIA	*Halecium halecinum*	0	0	2	0	0	0
CNIDARIA	*Abietinaria abietina*	0	0	1	0	0	0
CNIDARIA	*Diphasia attenuata*	1	0	0	0	0	0
CNIDARIA	*Dynamena pumila*	2	0	1	0	0	0
CNIDARIA	*Hydrallmania falcata*	0	1	1	0	0	0
CNIDARIA	*Sertularia cupressina*	1	0	0	0	0	0
CNIDARIA	*Antennella secundaria*	1	0	0	0	0	1
CNIDARIA	*Nemertesia antennina*	3	0	2	3	1	3
CNIDARIA	*Nemertesia ramosa*	0	1	1	0	1	0
CNIDARIA	*Plumularia setacea*	0	0	1	0	0	0
CNIDARIA	*Aglaophenia pluma*	0	0	5	0	0	0
CNIDARIA	*Gymnangium montagui*	2	0	1	0	0	0
CNIDARIA	*Rhizocaulus verticillatus*	0	0	0	0	0	1
CNIDARIA	*Laomedea angulata*	2	0	0	0	0	0
CNIDARIA	*Obelia bidentata*	1	0	0	0	0	0
CNIDARIA	*Obelia geniculata*	22	0	7	2	2	1
CNIDARIA	*Alcyonium digitatum*	4	1	2	0	2	0
CNIDARIA	*Eunicella verrucosa*	8	0	1	5	1	7
CNIDARIA	*Cerianthus lloydii*	12	0	3	0	0	1
CNIDARIA	*Pachycerianthus* indet. *('Dorothy')*	4	0	0	2	0	2
CNIDARIA	*Epizoanthus couchii*	2	0	2	0	0	1
CNIDARIA	*Isozoanthus sulcatus*	0	0	0	0	1	0
CNIDARIA	*Actinia equina*	148	0	3	26	0	0
CNIDARIA	*Actinia fragacea*	12	0	0	0	0	0
CNIDARIA	*Anemonia viridis*	208	0	17	42	3	1
CNIDARIA	*Urticina felina*	23	0	0	0	0	0
CNIDARIA	*Aulactinia verrucosa*	9	0	0	0	0	0

CNIDARIA	*Anthopleura ballii*	1	0	0	0	0	0
CNIDARIA	*Aureliania heterocera*	3	0	1	0	0	0
CNIDARIA	*Aiptasia mutabilis*	38	0	5	0	0	0
CNIDARIA	*Metridium senile*	2	0	0	0	0	0
CNIDARIA	*Sagartia elegans*	0	0	1	0	1	0
CNIDARIA	*Sagartia troglodytes*	0	0	1	0	0	0
CNIDARIA	*Cereus pedunculatus*	81	0	17	3	0	0
CNIDARIA	*Actinothoe sphyrodeta*	21	1	4	6	5	1
CNIDARIA	*Calliactis parasitica*	35	0	4	1	0	0
CNIDARIA	*Adamsia carciniopados*	2	0	1	1	0	0
CNIDARIA	*Mesacmaea mitchellii*	2	0	0	0	0	0
CNIDARIA	*Halcampa chrysanthellum*	2	0	0	0	0	0
CNIDARIA	*Edwardsiella carnea*	1	0	0	2	0	0
CNIDARIA	*Corynactis viridis*	3	0	0	1	1	3
CNIDARIA	*Caryophyllia inornata*	2	0	0	0	2	2
CNIDARIA	*Caryophyllia smithii*	14	0	2	3	2	6
CNIDARIA	*Hoplangia durotrix*	0	0	0	0	0	1
CNIDARIA	*Balanophyllia regia*	1	0	1	0	0	0
CNIDARIA	*Leptopsammia pruvoti*	0	0	0	0	1	3
PLATYHELMINTHES	*Prostheceraeus vittatus*	8	0	2	1	1	2
ACOELOMORPHA	*Symsagittifera roscoffensis*	15	0	0	4	0	0
NEMERTEA	*Lineus longissimus*	1	0	0	0	0	0
NEMERTEA	*Lineus ruber*	0	0	0	1	0	0
NEMERTEA	*Lineus viridis*	2	0	0	0	0	0
NEMERTEA	*Punnettia splendida*	1	0	0	0	0	0
PRIAPULIDA	*Priapulus caudatus*	2	0	0	0	0	0
ENTOPROCTA	*Pedicellina hispida*	1	0	0	0	0	0
SIPUNCULA	*Golfingia elongata*	13	0	0	1	0	0
SIPUNCULA	*Golfingia vulgaris*	12	0	0	1	0	0
ANNELIDA	*Alentia gelatinosa*	1	0	0	0	0	0
ANNELIDA	*Gattyana cirrhosa*	2	0	0	0	0	0
ANNELIDA	*Harmothoe lunulata*	1	0	0	0	0	0
ANNELIDA	*Lepidonotus clava*	12	0	0	1	0	0
ANNELIDA	*Malmgrenia castanea*	0	0	2	0	0	0
ANNELIDA	*Pelogenia arenosa*	4	0	0	0	0	0
ANNELIDA	*Sigalion mathildae*	2	0	0	0	0	0
ANNELIDA	*Eteone longa*	1	0	0	0	0	0
ANNELIDA	*Phyllodoce lineata*	2	0	0	0	0	0
ANNELIDA	*Phyllodoce maculata*	2	0	0	0	0	0
ANNELIDA	*Eulalia viridis*	7	0	0	0	0	0
ANNELIDA	*Phyllodoce lamelligera*	4	0	0	0	0	0
ANNELIDA	*Glycera alba*	2	0	0	0	0	0
ANNELIDA	*Kefersteinia cirrata*	4	0	1	0	0	0
ANNELIDA	*Typosyllis prolifera*	0	0	18	0	0	0
ANNELIDA	*Exogone hebes*	2	0	0	0	0	0
ANNELIDA	*Exogone naidina*	1	0	0	0	0	0
ANNELIDA	*Hediste diversicolor*	15	0	0	0	0	0
ANNELIDA	*Neanthes fucata*	1	0	0	0	0	0
ANNELIDA	*Neanthes virens*	2	0	0	0	0	0
ANNELIDA	*Nereis caudata*	2	0	0	0	0	0
ANNELIDA	*Nereis pelagica*	0	0	0	3	0	0
ANNELIDA	*Nereis zonata*	0	0	11	0	0	0
ANNELIDA	*Perinereis cultrifera*	1	0	0	0	0	0
ANNELIDA	*Platynereis dumerilii*	1	0	2	0	0	0
ANNELIDA	*Nephtys caeca*	38	0	0	3	0	0
ANNELIDA	*Nephtys cirrosa*	15	0	0	0	0	0
ANNELIDA	*Nephtys hombergii*	20	0	0	0	0	0
ANNELIDA	*Marphysa bellii*	0	0	7	0	0	0

ANNELIDA	*Marphysa sanguinea*	3	0	0	2	0	0
ANNELIDA	*Lumbrineris funchalensis*	1	0	0	0	0	0
ANNELIDA	*Arabella iricolor*	0	0	1	0	0	0
ANNELIDA	*Drilonereis filum*	1	0	0	0	0	0
ANNELIDA	*Orbinia latreillii*	1	0	0	0	0	0
ANNELIDA	*Scoloplos armiger*	55	0	5	0	0	0
ANNELIDA	*Aricidea minuta*	1	0	0	0	0	0
ANNELIDA	*Aonides oxycephala*	1	0	0	0	0	0
ANNELIDA	*Boccardia polybranchia*	1	0	0	0	0	0
ANNELIDA	*Malacoceros fuliginosus*	2	0	0	0	0	0
ANNELIDA	*Microspio mecznikowianus*	1	0	0	0	0	0
ANNELIDA	*Polydora ciliata*	0	0	7	0	0	0
ANNELIDA	*Pygospio elegans*	11	0	0	0	0	0
ANNELIDA	*Scolelepis foliosa*	1	0	0	0	0	0
ANNELIDA	*Spio filicornis*	1	0	0	0	0	0
ANNELIDA	*Spio martinensis*	2	0	0	0	0	0
ANNELIDA	*Chaetopterus variopedatus*	4	0	0	0	0	0
ANNELIDA	*Caulleriella bioculata*	1	0	0	0	0	0
ANNELIDA	*Caulleriella zetlandica*	1	0	0	0	0	0
ANNELIDA	*Chaetozone setosa*	1	0	0	0	0	0
ANNELIDA	*Cirratulus cirratus*	2	0	2	0	0	0
ANNELIDA	*Cirratulus filiformis*	1	0	0	0	0	0
ANNELIDA	*Cirriformia tentaculata*	1	0	0	0	0	0
ANNELIDA	*Capitella capitata*	12	0	1	0	0	0
ANNELIDA	*Capitellides giardi*	1	0	0	0	0	0
ANNELIDA	*Notomastus latericeus*	8	0	0	2	0	0
ANNELIDA	*Notomastus (Clistomastus) lineatus*	1	0	0	0	0	0
ANNELIDA	*Notomastus profundus*	2	0	0	0	0	0
ANNELIDA	*Arenicola defodiens*	1	0	0	0	0	0
ANNELIDA	*Arenicola marina*	32	0	0	0	0	0
ANNELIDA	*Maldane sarsi*	11	0	1	1	0	0
ANNELIDA	*Clymenura leiopygos*	1	0	0	0	0	0
ANNELIDA	*Euclymene lumbricoides*	15	0	0	0	0	0
ANNELIDA	*Euclymene oerstedii*	7	0	0	0	0	0
ANNELIDA	*Heteroclymene robusta*	10	0	0	0	0	0
ANNELIDA	*Ophelia bicornis*	0	0	4	0	0	0
ANNELIDA	*Ophelia rathkei*	1	0	0	0	0	0
ANNELIDA	*Travisia forbesii*	1	0	0	0	0	0
ANNELIDA	*Galathowenia oculata*	4	0	0	0	0	0
ANNELIDA	*Owenia fusiformis*	13	0	0	0	0	0
ANNELIDA	*Raphidrilus nemasoma*	1	0	0	0	0	0
ANNELIDA	*Sabellaria spinulosa*	3	0	0	1	0	0
ANNELIDA	*Eupolymnia nebulosa*	3	0	0	0	0	0
ANNELIDA	*Eupolymnia nesidensis*	1	0	0	0	0	0
ANNELIDA	*Lanice conchilega*	256	0	31	8	0	1
ANNELIDA	*Polycirrus caliendrum*	0	0	1	0	0	0
ANNELIDA	*Bispira volutacornis*	50	1	23	3	5	5
ANNELIDA	*Chone infundibuliformis*	1	0	0	0	0	0
ANNELIDA	*Megalomma vesiculosum*	6	0	0	2	0	0
ANNELIDA	*Myxicola infundibulum*	1	0	17	0	0	0
ANNELIDA	*Pseudopotamilla reniformis*	0	0	0	0	1	0
ANNELIDA	*Sabella pavonina*	38	0	3	1	1	0
ANNELIDA	*Sabella spallanzanii*	17	0	0	0	0	0
ANNELIDA	*Pomatoceros lamarcki*	22	0	1	2	0	0
ANNELIDA	*Pomatoceros triqueter*	1	0	0	1	0	1
ANNELIDA	*Filograna implexa*	6	0	1	0	0	0

ANNELIDA	*Filogranula calyculata*	0	0	0	0	0	1
ANNELIDA	*Protula tubularia*	1	0	1	1	0	1
ANNELIDA	*Salmacina dysteri*	3	0	0	0	0	0
ANNELIDA	*Spirorbis corallinae*	1	0	1	1	0	0
ANNELIDA	*Spirorbis spirorbis*	112	0	3	5	1	0
ANNELIDA	*Clitellio arenarius*	8	0	0	0	0	0
ANNELIDA	*Tubificoides benedii*	16	0	0	0	0	0
ANNELIDA	*Tubificoides insularis*	1	0	0	0	0	0
ANNELIDA	*Tubificoides pseudogaster*	1	0	0	0	0	0
CHELICERATA	*Nymphon gracile*	4	0	0	0	0	0
CHELICERATA	*Achelia echinata*	1	0	0	0	0	0
CHELICERATA	*Halacarus actenos*	0	0	1	0	0	0
CHELICERATA	*Halacarus bisulcus*	0	0	0	1	0	0
MYRIAPODA	*Hydroschendyla submarina*	6	0	1	0	0	0
CRUSTACEA	*Euterpina acutifrons*	0	0	0	1	0	0
CRUSTACEA	*Verruca stroemia*	0	0	1	0	0	1
CRUSTACEA	*Chthamalus montagui*	147	0	14	27	0	0
CRUSTACEA	*Chthamalus stellatus*	3	0	0	4	0	0
CRUSTACEA	*Elminius modestus*	2	0	0	0	0	0
CRUSTACEA	*Semibalanus balanoides*	396	0	30	186	0	0
CRUSTACEA	*Balanus amphitrite*	1	0	0	0	0	0
CRUSTACEA	*Balanus balanus*	1	0	0	0	0	0
CRUSTACEA	*Balanus crenatus*	5	0	2	1	0	2
CRUSTACEA	*Balanus perforatus*	16	0	3	5	0	0
CRUSTACEA	*Boscia anglica*	1	0	0	0	0	0
CRUSTACEA	*Prionotoleberis norvegica*	1	0	0	0	0	0
CRUSTACEA	*Cytheropteron inornatum*	0	0	0	1	0	0
CRUSTACEA	*Aurila convexa*	0	0	0	1	0	0
CRUSTACEA	*Loxoconcha rhomboidea*	0	0	0	1	0	0
CRUSTACEA	*Cytherois fischeri*	0	0	0	1	0	0
CRUSTACEA	*Costa runcinata*	0	0	0	1	0	0
CRUSTACEA	*Nebalia bipes*	4	0	0	0	0	0
CRUSTACEA	*Siriella clausii*	1	0	0	0	0	0
CRUSTACEA	*Siriella jaltensis*	2	0	0	0	0	0
CRUSTACEA	*Schistomysis ornata*	7	0	0	0	0	0
CRUSTACEA	*Schistomysis spiritus*	2	0	0	0	0	0
CRUSTACEA	*Apherusa jurinei*	1	0	0	0	0	0
CRUSTACEA	*Synchelidium haplocheles*	15	0	1	0	0	0
CRUSTACEA	*Peltocoxa damnoniensis*	0	0	0	1	0	0
CRUSTACEA	*Leucothoe incisa*	7	0	1	0	0	0
CRUSTACEA	*Leucothoe spinicarpa*	6	0	2	0	0	0
CRUSTACEA	*Stenothoe monoculoides*	0	0	0	2	0	0
CRUSTACEA	*Orchestia gammarellus*	20	0	0	6	0	0
CRUSTACEA	*Talitrus saltator*	2	0	0	0	0	0
CRUSTACEA	*Urothoe elegans*	1	0	0	0	0	0
CRUSTACEA	*Urothoe marina*	10	0	1	0	0	0
CRUSTACEA	*Urothoe poseidonis*	9	0	0	0	0	0
CRUSTACEA	*Metaphoxus pectinatus*	1	0	0	0	0	0
CRUSTACEA	*Lysianassa ceratina*	2	0	0	0	0	0
CRUSTACEA	*Lysianassa plumosa*	1	0	0	0	0	0
CRUSTACEA	*Orchomene nana*	0	0	4	0	0	0
CRUSTACEA	*Atylus guttatus*	0	0	5	0	0	0
CRUSTACEA	*Atylus swammerdamei*	1	0	0	0	0	0
CRUSTACEA	*Atylus vedlomensis*	3	0	0	0	0	0
CRUSTACEA	*Dexamine spinosa*	1	0	1	2	0	0
CRUSTACEA	*Ampelisca brevicornis*	3	0	0	0	0	0
CRUSTACEA	*Ampelisca typica*	1	0	0	0	0	0
CRUSTACEA	*Bathyporeia elegans*	3	0	0	0	0	0

CRUSTACEA	*Bathyporeia guilliamsoniana*	19	0	0	0	0	0
CRUSTACEA	*Bathyporeia nana*	2	0	0	0	0	0
CRUSTACEA	*Bathyporeia pelagica*	9	0	0	0	0	0
CRUSTACEA	*Bathyporeia pilosa*	14	0	1	0	0	0
CRUSTACEA	*Bathyporeia sarsi*	3	0	0	0	0	0
CRUSTACEA	*Haustorius arenarius*	5	0	0	0	0	0
CRUSTACEA	*Gammarus locusta*	9	0	0	0	0	0
CRUSTACEA	*Gammarus oceanicus*	1	0	0	0	0	0
CRUSTACEA	*Megaluropus agilis*	2	0	0	0	0	0
CRUSTACEA	*Abludomelita gladiosa*	1	0	0	0	0	0
CRUSTACEA	*Cheirocratus intermedius*	1	0	0	0	0	0
CRUSTACEA	*Maera grossimana*	0	0	2	0	0	0
CRUSTACEA	*Melita palmata*	2	0	0	0	0	0
CRUSTACEA	*Sunamphithoe pelagica*	1	0	0	0	0	0
CRUSTACEA	*Microprotopus maculatus*	3	0	0	0	0	0
CRUSTACEA	*Jassa falcata*	1	0	0	0	0	0
CRUSTACEA	*Corophium arenarium*	8	0	0	0	0	0
CRUSTACEA	*Corophium bonnellii*	2	0	0	0	0	0
CRUSTACEA	*Corophium crassicorne*	1	0	0	0	0	0
CRUSTACEA	*Corophium sextonae*	1	0	0	1	0	0
CRUSTACEA	*Corophium volutator*	1	0	0	0	0	0
CRUSTACEA	*Laetmatophilus tuberculatus*	0	0	0	1	0	0
CRUSTACEA	*Caprella acanthifera*	0	0	0	1	0	0
CRUSTACEA	*Pariambus typicus*	1	0	0	0	0	0
CRUSTACEA	*Phtisica marina*	1	0	1	0	0	0
CRUSTACEA	*Gnathia maxillaris*	1	0	0	1	0	0
CRUSTACEA	*Cyathura carinata*	2	0	0	0	0	0
CRUSTACEA	*Anilocra frontalis*	5	0	1	0	0	0
CRUSTACEA	*Anilocra physodes*	0	0	0	0	0	1
CRUSTACEA	*Eurydice pulchra*	5	0	4	0	0	0
CRUSTACEA	*Dynamene bidentata*	2	0	0	3	0	0
CRUSTACEA	*Sphaeroma serratum*	17	0	3	0	0	0
CRUSTACEA	*Jaera albifrons*	3	0	1	0	0	0
CRUSTACEA	*Janira maculosa*	0	0	5	0	0	0
CRUSTACEA	*Idotea baltica*	1	0	0	0	0	0
CRUSTACEA	*Idotea granulosa*	2	0	0	0	0	0
CRUSTACEA	*Idotea linearis*	3	0	0	0	0	0
CRUSTACEA	*Idotea pelagica*	5	0	0	1	0	0
CRUSTACEA	*Ligia oceanica*	4	0	0	1	0	0
CRUSTACEA	*Armadillidium album*	9	3	0	3	0	0
CRUSTACEA	*Tanais dulongii*	1	0	0	0	0	0
CRUSTACEA	*Pseudoparatanais batei*	0	0	1	0	0	0
CRUSTACEA	*Pseudotanais mediterraneus*	0	0	0	0	1	0
CRUSTACEA	*Tanaissus lilljeborgi*	11	0	0	1	0	0
CRUSTACEA	*Apseudes latreillii*	19	0	11	0	0	0
CRUSTACEA	*Cumopsis fagei*	4	0	0	0	0	0
CRUSTACEA	*Cumopsis goodsiri*	14	0	0	0	0	0
CRUSTACEA	*Cumopsis longipes*	11	0	0	0	0	0
CRUSTACEA	*Bodotria scorpioides*	10	0	0	0	0	0
CRUSTACEA	*Eocuma dollfusi*	5	0	0	0	0	0
CRUSTACEA	*Iphinoe tenella*	1	0	0	0	0	0
CRUSTACEA	*Iphinoe trispinosa*	10	0	0	0	0	0
CRUSTACEA	*Pseudocuma longicornis*	13	0	0	0	0	0
CRUSTACEA	*Lamprops fasciata*	0	0	0	1	0	0
CRUSTACEA	*Palaemon serratus*	51	0	0	16	0	0
CRUSTACEA	*Periclimenes sagittifer*	5	0	0	0	0	0

CRUSTACEA	*Athanas nitescens*	17	0	0	4	0	0
CRUSTACEA	*Eualus occultus*	2	0	0	0	0	0
CRUSTACEA	*Hippolyte varians*	4	0	1	0	0	0
CRUSTACEA	*Thoralus cranchii*	1	0	0	0	0	0
CRUSTACEA	*Processa edulis crassipes*	3	0	0	0	0	0
CRUSTACEA	*Crangon crangon*	8	0	0	0	0	0
CRUSTACEA	*Philoceras trispinosus*	2	0	0	0	0	0
CRUSTACEA	*Homarus gammarus*	44	0	5	4	0	1
CRUSTACEA	*Callianassa subterranea*	0	0	2	0	0	0
CRUSTACEA	*Callianassa tyrrhena*	1	0	0	0	0	0
CRUSTACEA	*Upogebia deltaura*	3	0	0	0	0	0
CRUSTACEA	*Palinurus elephas*	2	0	0	0	0	1
CRUSTACEA	*Diogenes pugilator*	10	0	1	0	0	0
CRUSTACEA	*Anapagurus hyndmanni*	1	0	0	0	0	0
CRUSTACEA	*Pagurus bernhardus*	39	0	3	0	0	0
CRUSTACEA	*Pagurus cuanensis*	4	0	1	0	0	0
CRUSTACEA	*Pagurus prideaux*	3	1	1	1	0	0
CRUSTACEA	*Galathea dispersa*	3	0	0	0	0	0
CRUSTACEA	*Galathea intermedia*	1	0	0	0	0	0
CRUSTACEA	*Galathea squamifera*	52	0	1	5	0	0
CRUSTACEA	*Galathea strigosa*	3	0	0	0	0	1
CRUSTACEA	*Pisidia longicornis*	54	1	1	4	0	2
CRUSTACEA	*Porcellana platycheles*	111	0	3	14	0	0
CRUSTACEA	*Ebalia tumefacta*	1	0	0	0	0	0
CRUSTACEA	*Maja squinado*	42	6	5	4	0	2
CRUSTACEA	*Inachus dorsettensis*	1	1	0	0	0	0
CRUSTACEA	*Inachus phalangium*	7	0	2	0	0	0
CRUSTACEA	*Macropodia deflexa*	1	0	0	0	0	0
CRUSTACEA	*Macropodia rostrata*	1	1	0	0	0	0
CRUSTACEA	*Macropodia tenuirostris*	0	1	0	0	0	0
CRUSTACEA	*Pisa armata*	6	1	0	0	0	0
CRUSTACEA	*Pisa tetraodon*	9	0	0	1	0	0
CRUSTACEA	*Corystes cassivelaunus*	3	0	0	0	0	0
CRUSTACEA	*Thia scutellata*	5	0	0	0	0	0
CRUSTACEA	*Pirimela denticulata*	2	0	0	0	0	0
CRUSTACEA	*Cancer pagurus*	141	0	5	14	0	4
CRUSTACEA	*Liocarcinus depurator*	3	0	0	0	0	0
CRUSTACEA	*Liocarcinus holsatus*	0	1	0	0	0	0
CRUSTACEA	*Liocarcinus marmoreus*	2	0	0	0	0	0
CRUSTACEA	*Liocarcinus pusillus*	2	2	0	0	0	0
CRUSTACEA	*Liocarcinus vernalis*	1	0	0	2	0	0
CRUSTACEA	*Necora puber*	74	1	6	6	0	1
CRUSTACEA	*Carcinus maenas*	102	0	2	7	0	0
CRUSTACEA	*Pilumnus hirtellus*	44	0	1	7	0	0
CRUSTACEA	*Xantho hydrophilus*	1	0	0	0	0	0
CRUSTACEA	*Xantho incisus*	13	0	0	0	0	0
CRUSTACEA	*Xantho pilipes*	1	0	0	0	0	0
CRUSTACEA	*Hemigrapsus sanguineus*	4	0	0	0	0	0
HEXAPODA	*Axelsonia littoralis*	1	0	0	0	0	0
HEXAPODA	*Anurida maritima*	3	0	0	3	0	0
HEXAPODA	*Micralymma marinum*	0	0	3	0	0	0
MOLLUSCA	*Leptochiton scabridus*	1	0	0	0	0	0
MOLLUSCA	*Lepidochitona cinerea*	9	0	0	2	0	0
MOLLUSCA	*Tonicella rubra*	0	0	0	1	0	0
MOLLUSCA	*Acanthochitona crinitus*	25	0	2	0	0	0
MOLLUSCA	*Acanthochitona fascicularis*	18	0	0	0	0	0
MOLLUSCA	*Haliotis tuberculata*	73	0	0	6	0	0
MOLLUSCA	*Diodora graeca*	11	0	0	0	0	0

MOLLUSCA	*Emarginula rosea*	0	0	1	0	0	0
MOLLUSCA	*Tricolia pullus*	1	0	3	1	1	0
MOLLUSCA	*Calliostoma granulatum*	1	0	0	0	1	0
MOLLUSCA	*Calliostoma zizyphinum*	119	0	16	17	3	4
MOLLUSCA	*Gibbula cineraria*	99	0	16	13	1	0
MOLLUSCA	*Gibbula magus*	32	0	4	3	0	0
MOLLUSCA	*Gibbula pennanti*	180	0	9	25	0	0
MOLLUSCA	*Gibbula tumida*	1	0	0	0	0	0
MOLLUSCA	*Gibbula umbilicalis*	241	0	9	57	0	0
MOLLUSCA	*Jujubinus exasperatus*	1	0	0	1	0	0
MOLLUSCA	*Jujubinus striatus*	3	0	0	0	0	0
MOLLUSCA	*Osilinus lineatus*	233	0	27	117	0	0
MOLLUSCA	*Dikoleps pusilla*	1	0	0	0	0	0
MOLLUSCA	*Tectura virginea*	1	0	0	0	0	0
MOLLUSCA	*Helcion pellucidum*	14	0	0	4	1	0
MOLLUSCA	*Patella depressa*	57	0	1	6	0	0
MOLLUSCA	*Patella ulyssiponensis*	12	0	0	2	0	0
MOLLUSCA	*Patella vulgata*	737	0	43	218	0	0
MOLLUSCA	*Bittium reticulatum*	1	0	0	0	0	0
MOLLUSCA	*Littorina littorea*	18	0	0	1	0	0
MOLLUSCA	*Littorina mariae*	66	0	1	1	0	0
MOLLUSCA	*Littorina obtusata*	65	0	5	4	0	0
MOLLUSCA	*Littorina saxatilis*	156	0	8	48	0	0
MOLLUSCA	*Melarhaphe neritoides*	4	0	0	1	0	0
MOLLUSCA	*Eatonina fulgida*	0	0	0	1	0	0
MOLLUSCA	*Alvania beanii calathus*	0	0	0	2	0	0
MOLLUSCA	*Alvania semistriata*	1	0	0	0	0	0
MOLLUSCA	*Cingula cingillus*	6	0	0	0	0	0
MOLLUSCA	*Onoba semicostata*	1	0	0	0	0	0
MOLLUSCA	*Pusillina inconspicua*	0	0	0	1	0	0
MOLLUSCA	*Pusillina sarsi*	1	0	0	0	0	0
MOLLUSCA	*Rissoa interrupta*	0	0	0	1	0	0
MOLLUSCA	*Rissoa parva*	2	0	0	1	1	1
MOLLUSCA	*Setia pulcherrima*	1	0	0	0	0	0
MOLLUSCA	*Caecum glabrum*	1	0	0	0	0	0
MOLLUSCA	*Calyptraea chinensis*	3	0	2	0	0	0
MOLLUSCA	*Crepidula fornicata*	116	3	20	3	0	0
MOLLUSCA	*Trivia arctica*	34	0	2	0	1	0
MOLLUSCA	*Trivia monacha*	15	0	1	2	0	0
MOLLUSCA	*Lamellaria latens*	4	0	1	0	0	0
MOLLUSCA	*Lamellaria perspicua*	4	0	0	0	0	0
MOLLUSCA	*Euspira catena*	1	0	0	0	0	0
MOLLUSCA	*Euspira nitida*	3	0	1	0	0	0
MOLLUSCA	*Epitonium clathrus*	1	0	0	0	0	0
MOLLUSCA	*Nucella lapillus*	244	0	9	54	0	0
MOLLUSCA	*Ocenebra erinacea*	52	0	5	13	2	2
MOLLUSCA	*Ocinebrina aciculata*	28	0	1	0	0	0
MOLLUSCA	*Buccinum undatum*	24	2	2	0	0	0
MOLLUSCA	*Chauvetia brunnea*	6	0	1	1	0	0
MOLLUSCA	*Hinia pygmaea*	2	0	1	0	0	1
MOLLUSCA	*Hinia reticulata*	103	1	10	9	0	2
MOLLUSCA	*Rissoella diaphana*	2	0	0	1	0	0
MOLLUSCA	*Liostomia clavula*	6	0	0	0	0	0
MOLLUSCA	*Retusa obtusa*	3	0	0	0	0	0
MOLLUSCA	*Elysia viridis*	1	0	0	0	0	0
MOLLUSCA	*Hermaea variopicta*	2	0	0	0	0	0
MOLLUSCA	*Aplysia depilans*	1	0	0	0	0	0
MOLLUSCA	*Aplysia fasciata*	2	0	1	0	0	0

MOLLUSCA	*Aplysia punctata*	67	1	14	21	2	3
MOLLUSCA	*Berthella plumula*	24	0	0	0	0	0
MOLLUSCA	*Berthellina citrina*	3	0	0	0	0	0
MOLLUSCA	*Pleurobranchus membranicus*	0	1	0	0	0	0
MOLLUSCA	*Tritonia lineata*	1	0	0	0	0	0
MOLLUSCA	*Tritonia nilsodhneri*	0	0	0	0	0	1
MOLLUSCA	*Trapania pallida*	1	0	0	0	0	0
MOLLUSCA	*Acanthodoris pilosa*	0	0	1	0	0	0
MOLLUSCA	*Crimora papillata*	2	0	0	0	0	0
MOLLUSCA	*Polycera faeroensis*	6	0	1	1	0	1
MOLLUSCA	*Polycera quadrilineata*	1	0	0	0	0	0
MOLLUSCA	*Limacia clavigera*	4	0	0	0	1	0
MOLLUSCA	*Archidoris pseudoargus*	23	1	2	0	1	0
MOLLUSCA	*Jorunna tomentosa*	3	0	0	0	0	0
MOLLUSCA	*Facelina auriculata*	0	0	1	0	0	0
MOLLUSCA	*Aeolidia papillosa*	2	0	0	0	0	0
MOLLUSCA	*Aeolidiella alderi*	3	0	0	0	0	0
MOLLUSCA	*Aeolidiella glauca*	1	0	0	0	0	0
MOLLUSCA	*Auriculinella bidentata*	3	0	0	0	0	0
MOLLUSCA	*Glycymeris glycymeris*	36	0	0	11	0	0
MOLLUSCA	*Modiolula phaseolina*	0	0	1	2	0	0
MOLLUSCA	*Modiolus barbatus*	1	0	0	0	0	0
MOLLUSCA	*Mytilus edulis*	21	0	0	0	0	0
MOLLUSCA	*Musculus discors*	0	0	0	1	0	0
MOLLUSCA	*Rhomboidella prideauxi*	0	0	0	0	0	1
MOLLUSCA	*Crassostrea gigas*	118	0	17	4	0	0
MOLLUSCA	*Ostrea edulis*	16	0	3	2	0	2
MOLLUSCA	*Aequipecten opercularis*	10	2	8	0	0	0
MOLLUSCA	*Talochlamys pusio*	2	0	0	0	0	0
MOLLUSCA	*Chlamys varia*	33	0	3	1	0	0
MOLLUSCA	*Pecten maximus*	36	1	15	5	2	3
MOLLUSCA	*Anomia ephippium*	1	0	0	0	0	0
MOLLUSCA	*Heteranomia squamula*	1	0	0	0	0	0
MOLLUSCA	*Loripes lucinalis*	3	0	0	0	0	0
MOLLUSCA	*Lasaea adansoni*	7	0	0	2	0	0
MOLLUSCA	*Acanthocardia tuberculata*	2	0	0	0	0	0
MOLLUSCA	*Cerastoderma edule*	146	3	0	3	0	0
MOLLUSCA	*Laevicardium crassum*	10	0	0	2	0	0
MOLLUSCA	*Parvicardium minimum*	1	0	0	0	0	0
MOLLUSCA	*Parvicardium ovale*	1	0	0	0	0	0
MOLLUSCA	*Lutraria angustior*	7	0	0	1	0	0
MOLLUSCA	*Lutraria lutraria*	3	0	0	0	0	0
MOLLUSCA	*Mactra glauca*	3	0	0	1	0	0
MOLLUSCA	*Spisula solida*	13	0	0	4	0	0
MOLLUSCA	*Solen marginatus*	7	0	0	0	0	0
MOLLUSCA	*Ensis arcuatus*	64	0	0	7	0	0
MOLLUSCA	*Ensis ensis*	3	0	0	1	0	0
MOLLUSCA	*Arcopagia crassa*	3	0	0	0	0	0
MOLLUSCA	*Macoma balthica*	4	0	0	0	0	0
MOLLUSCA	*Donax variegatus*	0	0	0	4	0	0
MOLLUSCA	*Gari depressa*	1	0	0	0	0	0
MOLLUSCA	*Abra alba*	2	0	0	0	0	0
MOLLUSCA	*Abra tenuis*	6	0	0	0	0	0
MOLLUSCA	*Scrobicularia plana*	2	0	0	0	0	0
MOLLUSCA	*Arctica islandica*	1	0	0	0	0	0
MOLLUSCA	*Circomphalus casina*	1	0	0	0	0	0
MOLLUSCA	*Clausinella fasciata*	9	0	0	0	0	0

MOLLUSCA	*Dosinia exoleta*	2	0	0	0	0	0
MOLLUSCA	*Tapes aureus*	5	0	0	0	0	0
MOLLUSCA	*Tapes decussatus*	1	0	0	0	0	0
MOLLUSCA	*Tapes philippinarum*	5	0	0	0	0	0
MOLLUSCA	*Tapes rhomboides*	29	0	1	2	0	0
MOLLUSCA	*Timoclea ovata*	1	0	0	0	0	0
MOLLUSCA	*Venus verrucosa*	35	0	3	10	0	3
MOLLUSCA	*Turtonia minutum*	2	0	0	0	0	0
MOLLUSCA	*Mya truncata*	1	0	0	0	0	0
MOLLUSCA	*Pandora inaequivalvis*	4	0	0	0	0	0
MOLLUSCA	*Sepia officinalis*	12	2	6	2	0	5
MOLLUSCA	*Sepiola atlantica*	4	0	0	2	0	0
MOLLUSCA	*Loligo vulgaris*	2	0	0	0	0	0
BRACHIOPODA	*Argyrotheca cistellula*	0	0	0	0	0	1
BRYOZOA	*Filicrisia geniculata*	1	0	0	0	0	0
BRYOZOA	*Crisidia cornuta*	0	0	0	1	0	0
BRYOZOA	*Crisia denticulata*	2	0	0	1	0	0
BRYOZOA	*Disporella hispida*	4	0	0	0	0	0
BRYOZOA	*Alcyonidium diaphanum*	25	2	6	2	5	4
BRYOZOA	*Alcyonidium gelatinosum*	1	0	0	0	0	0
BRYOZOA	*Flustrellidra hispida*	2	0	2	1	0	0
BRYOZOA	*Vesicularia spinosa*	5	0	0	0	0	2
BRYOZOA	*Amathia guernseii*	1	0	0	0	0	0
BRYOZOA	*Amathia lendigera*	5	0	0	0	0	0
BRYOZOA	*Bowerbankia citrina*	1	0	0	0	1	0
BRYOZOA	*Scruparia ambigua*	1	0	0	0	0	0
BRYOZOA	*Membranipora membranacea*	17	0	2	3	0	0
BRYOZOA	*Electra pilosa*	17	0	5	5	1	2
BRYOZOA	*Flustra foliacea*	13	1	3	1	0	2
BRYOZOA	*Chartella papyracea*	1	0	1	0	0	0
BRYOZOA	*Cauloramphus spiniferum*	1	0	0	0	0	0
BRYOZOA	*Amphiblestrum auritum*	1	0	0	0	0	0
BRYOZOA	*Bugula flabellata*	2	0	1	0	0	0
BRYOZOA	*Bugula neritina*	1	0	0	0	0	0
BRYOZOA	*Bugula plumosa*	19	1	5	0	4	2
BRYOZOA	*Bicellariella ciliata*	2	1	0	1	0	0
BRYOZOA	*Caberea boryi*	2	0	0	0	0	0
BRYOZOA	*Scrupocellaria reptans*	2	0	0	0	0	0
BRYOZOA	*Scrupocellaria scrupea*	0	0	0	1	0	0
BRYOZOA	*Tricellaria inopinata*	1	0	0	0	0	0
BRYOZOA	*Setosella vulnerata*	0	0	0	0	0	1
BRYOZOA	*Puellina innominata*	0	0	0	0	0	1
BRYOZOA	*Escharoides coccinea*	10	0	1	0	0	0
BRYOZOA	*Escharella ventricosa*	0	0	0	0	0	1
BRYOZOA	*Reptadeonella violacea*	1	0	0	0	0	0
BRYOZOA	*Watersipora subtorquata*	60	0	0	0	0	0
BRYOZOA	*Cryptosula pallasiana*	2	0	1	0	0	0
BRYOZOA	*Pentapora foliacea*	9	0	0	3	0	4
BRYOZOA	*Schizoporella unicornis*	30	0	0	11	0	0
BRYOZOA	*Cellepora pumicosa*	2	0	2	0	0	1
BRYOZOA	*Omalosecosa ramulosa*	0	0	0	0	0	1
ECHINODERMATA	*Luidia ciliaris*	0	0	3	0	0	0
ECHINODERMATA	*Asterina gibbosa*	96	0	4	8	4	1
ECHINODERMATA	*Asterina phylactica*	9	0	0	1	0	0
ECHINODERMATA	*Anseropoda placenta*	0	1	0	0	0	0
ECHINODERMATA	*Hymenaster pellucidus*	7	3	0	2	0	0
ECHINODERMATA	*Crossaster papposus*	1	0	0	0	0	0
ECHINODERMATA	*Henricia oculata*	0	0	0	0	0	2

ECHINODERMATA	*Marthasterias glacialis*	2	0	0	0	0	0
ECHINODERMATA	*Ophiothrix fragilis*	3	0	0	0	0	1
ECHINODERMATA	*Ophiocomina nigra*	0	0	1	0	0	0
ECHINODERMATA	*Amphiura brachiata*	3	0	0	0	0	0
ECHINODERMATA	*Amphiura denticulata*	1	0	0	1	0	0
ECHINODERMATA	*Amphipholis squamata*	24	0	7	0	1	0
ECHINODERMATA	*Ophiura albida*	6	0	1	0	0	0
ECHINODERMATA	*Ophiura ophiura*	3	0	0	0	0	0
ECHINODERMATA	*Psammechinus miliaris*	7	0	0	0	0	1
ECHINODERMATA	*Echinus esculentus*	1	0	1	0	0	0
ECHINODERMATA	*Neopentadactyla mixta*	6	0	6	1	0	1
ECHINODERMATA	*Pawsonia saxicola*	5	0	0	0	0	1
ECHINODERMATA	*Aslia lefevrei*	2	0	1	1	0	1
ECHINODERMATA	*Leptosynapta cruenta*	3	0	0	1	0	0
ECHINODERMATA	*Leptosynapta gallienii*	5	0	0	0	0	0
ECHINODERMATA	*Rhabdomolgus ruber*	2	0	0	0	0	0
HEMICHORDATA	*Saccoglossus ruber*	0	0	1	0	0	0
CHORDATA	*Clavelina lepadiformis*	6	0	3	1	1	3
CHORDATA	*Clavelina nana*	2	0	0	0	1	0
CHORDATA	*Pycnoclavella aurilucens*	1	0	2	1	1	1
CHORDATA	*Pycnoclavella stolonialis*	2	0	1	0	0	2
CHORDATA	*Archidistoma productum*	2	1	0	0	2	0
CHORDATA	*Polyclinum aurantium*	1	0	1	0	0	0
CHORDATA	*Morchellium argus*	24	0	1	3	0	4
CHORDATA	*Aplidium elegans*	0	0	1	0	1	2
CHORDATA	*Sidnyum turbinatum*	4	0	1	0	1	1
CHORDATA	*Aplidium proliferum*	1	0	0	0	0	0
CHORDATA	*Aplidium punctum*	11	1	1	0	2	3
CHORDATA	*Trididemnum tenerum*	1	0	0	0	0	0
CHORDATA	*Didemnum maculosum*	4	0	1	0	0	0
CHORDATA	*Polysyncraton lacazei*	1	0	0	0	0	3
CHORDATA	*Diplosoma listerianum*	4	0	0	1	0	0
CHORDATA	*Diplosoma spongiforme*	0	0	1	0	1	0
CHORDATA	*Lissoclinum perforatum*	14	0	2	1	2	1
CHORDATA	*Ciona intestinalis*	35	0	0	4	0	0
CHORDATA	*Diazona violacea*	1	0	0	0	0	0
CHORDATA	*Perophora japonica*	2	0	0	0	1	0
CHORDATA	*Perophora listeri*	1	0	0	0	0	0
CHORDATA	*Corella eumyota*	1	0	0	0	0	0
CHORDATA	*Corella parallelogramma*	2	0	0	0	0	1
CHORDATA	*Ascidiella aspersa*	10	0	2	0	1	1
CHORDATA	*Ascidiella scabra*	2	0	0	1	0	0
CHORDATA	*Ascidia conchilega*	0	0	1	0	0	0
CHORDATA	*Ascidia mentula*	30	1	6	7	7	1
CHORDATA	*Ascidia virginea*	0	1	0	0	0	0
CHORDATA	*Phallusia mammillata*	25	0	0	0	0	1
CHORDATA	*Styela clava*	34	1	5	1	0	1
CHORDATA	*Polycarpa pomaria*	1	0	0	0	0	0
CHORDATA	*Polycarpa scuba*	2	0	1	0	1	0
CHORDATA	*Dendrodoa grossularia*	13	0	1	2	2	4
CHORDATA	*Distomus variolosus*	3	0	2	0	1	0
CHORDATA	*Stolonica socialis*	17	0	6	2	3	3
CHORDATA	*Botryllus schlosseri*	76	1	34	8	2	2
CHORDATA	*Botrylloides diegensis*	1	0	0	0	0	0
CHORDATA	*Botrylloides leachi*	15	1	1	0	0	0
CHORDATA	*Botrylloides violaceus*	6	0	0	0	0	0
CHORDATA	*Oikopleura dioica*	1	0	1	1	0	0
CHORDATA	*Scyliorhinus canicula*	25	3	9	6	1	4

CHORDATA	*Scyliorhinus stellaris*	1	0	0	1	0	2
CHORDATA	*Galeorhinus galeus*	0	0	0	1	0	0
CHORDATA	*Mustelus asterias*	2	0	0	0	0	0
CHORDATA	*Mustelus mustelus*	2	0	0	0	0	0
CHORDATA	*Etmopterus spinax*	4	0	0	0	0	0
CHORDATA	*Torpedo marmorata*	4	0	0	1	0	0
CHORDATA	*Torpedo nobiliana*	2	0	0	0	0	0
CHORDATA	*Raja brachyura*	4	0	0	0	0	0
CHORDATA	*Raja clavata*	1	0	1	0	0	0
CHORDATA	*Raja undulata*	10	2	0	0	0	0
CHORDATA	*Dasyatis pastinaca*	5	0	0	0	0	0
CHORDATA	*Anguilla anguilla*	2	0	0	0	0	0
CHORDATA	*Conger conger*	2	0	0	1	1	1
CHORDATA	*Apletodon dentatus*	9	0	0	0	0	0
CHORDATA	*Diplecogaster bimaculata*	5	0	0	1	0	0
CHORDATA	*Lepadogaster candollei*	3	0	0	0	0	0
CHORDATA	*Lepadogaster lepadogaster*	8	0	0	0	0	0
CHORDATA	*Lepadogaster purpurea*	1	0	0	0	0	0
CHORDATA	*Ciliata mustela*	3	0	0	0	0	0
CHORDATA	*Gaidropsarus mediterraneus*	3	0	0	0	0	0
CHORDATA	*Gaidropsarus vulgaris*	2	0	0	0	0	0
CHORDATA	*Molva molva*	1	0	0	0	0	0
CHORDATA	*Pollachius pollachius*	26	0	7	7	4	4
CHORDATA	*Trisopterus luscus*	14	0	2	5	1	2
CHORDATA	*Trisopterus minutus*	1	1	0	1	1	0
CHORDATA	*Belone belone*	0	0	0	1	0	0
CHORDATA	*Atherina presbyter*	7	0	0	0	0	0
CHORDATA	*Zeus faber*	4	0	0	0	0	0
CHORDATA	*Gasterosteus aculeatus*	1	0	0	0	0	0
CHORDATA	*Spinachia spinachia*	1	0	0	0	0	0
CHORDATA	*Entelurus aequoreus*	4	0	0	0	0	0
CHORDATA	*Nerophis lumbriciformis*	3	0	0	1	0	0
CHORDATA	*Syngnathus acus*	2	1	0	0	0	0
CHORDATA	*Syngnathus rostellatus*	2	0	0	0	0	0
CHORDATA	*Aspitrigla cuculus*	2	0	0	0	0	0
CHORDATA	*Trigla lucerna*	1	0	0	0	0	0
CHORDATA	*Trigloporus lastoviza*	0	1	0	0	0	0
CHORDATA	*Myoxocephalus scorpius*	2	0	0	0	0	0
CHORDATA	*Taurulus bubalis*	3	0	1	0	0	0
CHORDATA	*Cyclopterus lumpus*	2	0	0	0	0	0
CHORDATA	*Liparis montagui*	2	0	0	0	0	0
CHORDATA	*Dicentrarchus labrax*	5	0	0	7	0	0
CHORDATA	*Spondyliosoma cantharus*	3	2	1	2	0	0
CHORDATA	*Mullus surmuletus*	1	0	0	0	0	1
CHORDATA	*Chelon labrosus*	4	0	0	0	0	0
CHORDATA	*Centrolabrus exoletus*	5	0	0	3	1	2
CHORDATA	*Crenilabrus bailloni*	5	1	1	2	1	1
CHORDATA	*Symphodus melops*	35	0	7	3	2	2
CHORDATA	*Ctenolabrus rupestris*	30	0	7	6	2	4
CHORDATA	*Labrus bergylta*	45	0	8	7	3	4
CHORDATA	*Labrus mixtus*	14	0	4	12	3	5
CHORDATA	*Blennius ocellaris*	1	1	0	0	0	0
CHORDATA	*Lipophrys pholis*	26	0	0	4	0	0
CHORDATA	*Parablennius gattorugine*	28	0	2	4	2	3
CHORDATA	*Tripterygion delaisi*	7	0	1	1	1	1
CHORDATA	*Pholis gunnellus*	1	0	0	0	0	0
CHORDATA	*Ammodytes marinus*	0	0	0	0	0	1

CHORDATA	*Ammodytes tobianus*	3	0	1	9	0	0
CHORDATA	*Hyperoplus lanceolatus*	1	0	1	3	0	0
CHORDATA	*Callionymus lyra*	17	2	12	1	1	1
CHORDATA	*Callionymus reticulatus*	11	0	4	3	0	0
CHORDATA	*Gobius cobitis*	5	0	0	0	0	0
CHORDATA	*Gobius niger*	10	0	5	0	0	0
CHORDATA	*Gobius paganellus*	13	0	2	0	0	0
CHORDATA	*Gobiusculus flavescens*	8	0	0	1	0	0
CHORDATA	*Lebetus guilleti*	1	0	1	0	0	0
CHORDATA	*Pomatoschistus microps*	2	0	1	1	0	0
CHORDATA	*Pomatoschistus minutus*	3	0	41	2	0	0
CHORDATA	*Pomatoschistus pictus*	10	0	5	5	0	0
CHORDATA	*Thorogobius ephippiatus*	8	0	1	3	0	4
CHORDATA	*Scomber scombrus*	1	0	1	1	0	0
CHORDATA	*Phrynorhombus regius*	2	0	0	0	0	0
CHORDATA	*Zeugopterus punctatus*	10	0	0	2	0	0
CHORDATA	*Microstomus kitt*	1	0	0	0	0	0
CHORDATA	*Pleuronectes platessa*	10	0	0	0	0	0
CHORDATA	*Buglossidium luteum*	1	0	0	0	0	0
CHORDATA	*Solea solea*	8	3	0	0	0	0
CHORDATA	*Mola mola*	3	0	1	0	0	0
CHORDATA	*Halichoerus grypus*	0	0	0	3	0	0
CHORDATA	*Tursiops truncatus*	193	28	75	34	0	1
CHORDATA	*Phocoena phocoena*	1	0	0	0	0	0
BACILLARIOPHYTA	*Thalassiosira constricta*	0	0	1	0	0	0
BACILLARIOPHYTA	*Thalassiosira eccentrica*	0	0	0	3	0	0
BACILLARIOPHYTA	*Thalassiosira gravida*	0	0	1	0	0	0
BACILLARIOPHYTA	*Corethron pennatum*	0	0	0	1	0	0
BACILLARIOPHYTA	*Paralia sulcata*	0	0	2	1	0	1
BACILLARIOPHYTA	*Coscinodiscus wailesii*	1	0	0	0	0	0
BACILLARIOPHYTA	*Actinocyclus octonarius ralfsii*	4	0	0	1	0	0
BACILLARIOPHYTA	*Actinoptychus senarius*	1	0	0	2	0	0
BACILLARIOPHYTA	*Odontella sinensis*	1	0	0	0	0	0
BACILLARIOPHYTA	*Trieres regia*	1	1	0	0	0	0
BACILLARIOPHYTA	*Biddulphia alternans*	2	0	0	0	0	0
BACILLARIOPHYTA	*Cerataulina pelagica*	0	0	0	1	0	0
BACILLARIOPHYTA	*Helicotheca tamesis*	2	1	0	2	0	0
BACILLARIOPHYTA	*Guinardia flaccida*	2	0	1	0	0	1
BACILLARIOPHYTA	*Guinardia striata*	0	0	0	0	0	1
BACILLARIOPHYTA	*Rhizosolenia setigera*	2	0	1	2	0	0
BACILLARIOPHYTA	*Rhizosolenia styliformis*	1	0	0	0	0	0
BACILLARIOPHYTA	*Chaetoceros densus*	1	0	0	0	0	1
BACILLARIOPHYTA	*Chaetoceros socialis*	0	1	0	0	0	0
BACILLARIOPHYTA	*Licmophora abbreviata*	1	0	0	0	0	0
BACILLARIOPHYTA	*Navicula lyra*	1	0	0	0	0	0
BACILLARIOPHYTA	*Pleurosigma normanii*	1	0	0	1	0	0
BACILLARIOPHYTA	*Bacillaria paxillifer*	0	0	0	2	0	0
OCHROPHYTA	*Ectocarpus siliculosus*	1	0	0	5	0	0
OCHROPHYTA	*Pylaiella littoralis*	16	0	0	9	0	0
OCHROPHYTA	*Dictyosiphon foeniculaceus*	6	0	0	0	0	0
OCHROPHYTA	*Asperococcus bullosus*	17	0	0	1	0	0
OCHROPHYTA	*Asperococcus fistulosus*	3	0	0	0	0	0
OCHROPHYTA	*Colpomenia peregrina*	82	0	4	7	0	0
OCHROPHYTA	*Petalonia fascia*	8	0	0	8	0	0
OCHROPHYTA	*Chordaria flagelliformis*	9	0	0	6	0	0
OCHROPHYTA	*Leathesia difformis*	2	0	0	0	0	0
OCHROPHYTA	*Stilophora tenella*	0	0	0	1	0	0

OCHROPHYTA	*Zanardinia typus*	0	0	1	0	0	0
OCHROPHYTA	*Cladostephus spongiosus*	64	0	4	6	0	0
OCHROPHYTA	*Halopteris filicina*	8	0	0	0	1	2
OCHROPHYTA	*Stypocaulon scoparium*	26	0	0	2	0	0
OCHROPHYTA	*Dictyopteris polypodioides*	22	0	26	9	1	2
OCHROPHYTA	*Dictyota dichotoma*	64	0	139	7	3	5
OCHROPHYTA	*Dictyota spiralis*	2	0	0	1	0	0
OCHROPHYTA	*Padina pavonica*	1	0	0	0	0	0
OCHROPHYTA	*Taonia atomaria*	5	0	3	1	0	0
OCHROPHYTA	*Carpomitra costata*	0	0	0	1	0	0
OCHROPHYTA	*Sporochnus pedunculatus*	5	0	1	1	0	0
OCHROPHYTA	*Arthrocladia villosa*	2	0	4	0	0	0
OCHROPHYTA	*Desmarestia aculeata*	3	0	1	2	0	0
OCHROPHYTA	*Desmarestia ligulata*	15	0	3	3	2	1
OCHROPHYTA	*Desmarestia viridis*	6	0	2	0	0	0
OCHROPHYTA	*Alaria esculenta*	3	0	0	0	0	0
OCHROPHYTA	*Undaria pinnatifida*	29	0	0	0	0	0
OCHROPHYTA	*Chorda filum*	30	0	8	21	0	0
OCHROPHYTA	*Laminaria digitata*	78	0	1	75	0	0
OCHROPHYTA	*Laminaria hyperborea*	30	0	12	7	4	7
OCHROPHYTA	*Laminaria ochroleuca*	13	0	2	8	0	0
OCHROPHYTA	*Saccharina latissima*	42	0	1	18	0	0
OCHROPHYTA	*Saccorhiza polyschides*	28	0	3	2	1	0
OCHROPHYTA	*Bifurcaria bifurcata*	16	0	0	22	0	0
OCHROPHYTA	*Cystoseira baccata*	14	0	16	7	0	0
OCHROPHYTA	*Cystoseira foeniculacea*	12	0	0	9	0	0
OCHROPHYTA	*Cystoseira humilis myriophylloides*	14	0	0	0	0	0
OCHROPHYTA	*Cystoseira tamariscifolia*	41	0	0	10	0	0
OCHROPHYTA	*Halidrys siliquosa*	48	0	89	26	2	4
OCHROPHYTA	*Ascophyllum nodosum*	486	1	5	3	0	0
OCHROPHYTA	*Fucus serratus*	534	0	14	171	0	0
OCHROPHYTA	*Fucus spiralis*	133	0	11	20	0	0
OCHROPHYTA	*Fucus vesiculosus*	580	0	45	127	0	0
OCHROPHYTA	*Pelvetia canaliculata*	97	0	2	8	0	0
OCHROPHYTA	*Himanthalia elongata*	18	0	1	1	0	0
OCHROPHYTA	*Sargassum muticum*	355	1	31	105	0	0
GRACILICUTES	*Mastigocoleus testarum*	1	0	0	0	0	0
GRACILICUTES	*Rivularia bullata*	11	0	3	30	0	0
GRACILICUTES	*Coleofasciculus chthonoplastes*	1	0	0	0	0	0
RHODOPHYTA	*Porphyra dioica*	5	0	0	2	0	0
RHODOPHYTA	*Porphyra purpurea*	32	0	0	3	0	0
RHODOPHYTA	*Acrochaetium microscopica*	1	0	0	0	0	0
RHODOPHYTA	*Helminthocladia calvadosii*	11	0	0	0	0	0
RHODOPHYTA	*Helminthora divaricata*	0	0	12	0	0	0
RHODOPHYTA	*Asparagopsis armata*	9	0	2	1	0	0
RHODOPHYTA	*Bonnemaisonia asparagoides*	1	0	0	0	0	0
RHODOPHYTA	*Gelidium pusillum*	3	0	0	0	0	0
RHODOPHYTA	*Pterocladiella capillacea*	17	0	2	1	0	0
RHODOPHYTA	*Palmaria palmata*	36	0	1	84	0	0
RHODOPHYTA	*Rhodothamniella floridula*	57	0	6	5	0	0
RHODOPHYTA	*Ahnfeltia plicata*	14	0	3	1	0	0
RHODOPHYTA	*Hildenbrandia rubra*	0	0	0	1	0	0
RHODOPHYTA	*Corallina officinalis*	162	0	13	52	2	0
RHODOPHYTA	*Jania rubens*	40	0	2	4	0	0
RHODOPHYTA	*Lithophyllum incrustans*	81	0	6	29	0	0

RHODOPHYTA	*Lithothamnion corallioides*	9	9	0	0	0	0
RHODOPHYTA	*Mesophyllum lichenoides*	25	0	0	8	0	0
RHODOPHYTA	*Phymatolithon calcareum*	9	9	0	0	0	0
RHODOPHYTA	*Phymatolithon purpureum*	3	0	0	1	0	0
RHODOPHYTA	*Dermocorynus montagnei*	0	0	1	0	0	0
RHODOPHYTA	*Grateloupia filicina*	5	0	1	0	0	0
RHODOPHYTA	*Grateloupia subpectinata*	67	0	3	2	0	0
RHODOPHYTA	*Grateloupia turuturu*	23	0	0	1	0	0
RHODOPHYTA	*Polyopes lancifolius*	1	0	0	0	0	0
RHODOPHYTA	*Catenella caespitosa*	53	0	1	0	0	0
RHODOPHYTA	*Caulacanthus ustulatus*	3	0	0	0	0	0
RHODOPHYTA	*Calliblepharis ciliata*	18	1	105	8	2	1
RHODOPHYTA	*Calliblepharis jubata*	43	0	3	8	0	0
RHODOPHYTA	*Cystoclonium purpureum*	3	0	0	0	0	0
RHODOPHYTA	*Rhodophyllis divaricata*	1	0	0	0	0	0
RHODOPHYTA	*Dilsea carnosa*	22	0	23	6	3	0
RHODOPHYTA	*Dudresnaya verticillata*	0	0	2	0	0	0
RHODOPHYTA	*Dumontia contorta*	20	0	0	0	0	0
RHODOPHYTA	*Furcellaria lumbricalis*	95	0	70	31	0	1
RHODOPHYTA	*Halarachnion ligulatum*	4	0	10	0	0	0
RHODOPHYTA	*Chondracanthus acicularis*	71	0	0	9	0	0
RHODOPHYTA	*Chondrus crispus*	329	0	39	99	0	0
RHODOPHYTA	*Gigartina pistillata*	2	0	0	0	0	0
RHODOPHYTA	*Callophyllis laciniata*	2	0	1	1	0	0
RHODOPHYTA	*Meredithia microphylla*	10	0	3	3	1	2
RHODOPHYTA	*Ahnfeltiopsis devoniensis*	4	0	1	0	0	0
RHODOPHYTA	*Gymnogongrus crenulatus*	1	0	3	1	0	0
RHODOPHYTA	*Mastocarpus stellatus*	158	0	2	33	0	0
RHODOPHYTA	*Phyllophora crispa*	5	0	2	2	0	1
RHODOPHYTA	*Phyllophora pseudoceranoides*	3	0	1	2	0	1
RHODOPHYTA	*Phyllophora sicula*	0	0	1	0	0	0
RHODOPHYTA	*Schottera nicaeensis*	9	0	3	2	1	0
RHODOPHYTA	*Stenogramma interrupta*	0	0	1	1	0	0
RHODOPHYTA	*Polyides rotundus*	23	0	6	0	0	1
RHODOPHYTA	*Schizymenia dubyi*	2	0	0	0	0	0
RHODOPHYTA	*Solieria chordalis*	3	0	0	0	0	0
RHODOPHYTA	*Sphaerococcus coronopifolius*	4	0	5	2	0	0
RHODOPHYTA	*Gracilaria bursa-pastoris*	3	0	96	0	0	0
RHODOPHYTA	*Gracilaria gracilis*	16	0	1	1	0	0
RHODOPHYTA	*Gracilaria multipartita*	1	0	0	5	0	0
RHODOPHYTA	*Gracilaria vermiculophylla*	2	0	0	0	0	0
RHODOPHYTA	*Plocamium cartilagineum*	23	0	94	10	2	0
RHODOPHYTA	*Champia parvula*	10	0	0	0	0	0
RHODOPHYTA	*Chylocladia verticillata*	116	0	12	1	0	0
RHODOPHYTA	*Gastroclonium ovatum*	2	0	10	0	0	0
RHODOPHYTA	*Gastroclonium reflexum*	24	0	1	10	0	0
RHODOPHYTA	*Lomentaria articulata*	18	0	3	3	0	0
RHODOPHYTA	*Lomentaria clavellosa*	1	0	1	0	0	0
RHODOPHYTA	*Cordylecladia erecta*	1	0	4	1	0	0
RHODOPHYTA	*Rhodymenia ardissonei*	0	0	0	1	0	0
RHODOPHYTA	*Rhodymenia holmesii*	2	0	0	0	1	0
RHODOPHYTA	*Rhodymenia pseudopalmata*	2	0	0	1	0	0
RHODOPHYTA	*Aglaothamnion gallicum*	1	0	0	0	0	0
RHODOPHYTA	*Aglaothamnion hookeri*	1	0	0	0	0	0

RHODOPHYTA	*Antithamnionella ternifolia*	1	0	0	0	0	0
RHODOPHYTA	*Ceramium botryocarpum*	1	0	0	0	0	0
RHODOPHYTA	*Ceramium cimbricum*	0	0	0	1	0	0
RHODOPHYTA	*Ceramium virgatum*	13	0	0	1	0	0
RHODOPHYTA	*Ceramium pallidum*	1	0	0	0	0	0
RHODOPHYTA	*Ceramium secundatum*	1	0	0	0	0	0
RHODOPHYTA	*Ceramium shuttleworthianum*	2	0	0	1	0	0
RHODOPHYTA	*Griffithsia corallinoides*	2	0	1	0	0	0
RHODOPHYTA	*Halurus equisetifolius*	4	0	0	7	0	0
RHODOPHYTA	*Halurus flosculosus*	4	0	0	1	0	0
RHODOPHYTA	*Pterothamnion crispum*	1	0	0	0	0	0
RHODOPHYTA	*Pterothamnion plumula*	1	0	0	0	0	0
RHODOPHYTA	*Sphondylothamnion multifidum*	2	0	1	0	0	0
RHODOPHYTA	*Spyridia filamentosa*	14	0	1	0	0	0
RHODOPHYTA	*Heterosiphonia japonica*	1	0	0	0	0	0
RHODOPHYTA	*Heterosiphonia plumosa*	26	0	132	5	0	0
RHODOPHYTA	*Acrosorium ciliolatum*	6	1	5	3	0	1
RHODOPHYTA	*Apoglossum ruscifolium*	0	0	0	2	0	0
RHODOPHYTA	*Cryptopleura ramosa*	6	0	7	6	1	0
RHODOPHYTA	*Delesseria sanguinea*	8	0	7	4	2	0
RHODOPHYTA	*Drachiella heterocarpa*	0	0	0	1	0	0
RHODOPHYTA	*Drachiella spectabilis*	4	0	0	0	1	0
RHODOPHYTA	*Erythroglossum laciniatum*	0	0	0	0	1	0
RHODOPHYTA	*Hypoglossum hypoglossoides*	0	0	0	0	1	0
RHODOPHYTA	*Membranoptera alata*	1	0	0	1	0	0
RHODOPHYTA	*Nitophyllum punctatum*	0	0	61	0	0	0
RHODOPHYTA	*Phycodrys rubens*	2	0	1	0	0	0
RHODOPHYTA	*Radicilingua thysanorhizans*	1	0	0	0	0	0
RHODOPHYTA	*Boergeseniella fruticulosa*	138	0	9	52	0	0
RHODOPHYTA	*Brongniartella byssoides*	11	0	4	1	0	0
RHODOPHYTA	*Chondria capillaris*	44	0	0	0	0	0
RHODOPHYTA	*Chondria dasyphylla*	16	0	3	1	0	0
RHODOPHYTA	*Halopithys incurvus*	46	0	22	7	0	0
RHODOPHYTA	*Laurencia obtusa*	12	0	0	0	0	0
RHODOPHYTA	*Osmundea hybrida*	1	0	0	0	0	0
RHODOPHYTA	*Osmundea osmunda*	4	0	0	1	0	0
RHODOPHYTA	*Osmundea pinnatifida*	157	0	12	45	0	0
RHODOPHYTA	*Polysiphonia elongata*	3	0	0	0	0	0
RHODOPHYTA	*Polysiphonia fibrata*	1	0	0	0	0	0
RHODOPHYTA	*Polysiphonia fucoides*	4	0	104	1	0	0
RHODOPHYTA	*Polysiphonia harveyi*	7	0	0	2	0	0
RHODOPHYTA	*Vertebrata lanosa*	83	0	4	1	0	0
RHODOPHYTA	*Polysiphonia nigra*	25	0	1	4	0	0
RHODOPHYTA	*Polysiphonia stricta*	6	0	0	1	0	0
RHODOPHYTA	*Pterosiphonia parasitica*	0	0	2	0	0	0
RHODOPHYTA	*Rhodomela confervoides*	1	0	1	0	0	0
CHLOROPHYCOTA	*Prasiola stipitata*	4	0	0	2	0	0
CHLOROPHYCOTA	*Spongomorpha aeruginosa*	5	0	0	0	0	0
CHLOROPHYCOTA	*Acrosiphonia arcta*	5	0	7	4	0	0
CHLOROPHYCOTA	*Ulothrix flacca*	3	0	0	20	0	0
CHLOROPHYCOTA	*Blidingia chadefaudii*	2	0	0	0	0	0
CHLOROPHYCOTA	*Blidingia marginata*	8	0	0	5	0	0
CHLOROPHYCOTA	*Blidingia minima*	18	0	0	2	0	0
CHLOROPHYCOTA	*Ulva clathrata*	3	0	0	0	0	0

CHLOROPHYCOTA	*Ulva compressa*	61	0	1	13	0	0
CHLOROPHYCOTA	*Ulva intestinalis*	269	0	21	115	0	0
CHLOROPHYCOTA	*Ulva prolifera*	3	0	0	0	0	0
CHLOROPHYCOTA	*Ulva gigantea*	1	0	6	0	0	0
CHLOROPHYCOTA	*Ulva lactuca*	305	0	45	95	0	0
CHLOROPHYCOTA	*Ulva rigida*	33	0	0	1	0	0
CHLOROPHYCOTA	*Chaetomorpha linum*	6	0	0	1	0	0
CHLOROPHYCOTA	*Chaetomorpha ligustica*	1	0	0	0	0	0
CHLOROPHYCOTA	*Cladophora albida*	1	0	0	0	0	0
CHLOROPHYCOTA	*Cladophora pellucida*	3	0	1	2	0	0
CHLOROPHYCOTA	*Cladophora prolifera*	0	0	96	0	0	0
CHLOROPHYCOTA	*Cladophora rupestris*	156	0	13	32	0	0
CHLOROPHYCOTA	*Cladophora sericea*	11	0	0	0	0	0
CHLOROPHYCOTA	*Bryopsis plumosa*	5	1	1	0	0	0
CHLOROPHYCOTA	*Derbesia marina*	0	0	68	1	0	1
CHLOROPHYCOTA	*Codium bursa*	2	0	0	0	0	0
CHLOROPHYCOTA	*Codium fragile fragile*	33	0	0	1	0	0
CHLOROPHYCOTA	*Codium tomentosum*	52	0	6	45	0	0
CHLOROPHYCOTA	*Codium vermilara*	1	0	1	2	0	0
ANGIOSPERMOPHYTA	*Zostera marina*	42	1	1	11	0	0
ANGIOSPERMOPHYTA	*Zostera noltii*	259	0	0	0	0	0
ASCOMYCOTA	*Caloplaca marina*	2	0	0	0	0	0
ASCOMYCOTA	*Flavoparmelia caperata*	1	0	0	0	0	0
ASCOMYCOTA	*Lichina pygmaea*	123	0	5	47	0	0
ASCOMYCOTA	*Ramalina siliquosa*	6	0	0	0	0	0
ASCOMYCOTA	*Verrucaria mucosa*	68	0	2	35	0	0
ASCOMYCOTA	*Verrucaria maura*	106	0	6	27	0	0
ASCOMYCOTA	*Xanthoria parietina*	9	0	1	1	0	0

Appendix II – Habitat Map Methodology

A-II.1 – Intertidal Substrates

Prior to the JMSP there were no habitat maps covering the whole of Jersey's coastal region although detailed maps, created form fieldwork and GIS mapping, did exist for the principal offshore reefs at Les Ecrehous, Les Dirouilles, Les Minquiers and Paternosters (see Chambers *et al.* 2016; Chambers *et al.* 2019). The offshore reef mapping project used fieldwork and GPS positions to identify intertidal and shallow marine habitats (using the JNCC marine biotope classification) and, using GIS software and aerial images, locate and map the extent of individual habitats.

This project created detailed habitat maps for Jersey's network of offshore reefs (Chambers, Binney and Jeffreys, 2016; Chambers *et al.* 2019) but producing a similar map for Jersey's intertidal and shallow marine area proved problematic. Although the fieldwork was complete by 2018 (with 34,074 geolocated records), the range of habitats was greater than for the offshore reefs and seashore areas wider and more complex. Mapping habitats from survey data alone was time consuming and by 2020 it became clear that completion of a usable map could take several years.

Since 2006 (and sporadically beforehand) the Government of Jersey has commissioned an annual aerial image of the whole island which, when tide times and weather permit, includes the intertidal area at low water. These images cover the whole of Jersey's intertidal but also, where turbidity and light penetration permit, include subtidal imagery to a depth of up to five metres. The aerial images were orthorectified and processed into a single ECW file.

The imagery survey was by aeroplane and occurs on a single date usually during the summer months although some images have been taken during the spring and autumn. The stitched ECW images resolution is 20 cm (i.e. each pixel represents a 20 x 20 cm square) using three colour bands (red, green, blue) each with a colour value between 0 and 255.

In 2020 slow progress with the mapping of Jersey's intertidal habitats led to rethink about how the project's timescale could be advanced but without compromising on its objective of a high resolution, reliable map. Options included looking at remote monitoring and especially machine learning techniques which have the potential to autoclassify habitats from the aerial imagery.

Initial attempts at using Random Forest algorithms on government aerial images produced results that were less than ideal. Principal issues are variations in light conditions across the image (each aerial image requires a flight time of up to 120 minutes during which light conditions change) and the complex nature of seashore habitats. In particular, while some biotopes are readily identifiable at ground level, they may lack visual uniformity when viewed from the air. This, in combination with complex, gradational boundaries between habitats, created issues with the classification process and post-classification processing. With a survey area of over 37 km2, lengthy computer processing times and resultant file size were also an issue. An alternative methodology was sought.

Image Processing and Analysis

Rather than undertaking pixel orientated analyses of the whole aerial photograph, it was felt that issues around habitat variation, gradation and processing time could be overcome by focusing the analysis onto regular units, each covering a set area of seashore. Each unit would contain several hundred image pixels which would be analysed and then classified as a single habitat. Subdividing the images into regular units would, it was hoped, cut processing time and reduce issues around complex patterning and defining habitat boundaries.

This required finding a unit size that would be small enough be representative of a single habitat (i.e. each unit would not encompass several distinct habitats) but large enough to reduce processing time. Too small and the model would be unwieldy; too large and it would produce less accurate map. Balancing the need for accuracy and processing time was a matter of trial and error.

In the software QGIS (v3.16), grids of square polygons with side lengths of between 10 and 2 metres were imposed on selected intertidal areas within the aerial images. Eventually a grid with a square polygon length of 5 x 5 metres was chosen as this created a manageable number of polygons (4.3 million for a whole aerial photo) while still being sufficiently representative of the seashore habitats they encompassed.

Three aerial images were selected for analysis from the years 2003, 2018 and 2018. The 2003 image was selected as it was taken in March when seaweed cover is minimal. The other two images were taken in September and August respectively and were chosen because they were taken on large spring tides and were the latest images available. Each image has three colour bands available (red, green and blue); these were manually adjusted (using 'Band Rendering' in QGIS) prior to analysis in order to accentuate different habitat features. Obtaining the best colour balance was a matter of trial and error.

Using the QGIS 'Zonal Histogram' function, a count was made of the number of pixels relating to each colour value (between 0 and 255) inside each 5 x 5 metre square polygon; the total number of pixels per 5 x 5 metre polygon was 625. This provided information about the distribution of colour within each polygon. To this was appended the results of a basic statistical analysis for each polygon (using the QGIS 'Zonal Statistics' function) which obtained the following figures for the pixel colour values: mean, median, mode, maximum/minimum value, range and variance.

After this analysis each polygon had an attribute table with 266 columns which, with over 4 million polygons per aerial image, presented an issue with computer file sizes. To reduce the number of fields, the results from colour histogram analysis (which had a column for each pixel value from 0 to 255) were grouped into 26 bins based on class sizes of 10 (e.g. 0 to 9, 10 to 19, etc., with the final one being 250 to 255). This reduced the number of columns to be analysed from 266 to 33 decreasing the file size significantly.

To perform the machine learning, a 'training dataset' (i.e. a dataset that could be used to train the algorithm to recognise habitats) was created using forty separate intertidal areas within the image. This covered a collective area of 10.2 km2 with the areas being selected to represent a variety of seashore characteristics including: tidal height; substrate; vegetation cover; and exposure. It was expected that these areas would contain examples of the key habitats within Jersey's intertidal area. Within this area were 408,311 square polygons (each 5 x 5 metre) were extracted as a subset from the grid referred to earlier. These formed the training dataset to which polygons from the wider seashore area could be compared.

The polygon analysis results were imported into the statistical software R and a k-means cluster analysis was used to group the polygons based on the analysis of their colour properties. Several attempts were made for each image, varying the number of clusters (k) between 20 and 40. Both by looking for the 'elbow point' (where increasing k offers only marginal improvements) and by reimporting the results into QGIS and comparing them with the aerial image and the fieldwork data. From this the number of clusters was set at 30 (i.e. k = 30) with the results being used on each of the three aerial images to create a training dataset for that image.

In R a kNN 'machine learning' algorithm was used from the Class package to classify the 4.3 million square polygons by comparing their statistical properties with those in the training dataset. Each polygon was compared with the k-mean cluster analysis training dataset and, based on its closest match, assigned a single cluster number from 1 to 30. After trial and error, k (representing the number of nearest neighbours to be used in the analysis) was set at 465. The results for all three aerial images were reimported into QGIS.

High Resolution Habitat Classification

The process of identifying the 30 cluster numbers to JNCC biotopes was complex and required multiple stages of refinement. The raw dataset contained over 4.3 million polygons which, because the stitched aerial images extend offshore, included many that contained only sea. As the focus of this project is intertidal, any polygon in an area below chart datum (i.e. offshore) was excluded. The position of chart datum (which equals the lowest possible astronomical tide) was determined using a GIS file where the position of chart datum on Admiralty charts had been adjusted using fieldwork data.

Jersey has a tidal range of up to 12.2 metres and height above chart datum plays an important role in the distribution of species and habitats. In 2020 Jersey Heritage (a local NGO tasked with the conservation and promotion of Jersey's major historic and cultural sites) commissioned a LiDAR survey for the whole of the island. Although primarily undertaken for the evaluation of terrestrial archaeology, the survey had been scheduled to coincide with low water for a large spring tide. Jersey Heritage kindly made the LiDAR results available to this project which meant highly accurate height data could be added to the analysis.

As with the image colour analysis, for each 5 x 5 metre polygon within the LiDAR survey area was analysed in QGIS to obtain basic statistical height parameters such as mean, median, mode, maximum/minimum value, range and variance. Using the LiDAR data, any polygon with a mean height >15 metres above chart datum was classified as being terrestrial and excluded from the dataset while heights between 11.5 and 15 metres were classified as within the 'splash zone' and, while kept in the dataset, were not analysed further. This left 1.4 million polygons for each aerial image with accurate height information which could be combined with the colour analysis data.

Further processing was undertaken in QGIS with the objective of using the 30 clusters to identify characteristics that could be matched to a JNCC biotope code and so allow all polygons with that cluster number to be assigned the same JNCC code. This was done in stages.

The first stage identified whether the substrate inside each polygon was rock or sediment. This was achieved using a combination of polygon colour signature (rock generally averaging <100 and sediment >100) plus the range and variance parameters from the LiDAR data. A polygon LiDAR range <0.35 and variance >0.008 indicates rock. Within this the LiDAR range and variance could be used to identify the steepness and ruggedness of rock or the angle of slope for sediment. This process was able to separate areas that had a similar colour signature (such as dry sand and barren granitic rock) but different topographic properties (e.g. sand is less rugged than rock).

A second stage combined the rock and sediment information with the colour signature (as represented by the clusters) for each polygon to identify the degree of vegetation cover in an area and whether that vegetation was sub-aerially exposed or underwater.

In QGIS different combinations of the thirty clusters were combined to create 12 broadly descriptive habitat groups which included: rock with dense seaweed; bare/barnacle dominated rock; wet sand; dry sand; seagrass; vegetation underwater; and mixed sediment/seaweed. These cluster combinations were filtered across the three images so that each polygon could be assigned to a single broadly descriptive group based on a combination of data from the three aerial images.

This produced a basic, high level intertidal map with twelve generalised 'habitats' based on characteristics relating to substrate, vegetation cover and, in some cases, water cover (e.g. large rock pools). However, with the exception of intertidal seagrass meadows (*Zostera noltei*), high level JNCC biotope assignments could yet not made.

For rocky shores process and areas of mixed sediment and seaweed, the of assigning more specific JNCC codes required using LiDAR information that could be attached to 8,665 of the intertidal biotope identifications made during fieldwork for habitat mapping. Beginning at chart datum, Jersey's 12 metre tidal range was divided into 50 cm classes (0 to 50 cm; 50 cm to 1 metre, etc.) and for key biotope identifications, the number of records per height class was counted. This provided the vertical seashore range for the key biotopes and also an indication of abundance for each height class.

With seaweed dominated rocky and mixed sediment areas having already been identified, the vertical range of key seaweed species was calculated using 2 x standard deviations from the mean height. The species measured were: *Pelvetia canaliculata; Fucus spiralis; Fucus vesiculosus; Fucus serratus; Ascophyllum nodosum*; and *Chondrus crispsus/Mastocarpus stellatus*.

The analysis showed there is little overlap between the vertical ranges of all species with the exception of *Fucus vesiculosus* and *Ascophyllum nodosum* whose range is near identical. However, analysis of the fieldwork records against the density of seaweed cover suggested that areas with *Ascophyllum* had between 60 to 100% seaweed cover while *F. vesiculosus* would generally be less dense at <60%.

Those descriptive groups with subaerial seaweed cover (rock with dense seaweed; mixed sediment/seaweed) were filtered using the height range for each species. For *Ascophyllum* and *F. vesiculosus* the percentage of seaweed cover was also used. The polygons identified by filtering were assigned to new classes which were based on the dominant seaweed species. For example, the vertical range of F. serratus was determined to be between 1.8 and 3.4 metres above chart datum. Rock and mixed sediment habitats between this range where assigned to new classes represented, respectively, by LR.MLR.BF.Fser (*F. serratus* on moderately exposed lower eulittoral rock) or LR.LLR.F.Fserr.X (*F. serratus* on lower eulittoral mixed substrata).

The same analysis was performed on rocky habitats with little or no seaweed cover to obtain vertical ranges for biotopes dominated by lichen (yellow and orange splash zone species, *Verrucaria maura*) and barnacle species (Chthamalus, Semibalanus). Similarly, sediment habitats with no vegetation were classified into areas dominated by sandmason worms (LS.LSa.MuSa.Lan) and burrowing polychaetes (LS.LSa.FiSa.Po).

Although this methodology cannot fully represent the gradational nature of some seashore habitats (e.g. from *F. vesiculosus* to *F. serratus*), when compared to the field data, is seems to be no less representative than mapping by hand and certainly accurate enough for use in ecological and other studies.

With the processing and biotope assignment process completed, a period of ground-truthing was initiated. This involved comparing assigned habitat/biotopes to the field work data but also to the aerial images where some habitats (such as Verrucaria, Zostera and Sargassum dominated areas) may be readily identified by eye.

Where problems were identified, manual adjustments were made to polygon biotope assignments. However, in general terms, the semi-automatic mapping of habitats/biotopes using a combination of colour and LiDAR analyses was an accurate reflection of reality.

Issues did occur with sloping upper shore sand and shingle which, despite further processing, could not automatically be identified. the same was true of low gradient seashore areas dominated by boulders and light-coloured bedrock. Polygons in these areas were mapped manually using a combination of fieldwork data/photos and the aerial images. As the boundaries around Jersey's intertidal seagrass meadows may change considerably between years, the extent of this biotope was defined by the 2019 aerial image (the latest available).

Finally, there is ecological interest in the network of *Sargassum* dominated 'flooded gullies' on the island's south and west coasts as these occupy large areas of seashore with flowing seawater that may be metres deep in places. Although *Sargassum* dominated habitats were identifiable from the above analyses, it included the flooded gullies and large rock pools. To separate these, the flooded gullies were adjusted manually too.

At the end of this process was a seashore habitat map covering the whole of Jersey's intertidal area (splash zone to chart datum and, where possible, shallow marine) using 1.4 million polygons each 25 m^2 (5 x 5 metres). Rather than years of manual mapping, the processing, analysis and assignment process had taken months with an end result that is accurate and visually impressive. Although this Jersey study was fortunate to have access to high resolution aerial imagery and LiDAR data plus an extensive field data dataset, it is nonetheless felt that this methodology for semi-automatic classification could be adapted for use in other ecological setting and locations.

A-II.2 - Offshore Substrates

The habitat map created in Section A-II.1 covers intertidal areas and, where light penetration and turbidity permitted, shallow marine areas to circa five metres below chart datum. Detailed seabed habitat maps covering the whole of Jersey's waters were created in the 1970s and 80s (Retière, 1979; Le Hir *et al.* 1986) and were revised in 2014 (Le Mao *et al.* 2019).

The benthic habitat GIS modelling began with a systematic survey of data sources relating to Jersey's territorial waters but especially those concerning physical, biological and oceanographic properties. This survey included data from several regional studies from the 1960s, 1970s and 1980s as well as localised information from Admiralty charts, oceanographic surveys, etc. Data from these sources (whether in the form of digital files, tables, maps or charts) were digitised and georeferenced using open-source GIS software (QGIS 3.16).

The datasets obtained during the survey often used differing classification schemes, scales and units to describe the same parameters. Water depth, for example, might be expressed in fathoms, feet or metres and could be measured against the lowest astronomical tide (LAT) or Jersey datum (5.88 metres above LAT) while seabed sediment could be classified according to differing but broadly compatible grain-size distribution schemes. To integrate these data, imperial units were converted to metric and differing sedimentary classifications, etc., were reclassified using numerical scales where integers were used to represent defined classes.

The sediment grain-size classification scale used is, for example, based on Folk (1954) and uses integers to represent broad sediment/substrate descriptions from bedrock (1) through to silt/mud (10). Reclassifying datasets in this manner allowed the results from different regional surveys to be combined to provide a wider coverage and greater detail than any one individual dataset. Once the reclassification had been completed, the datasets were merged to form single GIS point datasets relating to individual parameters such as water depth, substrate grain-size and carbonate content.

The point data within each GIS dataset were interpolated (via inverse distance weighting) into a raster file with cell dimensions equivalent to 50 x 50 metres. A GIS point grid (250 metres on the x and y-axes) was used to resample the interpolated raster files to provide values for 37,055 points covering all of Jersey's offshore waters. Additional GIS processing (using standard software tools) included using selected raster files to estimate seabed slope, roughness, distance from shore and exposure to wave/wind energy. Additional data relating to tidal current velocity, wind strength/direction, wave height, temperature, productivity, etc., were obtained from open-source datasets available from NASA, ESA and the UK Renewables Atlas.

At the end of this process the GIS model contained point datasets with standardised values for a range of biological, geological, oceanographic and other parameters. These datasets are useful for modelling individual aspects of the local marine environment but could also be used to classify and spatially map benthic habitats.

Benthic Habitat Identification

Benthic habitat maps covering all of Jersey's subtidal waters were published by Retière (1979) Le Hir *et al.* (1986) and Le Mao *et al.* (2019) but with a large volume of additional physical and environmental data available, an opportunity existed to map habitats in greater detail. The objective was to identify benthic habitats that could be matched to the JNCC's marine biotope classification scheme. This was achieved in two stages, the first of which was to use a select range of parameters to identify broad habitats and then to use additional data to map these onto the JNCC biotope classification.

The initial stage selected key parameters used by the JNCC in the creation of their biotope scheme (Connor *et al.* 2004). These were: water depth, substrate, exposure to wave energy and tidal current velocity. A high degree of correlation between wave exposure and tidal current velocity led to the latter being dropped from the query.

For each of the 37,055 points in the GIS model, the following layers were queried. Water depth, substrate type and wave exposure. A combination of these acted as an environmental summary within the 250 x 250 metre grid.

The dataset was cross-tabulated to identify unique parameter combinations and, for each of these, the number of polygons these represented. This process produced a list of 35 different combinations which could be matched the habitats to at least level 3 of the JNCC biotope scheme. Following this, an extended assessment process was used to: further refine the classification; to identify problem areas; and to match these broad benthic habitats more precisely to the JNCC biotope classification.

The initial stage of refinement determined the number of data points represented by each of the 35 parameter combinations. Those combinations with fewer than 100 data points (0.27% of the total dataset) were merged with the nearest category (in environmental terms). This reduced the number of different combinations from 35 to 25.

It began with the additional processing of the datasets using specialist parameters. For example, areas of probable kelp forest were identified using parameter values which indicated that individual points were infralittoral (<20 metres below chart datum), on bedrock or boulders and on a steep slope. These could be further refined by relabelling kelp forest (IR.MIR.KR.Lhyp) with a water depth greater than 12 metres as kelp park (IR.MIR.KR.Lhyp.Pk).

Similarly, identifying areas of coarse sediment with a high carbonate content might indicate maerl (SS.SMp.Mrl) or bivalve beds (SS.SCS.ICS.MoeVen). By this means hard substrates could be matched with a reasonable level of confidence to biotopes at level four in the JNCC scheme. However, sedimentary substrates were generally more difficult to classify remotely and were usually matched to biotopes at JNCC level three.

A further stage of verification required the use of georeferenced field data that had not been included in the original systematic survey. Much of this was localised data from commercial surveys, student research and/or work by NGOs. This included 24,937 biotope and species records gathered by the Société Jersiaise and SeaSearch UK since 1997, side-scan sonar surveys by Ports of Jersey and Jersey Electricity, underwater video footage from divers and towed cameras, aerial photographs, sediment and biological data from a variety of EIAs and other surveys associated with commercial projects.

The level initial biotope assignments were cross-referenced against these detailed survey data and, where necessary, adjustments were made. Other adjustments came from the use of specialist survey data relating to specific biogenic habitats whose extent had been mapped with precision from aerial, diver or camera surveys. This included seagrass (*Zostera marina*) meadows, high density maerl beds, kelp forest (*Laminaria* spp.), slipper limpet (*Crepidula fornicata*) beds, sandmason worms (*Lanice conchilega*) beds and some types of bivalve bed (e.g. *Venus verrucosa, Glycymeris glycymeris*, *Tapes* spp.). These habitats generally occur in shallow water and are of scientific interest for reasons of biodiversity (including non-native species), ecosystem service provision.

At this stage the seabed habitat map covering Jersey offshore waters consisted of 37,055 points each of which had been classified to one of 18 JNCC biotopes. The spatial habitat data and habitat locations were then evaluated against underwater towed video surveys (not used in the above methodology) undertaken as part of a PhD research project in Jersey waters (Blampied, 2022).

The towed video sequences used in the evaluation of the habitat map were filmed between 2017 and 2020 mostly in areas to the north, east and south of Jersey. The videos were taken with GoPro cameras (in a SpotX Pro Squid (SpotXTM Underwater Vision) housing) and contained high quality seabed footage from which habitat types and extents can be visually classified and accurately located. The tow paths were geolocated and the seabed habitats categorised using the EUNIS classification which is directly comparable to JNCC biotope codes. It should be noted that the towed video dataset did not include all the biotopes used in the modelled data but enough were included to be able to assess the model's accuracy. The modelled habitat data has a spatial resolution of 250 metres, meaning the maximum distance within one cell is 354 metres. The cut off distance for accuracy within one cell was therefore set at 354 metres.

Of the EUNIS habitat positions identified from the towed videos, 75% occurred within 354 metres of the modelled habitats. This accuracy increased to 82% within two cells (i.e. 708 metres). As most towed videos cover a 100 metre transect with a 0.4 metre field of view (i.e. 40 m^2) within habitat map cells that are 250 x 250 metres (0.0625 km^2), it is possible that some habitats were missed. The least accurately predicted EUNIS habitat is A5.2 (coarse/medium sand) which was often in map cells that were assigned to habitats containing a mix of bedrock and sand. This may have been a function of the limited coverage of a towed video within the wider area of the cell.

The results suggest that for those areas where towed videos were evaluated the model is 75% accurate at a one cell resolution (354 metres). Given the number of cells (37,055) covering Jersey's territorial waters, this assessed level of accuracy should be sufficient when running queries for physical and biological information. As such, it is a potentially useful tool for high level decision-making and, as more information is added into the model, so its use for marine management and spatial planning will increase. However, for the purposes of this report, data extracted from this model will be used to provide a Blue Carbon assessment of Jersey's territorial waters.

The 66 biotopes identified in the intertidal and subtidal map were classified between levels four and five of the JNCC biotope scheme. When creating a habitat map for assessment purposes within the JMSP the biotopes were reclassified at a higher level into 14 groups based on substrate (rock or sediment) and basic biological properties; the group is described in [REF TO ES REPORT] and the habitat group properties in [REF TO habitat Sensitivity Report].

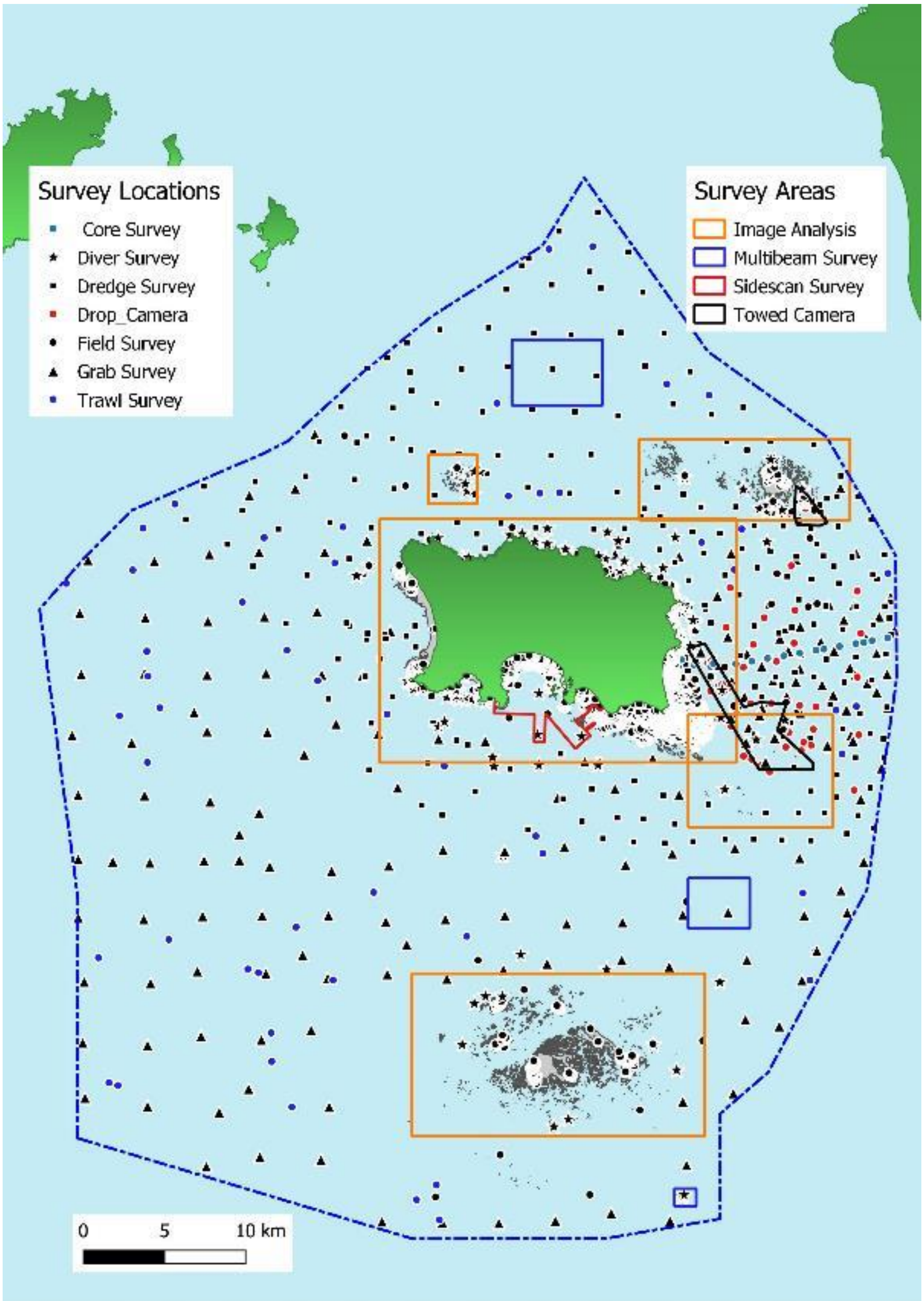

Figure AII.1 – The location of samples and survey areas used to create the marine habitat map.

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