

NPWS

Porcupine Shelf SAC

(site code: 002267)

**Conservation objectives supporting document -
Marine Habitats**

Version 1

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Contents

Introduction	1
Section 1.....	3
Principal Benthic Communities.....	3
Porcupine Shelf Reef Community Complex	3
Section 2.....	8
Appropriate Assessment Notes	8
Annex I Habitats.....	8
Bibliography	12
Figure 1. Porcupine Shelf Canyon SAC Designation.....	13
Figure 2. Extent of Reefs in Porcupine Shelf SAC.....	14
Figure 3. Modelled Reef Community Complex in Porcupine Shelf SAC.....	15

Please note that this document should be read in conjunction with the following report: NPWS (2026) Conservation Objectives: Porcupine Shelf SAC 002267. Version 1. National Parks and Wildlife Service, Department of Housing, Local Government and Heritage.

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Introduction

The Porcupine Shelf SAC is located towards the northern end of the Porcupine Bank where it slopes down to the south-eastern Rockall Trough (**Figure 1**). Its northern boundary is located approximately 267km west of Malin Head, Co. Donegal and its southern boundary is 410km west of Clare Island, Co. Mayo. This site is designated for the marine Annex I qualifying interest of Reefs (EU habitat code 1170) (**Figure 2**).

The national seabed mapping programme INFOMAR (Dorschel *et al.*, 2010) and the Irish National Seabed Survey (Geological Survey of Ireland, 2002) provided the offshore bathymetry data that allowed the identification of likely carbonate mounds, canyons and escarpments. These features are used as proxies for reef habitat in this site (**Figure 2**). Surveys within the Porcupine Shelf SAC provided information on the geology of some of these mounds (Rengstorf *et al.*, 2013, Sacchetti *et al.*, 2012). The 2017 Sea Rover survey provides biological data on a variety of geological formations within the site, including canyons, mounds and escarpments (Ross *et al.*, 2018, Picton *et al.*, 2021). A synthesis report commissioned by NPWS in 2017 (Forde *et al.*, 2017) outlines the ecological setting, distribution and structure of reef habitat and associated communities in Irish offshore waters.

In the Irish offshore environment (*i.e.* waters greater than 200m in depth), reef communities are associated with geological features such as sea mounds, canyons, escarpments, flat and sloping bedrock, and boulder, cobble and/or drop-stone pavements. The occurrence of these features are used as proxies for reef communities. The reef communities can be broadly divided into geogenic and biogenic reef. Geogenic reef is defined as rock substrate on which epifaunal species occur; biogenic reef is defined as hard substrate formed by animals.

Geogenic reef tends to be found on the continental slope, particularly in submarine canyons and on the flanks of seamounts. The communities commonly form multispecies assemblages of octocorals and antipatharians known as coral gardens which in turn create structural habitat for other fauna.

In Irish offshore waters, biogenic reef is largely the result of the scleractinian coral *Desmophyllum pertusum* (*syn.* *Lophelia pertusa*), which is common and widespread here (Forde *et al.*, 2017). The secondary scleractinians, reef-forming species *Madrepora oculata* and *Solenosmilia variabilis*, also occur. Coral carbonate mounds are distinct features that are formed over timescales of one to two million years by successive periods of growth, erosion and sedimentation of reef-forming corals. Morphological variation between mounds is attributed to the local environmental conditions under

which the mounds are initiated and grow. These mounds can comprise a variety of habitat types including coral reef, coral rubble, stabilised and mobile sediments, and cobble grounds, each supporting distinct macrofaunal communities.

In the offshore environment where reef occurs, regardless of whether it is geogenic or biogenic, biodiversity is greatly increased and therefore these communities are considered to be keystone communities.

Aspects of the ecology of the Annex I Reefs habitat are provided in **Section 1**. The corresponding site-specific conservation objective will facilitate Ireland delivering on its surveillance and reporting obligations under the EU Habitats Directive (92/43/EC), and the preservation or restoration of the integrity of the Natura site.

Ireland also has an obligation to ensure that consent decisions concerning operations/activities planned for Natura 2000 sites (also known as European sites) are informed by an appropriate assessment of the likelihood that such operations or activities are having a significant effect on the site, or adversely affecting site integrity. Further ancillary information concerning the practical application of the site-specific conservation objective and its associated targets in the completion of such assessments is provided in **Section 2**.

Section 1

Principal Benthic Communities

Natural features are frequently composed of a number of different biological communities. The reasons for the occurrence of communities on a feature can sometimes vary over small spatial scales. Accurate representation of such communities when using spatial targets for conservation objectives can be difficult. By acknowledging this natural complexity as an amalgam of mosaicked communities (*i.e.* a complex), meaningful conservation objectives based on spatial targets for such a complex can be established. However, that the components of this complex may have certain species in common, albeit it at varying prevalence, and have physical parameters may or may not overlap is recognised by identifying the MHCBI communities (Parry *et al.*, 2015) which occur within this complex.

The biological communities found within Porcupine Shelf SAC exhibit this pattern and have been grouped together into a suitable ecological unit on which to develop conservation targets.

The Operational Taxonomy Unit (OUT) given is as per Howell and Davies (2010).

Porcupine Shelf Reef Community Complex

Twenty two individual canyons systems run from the Porcupine shelf edge to the Rockall Trough at this site (**Figure 3**). These canyons range from a single canyon to complex canyon systems with many tributaries. The longest measures 71km from the top of the main canyon to its base at the abyssal plain, while the shortest is 14km in length. In the central area of the site where the shelf is steepest the head of the canyons lay at the shelf edge in water depths of 800m. Elsewhere the canyon heads start at approximately 1000m.

A long escarpment feature runs almost continuously for approximately 350km from the southern part of the site along the shelf edge in a northern eastern direction (**Figure 3**). It was observed at depths of between 480m and 780m approximately. It consists of steep cliffs and ledges which are occasionally terraced. Overhangs are also apparent along this feature. Escarpment features also occur within canyon systems.

One hundred and six sea mounds have been identified within the site (**Figure 3**). Fifty one of these are located in the southwest corner of the site at depths of between 2000m to 3000m. The range in size from 21km² to 0.4km² at their base. At the southern end of the site a series of very small mounds occur at depths of between 600m and 1000m. Larger mounds occur midway along the shelf margin,

ranging in size from 55km² to 2km² at their base. A single mound, 1.5 km², is present at the northern end of the site.

A long escarpment feature runs almost continuously from the southern part of the site along the shelf edge in a northern eastern direction for approximately 350km. It was observed at depths of between 480m and 780m approximately. It consists of steep cliffs and ledges which are occasionally terraced. Overhangs are also apparent along this feature. The rock is sedimentary and is occasionally covered with a mud/sand veneer. Cobble/boulders field are also present here.

Along the long escarpment feature, on overhangs and on vertical walls, a community hosting the solitary stone coral *Desmophyllum cf dianthus*, the pink/purple anemone *Actiniaria* sp. and discrete *Desmophyllum pertusum* (syn. *Lophelia pertusa*) colonies was noted. This is considered to be a new biotope and a variant of the Discrete *Lophelia pertusa* colonies on Atlantic mid bathyal rock and other hard substrata. Where it occurs without *D. pertusum*, it may be considered an escarpment variant of the Mixed cold water coral community on Atlantic upper bathyal rock and other hard substrata. A variant of the Deep sponge aggregation on Atlantic upper bathyal rock and other hard substrata also occurs on this escarpment feature. The fauna here is dominated by encrusting sponges including a pale encrusting globose form. The solitary stone coral *D. cf. dianthus* occurs on the overhangs. The anemone *Actiniaria* sp. and a bushy hydrozoan are also recorded here.

A Sparse encrusting community on Atlantic upper bathyal rock and other hard substrata was commonly present on this long escarpment feature. It occurred on vertical to steeply sloping carbonate substrate. The encrusting fauna consists of sponges and serpulid polychaetes. A variety of anemones are also present including Actiniidae sp. (Sand *Bolocera*) and an unknown yellow anthozoan. In areas where there is a sand veneer the urchin *Cidaris cidaris* is one of the dominant species visible. The urchin *Araeosoma fenestratum* is also present within this community, as are the bryozoan *Reteporella* sp. and the hydroid *Pliobrothus* sp.

At the southern end of the escarpment feature a variant of the Sparse encrusting community on Atlantic upper bathyal rock and other hard substrata is seen on ROV dives. This community resembles the sparse encrusting community often dominated by the sedentary holothurian *Psolus squamatus* but it is actually dominated by the hydrozoans *Stylaster* sp. and *Pliobrothus* sp. and the bryozoan *Reteporella* sp. Some discrete colonies of the scleractinian *D. pertusum* (syn. *Lophelia pertusa*) are present but these are not prolific. Where cobbles and boulder fields occur they host the holothurian

P. squamata and the bivalve *Anomiidae* sp. This is an upper bathyal variant of the sea cucumber *Psolus squamatus*, bivalve *Anomiidae* sp, and serpulid polychaetes and occasional squat lobsters (*Munida* sp.) on Atlantic mid bathyal rock and other hard substrata assemblage. In this variant a variety of crab species *Chaceon affinis* and *Paramola cuvieri* also occur. The urchin *Cidaris cidaris*, the holothurian *Araeosoma fenestratum* and fish species including the elasmobranch *Apristurus* sp. are present as well but in lower numbers.

On steep geogenic reef substrate in canyons at depths of 1000-2000 metres the reef forming scleractinian coral *Solenosmilia variabilis* is commonly recorded. It occurs as three different community types. Firstly as coral gardens of Atlantic lower bathyal live *Solenosmilia variabilis* reef (biogenic structure) which can cover large areas. Secondly as discrete clumps of live *Solenosmilia variabilis* which is recognised as the Discrete *Solenosmilia variabilis* colonies on Atlantic lower bathyal rock and other hard substrata community. Finally at the base of cliffs and at the lower reaches of escarpment features within the canyons areas of dead *Solenosmilia* rubble occur and are recognised as a Mixed coral assemblage on Atlantic lower bathyal *Solenosmilia* reef framework (biogenic structure) community.

Within these *S. variabilis* communities a wide variety of lamellate and massive globose sponge species occur. A mid bathyal variant of the Deep sponge aggregation on Atlantic upper bathyal rock and other hard substrata occurs at between 1000m and 1100m on carbonate sediment within the canyons. Encrusting globose sponges are very prominent. Fish species present within these reefs include the IUCN listed species Orange Roughy (*Hoplostethus atlanticus*), the grenadiers (*Coryphaenoides rupestris* and *C. guentheri*), and the oreo (*Lepidon eques*). This biogenic reef hosts a variety of species including bamboo corals such as *Lepidisis* sp. and *Acanella arbuscula*, black corals including *Leiopathes* sp., *Stichopathes* sp. and *Parantipathes* sp. (unbranched). Gorgonian fans such as *Chrysogorgiidae* sp. and *Paramuricea* sp. are also present. Occasionally solitary scleractinian corals such as *Caryophyllia* sp. or *Caryophyllia/Fabellidae* sp. also occur here.

A lower bathyal variant of the Barnacle dominated community on Atlantic mid bathyal rock and other hard substrata occurs within the canyons throughout the site. It is recorded at depths of between 1300m and 1850m. The barnacles *Cirripedia* sp. occur on boulders, cobbles and pebbles. Other encrusting fauna and some corals also occur with the black coral species *Stichopathes* sp. being most numerous on occasion. Large lamellate sponges were also encountered within this community. On occasion boulders are dominated by barnacles with mixed corals, including the scleractinian

Solenosmilia variabilis. This is considered to be a mosaic of hard substrate biotopes Discrete *Solenosmilia variabilis* colonies on Atlantic lower bathyal rock and other hard substrata and the lower bathyal variant of Barnacle dominated community on Atlantic mid bathyal rock and other hard substrata. Mixed cold water coral community on Atlantic lower bathyal rock and other hard substrata is recorded widely throughout the site at depths of 1300m to below 2000m. It occurs on a variety of substrate types from boulders and cobbles, vertical bedrock cliffs to carbonate substrate. It is present in canyons, on carbonate mounds and escarpment features. The fauna consists of coral gardens consisting of black and gorgonian corals, in particular *Stichopathes* sp. and *Chrysogorgiidae* sp. A variety of sponges, including a massive lobose species and a distinctive glass sponge species also occur within this community. The stalked crinoids *Democrinus* sp. and *Bathycrinidae*, the bamboo coral *Lepidisis* sp. and the zoanthid *Zoanthidea* sp. also present. Occasionally clumps of the scleractinian coral *Solenosmilia variabilis* occur either as rubble at the base of a cliff or live on overhangs. The lower bathyal (variant of) Sparse encrusting community on Atlantic mid bathyal rock and other hard substrata was recorded at the northern end of the site at depths of between 1300m and 1980m on carbonate and bedrocks cliffs and slopes. An encrusting white sponge, the black coral *Stichopathes* sp., the polychaete *Serpulidae* sp., yellow sea stars and the solitary cup coral *Caryophyllia* sp. were observed within this community. A lower bathyal variant of the Lobose sponge and stylasterid assemblage on Atlantic upper bathyal rock and other hard substrata was recorded in the northern part of the site on an escarpment feature. It is present on bedrock which hosted the large hydrocoral *Stylaster* sp. and lamellate/lobose sponge aggregations, in particular *Aphrocallistes* sp.

An upper abyssal variant of this Mixed cold water coral community on Atlantic lower bathyal rock and other hard substrata occurs on bedrock and escarpment areas within the canyon systems throughout the site. This variant is largely recorded in depths of between 2100m and 2400m. It is diverse and hosts a variety of stalked crinoids including, *Bathycrinidae* sp. and *Anachalypsicrinus nefertiti*, the sponges *Rhabdodictyum* sp., and *Geodia cf baretii* and chrysogorgiid corals, including *Chrysogorgiidae* sp. This community resembles the mixed coral rock assemblages but the corals are rarely dominant. Other species occurring here include the sponge *Poecilosclerida* sp. and a fine branching form of the bamboo coral *Keratoisis* sp. Where this community variant occurs on the deep sea mounds at the very south-western edge of the site 30 egg cases of an unknown elasmobranch were visible amongst dense, mature corals and sponges. A new biotope, Atlantic upper abyssal rock and other hard substrata (Ross *et al.*, 2017) was recorded at depths greater than 2000m throughout the site. This diverse community was recorded on hard substrate and hosts mixed stalked crinoids, sponges and corals, however the corals are rarely dominant. Crinoids include *Anachalypsicrinus nefertiti*, *Bathycrinidae* spp.,

Democrinus sp. and *Porphyrocrinus thalassae*. Large sponge species such as *Rhabdodictyum cf delicatum*, *Geodia cf baretii* and the massive lobose cf *Geodia* sponge are also present here. Corals primarily include chrysogorgiid such as *Chrysogorgiidae* sp. and *Radicipes cf gracilis* but the black corals *Stauropathes arctica* and *Leiopathes* sp. also occur as does the finely branching bamboo coral *Keratoisis* sp.

Individual Orange Roughy (*Hoplostethus atlanticus*) which is listed by IUCN as vulnerable were observed at a number of areas within this site. However large numbers were recorded on a sea mound in the central area of the site and aggregations of approximately 20 juveniles were noted in two canyons in the northern half of the site. The Leafscale Gulper Shark (*Centrophorus squamosus*) also listed as vulnerable by IUCN was noted in a number of areas in the centre of the site at depths of between 600m and 1500m.

Table 1 Species associated with the Porcupine Shelf Reef Community Complex

Porcupine Shelf Reef Community Complex	
<i>Solenosmilia variabilis</i>	<i>Cidaris cidaris</i>
<i>Desmophyllum pertusum</i>	<i>Araeosoma fenestratum</i>
<i>Stichopathes</i> sp.	<i>Reteporella</i> sp.
<i>Chrysogorgiidae</i> sp.	<i>Pliobrothus</i> sp.
<i>Lepidisis</i> sp.	<i>Psolus squamatus</i>
<i>Acanella arbuscula</i>	<i>Leiopathes</i> sp.

Section 2

Appropriate Assessment Notes

Many plans and projects of a particular nature and/or size require the preparation of an environmental impact assessment of the likely effects of their planned development. While smaller operations/activities (*i.e.* sub-threshold developments) may not require the undertaking of such an assessment, an appropriate assessment and Natura Impact Statement is required of any project that may significantly affect the integrity of a Natura or European site. The assessment is to be used as part of the decision-making process, as to whether or not the project proceeds. The assessment should be recorded in a transparent manner, and should assess, in a reasoned manner, the likely effects on a Natura 2000 site of a proposed plan or project. General guidance on the completion of such assessments has been prepared and is available at www.npws.ie and at https://ec.europa.eu/environment/nature/natura2000/management/guidance_en.htm.

Annex I Habitats

It is worth considering at the outset that the extent and quality of all habitats varies considerably in space and time, and marine habitats are particularly prone to such variation. Habitats which are varying naturally, *i.e.* biotic and/or abiotic variables are changing within an envelope of natural variation, must be considered to have favourable conservation condition. Anthropogenic disturbance may be considered significant when it causes a change in biotic and/or abiotic variables in excess of what could reasonably be envisaged under natural processes. The capacity of the habitat to recover from this change is obviously an important consideration (*i.e.* habitat resilience) thereafter.

This Department has adopted a prioritized approach to conservation of structure and function in marine Annex I habitats.

1. Those communities that are key contributors to overall biodiversity at a site by virtue of their structure and/or function (keystone communities) and their low resilience should be afforded the highest degree of protection; any significant anthropogenic disturbance should be avoided.
2. In relation to the remaining constituent communities that are structurally important (*e.g.* broad sedimentary communities) within an Annex I marine habitat, the following must be considered:
 - 2.1. Significant anthropogenic disturbance may occur with such intensity and/or frequency as to effectively represent a continuous or ongoing source of disturbance over time and space (*e.g.* effluent discharge within a given area). Drawing from the principle outlined in the European Commission's Article 17 reporting framework that disturbance of greater than 25% of the

area of an Annex I habitat represents unfavourable conservation status, this Department takes the view that the cumulative area of continuous disturbance of each community type should not exceed an approximate area of 15%. Thereafter, an increasingly cautious approach is advocated. Prior to any consent being granted for any project or activities that would result in more than 15% of any Annexed marine habitat community type within a Natura site being disturbed on a cumulative basis, an inter-Departmental management review (considering *inter alia* robustness of available scientific knowledge, future site requirements, etc.) of the site is recommended.

- 2.2. Some activities may cause significant disturbance but may not necessarily represent a continuous or ongoing source of disturbance over time and space. This may arise for intermittent or episodic activities for which the receiving environment would have some resilience and may be expected to recover within a reasonable timeframe relative to the six-year reporting cycle (as required under Article 17 of the Directive). This Department is satisfied that such activities could be assessed in a context-specific manner giving due consideration to the proposed nature and scale of activities during the reporting cycle and the particular resilience of the receiving habitat in combination with other activities within the designated site.

The following technical clarification is provided in relation to specific conservation objectives and targets for Annex I habitat Reefs to facilitate the appropriate assessment process:

Objective **To restore the Favourable conservation condition of Reefs (EU habitat code 1170) in Porcupine Shelf SAC, which is defined by the following list of attributes and targets**

Target 1	The permanent area is stable or increasing, subject to natural processes.
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- In the deep water environment reef habitat is associated with geological features such as canyons, sea mounds, terraces and escarpments. In Porcupine Shelf SAC, modelled reef, mounds and escarpments have been used as indicators of the likely distribution of reef habitat in this SAC (**Figure 2**). However, it should be noted that the area and distribution of Reefs within this SAC is an approximation. The full extent of the aforementioned geological features and certain topographies, such as rock outcrops and cobble or boulder fields, may not have been mapped.
- Reefs may further encompass topographic features including vertical rock wall, ledges, overhangs, sloping or flat bedrock, and boulder and cobbles fields. A reference

area for the habitat is therefore a gross underestimate of the actual area present due to the three-dimensional nature of this habitat.

- This target refers to the permanent amount of habitat area within the site. It needs to be considered particularly when assessing the effects of projects, plans, activities or operations that propose to permanently remove habitat from the site, thereby reducing the permanent amount of habitat area within it. It does not incorporate the consideration of long or short term disturbance of the biology of a site.
- Early consultation or scoping with the Department in advance of a formal application to a consenting authority is advisable for such proposals.

Target 2	The distribution of Reefs is stable or increasing, subject to natural processes.
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- The mapping of the seafloor with sophisticated acoustic systems, followed by surveying of identified features with camera systems attached to Remotely Operated Vehicles (ROV), has allowed the distribution of certain geological features to be used as indicators of the likely distribution of reef habitat. In the case of Porcupine Shelf SAC, modelled reef, mounds and escarpments are the indicators of reef in this SAC (**Figure 2**).
- Both biogenic and geogenic reef communities are considered to be keystone communities that are of considerable importance to the overall ecology and biodiversity of a habitat by virtue of their physical complexity; any significant anthropogenic disturbance to the distribution of these features within the SAC should be avoided.
- This target refers to activities or operations that propose to permanently remove reef habitat, thus reducing the range over which this habitat occurs within the site. Reef habitat refers to any hard substrate including coral rubble. It does not refer to long or short term disturbance of the biology of reef habitats.
- Early consultation or scoping with the Department in advance of a formal application is advisable for such proposals.

Target 3 Maintain the structural integrity of the Porcupine Shelf Reef Community Complex, subject to natural processes.

- For biogenic reef, this means that the three-dimensional structure of the reef remains intact and the proportion of living to dead coral remains within the range expected through natural processes.
- For geogenic reef this requires the continuing occurrence of large erect epifaunal species.
- It also requires that no evidence of increased siltation over the reef feature is present.
- Any significant anthropogenic disturbance to the structural integrity of these features within the SAC should be avoided.

Target 4 Conserve the Porcupine Shelf Reef Community Complex in a natural condition, subject to natural processes.

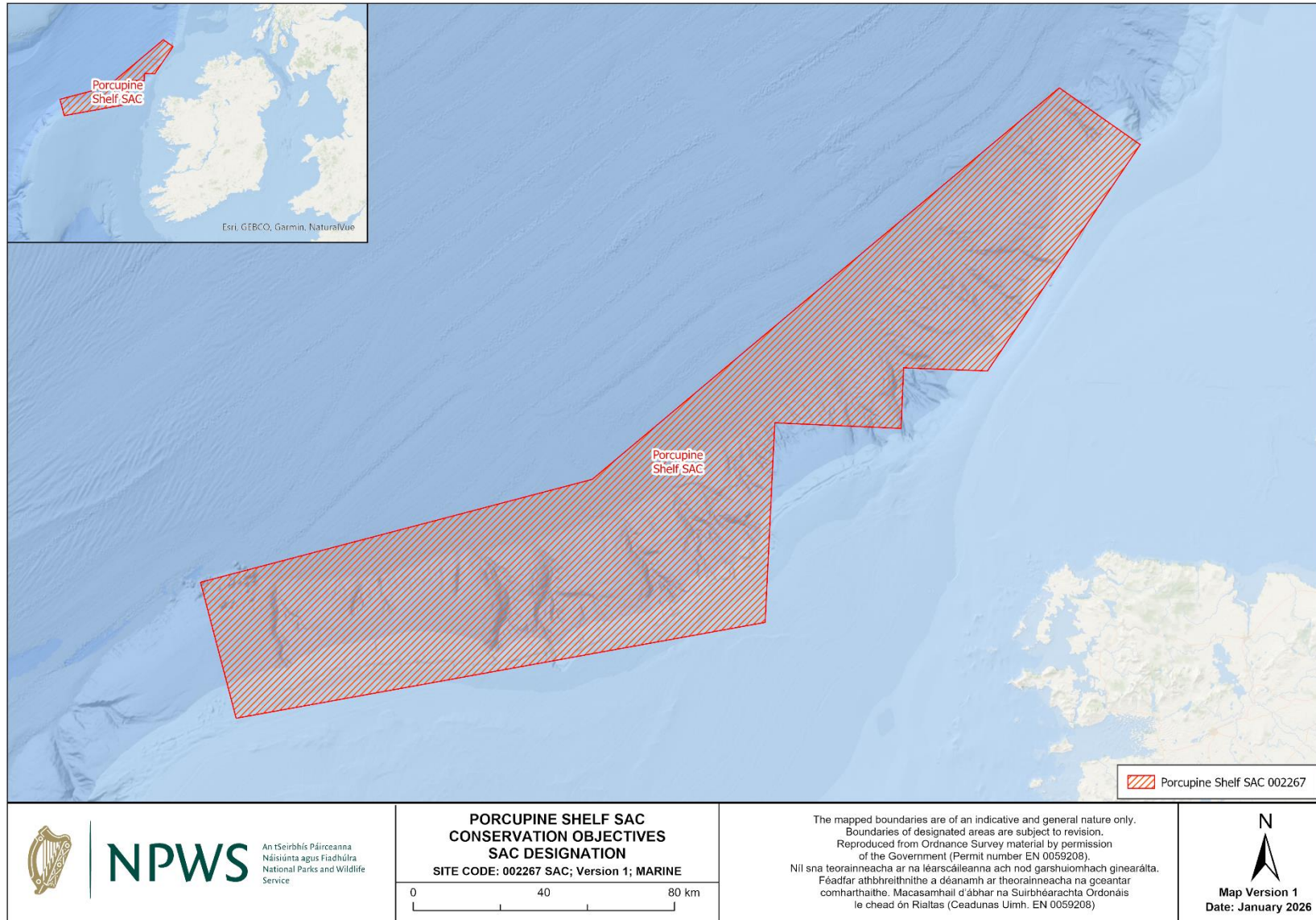
- Biodiversity on both biogenic and geogenic reefs is dependent on the presence of habitat-forming coral species. In the Irish waters, deep water biogenic reef is largely the result of the scleractinian coral *Desmophyllum pertusum* (syn. *Lophelia pertusa*). On geogenic reef, a number of Alcyonacean and Antipatharian species that are potentially habitat-forming are found in Irish waters.
- A semi-quantitative description of the Porcupine Shelf Reef Community Complex at this site has been provided in **Section 1**.
- An interpolation of their likely distribution is provided in **Figure 3**.
- Within Porcupine Shelf SAC, the estimated area of known and likely features are:

Modelled Reef	4,994ha
Mounds	8,811ha
Escarments	6,924ha
- This target relates to the structure and function of the reef and therefore it is of relevance to those activities that may cause disturbance to the ecology of the habitat.
- Any significant anthropogenic disturbance to the faunal assemblages of reef habitat within the SAC should be avoided.

Bibliography

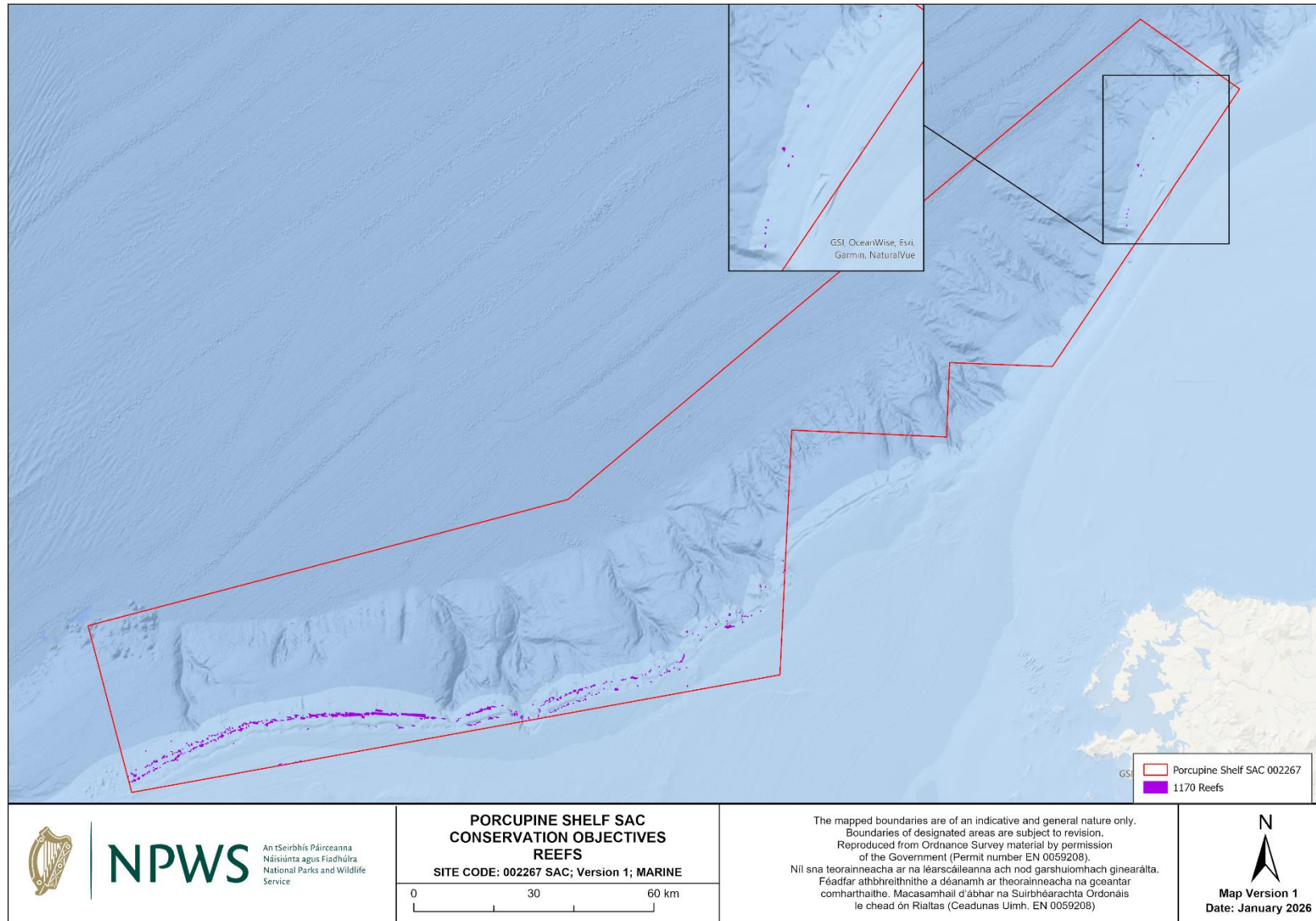
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Figure 1. Porcupine Shelf Canyon SAC Designation



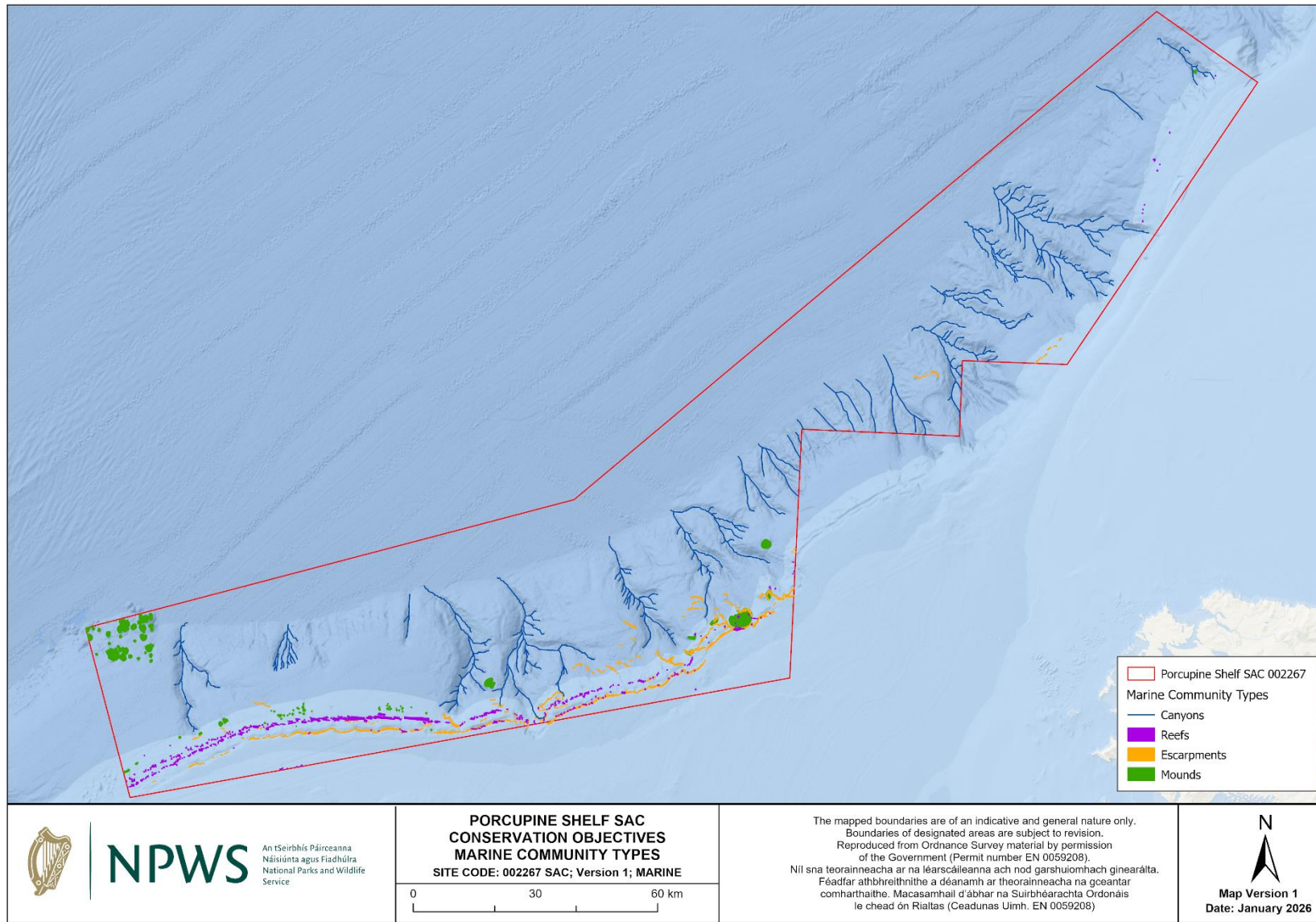
Map to be read in conjunction with the NPWS Conservation Objectives Document.

Figure 2. Extent of Reefs in Porcupine Shelf SAC



Map to be read in conjunction with the NPWS Conservation Objectives Document.

Figure 3. Modelled Reef Community Complex in Porcupine Shelf SAC



Map to be read in conjunction with the NPWS Conservation Objectives Document.