Comhairle Contae Fhine Gall
Fingal County Council

Vegetated Sea Cliffs Survey of Howth Head, Co. Dublin

Report for Fingal County Council

FitzGerald Ecology

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1. Introduction

Fingal County Council commissioned FitzGerald Ecology to produce a detailed survey of the EU Habitats Directive Annex I habitat, [1230] Vegetated sea cliffs of the Atlantic and Baltic coasts, within the entire Howth Head SAC [Site Code: 000202], which is located along the coastline of the Howth Head peninsula in north Co. Dublin. The aim of the study was to provide baseline information for the Conservation Objectives of the sea cliffs habitat within the Howth Head SAC and to determine the quality status of the sea cliffs habitat in this area.

The main objectives of the survey were as follows:

1. Review attributes and targets for sea cliffs within the Howth Head SAC;
2. Carry out a site survey and report (in line with a similar report by Barron & Perrin (2020) for [4030] European dry heaths within Howth Head SAC) to provide baseline data for attributes and assess against targets;
3. Collate any historical information on the sea cliffs (status) on Howth Head from reports and individuals and compare the 2023 findings with any historical records;
4. Prepare quality indicators for the sea cliffs on Howth Head in consultation with Fingal County Council;
5. Prepare a map showing the locations of poor, medium and good quality sea cliff habitat on Howth Head;
6. Prepare a map showing the distribution of negative indicator species (smallest area 20x20m) and show the acreage on the map, these areas need only be mapped if they are additional to areas already mapped by Ní Dhúill & Smyth (2018);
7. Make site specific recommendations on the actions required to increase the conservation status of poor and medium quality sea cliff habitat to good quality sea cliff habitat;
8. Set up 20 Permanent Quadrats (PQ) (or more if considered appropriate), provide the coordinates of these sites (in ITM), provide an overview of the species composition, their abundancies and heights in each PQ and provide a detailed method statement for a future monitoring program that will allow us to monitor the changes in vegetation;
9. To give a 20 minutes presentation at the end of the project to the Howth Special Area Amenity Order (SAAO) Committee to present the findings of the study.

Almost all of the sea cliffs habitat on Howth Head is contained within the *Howth Head Special Area of Conservation (SAC)*, which is a site of **International importance**. This SAC was primarily designated for its important coastal and heathland habitats. Indeed, the EU Habitats Directive Annex I habitat, [1230] Vegetated sea cliffs of the Atlantic and Baltic coasts, is a Qualifying Interest (QI) for this SAC, and therefore areas of sea cliffs habitat within the SAC are also of **International importance**. With the exception of the lands at Redrock, all sea cliffs in Howth Head are in private ownership. The Council assists landowners with the management of private lands included in the Howth Special Area Amenity Order (SAAO). The protection of the Howth Head SAC and its important habitats is also included in both the *Fingal Development Plan 2023-2029* and the *Fingal Biodiversity Action Plan 2022-2030*.

The study area for this survey was all publicly and safely accessible and/or viewable areas of sea cliffs habitat within the Howth Head SAC (see Figure 1). This area includes the low cliffs at Redrock

surrounding the Martello Tower in the south-west of Howth Head, around past the sea cliffs surrounding the Bailey Lighthouse, northwards along the Howth Cliff Walk pathway and around the Nose of Howth to Balscadden Bay in the north-east. The study area has a distinct geology, characterised by a transition zone (along a geological fault line) from Tournaisian limestone towards the north end of Balscadden Bay, to Cambrian quartzite, greywacke and slate, which dominates from the south end of Balscadden Bay all the way around to Redrock in the south-west. The latter bedrock types are all hard rocks and so the vast majority of sea cliffs habitat on Howth Head is of the hard type. Glacial till and other organic deposits may sit above the bedrock and be exposed locally, however, heavy erosion of this overlying material on the sheer cliffs generally leads to dominant bedrock exposure.

2. Methodology

A habitat survey was first conducted in order to locate and map the extent of existing '[1230] Vegetated sea cliffs of the Atlantic and Baltic coasts' habitat within the Howth Head SAC (represented by both rocky sea cliffs (CS1) and sea stacks and islets (CS2) habitats, according to Fossitt 2000). The sea cliffs habitat and conservation assessment surveys were carried out by Alexis FitzGerald B.A. M.Sc. from June to October 2023, with reference to Smith *et al.* (2011). The habitats were classified according to the Irish Heritage Council classification system (Fossitt, 2000). The locations of rare native and new non-native species populations (with minimum coverage of 20 m^2) were also recorded. EU Habitats Directive Annex I habitats were classified as per Commission of the European Communities (2013), also with reference to the corresponding national habitat survey reports and descriptions, particularly NPWS (2019). The nomenclature for the Annex I habitats also follows Commission of the European Communities (2013), with any abbreviated names for the habitats following NPWS (2019). Vascular plant taxonomy and nomenclature follows Stace (2019), whilst bryophyte taxonomy and nomenclature follow Atherton *et al.* (2010). Lichen taxonomy and nomenclature follow Dobson (2018). Ecological evaluations were made according to the criteria as set out in Appendix II.

A full conservation assessment survey was then conducted for the located Annex I sea cliffs habitat across the entire study area. A stretch of low sea cliffs at Redrock immediately north of the Martello Tower is just outside the SAC boundary, however, this was nonetheless included in the habitat survey and conservation assessments. The conservation assessment followed the assessment methodology laid out by Barron *et al.* (2011), with some minor alterations to suit this more site-based comprehensive local survey (as opposed to a national survey covering multiple different cliff sites). 17 sections of sea cliffs habitat were separated out along the entire coastline of Howth Head SAC and were assessed separately for their conservation condition. Areas of sea stacks and islets (CS2) habitat which adjoined some areas of sea cliff were generally not physically accessible, and were assessed (from a distance with binoculars/telescope) alongside the rocky sea cliffs (CS1) sections to which they were adjoining. Each section of sea cliff was assessed in its entirety, as much as was feasible with regard to effective access and viewing. These separations were based on various factors including the contiguous height and/or slope of different sections of sea cliffs, separation of sea cliff sections by bays on either side, and other relevant factors.

Each of the 17 sections were then assessed according to the conservation assessment criteria laid out by Barron *et al.* (2011), which were transposed into a GIS attribute table for recording in the field on a digital tablet (using Qfield software). These included various assessments under the three broad categories of 'Extent', 'Structure and Function' and 'Future Prospects'. The Structure and Function

aspect was further broken down into four main criteria, along with a set of additional vegetation 'zone type' assessment criteria (see Section 3 for more details). The three broad categories were ultimately considered together in order to give an 'Overall Assessment' of conservation condition for each area of sea cliffs habitat. These 17 overall assessments were then used to create an overall site-level assessment for sea cliffs habitat in Howth Head SAC. Overall site-level assessments were also made on the current status of the SAC with regard to the Site-Specific Conservation Objectives targets (NPWS, 2016a) and whether or not they are currently being met.

For the assessment criteria, the only diversion from the guidance in Barron *et al.* (2011) was with regard to invasive species, as for the present survey, Ní Dhúill & Smyth (2018) was used as the reference guide for the most problematic invasive species on Howth sea cliffs (although both publications draw on similar guidance for establishing the levels of invasive risk posed by different plant species), and the invasive species recorded were assessed in the context of the latter publication. Furthermore, with regard to the 'swathes' of Barron *et al.* (2011), which were 20 metre-wide sections of cliff that were used to assess each cliff site nationally, the effective equivalent of the swathes for the present survey is each of the separate 17 sections recorded along the entire length of the Howth Head SAC sea cliffs for their conservation condition.

Furthermore, 20 permanent quadrats (PQ) were established in areas of safely accessible sea cliffs habitat in order to serve as permanent vegetation monitoring locations for the sea cliffs habitat within Howth Head SAC. The PQ data were recorded on the Turboveg (Version 1.56) vegetation recording software, on a digital tablet. The PQ locations were selected by the author in order to represent the widest variety of vegetation types possible, including all of the various 'zone types' observable within the site, as described by Barron *et al.* (2011). The PQ locations are distributed mostly across the northern and southern stretches of sea cliff, as these were generally the most safely accessible and/or viewable cliff sections for vegetation recording purposes. PQs were recorded in 2x2 metre size, plotted out with string and tent pegs, or where this was not feasible, the appropriate size was measured out with a tape measure and visually examined, with the exact plot outline later drawn on a photograph of the plot area (see Appendix Ifor PQ data). Vascular plants, bryophytes and a few prominent lichen species (lichens were only identified to genus level) were recorded, along with their abundance in percentage scale. Other physical features such as rock cover, slope, etc. were also recorded.

Sea cliffs were accessed via a combination of walking and direct observation from lookout points (using binoculars and/or telescope) and access paths down through cliff habitats (numerous of which can be found on Howth Head) or from the base of the cliffs, e.g. at beaches/shingle shores. These observations were also supplemented with the use of commercial boat tours along the coastline adjacent to the cliffs (commercial boat tours were not available to view sea cliffs to the west of the Bailey Lighthouse). Drones were not employed for this survey but should be considered for future follow-up surveys, especially for the more inaccessible and sheer sections of cliff, e.g. cliffs below the Howth Cliff Walk pathway along the eastern edge of the peninsula. Cliff slope was measured from representative positions on a cliff section using an handheld clinometer (Invicta Education Mk 2), and averages of multiple measurements were taken. Height was measured, where feasible, using a 30m long tape measure extended to the cliff base from safe vantage points at the tops of the cliff sections, and averages of multiple measurements were taken. Where this was not feasible, a visual estimate was given based on the nearest measured section of sea cliff (or were left unrecorded).

3. Desktop Study

Historical References

The sea cliffs of Howth Head are among the most extensive areas of sea cliff habitat to be found in Co. Dublin, and along the wider east coast of Ireland. Historical information on the conservation status of the sea cliffs of Howth Head (SAC) is relatively sparse, hence the need for the present study. Some discussion of rare or otherwise notable plant species and sea cliff habitats on Howth Head in the historic literature gives us some early insight into the condition of sea cliff habitats in the past.

One of the earliest botanical references to plants on the sea cliffs of Howth Head was made by Walter Wade, in his *Catalogus systematicus Plantarum indigenarum in Comitatu Dublinensi inventarum* (Wade 1794). In it, he notes the occurrence of *Crithmum maritimum* "*in rock clefts below the light-house at Howth*", i.e. on sea cliffs below the Bailey Lighthouse in SE Howth Head. This species is still quite frequent along much of the Howth sea cliffs in crevices, ledges and other suitable locations, often within the salt spray zone.

Later on in the late 1800s, Henry Chicester Hart used his mountaineering skills to explore the steep sea cliffs of Howth Head and published his Howth plant records and findings in the *Flora of Howth* (Hart 1887). Examples of sea cliff plants he recorded include *Atriplex portulacoides* "*on rocky banks by the sea at the Martello Tower below Sutton, and again about a hundred yards south of it; in two places on the rocks below The Cliffs, about a mile further south from the last station*". This species still occurs here today (as confirmed during the present 2023 surveys) on and near the cliffs to the south and north of the Martello Tower at Redrock, Howth, as does *Inula crithmoides,* which Hart similarly recorded from that area. Both are notable coastal species in Co. Dublin (Doogue *et al.* 1998, BSBI 2023). Hart further noted that on the southern and eastern coastal margins of Howth Head, "*the scenery is composed of an imposing and varied wall of cliffs and steep sea-banks…which afford protection to several interesting forms of bird and plant life, and admirable opportunities for a difficult scramble in their search*".

These records later formed the basis of most of the Howth records that were published in *Flora of the County Dublin* (Colgan 1904). In 1903, Nathaniel Colgan recorded the rare Irish species *Scilla verna* on grassy cliff tops on Howth Head, and the species is still known there today. He also recorded *Asplenium marinum* in 1901 on sea cliffs on the south side of Howth Head. This same species was recorded during the present 2023 surveys (see Section 4). Doogue *et al.* (1998) produced the most modern instantiation of a flora book for Co. Dublin, which reported many up-to-date plant records from Howth Head, including from its sea cliffs habitat. For example, the authors report the occurrence of the very rare Irish grass species *Parapholis incurva* from a steep boulder clay slope (presumably just above the vertical cliff section) at the Bailey Lighthouse in SE Howth. The first records for Ireland were from Howth Head.

Goodwillie *et al.* (1988) makes only passing mention of the sea cliffs habitat on Howth Head and its importance for nesting birds, but states that the most interesting parts ecologically are the areas of natural vegetation adjacent to the cliffs, such as at Redrock, where a high diversity of ant species have been recorded.

Doogue (2019) made some incisive notes on the recent conservation condition of sea cliff habitats on Howth Head. In this publication, the author noted on the subject of the sea cliffs of Howth Head that "*many of the wetland features of the cliffs have been lost as a result of routing natural waters*[sic] *courses into pipes and drains*". These drains and pipes are often related to more recent residential

developments just above the cliff tops. The author also noted the scourge caused by dumping of garden waste on and near cliff tops (as well as the introduction of various garden plants into cliff top residential gardens), which has led to the spread of a number of invasive plant species on the sea cliffs in recent years, with *Carpobrotus edulis* being a notable and infamous example. The author also notes particular issues with the species *Centranthus ruber, Heracleum mantegazzianum, Allium triquetrum, Lysichiton americanus, Kniphofia species, Crocosmia* × *crocosmiiflora* and *Echium pininana* on Howth Head. The author further notes how some of these plants' "*ecological requirements are matched closely by the warm sunny conditions of the cliffs and they threaten to engulf much of the natural vegetation*". As a management recommendation relating to cliff habitat on Howth Head, the author noted in particular that freshwater percolation on to the low damp cliffs in the Redrock area is of benefit to the flora and vegetation of the sea cliffs in that area, and that the source waterway existing here (which is mostly underground currently) could be managed/altered to restore wetland habitat locally, on and near the cliffs, insofar as nature conservation "*in such circumstances requires the reduction in the rate of loss of water, thereby extracting the maximum ecological benefit form*[sic] *the available water*".

Rabbit populations appear to have been very important historically for maintaining well-grazed, open, species-rich coastal grassland swards on and near cliffs in such places as Redrock and the Bailey Lighthouse. However, these populations have suffered in recent years, presumably from multiple rounds of myxomatosis (Declan Doogue, pers. comm., November 2023). Casual horse and pony grazing on cliffs trails may also have been important historically (Declan Doogue, pers. comm., November 2023), but allowing these animals near the cliff paths today is likely impractical.

The seminal national conservation assessment study of Irish sea cliffs habitat by Barron *et al.* (2011) did not include Howth Head as a study sub-site, although Barron & Perrin (2020) did later map the extent of rocky sea cliffs (CS1) habitat within Howth Head SAC in the course of their heathland fieldwork (P. Perrin, pers. comm., July 2023). However, as noted by NPWS (2016b), the site was assessed in an earlier inventory of sea cliffs and coastal heath by Browne (2005) and the extent of the sea cliffs was reviewed by Barron *et al*. (2011) using the methodology outlined in that publication. The overall conservation objective for the Qualifying Interest (QI) habitat, [1230] Vegetated sea cliffs of the Atlantic and Baltic coasts, within the Howth Head SAC is to "*maintain favourable conservation condition*" (NPWS 2016a, 2016b).

Barron *et al.* (2011) sub-divide the EU Habitats Directive Annex I habitat, [1230] Vegetated sea cliffs of the Atlantic and Baltic coasts, into eight different 'zone types', not all of which may be present in each individual section of sea cliff (or indeed in any one sea cliff site – Howth Head SAC is dominated by hard cliff communities). These zone types are as follows:

1) Splash zone – heavily exposed and salt-sprayed rocky zone above the limit of barnacle growth where the rock colour changes and lichens become more prominent, including *Ramalina* spp., *Xanthoria* spp. and *Verrucaria maura*.
2) Crevice and ledge – exposed, rocky zone with more permanent vascular plant vegetation cover (not exceeding 50%) with *Armeria maritima, Festuca rubra* agg. and *Silene uniflora* being typical species here.
3) Ungrazed grassland on hard cliffs – typically dominated by the grasses *Festuca rubra* agg. and *Holcus lanatus*, with broadleaved herbs such as *Armeria maritima* and *Silene uniflora* also often occurring.

4) Grazed grassland on hard cliffs – here should be evidence of grazers (generally sheep or goats) accessing this habitat zone. The sward should be short, with species such as *Plantago coronopus, Festuca rubra* agg. and *Armeria maritima* occurring.
5) Coastal grassland on soft cliffs – this habitat type should only be considered for unstable soft cliffs. It is quite distinct from grasslands on hard cliffs and grasslands which develop on unconsolidated material lying on top of hard cliffs. It is generally ungrazed, with a wide range of species occurring. These include *Agrostis stolonifera, Tussilago farfara, Daucus carota* and *Lotus corniculatus.*
6) Soft cliff pioneer – areas of soft cliff are characteristically unstable. Areas of newly exposed substrate and slumped soft material with an overall vegetation cover of less than 50% are considered here. *Agrostis stolonifera* and *Tussilago farfara* are characteristic species.
7) Flush on soft cliff – this can be a point feature rather than a zone. It is an uncommon and understudied habitat type characterised by *Equisetum* spp. and *Schoenus nigricans* and may be important for orchids. However, only a 'Flush on hard cliff' type was recorded in Howth Head SAC, the soft cliff type was not recorded. More research needs to be done on hard cliff flushes (see Section 6).
8) Coastal heath – to be considered coastal heath a zone requires at least 25% cover of dwarf shrubs. *Calluna vulgaris, Erica tetralix, E. cinerea* and *Ulex gallii* are typical species.

Most recently, Alexis FitzGerald completed the *Wetland Study Phase I Howth Co. Dublin* in 2020 (Scott Cawley, 2022) and noted a series of wetland features which emerge onto sea cliffs habitat along the coastline of Howth Head SAC. The relevant wetland features are as follows: flushes which emerge on sea cliffs habitat at and near the south end of Balscadden Beach, the largely culverted outfall of Coulcoor Brook further east of Balscadden Bay, the Eastern Stream and Northern Stream which outfall on cliffs at the Nose of Howth (by the Howth Cliff Walk pathway), the outfall of the Whitewater Brook in SE Howth Head and the outfall of Balsaggart Stream on the sea cliffs of SW Howth Head. Vegetation quadrats were also recorded within many of these wetland features (although mostly not where they emerged onto the steep sea cliffs due to access difficulties) and their Irish Vegetation Classification (IVC) status assessed. The wetland vegetation of the Whitewater Brook occurring on the sea cliff just before it emerges on the stony beach below was recorded in detail in this report. The report noted the poor condition of some wetland features, particularly the Coulcoor Brook. The report also includes a series of management recommendations for each wetland feature in order to improve their conservation condition. These include intermittent scrub clearance/cutting on the higher sea cliff slopes, de-culverting/de-piping of streams near their cliff outfall points, water quality surveys, and other measures. Many of these measures have the potential to benefit sea cliff conservation status in Howth Head SAC and have been considered in Section 6 below which explores recommendations for sea cliffs habitat on Howth Head.

Conservation Objectives

The current attributes and targets for the habitat, [1230] Vegetated sea cliffs of the Atlantic and Baltic coasts, in Howth Head SAC are as follows, according to the following table taken from NPWS (2016a):

Table 1. Site-Specific Conservation Objectives (SSCOs) for Howth Head SAC [Site Code: 000202], taken from NPWS (2016a)

Attribute	Measure	Target	Notes
Habitat Length	Kilometres	Area stable, subject to natural processes, including erosion. Total length of cliff: 8.22km. See map 3	Cliffs are linear features and are therefore measured in kilometres. The Irish Sea Cliff Survey (Barron et al., 2011) identified the site, though did not survey it, and the length of cliffs within Howth Head SAC is estimated to be

			8.22km. The length of cliff is likely to be underestimated. See the Howth Head SAC conservation objectives supporting document for coastal habitats for further details
Habitat distribution	Occurrence	No decline, subject to natural processes. See map 3	See map 3 for the estimated distribution of sea cliffs in the SAC. Hard cliffs have been noted in this SAC and it is thought that all of the cliffs are of the hard type (Browne, 2005). See the coastal habitats supporting document for further details
Physical structure: functionality and hydrological regime	Occurrence of artificial barriers	No alteration to natural functioning of geomorphological and hydrological processes, including groundwater quality, due to artificial structures	Attribute and target based on Barron et al. (2011). Maintaining natural geomorphological processes, including natural erosion, is important for the health of vegetated sea cliffs. Hydrological processes maintain flushes, and in some cases tufa formations, that can be associated with sea cliffs. See the coastal habitats supporting document for further details
Vegetation structure: zonation	Occurrence	Maintain range of sea cliff habitat zonations including transitional zones, subject to natural processes including erosion and succession	Attribute and target based on Barron et al. (2011). A mosaic of European dry heath (4030) vegetation and maritime grassland occurs on the slopes above the sea cliff vegetation at Howth Head SAC. See the coastal habitats supporting document for further details
Vegetation structure: vegetation height	Centimetres	Maintain structural variation within sward	Attribute and target based on Barron et al. (2011). See the coastal habitats supporting document for further details
Vegetation composition: typical species and subcommunities	Percentage cover at a representative number of monitoring stops	Maintain range of subcommunities with typical species listed in the Irish Sea Cliff Survey (Barron et al., 2011)	In places, the cliffs at Howth Head SAC comprise fairly sheer, exposed rock faces. The maritime flora is of particular interest as a number of scarce and local plants have been recorded. Some of these are species of ledges on hard cliffs and coastal heath. See the coastal habitats supporting document for further details
Vegetation composition: negative indicator species	Percentage	Negative indicator species (including non-natives) to represent less than 5% cover	Attribute and target based on Barron et al. (2011). Hottentot fig (*Carpobrotus edulis*) is an aggressive invader of coastal habitats that poses a serious ecological threat. The first record for hottentot fig in the wild in Ireland is from Howth Head in 1962 (Reynolds, 2002). See the coastal habitats supporting document for further details
Vegetation composition: bracken and woody species	Percentage	Cover of bracken (*Pteridium aquilinum*) on grassland and/or heath less than 10%. Cover of woody species on grassland and/or heath less than 20%	Attribute and target based on Barron et al. (2011). Bracken occurs on the cliffs tops at Howth Head and there is some scrub encroachment on the heath. See the coastal habitats supporting document for further details

NPWS (2016b) noted that the "*targets set for the vegetated sea cliffs in Howth Head SAC are based primarily on the general findings and approach of the ISCS [Irish Sea Cliff Survey, by Barron et al. (2011)]. It should be noted, however, that they are generic in nature and may be subject to change in light of future survey work*". The present report aims to provide such greater context in light of the extensive survey work completed in 2023.

4. *Baseline Survey*

Legally Protected and Rare Flora

No plant species listed on the *Flora (Protection) Order 2022*, were recorded during the field surveys in 2023. Three infrequent native Dublin species were recorded on or near sea cliffs within the study area. These are: *Asplenium marinum, Inula crithmoides* and *Atriplex* × *gustafssoniana*. All of these species are already known from Howth Head sea cliff habitats (David Nash, pers. comm., October 2023).

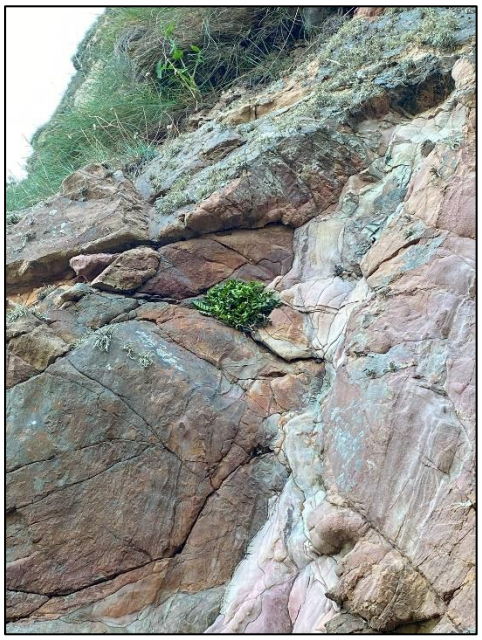

Plate 1. Lone mature plant of Asplenium marinum in sea cliff habitat near Doldrum Bay, in south end of Howth Head SAC – this species has long been known on the Howth sea cliffs

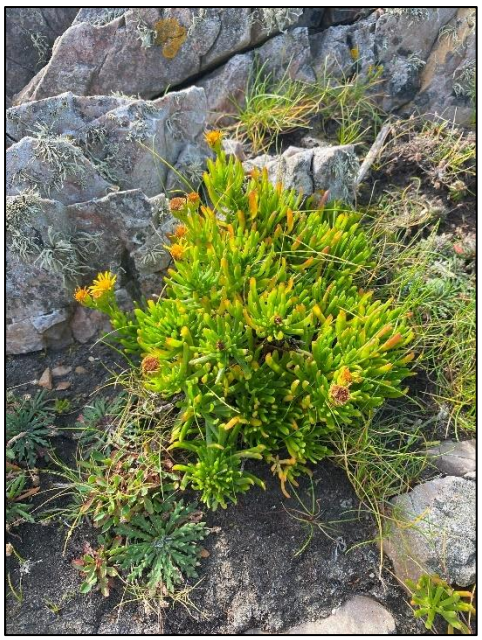

Plate 2. Inula crithmoides on sea cliff habitat near Redrock, in south-west Howth Head SAC – this species has long been known in this area

Non-native (Invasive) Flora

One plant species listed on the Third Schedule of the *European Communities (Birds and Natural Habitats) Regulations, 2011 to 2021* was recorded during the field surveys in 2023, namely, *Carpobrotus edulis*. This species has been established on the sea cliffs on the south side of Howth Head (including Lions Head and Drumleck Point) since at least 1989 (Doogue *et al.,* 1998), and indeed the first certain Irish record for this species is from Howth in the 1962 Atlas (Reynolds 2002). The National Botanic Gardens, Glasnevin, initiated a program in 2010 to control and ultimately eradicate the species at Howth Head. More recently, Ní Dhúill & Smyth (2018) mapped the extent of all non-native invasive plant species on and above the sea cliffs along the south edge of Howth Head, and they mapped the surviving populations of *Carpobrotus edulis* here as part of this exercise. Eradicating this species is one of the actions in the Operational Plan for the Howth Special Area Amenity Order (SAAO) but this action has not been implemented yet.

However, one new significant (20 m^2+) population of both *Veronica* × *franciscana* and *Kniphofia* species were recorded during the 2023 surveys, and these populations are mapped in Figures 9-10. These were likely both originally garden escapees which have become problematic locally. Further smaller populations of a range of invasive plant species were observed during the surveys but were not significant enough in size to warrant detailed recording on this occasion.

Plate 3. Carpobrotus edulis colony on the top of a sea cliff on the south side of Howth Head SAC – this same population was extensively mapped by Ní Dhúill & Smyth (2018)

Habitats

The sea cliff habitat types recorded within the study area according to the Heritage Council classification system (Fossitt, 2000) during the field surveys in 2023 are described in detail below (and are also mapped in Figures 2-5):

Table 2. Sea cliff habitat types within the study area, according to Fossitt (2000) classifications, with relevant valuations and EU Habitats Directive Annex I code(s)

Habitat Type (Fossitt, 2000)	EU Habitats Directive Annex I Code (if applicable)	Ecological Valuation
Rocky sea cliffs (CS1)	[1230] Vegetated sea cliffs of the Atlantic and Baltic coasts	International importance
Sea stacks and islets (CS2)	[1230] Vegetated sea cliffs of the Atlantic and Baltic coasts	International importance

Rocky sea cliffs (CS1) habitat extends along almost the entire coastline of Howth Head SAC. Hard rock predominates along the length of these sea cliffs. Varying amounts of glacial till material lie over this exposed bedrock, depending on the steepness of the cliff section. The areas of exposed bedrock generally provide limited substrate to which plants can bind. In the lowest 'splash zone' (see Section 3), lichens are dominant, with *Ramalina* species and *Xanthoria* species being common. Above this most exposed spray zone, some vascular plant species can be found growing in the 'crevice and ledge' zone, such as *Armeria maritima, Plantago coronopus* and *Silene uniflora*. Many of the species in this habitat are rarely found away from the coast and have a clear requirement for elevated salinity levels. For example, the local rarity *Asplenium marinum* is almost always found within the sea spray zone, in crevices on the cliff edges. Other characteristic species of the crevice and ledge zone present include *Limonium binervosum* agg. The notable Dublin species *Crithmum maritimum* and *Inula crithmoides* occur scattered on the cliffs here. The fleshy leaves of these two species reduce water loss in this exposed and well-drained environment.

Maritime grasslands (under zone type 'Ungrazed grassland on hard cliffs') also occur on the shallower upper slopes of the cliffs or on more extensive ledges, and here *Festuca rubra* agg. is often dominant, along with *Agrostis stolonifera* and lesser quantities of *Plantago lanceolata, Armeria maritima, Aster tripolium, Galium verum* and *Ononis repens*. 'Coastal grassland on soft cliffs' is considered to occur in one location, on the slope just above Balscadden Beach, where the bedrock geology shifts to Tournaisian limestone. Although only *c*. 43° in slope in this area, this area also harboured a number of positive indicator species for this zone type. These included *Arrhenatherum elatius, Dactylis glomerata* and *Agrostis stolonifera*. Flush (a hard cliff flush type was recorded in the study area, the soft cliff type was not recorded) occurs in a number of places, particularly on the sea cliffs by the south end of Balscadden Beach and at various locations further along Balscadden Road, where water passing through the lime-enriched glacial till/springs above flows down onto the coastline. Characteristic species of these flushes include *Eupatorium cannabinum, Cochlearia officinalis* agg., *Helosciadium nodiflorum* and *Marchantia polymorpha*. Coastal heath occurs in a few places, mostly on the tops of the sea cliffs as they transform into heath-laden hillsides further away from the coastline. *Calluna vulgaris* is frequent in this vegetation, along with a mix of grassland species such as *Festuca rubra* agg., *Anthoxanthum odoratum, Teucrium scorodonia* and *Rhytidiadelphus triquetrus.*

All of the rocky sea cliffs habitat on site corresponds to the EU Habitats Directive Annex I habitat [1230] Vegetated sea cliffs of the Atlantic and Baltic coasts.

Plate 4. Small beach at the outfall of the Whitewater Brook in south-east Howth Head SAC – high sea cliffs (CS1) surround this beach

Sea stacks and islets (CS2) habitat was recorded as small (less than one hectare) scattered rocky islets separated from the coastline by small bands of open water, from the southern coast of Howth Head SAC all the way around to the north coast near Balscadden Bay. The islets must protrude above the level of the high tide mark to be considered as true CS2 habitat. Where this was in doubt, the isolated rock islets were not included in the mapping. These CS2 islets are very exposed and are heavily salt-sprayed, usually with a dominance of lichens and relatively little coverage of vascular plant species. They often display the 'splash zone' vegetation of the opposing CS1 sea cliffs, with *Ramalina* species and *Xanthoria* species being common on both. Some crevice and ledge habitat may also occur, with *Armeria maritima, Plantago maritima,* etc. On some taller and larger islets, a maritime grassland habitat may develop on the relatively flat top of the islets. *Festuca rubra* agg. is often the most common grass species on these islets. These islets are often important for bird colonies, although small colonies of nesting cormorant and kittiwake were most often noted on these.

All of the sea stacks and islets (CS2) habitat on site corresponds to the EU Habitats Directive Annex I habitat [1230] Vegetated sea cliffs of the Atlantic and Baltic coasts.

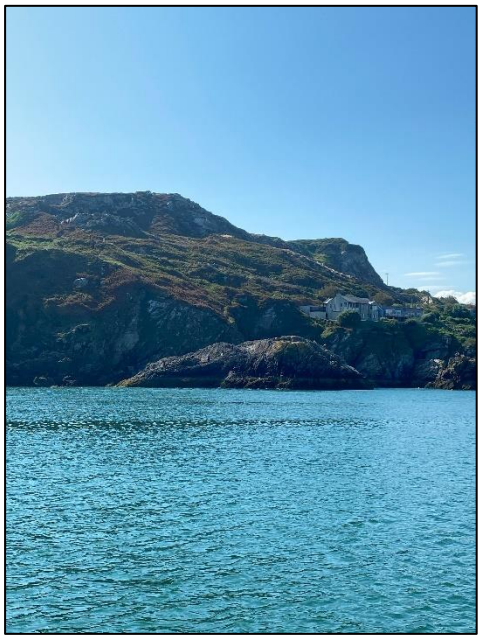

Plate 5. Islet (CS2) off the north-east coast of Howth Head SAC, which is often accessed by local swimmers and fishermen

The following zone types (as laid in Section 3 above) were recorded on sea cliffs habitat within Howth Head SAC during the 2023 surveys:

1) Splash zone;
2) Crevice and ledge;
3) Ungrazed grassland on hard cliffs;
4) Coastal grassland on soft cliffs;
5) Flush (hard cliff type);
6) Coastal heath.

Sometimes in association with the sea cliff habitats (and often just above the cliff tops), other habitats were recorded, namely, scrub (WS1), depositing/lowland rivers (FW2), exposed siliceous rock (ER1), reed and large sedge swamps (FS1), dry meadows and grassy verges (GS2), wet grassland (GS4) and dense bracken (HD1).

Sea Cliff Habitat Statistics

The total area of the EU Habitats Directive Annex I habitat, [1230] Vegetated sea cliffs of the Atlantic and Baltic coasts, recorded within Howth Head SAC during the field surveys was **24.54 hectares (ha) (23.8 ha of which was CS1, and 0.74 ha of which was CS2)**. This is considerably less than the total area of 74.97 ha given by NPWS (2018). This is similar to the over-estimate of [4030] European dry heaths recorded by Barron & Perrin (2020) from the same reference source. The entire area of Howth Head SAC is 372.72 ha, and 6.58% of this area is covered by Annex I sea cliffs habitat (CS1 and CS2).

The total length of sea cliff habitat was calculated as 9.732 kilometres (km). However, it must be noted that a stretch of low sea cliffs at Redrock immediately north of the Martello Tower was just outside the SAC boundary. This stretch is 422 m in length, and thus if excluded from the strict SAC sea cliff length calculation, the total would be 9.31 km. The raw total of 9.732 km is almost exactly the raw estimated length given by NPWS (2016b) as 9.7 km, which when clipped to the SAC boundary, gave them a total of 8.22 km. This is the number quoted in the main 'Conservation Objectives' document (NPWS 2016a). Therefore, **the current 2023 survey total of 9.31 km is 1.09 km more than the original**

estimated figure in NPWS (2016a), although in this document, they acknowledged (correctly, as it now proves) that this was likely to be an underestimate.

Permanent Quadrats

20 permanent quadrats (PQs) were recorded during the field surveys in 2023. The plot data for these PQs is presented in full in Appendix I (with high resolution Irish Transverse Mercator grid references included), with photographs displaying the locations associated with each PQ, to aid in returning to the exact locations of the PQs for future surveys. The locations of all PQs are also mapped in Figures 7-8.

The vegetation types recorded within the plots encompassed the full range of habitats which are found on the sea cliffs of Howth Head SAC, and include flush, coastal heath, coastal grassland (both hard cliff and soft cliff types), wet grassland, scrub, exposed siliceous rock, crevice and ledge and splash zone vegetation communities. 89 different plant species were recorded across the 20 PQs, including vascular plants, bryophytes and a few prominent lichen species which were noted. This relatively high species richness across the PQs indicates the variety of vegetation types which occur across the sea cliff habitats in Howth Head SAC. The mean number of species across the 20 PQs is 9.05.

Cover of bare rock ranged from 0% in the most densely vegetated grassland and scrub PQs, to 85% for some of the most sheer and exposed 'crevice and ledge' and 'splash zone' PQs. Lichen cover tended to be most high (25% maximum) in the latter PQs, as with salt indicator species such as *Plantago maritima, Armeria maritima, Aster tripolium, Atriplex portulacoides, Limonium binervosum* agg., etc. (particularly those PQs closest to the salt spray on the seashore). Lichen cover generally declined as vascular plants developed a foothold. Bryophyte cover was generally low and ranged from 0% to 20%, and bryophyte species-richness was generally very low (the common coastal bryophyte *Trichostomum brachydontium* was by far the commonest species in the PQs). The slope of the PQs ranged from 30° to 90°. Median vascular plant height (mean of four quadrant measurements) ranged from 11 cm in the 'crevice and ledge' and 'splash zone' PQs to 115 cm in taller, mature grasslands.

As noted by Barron & Perrin (2020) (with regard to heathlands), comparison of these PQ data with other similar sea cliff surveys on the (central) east coast of Ireland would be useful. Barron *et al.* (2011) note in their 'Inventory of Sites in Database' that MERC Ltd. completed surveys of sea cliffs at Killiney and Shankill in Co. Dublin, Bray Head and Arklow Head in Co. Wicklow, and Clogher Head in Co. Louth, all in 2009, with no other details provided. However, none of the datasets from these surveys were available and it is unclear if vegetation plots were recorded for these surveys. Barron *et al.* (2011) also recommended that Wicklow Head, Co. Wicklow, be surveyed as part of "*phase 2 of the national survey*".

Barron *et al.* (2011) only include 'Flush on soft cliff' as a zone type for flushes on sea cliffs. However, on Howth Head, a 'Flush/spring on hard cliff' (tentative name coined by the present author) is the dominant flush type which was recorded. PQs 1 and 12 were established in hard cliff flush vegetation. More research needs to be completed on hard cliff flush communities, including the association of these flushes with the EU Habitats Directive Annex I habitats, [*7220] Petrifying springs with tufa formation (Cratoneurion), and [7230] Alkaline fens. Indeed, Lyons & Kelly (2016) outlined a petrifying spring vegetation community, 'Group 1: *Eucladium verticillatum-Pellia endiviifolia* Tufa Cascades', which occurs mostly on coastal spray zone cliffs. The authors note that at "*coastal sites, Plantago maritima, Cochlearia officinalis, Samolus valerandi and Armeria maritima are frequent. Overall, species diversity is low*". Furthermore, Lyons (2015) noted that at sea cliff flushes/springs at Balscadden and Redrock, "*tufa-forming water issued onto the beach via a pipe into which surface*

water from the land above had been channelled. The result of channelling the water is that it can only impact on a much smaller area; while the water is still often tufa-depositing below the pipe outfall, the habitat is very much reduced in extent and depleted of species". Lyons (2015 – see Appendix V of this PhD thesis for water chemistry details) also completed water sampling of the flush/spring water emanating on the south end of Balscadden Beach, in the area where PQ 1 was completed during the present survey. It had a highly basic pH of 8.25.

Indeed, Barron *et al.* (2011) themselves note that soft cliff flush communities were under-represented in their surveys (and that the indicator species list for that zone type was incomplete) and that efforts should be made in subsequent surveys to assess the appropriateness of monitoring parameters for this zone type. The monitoring parameter 16, "*No evidence of anthropogenic impacts on the hydrological processes or water quality levels*", would seem to be appropriate and relevant for all flush/spring habitats, but would ideally require water chemistry analyses and investigation/knowledge of upstream water source management. Monitoring parameter 17, "*Number of positive indicator species present ≥ 1*", may need to be revised based upon any revised species lists.

The present author would suggest establishing a new zone type titled 'Flush/Spring on hard cliff', with an indicator species list and parameters based off of a detailed future vegetation study of the sea cliff flushes/springs in Howth Head SAC and other suitable hard cliff sites. It may ultimately be appropriate to adopt the above-mentioned petrifying spring vegetation community 'Group 1' as the basis for this new zone type.

Figure 1. Howth Head study area (i.e. all sea cliff areas within the red SAC boundary) – low cliffs at Redrock to the north of the Martello Tower are just outside of the SAC boundary but were nonetheless assessed during this survey

Figure 2. EU Habitats Directive Annex I habitat [1230] Vegetated sea cliffs of the Atlantic and Baltic coasts (represented by both CS1 – Rocky sea cliffs and CS2 – Sea stacks and islets) recorded within the study area during the field surveys in 2023

Figure 3. EU Habitats Directive Annex I habitat [1230] Vegetated sea cliffs of the Atlantic and Baltic coasts (represented by both CS1 – Rocky sea cliffs and CS2 – Sea stacks and islets) recorded within Howth Head SAC during the field surveys in 2023 – N section

Figure 4. EU Habitats Directive Annex I habitat [1230] Vegetated sea cliffs of the Atlantic and Baltic coasts (represented by both CS1 – Rocky sea cliffs and CS2 – Sea stacks and islets) recorded within Howth Head SAC during the field surveys in 2023 – SE section

Figure 5. EU Habitats Directive Annex I habitat [1230] Vegetated sea cliffs of the Atlantic and Baltic coasts (represented by both CS1 – Rocky sea cliffs and CS2 – Sea stacks and islets) recorded within Howth Head SAC during the field surveys in 2023 – SW section

Figure 6. Overall condition assessment of EU Habitats Directive Annex I habitat [1230] Vegetated sea cliffs of the Atlantic and Baltic coasts within Howth Head SAC – all 17 sea cliff section numbers are displayed

Figure 7. Permanent quadrats recorded in sea cliffs habitat within the north of the study area, from Balscadden Beach in the north-west to the Nose of Howth in the north-east

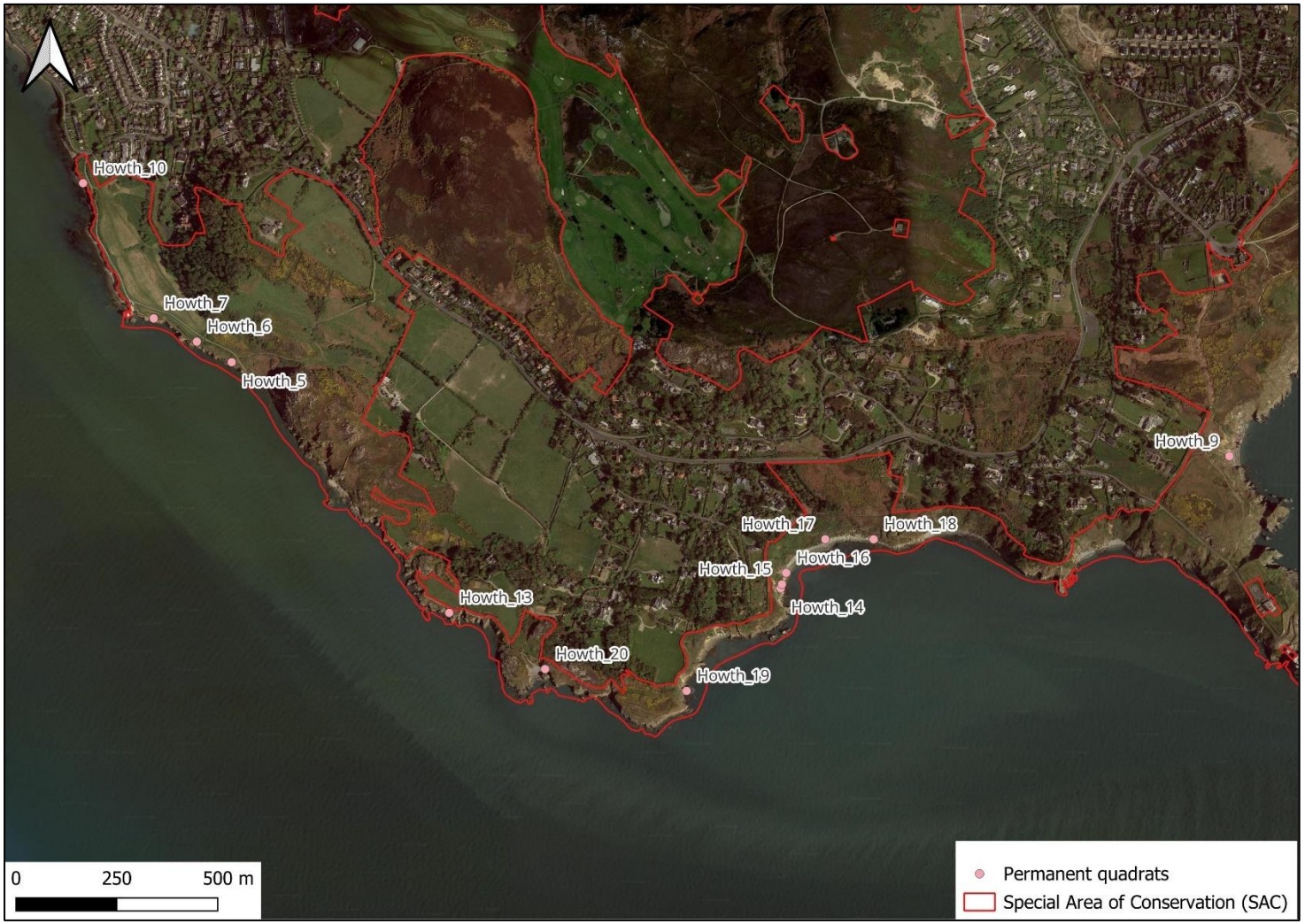

Figure 8. Permanent quadrats recorded in sea cliffs habitat within the south of the study area, from Redrock in the south-west to a small beach area just north of the Bailey Lighthouse in the south-east

Figure 9. New areas of invasive plant species (minimum area was set at 20 m²) (negative indicator species) recorded during the field surveys in 2023 – a large population of Veronica x franciscana was noted at Balscadden Bay; this was estimated to be 268 m² in area

Figure 10. New areas of invasive plant species (minimum area was set at 20 m^2) (negative indicator species) recorded during the field surveys in 2023 – a large population of Kniphofia species was noted on cliff slopes at Lions Head Beach; the species was recorded in lower quantities here by Ní Dhúill & Smyth (2018), however, the population appears to have expanded since then; this was estimated to be 251 m^2 in area, of mostly scattered singular plants

Figure 11. Proposed scrub removal trial areas in the SE of Howth Head SAC – these are located on the cliffs above Doldrum Bay and on the cliffs south of the Whitewater Brook outfall.

Table 3. Condition assessment data recorded for each of 17 separate sections of sea cliff habitat within Howth Head SAC – each row of data across the extended table below accounts for one section (Y = Yes, N = No, P = Pass, F = Fail, S & F = Structure and Function, Est. = Estimated). The assessment criteria follow Barron et al. (2011); the most up-to-date EU 'Pressures and Threats' impact codes are followed

Fossitt	FossLayer	Annex	Date	Recorder	Notes	Data Quality	Valuation	Extent	Sea Defences (Structure & Function)	Artificial Structures (Structure & Function)	Access Points (Structure & Function)	Non-native Species Present Y/N (Structure & Function)	Non-native Species (S and F)	Splash zone (S & F)	Number of positive indicator species present ≥ 1	Crevice and ledge zone (S & F)	Number of positive indicator species present ≥ 4	Coastal grassland on hard or soft cliffs (S & F)	Combined cover of Pteridium aquilinum and woody species (inc. Rubus fruticosus agg., Ulex europaeus, Prunus spinosa, Calluna vulgaris, Hedera helix etc.) is <5%
CS1 - Rocky sea cliffs	CS1 - Rocky sea cliffs	1230	17/07/2023	Alexis FitzGerald		V	International Importance	Stable	P	P	P	Y	Olearia traversiorum	Y	P			Y	F
CS1 - Rocky sea cliffs	CS1 - Rocky sea cliffs	1230	09/08/2023	Alexis FitzGerald	Inula crithmoides present along this stretch of cliff	V	International Importance	Stable	P	F	P	N		Y	P	Y	P	Y	P
CS1 - Rocky sea cliffs	CS1 - Rocky sea cliffs	1230	09/08/2023	Alexis FitzGerald		V	International Importance	Stable	P	P	P	N		Y	P	Y	P		
CS1 - Rocky sea cliffs/CS2 - Sea stacks and islets	CS1 - Rocky sea cliffs	1230	12/08/2023	Alexis FitzGerald		V	International Importance	Stable	P	P	P	N		Y	P	Y	P	Y	P
CS1 - Rocky sea cliffs/CS2 - Sea stacks and islets	CS1 - Rocky sea cliffs	1230	10/08/2023	Alexis FitzGerald		V	International Importance	Stable	P	P	P	N		Y	P	Y	P	Y	P
CS1 - Rocky sea cliffs/CS2 - Sea stacks and islets	CS1 - Rocky sea cliffs	1230	25/08/2023	Alexis FitzGerald		V	International Importance	Stable	P	P	P	N		Y	P	Y	P		
CS1 - Rocky sea cliffs/BL3 - Buildings and artificial surfaces	CS1 - Rocky sea cliffs	1230	27/06/2023	Alexis FitzGerald		V	International Importance	Unfavourable - Bad	F	F	F	N		Y	F	Y	F		
CS1 - Rocky sea cliffs	CS1 - Rocky sea cliffs	1230	26/06/2023	Alexis FitzGerald		V	International Importance	Stable	P	F	F	N		Y	P	Y	P	Y	P
CS1 - Rocky sea cliffs	CS1 - Rocky sea cliffs	1230	27/06/2023	Alexis FitzGerald		V	International Importance	Stable	P	F	F	Y	Phormium tenax, Crocosmia x crocosmiiflora					Y	F
CS1 - Rocky sea cliffs/CS2 - Sea stacks and islets	CS1 - Rocky sea cliffs	1230	27/06/2023	Alexis FitzGerald	Below mentioned flushes are on hard cliff but with soft tufa encrustation being present in places - this cliff is wet in many places	V	International Importance	Stable	P	F	P	Y	Hebe x franciscina, Cordyline australis, Phormium tenax	Y	F	Y	P	Y	F
CS1 - Rocky sea cliffs	CS1 - Rocky sea cliffs	1230	17/07/2023	Alexis FitzGerald		V	International Importance	Stable	P	F	F	Y	Centranthus ruber, Veronica x franciscana	Y	P	Y	P	Y	F
CS1 - Rocky sea cliffs/CS2 - Sea stacks and islets	CS1 - Rocky sea cliffs	1230	10/08/2023	Alexis FitzGerald	Old bathing area concrete structures and concrete access paths in this area, walls also built at base of houses on the cliffs at upper margins; pipe at top of flush showing influence on hydrological processes above cliff; note that indicator species for flushes need updating - no category for flushes on hard cliff, which is applicable here	V	International Importance	Stable	P	F	F	Y	Veronica x franciscana, Calystegia silvatica, Phormium tenax, Crocosmia x crocosmiiflora	Y	P	Y	P	Y	P
CS1 - Rocky sea cliffs	CS1 - Rocky sea cliffs	1230	25/08/2023	Alexis FitzGerald		V	International Importance	Stable	P	F	P	N		Y	P	Y	P		
CS1 - Rocky sea cliffs/CS2 - Sea stacks and islets	CS1 - Rocky sea cliffs	1230	09/09/2023	Alexis FitzGerald	Limited access to this private area, mostly viewed from boat and walking paths adjacent to walled off area	V	International Importance	Stable, some old lighthouse developments just above cliff	P	F	F	N		Y	P	Y	P		
CS1 - Rocky sea cliffs	CS1 - Rocky sea cliffs	1230	09/09/2023	Alexis FitzGerald		V	International Importance	Stable, some evidence of erosion	P	P	F	Y	Cordyline australis			Y	F	Y	F
CS1 - Rocky sea cliffs/CS2 - Sea stacks and islets	CS1 - Rocky sea cliffs	1230	21/10/2023	Alexis FitzGerald		V	International Importance	Stable	P	P	P	Y	Veronica x franciscana, Carpobrotus edulis, Berberis species, Cupressus species	Y	P	Y	P	Y	F
CS1 - Rocky sea cliffs	CS1 - Rocky sea cliffs	1230	21/10/2023	Alexis FitzGerald		V	International Importance	Stable	P	P	P	Y	Kniphofia species	Y	P			Y	F

Coastal grassland on hard cliffs (S & F)	No negative indicator species present	Ungrazed coastal grassland on hard cliffs (S & F)	Ungrazed grassland sward height is ≥ 10 cm	Number of positive indicator species present ≥ 2	Coastal grassland on soft cliffs (S & F)	Number of positive indicator species present ≥ 2	Flush on soft cliff (S & F)	No evidence of anthropogenic impacts on the hydrological processes or water quality levels	Number of positive indicator species present ≥ 1	Coastal heath (S & F)	Number of positive indicator species present ≥ 2	No negative indicator species present.	Cover of Pteridium aquilinum < 10%	Cover of scattered native trees, shrubs and woody climbers < 20%	No signs of burning of heath habitat on the cliff. If target is failed record the cliff section(s) this occurs in	Other habitats	Impact Code 1 (Future Prospects)	% area affected	Intensity (H/M/L)	+/-/0	Internal/External	Impact Code 1 - Notes
					Y	P										WS1	PM07	1 to 25	M	-	Internal	Scrub encroachment on tops of cliff, Rubus fruticosus agg. and Hedera helix mostly
Y	P															HD1	PA05	100	M	-	Internal	Abandonment of traditional grazing management on or near cliffs
																	PX04					
Y	P	Y	P	P												CS2	PX04					
Y	P	Y	P	P												CS2	PX04					
																CS2	PF15	1 to 25	L	-	External	Derelict building built at edge of cliff top here
																FS1	PE01	26-50	H	-	External	Wide concrete access path here
Y	P	Y	P	P													PE01	1 to 25	L	-	Internal	Coastal pathway with small area infringing on top of sea cliff
					Y	P										WS1, FS1	PE01	1 to 25	M	-	Internal	Access path down to Balscadden Bay
Y	P	Y	P	P			Y	F	F							WS1, GS4, FW2, FS1, CS2	PF15	1 to 25	M	-	Internal	Slipways built in some areas below residential properties, including a pier connecting cliffs to a small sea stack
Y	F	Y	F	P						Y	P	P	P	P	P	FW2, WS1, HD1	PE01	1 to 25	L	-	Internal	Access pathway to beach with concrete steps
Y	F	Y	P	P			Y	F	F	Y	P	P	P	P	P	FW2, CS2	PF05	1 to 25	M	-	Internal	Areas built to allow access by bathers and fishermen who actively use this stretch of cliff
																	PF15	1 to 25	L	-	Internal	Wall built on top of cliff
																CS2	PF15	1 to 25	H	-	Internal	Developments related to lighthouse affecting cliff habitat locally
Y	P	Y	P	P												WS1, HD1, FW2	PE01	1 to 25	M	-	Internal	Steep access path to Doldrum Beach
Y	F															WS1, HD1, CS2	PI02	1 to 25	M	-	Internal	Various invasive plant species in and just above cliffs here
Y	F															WS1, HD1	PM07	51-75	M	-	Internal	WS1 and HD1 extensive on slope

Impact Code 2 (Future Prospects)	% area affected (2)	Intensity (H/M/L) (2)	+/-/0 (2)	Internal/External (2)	Impact Code 2 - Notes	Impact Code 3 (Future Prospects)	% area affected (3)	Intensity (H/M/L) (3)	+/-/0 (3)	Internal/External (3)	Impact Code 3 - Notes	Impact Code 4 (Future Prospects)	% area affected (4)	Intensity (4)	+/-/0 (4)	Internal/External (4)	Impact Code 4 - Notes
PA05	100	M	-	Internal	Abandonment of traditional management on and near cliffs	PI02	1 to 25	L	-	Internal	One tree of Olearia traversiorum at top of cliff						
PM07	1 to 25	M	-	Internal		PF15	1 to 25	M	-	Internal	Boundary wall constructed at top of cliff presumably to keep in livestock, at eastern edge of polyline						
PF15	100	H	-	Internal	Sea walls built to support and defend building above cliff, blocking off much of the original cliff face with concrete	PF13	100	H	-	Internal	Water diverted into drain pipes throughout the cliff face	PA05	100	M	-	Internal	Abandonment of traditional management on and near the cliffs
PM07	76-99	H	-	Internal	Scrub encroachment on this ungrazed slope	PI02	1 to 25	L	-	Internal	See invasive listed above						
PI02	1 to 25	H	-	Internal	See invasive listed above - Veronica x fransiscana colonies are extensive	PF13	100	H	-	Internal	Many flushes and streams have been diverted, culverts or canalised, threatening the local flush habitats	PM07	26-50	H	-	Internal	Scrub encroachment is extensive on these ungrazed and unmanaged upper cliffs
PI02	1 to 25	M	-	Internal	Invasive plant species	PM07	1 to 25	M	-	Internal	Scrub encroachment	PA05	100	M	-	Internal	Abandonment of traditional management on and near the cliffs
PE01	1 to 25	M	-	Internal	Concrete access path to cliff base built here; also walls built at bottom of houses near upper margins of cliffs	PI01	1 to 25	M	-	Internal	Scrub and dense bracken encroaching locally near cliff tops here	PA05	100	M	-	Internal	Abandonment of traditional management on and near the cliffs
PI02	1 to 25	L	-	Internal	Invasive plant species	PM07	76-99	H	-	Internal	WS1 and HD1 are widespread						
PM07	1 to 25	M	-	Internal	WS1 and HD1 spreading locally												
PI02	1 to 25	M	-	Internal	Various invasive plant species on slope												

Impact Code 5 (Future Prospects)	% area affected (5)	Intensity (5)	+/-/0 (5)	Internal/External (5)	Impact Code 5 - Notes	Other Impact Notes	Bird Colonies	Other Fauna Notes	Adjacent Habitats (Fossitt Level 2) - Cliff Top	Adjacent Habitats (Fossitt Level 2) - Cliff Base	Cliff Type (hard/soft)	Cliff Section Number	Vantage Point for Section Assessment (ITM) (1)	Vantage Point for Section Assessment (ITM) (2)	Reason for Separation of Section
									GS	LR	Hard (with deep till sediment layer over bedrock)	17	726586, 737471	726690, 737197	Coherent section of cliff with bedrock and deep overlying glacial till sediment layer, ends at the Martello Tower which acts as a barrier
									GS/ER	LR	Hard	15	726843, 737095	727215, 736755	Higher cliff section which ends to the west in lower cliff and to the east in a beach with no cliff
									GS	LR	Hard	14	727356, 736613		Consistent area of low steep cliff
							Kittiwake colonies on cliff face		HH	LR	Hard	5	730003, 738995	730195, 739045	Consistent area of very high vertical cliff, 30 m on average
									GS/HD/WS	LR	Hard	6	729901, 737735	730328, 738333	Lower cliff than area to north and with long sloping cliff top to higher walking path
									GS	LR	Hard	12	727729, 736263	727727, 736297	Bounded by areas of non cliff habitat
									BL	LR	Hard	1	728857, 739224		This area is separate from adjacent soft cliff and is affected by development above
								Brown rat seen on rocks	GS	LR	Hard	16	726786, 737141		Grassland vegetation at the top of the cliff is covered with salt indicator species such as Atriplex portulacoides, Plantago maritima, Armeria maritima, Limonium binervosum agg., etc.
									BL	BL	Soft	2	728848, 739157		Soft cliff due to underlying bedrock geology (Tournaisian limestone) different to surrounding hard cliffs bedrock geology and presence of indicator species for 'Coastal grassland on soft cliffs' - this area is tentatively considered soft cliff and is potentially subject to revision
PA05	100	M	-	Internal	Abandonment of traditional management on and near the cliffs				BL	LR	Hard	3	728896, 739109	729143, 739265	Hard cliff due to underlying bedrock geology, different to adjacent soft cliffs bedrock geology; also plentiful water input along these cliffs, with evidence of flushing locally
							Kittiwake colony at eastern end of polyline		HD	LR	Hard	7	729425, 736872	729404, 736885	Coherent section around a bay with stream outflow
PF13	1 to 25	M	-	Internal	Alteration of hydrology of flushes locally due to housing above cliff				WS/HD	LR	Hard	4	729791, 739062	729865, 739286	Area separated by soft cliff to the west and higher cliff to the east
									GS	LR	Hard	13	727545, 736436		Bounded by areas of non cliff
							Small bird colonies here, ?cormorant		GS	LR	Hard	8	729545, 736725	729650, 736872	Area of high cliff surrounding Bailey Lighthouse
									WS	LR	Hard (with shallow glacial till sediment layer above bedrock)	10	728446, 736638		Shallower slope with soft till or other sediment over bedrock, abundant mature WS1 across this area of cliff
							Cormorants possibly nesting locally on small islets along this stretch		GS	LR	Hard	11	728082, 736239	727741, 736260	Higher areas of cliff, adjoined by bays on both sides
									CB	WS	Hard	9	729019, 736603		Steep cliff section between two small bays

Est. Mean Slope of Section	Est. Mean Height of Cliff Section	Extent - Final Assessment	Structure and Function - Final Assessment	Future Prospects - Final Assessment	Overall Assessment	Primary Reasons for Overall Assessment	Length (m)
60	7	Favourable	Favourable	Favourable	Favourable	Minimal conservation issues at present	422
50	11	Favourable	Favourable	Favourable	Favourable	Minimal conservation issues at present	581
60	5	Favourable	Favourable	Favourable	Favourable	Minimal conservation issues at present	240
75	30	Favourable	Favourable	Favourable	Favourable	Minimal conservation issues at present	385
70	25	Favourable	Favourable	Favourable	Favourable	Minimal conservation issues at present	2177
70	7	Favourable	Favourable	Favourable	Favourable	Minimal conservation issues at present	213
85	6	Favourable	Unfavourable - Bad	Unfavourable - Bad	Unfavourable - Bad	Heavily affected by hotel development above and around this cliff section	35
48	10	Favourable	Unfavourable - Inadequate	Favourable	Unfavourable - Inadequate	Artificial structures and access points present	127
36	20	Favourable	Unfavourable - Inadequate	Unfavourable - Inadequate	Unfavourable - Inadequate	Artificial structures and access points present; also scrub encroachment and invasive species present	91
70	20	Favourable	Unfavourable - Inadequate	Unfavourable - Inadequate	Unfavourable - Inadequate	Artificial structures present; also scrub encroachment and invasive species present, and flush condition assessments failed	294
55		Favourable	Unfavourable - Inadequate	Favourable	Unfavourable - Inadequate	Artificial structures and access points present; also scrub encroachment and invasive species present	435
70	17	Favourable	Unfavourable - Inadequate	Unfavourable - Inadequate	Unfavourable - Inadequate	Artificial structures and access points present; also scrub encroachment and invasive species present, and flush condition assessments failed	958
80	8	Favourable	Unfavourable - Inadequate	Favourable	Unfavourable - Inadequate	Artificial structures present	368
65		Favourable	Unfavourable - Inadequate	Favourable	Unfavourable - Inadequate	Artificial structures and access points present - related to Bailey Lighthouse	1344
60	15	Favourable	Unfavourable - Inadequate	Unfavourable - Inadequate	Unfavourable - Inadequate	Access points and invasive species present	709
65	17	Favourable	Unfavourable - Inadequate	Unfavourable - Inadequate	Unfavourable - Inadequate	Scrub encroachment and invasive species present	1066
75	10	Favourable	Unfavourable - Inadequate	Unfavourable - Inadequate	Unfavourable - Inadequate	Scrub encroachment and invasive species present	287

5. Sea Cliffs Condition Assessments

Section Assessments

Conservation status assessments for sea cliffs habitat require consideration of three parameters, according to Barron *et al.* (2011): 'Extent', 'Structure and Function', and 'Future Prospects'. Extent is the consideration of whether the area of the sea cliffs habitat is stable/increasing or declining (natural erosion should not be considered as loss of habitat), and Future Prospects consider the likelihood of impacts to the habitat in the future from threats and pressures. Structure and Function can be assessed in detail through various structural and vegetation parameters.

Each of 17 separate sections of sea cliff habitat in Howth Head SAC were assessed for their conservation condition. The Overall Assessment results for each section are displayed in Figure 6. This shows that the eastern and south-western stretches of sea cliffs habitat are currently in 'Favourable' condition.

Table 3 presents all of the assessment criteria and other data recorded for each section of cliff in the GIS attribute table, and provides further insight into the reasons for their conservation condition (see column 'Primary Reasons for Overall Assessment'). The most common conservation issues were as follows, and mostly fall under the Structure and Function criteria:

1) Access points – trackways and other infrastructure built down through the sea cliff habitat to allow access to fishermen, swimmers, etc.
2) Artificial structures – walls, piers or other infrastructure built on or just above the sea cliffs
3) Building developments on or above the sea cliffs, e.g. residential properties.
4) Invasive plant species – a range of different invasive plant species were recorded in certain areas, some in large quantities
5) Scrub encroachment – encroachment of scrub (WS1) and dense bracken (HD1) on some cliff sections were extensive
6) Failure of vegetation zone type assessment criteria (Structure & Function criteria) – failure of various vegetation zone types to pass monitoring criteria, e.g. for 'Coastal grassland on hard or soft cliffs', some sections failed as they contained equal to or greater than 5% combined cover of *Pteridium aquilinum* and woody species (inc. *Rubus fruticosus agg., Ulex europaeus, Prunus spinosa, Calluna vulgaris, Hedera helix* etc.). Various different criteria apply to each different zone type, as and when they are recorded in a particular sea cliff section. These criteria are set out in detail by Barron *et al.* (2011). The above examples are closely related to the issue of scrub encroachment.

Extent (although often difficult to ascertain) was generally considered to be stable and no obvious signs of sea cliff habitat loss were recorded.

Future Prospects was generally considered to be either Favourable (especially where recorded impacts were none/few and/or were low in intensity or area of coverage) or Unfavourable – Inadequate, where a greater number and/or intensity/coverage of impacts was noted. As this is a baseline assessment for the site, no comparisons with previous impact datasets were available for the site. Future surveys should compare with the present findings and record if the intensity of impact(s) are increasing or decreasing, as per the recommendation of Barron *et al.* (2011).

Cliff sections 5, 6 and 14 passed all of the relevant assessment criteria under the three broad categories mentioned above and no pressures and threats were recorded (see Figure 6 for locations

of these sections). These are the areas of sea cliff with the highest quality conservation condition according to the collected data.

The areas of sea cliff habitat in 'Favourable' conservation condition appropriately tend to coincide with the areas of cliff which are least built upon and above by residential and other developments, whilst those areas in 'Unfavourable – Inadequate' and 'Unfavourable – Bad' conservation condition tend to coincide with the most developed coastal areas. These more developed areas include the cliff sections along Balscadden Road and along Doldrum Bay and Drumleck Point, which both feature a range of mostly residential developments on/near the sea cliffs. The section of sea cliffs around the Bailey Lighthouse is affected by that much older development.

38.6% of the length of sea cliffs habitat was assessed as being in 'Favourable' conservation condition, whilst 'Unfavourable – Inadequate' sections account for 61.03% and 'Unfavourable – Bad' sections account for 0.37%. Therefore, the majority of the sea cliffs habitat within the SAC is currently in 'Unfavourable – Inadequate' conservation condition.

Site-level Assessment

In terms of an overall site-level assessment of conservation condition for the sea cliffs of Howth Head SAC, based on the findings above, it is considered that 'Unfavourable - Bad' condition is currently appropriate. This is based on the general evaluation procedure as presented by Barron *et al.* (2011), and the details for the current site are summarised below in Table 4:

Table 4. Summary conservation condition assessment table for the habitat, [1230] Vegetated sea cliffs of the Atlantic and Baltic coasts, within Howth Head SAC, according to the 2023 survey work

Parameter	Extent	Structure and Function	Future Prospects	Overall Assessment
Summary of Results	No decline recorded	More than 25% of sections failed the assessments	Impacts were noted in the field	One or more Unfavourable – Bad
Assessment	Favourable	Unfavourable – Bad	Unfavourable – Inadequate	Unfavourable – Bad

The current condition of the sea cliffs habitat in Howth Head SAC is also likely poor by historical standards. Howth Head is one of the more intensively studied coastal sites on the east coast of Ireland, with a detailed local flora having been published for the area in 1887 (Hart 1887). Historical references, as discussed in Section 3, including Doogue *et al.* (2019), outline a number of mostly modern conservation issues with sea cliffs habitat on Howth Head which were not evident to the same extent (or at all) in older floras and sources. For example, the preponderance of non-native invasive species spreading from recently privatised cliff top gardens onto sea cliffs is of particularly recent origin, as is the piping/culverting of formerly diffuse (flush) water sources. A higher diversity of rare plant species, particularly those species associated with well-managed maritime grasslands and intact flushes and stream outfalls associated with the sea cliffs, have seen notable declines locally in recent decades (Declan Doogue, pers. comm., November 2023).

Site-specific Conservation Objectives – Targets

Table 6 below presents the up-to-date Site-Specific Conservation Objectives (SSCOs) for Howth Head SAC. Table 5 below presents the conclusions which have been reached regarding each of the eight targets as a result of the 2023 surveys. In summary, all targets were considered to pass, with the exception of Attribute 3 (Physical structure: functionality and hydrological regime) and Attribute 8 (Vegetation composition: bracken and woody species):

Table 5. Site-Specific Conservation Objectives (SSCOs) for Howth Head SAC [Site Code: 000202], updated targets according to Table 6 in section 6 below.

Attribute	Measure	Target	Target Conclusions (2023 Survey)
Habitat length	Kilometres	Area stable, subject to natural processes, including erosion. Total length of cliff: 9.31km	**Pass** – the overall area of sea cliffs habitat is considered stable at present
Habitat distribution	Occurrence	No decline, subject to natural processes. See map 3	**Pass** – no decline in distribution of sea cliffs habitat recorded at present
Physical structure: functionality and hydrological regime	Occurrence of artificial barriers	No alteration to natural functioning of geomorphological and hydrological processes, including groundwater quality, due to artificial structures	**Fail** – artificial structures (drains, pipes, culverts) affecting the hydrological processes of the sea cliffs were noted extensively along cliff sections above Balscadden Road east to the Nose of Howth; See section 6 for recommendations on how to reverse this trend
Vegetation structure: zonation	Occurrence	Maintain range of sea cliff habitat zonations including transitional zones, subject to natural processes including erosion and succession	**Pass** – a full range of (hard) sea cliff habitat zonations were recorded across the SAC, namely: 1) Splash zone; 2) Crevice and ledge; 3) Ungrazed grassland on hard cliffs; 4) Coastal grassland on soft cliffs; 5) Flush (hard cliff type), and; 6) Coastal heath
Vegetation structure: vegetation height	Centimetres	Maintain structural variation within sward	**Pass** – median vascular plant height in PQs ranged from 11 cm in the 'crevice and ledge' and 'splash zone' PQs to 115 cm in taller, mature grasslands
Vegetation composition: typical species and subcommunities	Percentage cover at a representative number of monitoring stops	Maintain range of subcommunities with typical species listed in the Irish Sea Cliff Survey (Barron et al., 2011)	**Pass** – a full range of (hard) sea cliff subcommunities were recorded with typical indicator species, as evidenced by the 20 PQs and the Structure and Function (S & F) indicator species data recorded for each of the 17 cliff sections (see Table 3)
Vegetation composition: negative indicator species	Percentage	Negative indicator species (including non-natives) to represent less than 5% cover	**Pass** – no negative indicator species for either 'coastal grassland on hard cliffs' or 'coastal heath' were recorded during the field surveys; areas of non-native invasive species covered less than 5% of the total area of sea cliffs habitat
Vegetation composition: bracken and woody species	Percentage	Cover of bracken *(Pteridium aquilinum*) on coastal heath less than 10% and cover of woody species (*Prunus spinosa, Hedera helix* s.l., *Rubus fruticosus* agg. and *Ulex europaeus*) less than 20%; combined cover of bracken (*Pteridium aquilinum*) and woody species in coastal grassland on hard or soft cliff is <5%	**Fail** – coastal heath targets met; however, combined cover of bracken and woody species in coastal grasslands across the study area was greater than 5% (estimated to be *c.* 15% in total coverage across the study area) – cliff sections 2, 3, 7, 9, 10 and 11 all had greater than 5% combined cover (17 also but this section is not strictly within the SAC and so is not considered)

6. Management Recommendations

Site-Specific Conservation Objectives for Sea Cliffs within Howth Head SAC

As already mentioned in Section 3, the overall conservation objective for the Qualifying Interest (QI) habitat, [1230] Vegetated sea cliffs of the Atlantic and Baltic coasts, within the Howth Head SAC is to "*maintain favourable conservation condition*" (NPWS 2016a, 2016b). However, based on the site-level assessment provided above, **it is more appropriate for the overall objective to be to "*restore the favourable condition*"**. The same conclusion was reached by Barron & Perrin (2020) with regard to the other QI habitat for Howth Head SAC, [4030] European dry heaths. The authors further discuss the following important points: "*The obvious implication is that active management is required to address the factors that are contributing to this unfavourable conservation condition rather than a situation of maintaining the status quo. The development of a management plan can quickly improve the Future Prospects of a site as, where there is evidence of a management plan being implemented, the trend for the Future Prospects will improve. It may, however, take some time for an altered management regime to be evident in an improved Structure and Functions assessment*".

Recommendations:

- Change the overall conservation objective for the Qualifying Interest (QI) habitat, [1230] Vegetated sea cliffs of the Atlantic and Baltic coasts, within the Howth Head SAC to "*to restore the favourable conservation condition*". This comment is within the Site-Specific Conservation Objectives document for the SAC, the most recent version being NPWS (2016a). This change should also be made in NPWS (2016b).

Habitat Length, Area and Other Attributes

NPWS (2016a) stated that the length of cliff was an estimate (and a likely underestimate) and that has proven to be the case according to the present study – see Section 4. Baseline Survey (**Sea Cliff Habitat Statistics**) for a detailed discussion of these results. The area is stated as being "*stable, subject to natural processes, including erosion*". The latter is still the case according to the results of the present study. The document also states that as sea cliffs are linear features, they are measured in kilometres. However, the present study measured the extent of the habitat both as a linear feature, and as habitat polygons with an area in hectares included, as an area estimate was originally given by NPWS (2018). See table 6 below for all of the necessary changes.

Recommendations:

- Update Attribute No. 1 (Habitat length) in NPWS (2016a, 2016b) and NPWS (2018) to reflect the findings of the current study with regard to both linear length (km) and area (ha) for the sea cliffs habitat in Howth Head SAC.
- Update Attribute No. 2 (Habitat distribution) in NPWS (2016a, 2016b) to reflect the findings of the current study with regard to the mapped distribution of sea cliffs habitat and the dominant cliff type in Howth Head SAC.
- Update Attribute No. 8 (Vegetation composition: bracken and woody species) in NPWS (2016a, 2016b) to reflect a new combined cover target of less than 5% for bracken (*Pteridium aquilinum*) and woody species in coastal grassland on hard or soft cliff; also update the Notes section to state that woody species of particular concern for the sea cliffs habitat in Howth Head SAC (according to the results of the present study) are as follows: *Prunus spinosa, Hedera*

helix s.l.*, Rubus fruticosus* agg. and *Ulex europaeus.* These species should be the main focus of future woody species monitoring.

- Add the present report reference to the references section of NPWS (2016b), as follows: FitzGerald Ecology (2023). *Vegetated Sea Cliffs Survey of Howth Head, Co. Dublin*. Report for Fingal County Council.

Table 6. Site-Specific Conservation Objectives (SSCOs) for Howth Head SAC [Site Code: 000202], adapted from NPWS (2016a) – recommended amendments and additions to the table are underlined.

Attribute	Measure	Target	Notes
Habitat length	Kilometres	Area stable, subject to natural processes, including erosion. Total length of cliff: 9.31km	Sea cliffs within the SAC has been mapped in 2023 as 9.31 km as a linear feature, 24.54 ha in total area of coverage
Habitat distribution	Occurrence	No decline, subject to natural processes. See map 3	See Figures 2 to 6 in FitzGerald Ecology (2023) for the mapped distribution of sea cliffs in the SAC. Hard cliffs are the dominant cliff type in the SAC, according to the results of the 2023 study.
Physical structure: functionality and hydrological regime	Occurrence of artificial barriers	No alteration to natural functioning of geomorphological and hydrological processes, including groundwater quality, due to artificial structures	Attribute and target based on Barron et al. (2011). Maintaining natural geomorphological processes, including natural erosion, is important for the health of vegetated sea cliffs. Hydrological processes maintain flushes, and in some cases tufa formations, that can be associated with sea cliffs. See the coastal habitats supporting document for further details
Vegetation structure: zonation	Occurrence	Maintain range of sea cliff habitat zonations including transitional zones, subject to natural processes including erosion and succession	Attribute and target based on Barron et al. (2011). A mosaic of European dry heath (4030) vegetation and maritime grassland occurs on the slopes above the sea cliff vegetation at Howth Head SAC. See the coastal habitats supporting document for further details
Vegetation structure: vegetation height	Centimetres	Maintain structural variation within sward	Attribute and target based on Barron et al. (2011). See the coastal habitats supporting document for further details
Vegetation composition: typical species and subcommunities	Percentage cover at a representative number of monitoring stops	Maintain range of subcommunities with typical species listed in the Irish Sea Cliff Survey (Barron et al., 2011)	In places, the cliffs at Howth Head SAC comprise fairly sheer, exposed rock faces. The maritime flora is of particular interest as a number of scarce and local plants have been recorded. Some of these are species of ledges on hard cliffs and coastal heath. See the coastal habitats supporting document for further details
Vegetation composition: negative indicator species	Percentage	Negative indicator species (including non-natives) to represent less than 5% cover	Attribute and target based on Barron et al. (2011). Hottentot fig (*Carpobrotus edulis*) is an aggressive invader of coastal habitats that poses a serious ecological threat. The first record for hottentot fig in the wild in Ireland is from Howth Head in 1962 (Reynolds, 2002). See the coastal habitats supporting document for further details
Vegetation composition: bracken and woody species	Percentage	Cover of bracken *(Pteridium aquilinum*) on coastal heath less than 10% and cover of woody species (*Prunus spinosa, Hedera helix* s.l., *Rubus fruticosus* agg. and *Ulex europaeus*) less than	Attribute and target based on Barron et al. (2011). Bracken occurs on the cliffs tops at Howth Head and there is some scrub encroachment on the heath. Woody species of particular concern for the sea cliffs habitat in Howth Head SAC, according to the results of the 2023 study (FitzGerald Ecology, 2023), are

		20%; combined cover of bracken (*Pteridium aquilinum*) and woody species in coastal grassland on hard or soft cliff is <5%	as follows: *Prunus spinosa, Hedera helix* s.l., *Rubus fruticosus* agg. and *Ulex europaeus.* These species should be the main focus of future woody species monitoring. See the coastal habitats supporting document for further details

Water Management

A multitude of streams, as well as more diffuse flushes/springs, can be found across the sea cliffs of Howth Head SAC. These areas need to be surveyed and managed more effectively. These main areas of water flow are laid out in detail in the *Wetland Study Phase I Howth Co. Dublin* (Scott Cawley 2022), and are also summarised in Section 3 above.

Recommendations:

- Complete a detailed hydrological survey and management plan assessing the current state of water courses along the sea cliffs of Howth Head SAC. This should include water quality assessments, as well as a management plan on how the piped/culverted areas of water can be de-piped/de-culverted in order to slow the loss of water and maximise the ecological potential of the water resources on the sea cliffs. The flushes along sea cliffs below Balscadden Road are of particular interest as these areas previously harboured a variety of rare plant species which are now generally in decline due to disturbances to their water sources upstream (Doogue 2019). Coulcoor Brook also outfalls in this area and would benefit in particular from a detailed survey as it is currently heavily culverted/piped.

Non-native Invasive Plant Species

Many non-native species have been recorded on and above the sea cliffs of Howth Head SAC, e.g. by Ní Dhúill & Smyth (2018). These have been discussed in detail in Section 3 and 4, including control/eradication programs which have been carried out in the past, e.g. to control the Third Schedule-listed *Carpobrotus edulis* populations in the south of Howth Head. Most of these invasives do not pose a significant near-term threat to the native vegetation and habitats on the vertical sections of sea cliffs (*Carpobrotus edulis* being a notable exception to this), however, they do threaten the cliff top vegetation where the vertical sections of cliff give way to shallower angles of gradient, or on sea cliffs which are naturally more shallow in gradient and do not have vertical/near-vertical components, e.g. cliff sections above beaches/in bays.

Recommendations:

- Complete an invasive plant survey of the entire length of sea cliffs of Howth Head SAC, including all areas surveyed by Ní Dhúill & Smyth (2018). This survey should be repeated on a 4/5 year basis.
- Develop a renewed eradication program for the recorded *Carpobrotus edulis* populations, as this species is considered to have the highest potential for further spread on all areas of sea cliff habitat in Howth Head SAC, including vertical/near-vertical sections, which sections are naturally protected from most invasive plant species. All control/eradication of invasive species should be undertaken by an invasive species specialist contractor, with the guidance of a qualified botanist/ecologist.
- Develop an Invasive Species Management Plan for the sea cliffs of Howth Head SAC.

Scrub Encroachment on Sea Cliffs

Whilst scrub (WS1) may be an important part of the natural variation in semi-natural vegetation on the sea cliffs of Howth Head SAC, they can also encroach onto other important habitats within the site where it becomes too extensive, including dry heath (HH1) ('coastal heath' zone type) and areas of species-rich maritime grassland. They may also overtake areas of true sea cliff habitat which are naturally less steep in gradient and thus maintain a soil surface deep enough to allow woody species to take over.

Recommendations:

- Develop trial areas of intermittent cutting of scrub on an e.g. biennial basis. Trial areas could include sections of the dense *Prunus spinosa* scrub in the Doldrum Bay area and on slopes to the south of the Whitewater Brook outfall (see Figure 11 for locations). Monitoring surveys (including Permanent Quadrats) would be required annually for 3-5 years to closely observe vegetation changes. These trial areas may coincide with fire management strategies for coastal areas of Howth Head, and fire breaks could also be used as trial areas for clearance and monitoring. Other areas of extensive scrub which require control can be found along sea cliffs below Balscadden Road, and at Lions Head Beach (amongst others). Clearance at these various locations (depending on how much is controlled at each location) will allow the SSCO target, "*combined cover of bracken (Pteridium aquilinum) and woody species in coastal grassland on hard or soft cliff is <5%*" to be achieved in the future. The target grassland vegetation type to restore should be the 'ungrazed grassland on hard cliffs' zone type (see Section 4. Baseline Survey – **Habitats** – for a description of this zone type in the context of Howth Head SAC). *Scilla verna* is a rare Dublin species (Doogue *et al.* 1998) which occurs in this zone type in Howth Head SAC. However, it should be noted that, depending on the steepness of the cliff section, 'crevice and ledge' zone type communities may be restored instead.
- Goat grazing could be trialled on scrub-dominated areas of slope which are less steep, e.g. Doldrum Bay area.
- Aim for all areas of coastal grassland (on hard or soft cliff) to be below 5% combined cover of *Pteridium aquilinum* and woody species (including *Rubus fruticosus* agg., *Ulex europaeus, Prunus spinosa, Hedera helix,* etc.); and for all areas of coastal heath (on sea cliff) to be maintained below 20% cover of scattered native trees, shrubs and woody climbers, and below 10% cover of *Pteridium aquilinum*. Areas of scrub clearance may overlap with areas where sea cliff grassland can be promoted in its stead, as these areas will most likely revert to grassland after scrub clearance has taken place. In this way, both scrub reduction and coastal grassland enhancement can overlap.

Monitoring and Research

20 Permanent Quadrats (PQs) have been established within the study area in 2023, with high resolution grid references and photographs provided in Appendix I to facilitate re-finding of exact plot locations. These provide baseline information on the current condition of the sea cliff vegetation communities and will serve as permanent monitoring stations for future surveys with regard to the 'Structure and Function' conservation status of the vegetation. The PQs should be revisited every four/five years.

Recommendations:

- Re-survey PQs in 2027/2028, and continue this monitoring at four/five year intervals, with detailed comparison to previous survey periods.
- Establish further new plots in 2027/2028, if considered necessary, to expand the scope of the monitoring and capture further diversity in the plant communities and their change over time. These should focus on areas where management issues have been highlighted and/or actioned upon by Fingal County Council (e.g. scrub/invasive removal areas).
- As discussed in Section 4 above, more research needs to be completed on hard cliff flush communities, including the association of these flushes with the EU Habitats Directive Annex I habitats, [*7220] Petrifying springs with tufa formation (Cratoneurion), and [7230] Alkaline fens. The present author would suggest establishing a new zone type titled 'Flush/Spring on hard cliff', with an indicator species list and parameters based off of a detailed future vegetation study of the sea cliff flushes/springs in Howth Head SAC and other suitable hard cliff sites.

Educating the Local Community and Private Landowners

Progress on restoring the favourable conservation condition of sea cliffs habitat in Howth Head SAC will be difficult without the co-operation, understanding and good will of local landowners and community members.

Recommendations:

- Educate local landowners on the threats caused by introducing and harbouring non-native invasive plant species (particularly species like *Carpobrotus edulis, Veronica* × *franciscana, Echium pininana,* etc.) in their gardens, particularly those adjacent to sea cliffs, e.g. along Balscadden Road, and residential properties near Doldrum Bay and Drumleck Point. Encourage them to plant native Irish plant species and remove invasives from their gardens, and to reduce mowing and promote grassland growth in their gardens. Patches of semi-natural grassland, outcrop, scrub and other habitats may still survive in these now privatised areas of garden land and should be stewarded appropriately.
- Erect interpretation signage in areas of active management (e.g. in non-native invasive plant hotspots) to inform the public of its purpose.

7. Summary

This report presents a summary of findings from field surveys of the EU Habitats Directive Annex I habitat, [1230] Vegetated sea cliffs of the Atlantic and Baltic coasts, within Howth Head SAC, from June to October of 2023. A total of 17 separate sea cliff sections were recorded across the study area for their conservation condition, and these evaluations were used to create a site-level assessment of sea cliffs habitat within the SAC. The conclusion was that the sea cliffs habitat in the SAC is in 'Unfavourable – Bad' conservation condition currently. All of the Site-Specific Conservation Objectives targets passed, with the exception of the targets under Attributes 3 and 8. 20 Permanent Quadrats were established across a range of sea cliff vegetation types and will be used as permanent monitoring stations for future conservation assessment surveys. A few new populations of non-native invasive plant species were also recorded along the sea cliffs. Moving forward, a significant emphasis will be placed on restoring the conservation condition and integrity of the sea cliff habitats and plants present within the study area. A series of management recommendations have been provided in order to help restore the sea cliffs habitat of Howth Head SAC to a 'Favourable' condition. These include invasive

plant species treatments, monitoring, water management changes, managing scrub encroachment and education of the local public.

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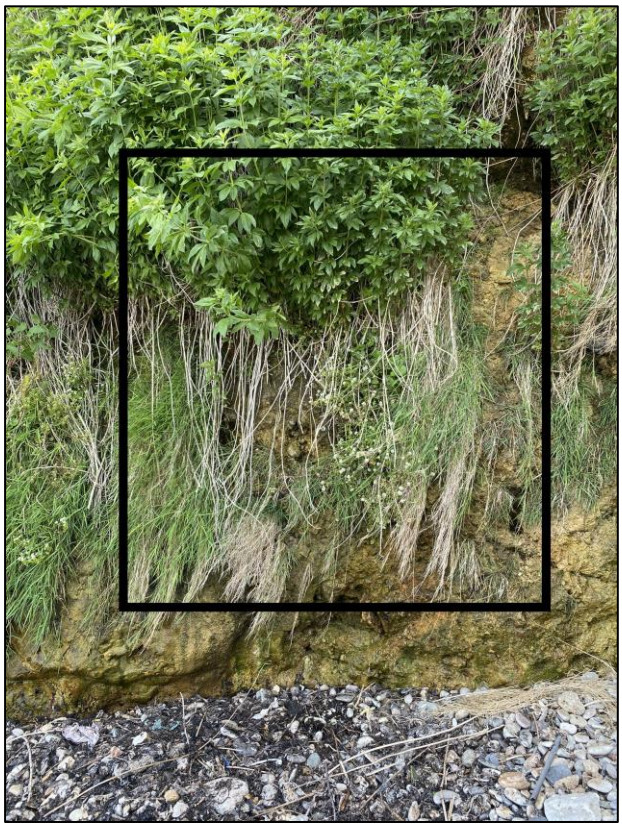
Appendix I: Permanent Quadrat (PQ) Data

Below is presented all of the Permanent Quadrat (PQ) data for 20 plots recorded within the study area during the field surveys in 2023. Below each PQ table are photograph(s) of the contextual location and/or a closeup view of each PQ (with plot boundaries drawn) (a photograph for PQ 8 was unavailable):

PQ 1	
Feature	**Value**
Date	08/06/2023
Recorder	AF
Grid Reference (ITM Easting, ITM Northing)	728884.000, 739116.000
Longitude, Latitude	-6.06266200, 53.38678000
Relevé Reference	Howth_1
Aspect	N
Slope	90°
Habitat - Fossitt	CS1
Habitat – Annex I	1230
Species Recording Scale	Percentage
Relevé Area (m^2)	4
Species total	6
Species	Percentage
Agrostis stolonifera	30
Cochlearia officinalis agg.	15
Eupatorium cannabinum	35
Brachythecium rutabulum	0.5
Bryoerythrophyllum recurvirostrum	0.1
Trichostomum brachydontium	0.5
Physical Criteria	Percentage
Bare Soil	0
Rocks	10
Litter	0.1
Surface Water	0
Grazing regime	Ungrazed
Remarks	zone type = flush (‘hard cliff type’); plot Fossitt - CS1, 1230; cliff section number = 3; relevé above high tide mark; some tufa encrusting here due to lime-rich flush water trickling down the slope above; bedrock here is cambrian greywacke, slate and quartzite; median vascular plant height = 55 cm



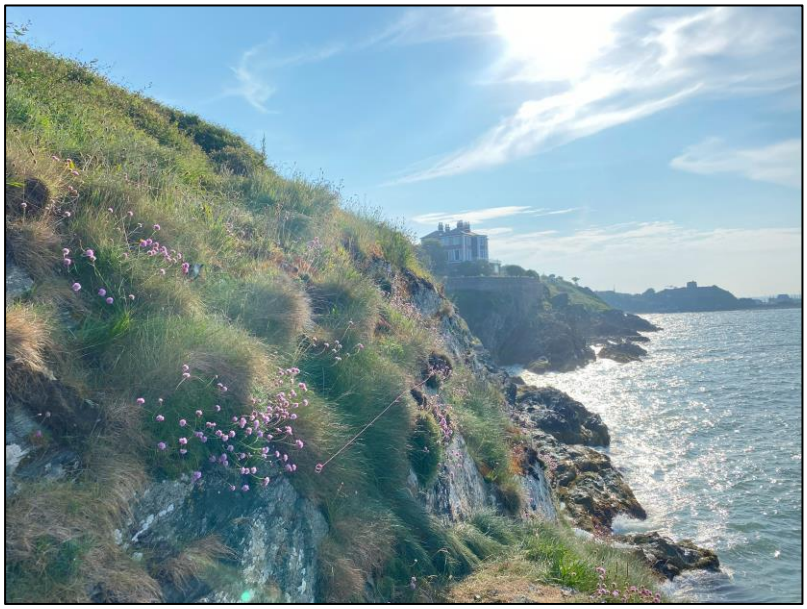
PQ 2	
Feature	**Value**
Date	08/06/2023
Recorder	AF
Grid Reference (ITM Easting, ITM Northing)	729077.000, 739047.000
Longitude, Latitude	-6.05963200, 53.38574000
Relevé Reference	Howth_2
Aspect	N
Slope	30°
Habitat - Fossitt	CS1
Habitat – Annex I	1230
Species Recording Scale	Percentage
Relevé Area (m^2)	4
Species total	9
Species	Percentage
Acer pseudoplatanus	10
Calystegia silvatica	10
Equisetum telmateia	15
Galium aparine	15
Hedera helix	7
Heracleum sphondylium	1
Rubus fruticosus agg.	3
Smyrnium olusatrum	3
Urtica dioica	20
Physical Criteria	Percentage
Bare Soil	1
Rocks	0
Litter	25
Surface Water	0
Grazing regime	Ungrazed
Remarks	zone type = n/a; plot Fossitt - WS1; cliff section number = 3; relevé above high tide mark; much of the litter is made up of conifer needles from dumped garden waste; bedrock here is cambrian greywacke, slate and quartzite; median vascular plant height = 64 cm

PQ 3	
Feature	**Value**
Date	08/06/2023
Recorder	AF
Grid Reference (ITM Easting, ITM Northing)	729637.000, 739066.000
Longitude, Latitude	-6.05120500, 53.38572000
Relevé Reference	Howth_3
Aspect	N
Slope	40°
Habitat - Fossitt	CS1
Habitat – Annex I	1230
Species Recording Scale	Percentage
Relevé Area (m^2)	4
Species total	26
Species	Percentage
Anthoxanthum odoratum	5
Anthyllis vulneraria	0.1
Arrhenatherum elatius	0.3
Calluna vulgaris	30
Carex nigra	3
Centranthus ruber	0.1
Dactylis glomerata	0.3
Holcus lanatus	0.5
Hypochaeris radicata	0.3
Linum catharticum	0.1
Pilosella officinarum	0.1
Plantago lanceolata	0.5
Plantago maritima	0.5
Solidago virgaurea	3
Teucrium scorodonia	5
Trifolium pratense	1
Calliergonella cuspidata	0.5
Campyliadelphus chrysophyllus	0.1
Dicranum scoparium	1
Lophocolea bidentata	0.1
Rhytidiadelphus squarrosus	0.5
Rhytidiadelphus triquetrus	15

Hypnum species	0.5
Veronica species	0.1
Festuca rubra	35
Bryum pseudotriquetrum	3
Physical Criteria	Percentage
Bare Soil	0
Rocks	0
Litter	1
Surface Water	0
Grazing regime	Ungrazed
Remarks	zone type = coastal heath; plot Fossitt: HH1, 4030; cliff section number = 4; relevé above high tide mark; bedrock here is cambrian greywacke, slate and quartzite; median vascular plant height = 21 cm

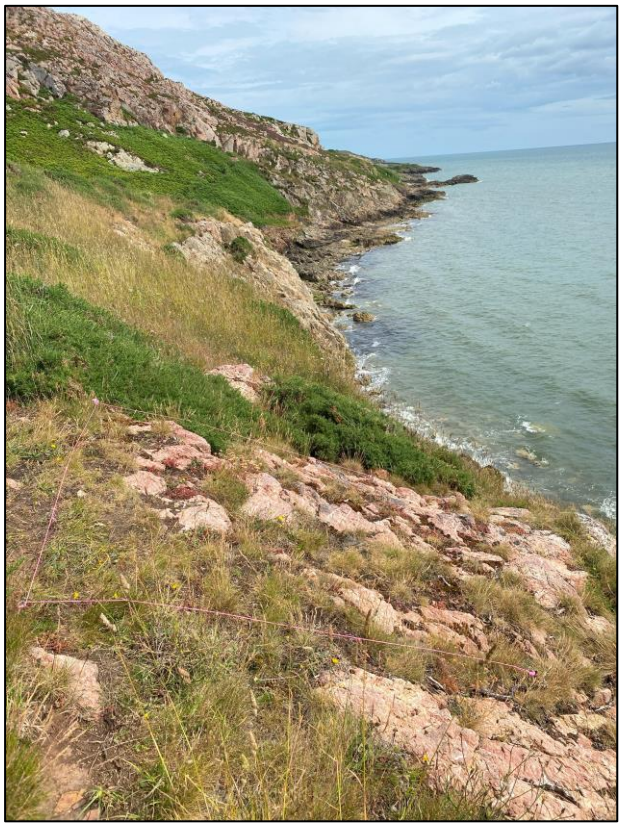
PQ 4	
Feature	**Value**
Date	08/06/2023
Recorder	AF
Grid Reference (ITM Easting, ITM Northing)	729603.000, 739076.000
Longitude, Latitude	-6.05164300, 53.38595000
Relevé Reference	Howth_4
Aspect	4
Slope	50°
Habitat - Fossitt	CS1
Habitat – Annex I	1230
Species Recording Scale	Percentage
Relevé Area (m^2)	4
Species total	13
Species	Percentage
Acer pseudoplatanus	0.1
Anthoxanthum odoratum	0.1
Holcus lanatus	0.5
Plantago lanceolata	15

Festuca rubra	50
Armeria maritima	7
Aster tripolium	0.1
Senecio jacobaea	0.1
Sonchus oleraceus	0.1
Spergularia rupicola	0.1
Taraxacum officinale agg.	1
Funaria hygrometrica	20
Trichostomum crispulum	0.1
Physical Criteria	Percentage
Bare Soil	3
Rocks	7
Litter	0.1
Surface Water	0
Grazing regime	Ungrazed
Remarks	zone type = coastal grassland on hard cliffs; plot Fossitt: coastal GS1; cliff section number = 4; relevé above high tide mark; bedrock here is cambrian greywacke, slate and quartzite; median vascular plant height = 28 cm



PQ 5	
Feature	**Value**
Date	26/06/2023
Recorder	AF
Grid Reference (ITM Easting, ITM Northing)	726966.000, 737043.000
Longitude, Latitude	-6.09212900, 53.36832000
Relevé Reference	Howth_5
Aspect	SW
Slope	30°
Habitat - Fossitt	CS1
Habitat – Annex I	1230
Species Recording Scale	Percentage
Relevé Area (m^2)	4
Species total	10
Species	Percentage
Trichostomum brachydontium	3
Dactylis glomerata	0.5
Hypochaeris radicata	3
Armeria maritima	1

Spergularia rupicola	0.1
Aira praecox	0.1
Festuca ovina agg.	25
Jasione montana	0.5
Sedum anglicum	7
Ulex europaeus	1
Physical Criteria	Percentage
Bare Soil	10
Rocks	50
Litter	0.1
Surface Water	0
Grazing regime	Ungrazed
Remarks	zone type = coastal grassland on hard cliffs; plot Fossitt: ER1; cliff section number = 15; relevé above high tide mark; bedrock here is cambrian greywacke, slate and quartzite; median vascular plant height = 29 cm



PQ 6	
Feature	**Value**
Date	26/06/2023
Recorder	AF

Grid Reference (ITM Easting, ITM Northing)	726875.000, 737084.000
Longitude, Latitude	-6.09348500, 53.36873000
Relevé Reference	Howth_6
Aspect	SW
Slope	40°
Habitat - Fossitt	CS1
Habitat – Annex I	1230
Species Recording Scale	Percentage
Relevé Area (m^2)	4
Species total	13
Species	Percentage
Agrostis stolonifera	45
Plantago lanceolata	0.5
Festuca rubra	15
Taraxacum officinale agg.	0.3
Achillea millefolium	0.5
Brachypodium sylvaticum	20
Carex flacca	0.1
Cirsium arvense	0.1
Daucus carota	3
Festuca pratensis	1
Galium verum	10
Ononis repens	15
Thymus polytrichus	1
Physical Criteria	Percentage
Bare Soil	0
Rocks	0
Litter	0.5
Surface Water	0
Grazing regime	Ungrazed
Remarks	zone type = coastal grassland on hard cliffs; plot Fossitt: GS1; cliff section number = 15; relevé above high tide mark; bedrock here is cambrian greywacke, slate and quartzite; median vascular plant height = 50 cm

PQ 7	
Feature	**Value**
Date	26/06/2023
Recorder	AF
Grid Reference (ITM Easting, ITM Northing)	726769.000, 737140.000
Longitude, Latitude	-6.09508100, 53.36928000
Relevé Reference	Howth_7
Aspect	SW
Slope	40°
Habitat - Fossitt	CS1
Habitat – Annex I	1230
Species Recording Scale	Percentage
Relevé Area (m^2)	4
Species total	7
Species	Percentage
Plantago maritima	5
Festuca rubra	25
Armeria maritima	1
Aster tripolium	15
Atriplex portulacoides	50
Limonium binervosum agg.	5
Cochlearia species	0.1
Physical Criteria	Percentage
Bare Soil	3
Rocks	0
Litter	0.1
Surface Water	0
Grazing regime	Ungrazed
Remarks	zone type = coastal grassland on hard cliffs; plot Fossitt: salt-sprayed GS1; cliff section number = 16; relevé above high tide mark; bedrock here is cambrian greywacke, slate and quartzite; median vascular plant height = 38 cm

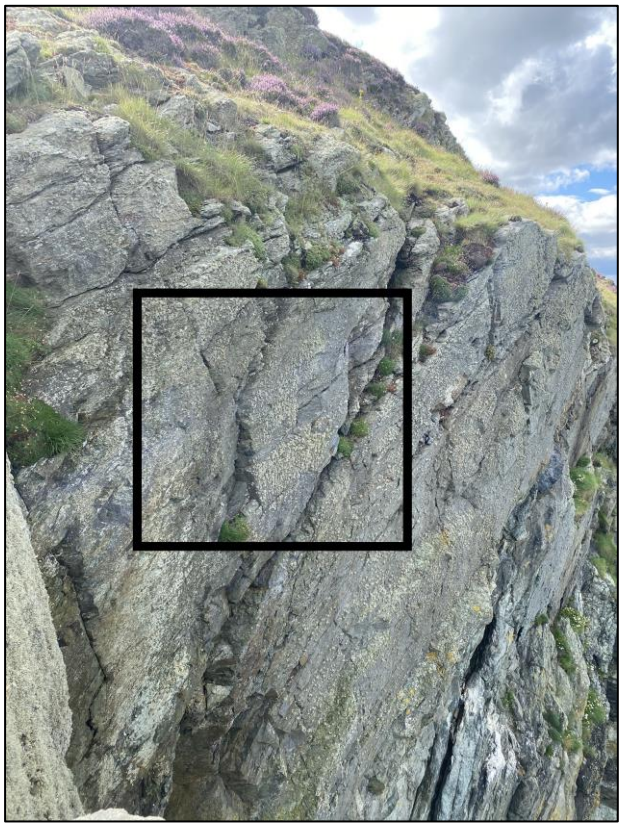
PQ 8	
Feature	**Value**
Date	27/06/2023
Recorder	AF
Grid Reference (ITM Easting, ITM Northing)	728866.000, 739120.000
Longitude, Latitude	-6.06290500, 53.38652000
Relevé Reference	Howth_8
Aspect	N
Slope	43°
Habitat - Fossitt	CS1
Habitat – Annex I	1230
Species Recording Scale	Percentage
Relevé Area (m^2)	4
Species total	11
Species	Percentage
Agrostis stolonifera	1
Galium aparine	20
Rubus fruticosus agg.	1
Urtica dioica	7
Arrhenatherum elatius	60
Holcus lanatus	5
Cirsium arvense	5
Anisantha sterilis	0.1
Ranunculus repens	1
Calystegia species	15
Beta vulgaris subp. *maritima*	5
Physical Criteria	Percentage
Bare Soil	0
Rocks	0
Litter	0.1
Surface Water	0
Grazing regime	Ungrazed
Remarks	zone type = coastal grassland on soft cliffs - positive indicator species are *Arrhenatherum elatius* and *Agrostis stolonifera*; plot Fossitt: GS2; cliff section number = 2; relevé above high tide mark; bedrock here is Tournaisian limestone; median vascular plant height = 115 cm

PQ 9	
Feature	**Value**
Date	17/07/2023
Recorder	AF
Grid Reference (ITM Easting, ITM Northing)	729441.000, 736878.000
Longitude, Latitude	-6.05493800, 53.36614000
Relevé Reference	Howth_9
Aspect	E
Slope	55°
Habitat - Fossitt	CS1
Habitat – Annex I	1230
Species Recording Scale	Percentage
Relevé Area (m^2)	4
Species total	10
Species	Percentage
Agrostis stolonifera	3
Cochlearia officinalis agg.	0.1
Eupatorium cannabinum	15
Rubus fruticosus agg.	3
Centranthus ruber	0.5
Plantago maritima	1
Festuca rubra	10
Epilobium hirsutum	10
Festuca arundinacea	60
Tripleurospermum maritimum	7
Physical Criteria	Percentage
Bare Soil	0
Rocks	0
Litter	0.1
Surface Water	0
Grazing regime	Ungrazed
Remarks	zone type = n/a; plot Fossitt: GS4; cliff section number = 7; relevé above high tide mark; bedrock here is Cambrian greywacke, slate, quartzite; median vascular plant height = 114.5 cm

PQ 10	
Feature	**Value**
Date	17/07/2023
Recorder	AF
Grid Reference (ITM Easting, ITM Northing)	726587.000, 737473.000
Longitude, Latitude	-6.09769300, 53.37229000
Relevé Reference	Howth_10
Aspect	SW
Slope	50°
Habitat - Fossitt	CS1
Habitat – Annex I	1230
Species Recording Scale	Percentage
Relevé Area (m^2)	4
Species total	6
Species	Percentage
Plantago maritima	15
Festuca rubra	35
Aster tripolium	3
Daucus carota	0.5
Atriplex portulacoides	25
Limonium binervosum agg.	3
Physical Criteria	Percentage
Bare Soil	15
Rocks	10
Litter	0.1
Surface Water	0
Grazing regime	Ungrazed
Remarks	zone type = coastal grassland on hard cliffs; plot Fossitt: GS1; cliff section number = 17; relevé above high tide mark; salt-sprayed and partially eroded bank; bedrock here is Cambrian greywacke, slate, quartzite - heavy layer of till over bedrock here; median vascular plant height = 39 cm

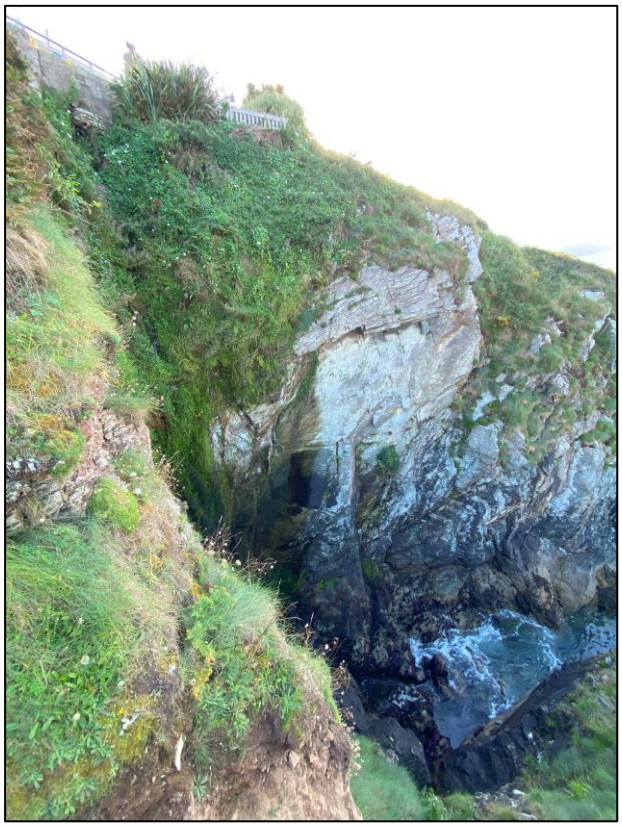
PQ 11	
Feature	**Value**
Date	12/08/2023
Recorder	AF
Grid Reference (ITM Easting, ITM Northing)	

Longitude, Latitude	729997.000, 738991.000
Relevé Reference	Howth_11
Aspect	N
Slope	90°
Habitat - Fossitt	CS1
Habitat – Annex I	1230
Species Recording Scale	Percentage
Relevé Area (m^2)	4
Species total	2
Species	Percentage
Armeria maritima	5
Ramalina species	20
Physical Criteria	Percentage
Bare Soil	0
Rocks	75
Litter	0
Surface Water	0
Grazing regime	Ungrazed
Remarks	zone type = crevice and ledge; plot Fossitt: CS1, 1230; cliff section number = 5; relevé above high tide mark; bedrock here is Cambrian greywacke, slate, quartzite; median vascular plant height = estimate is 35 cm

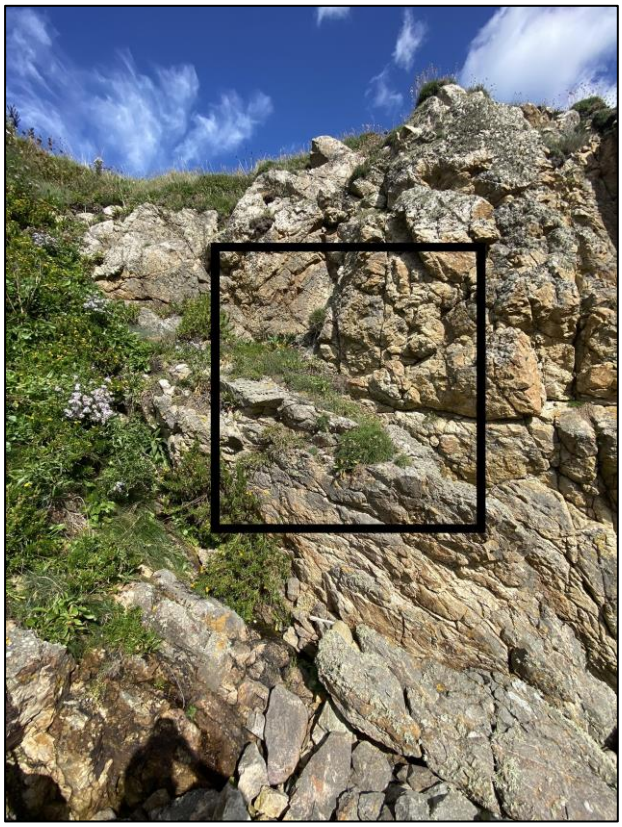


PQ 12	
Feature	**Value**
Date	12/08/2023
Recorder	AF
Grid Reference (ITM Easting, ITM Northing)	729776.000, 739060.000
Longitude, Latitude	
Relevé Reference	Howth_12
Aspect	NE
Slope	85°
Habitat - Fossitt	CS1
Habitat – Annex I	1230
Species Recording Scale	Percentage
Relevé Area (m^2)	4
Species total	5
Species	Percentage
Aster tripolium	1
Tripleurospermum maritimum	0.5
Apium nodiflorum	5
Rumex obtusifolius	0.5

Marchantia polymorpha	7
Physical Criteria	Percentage
Bare Soil	0
Rocks	85
Litter	0
Surface Water	0
Grazing regime	Ungrazed
Remarks	zone type = flush (‘hard cliff type’); plot Fossitt - CS1, 1230; cliff section number = 4; relevé above high tide mark; bedrock here is cambrian greywacke, slate and quartzite; median vascular plant height = unknown



PQ 13	
Feature	**Value**
Date	25/08/2023
Recorder	AF
Grid Reference (ITM Easting, ITM Northing)	727520.000, 736433.000
Longitude, Latitude	-6.08415200, 53.36272000
Relevé Reference	Howth_13
Aspect	SW
Slope	85°
Habitat - Fossitt	CS1
Habitat – Annex I	1230
Species Recording Scale	Percentage
Relevé Area (m^2)	4
Species total	8
Species	Percentage
Festuca rubra	3
Armeria maritima	3
Spergularia rupicola	3
Beta vulgaris subsp. *maritima*	3
Ramalina species	1
Inula crithmoides	3
Plantago coronopus	0.3
Xanthoria species	0.3
Physical Criteria	Percentage
Bare Soil	0.1
Rocks	85
Litter	0.1
Surface Water	0
Grazing regime	Ungrazed
Remarks	zone type = crevice and ledge; plot Fossitt - CS1, 1230; cliff section number = 13; relevé above high tide mark; bedrock here is cambrian greywacke, slate and quartzite; median vascular plant height = 33 cm



PQ 14	
Feature	**Value**
Date	09/09/2023
Recorder	AF
Grid Reference (ITM Easting, ITM Northing)	728346.000, 736512.000
Longitude, Latitude	-6.07146300, 53.36317000
Relevé Reference	Howth_14
Aspect	E
Slope	55°
Habitat - Fossitt	CS1
Habitat – Annex I	1230
Species Recording Scale	Percentage
Relevé Area (m^2)	4
Species total	4
Species	Percentage
Plantago maritima	1
Festuca rubra	3
Ramalina species	15
Xanthoria species	0.1

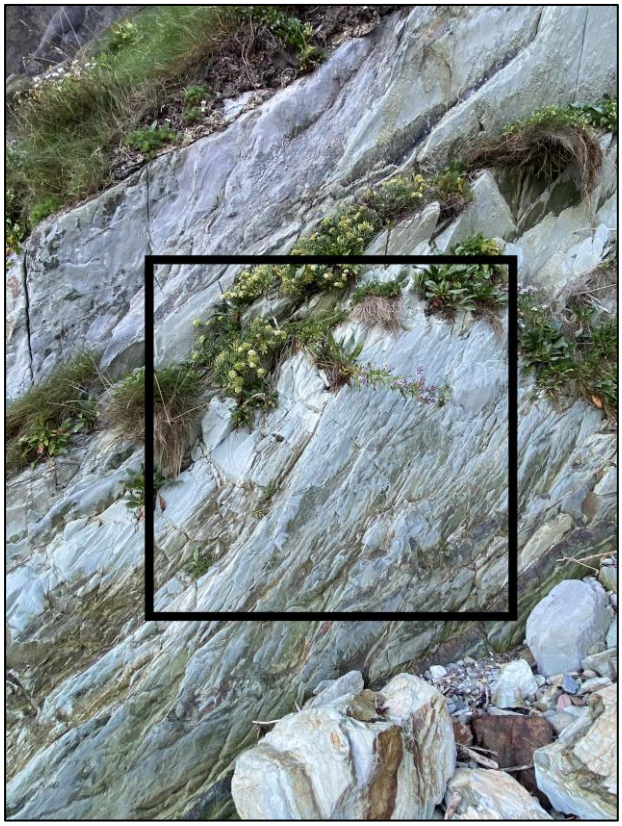
Physical Criteria	Percentage
Bare Soil	0
Rocks	85
Litter	0
Surface Water	0
Grazing regime	Ungrazed
Remarks	zone type = splash zone; plot Fossitt - CS1, 1230; cliff section number = 11; relevé above high tide mark; bedrock here is cambrian greywacke, slate and quartzite; median vascular plant height = 21 cm

PQ 15	
Feature	**Value**
Date	09/09/2023
Recorder	AF
Grid Reference (ITM Easting, ITM Northing)	728342.000, 736527.000

Longitude, Latitude	
Relevé Reference	Howth_15
Aspect	E
Slope	65°
Habitat - Fossitt	CS1
Habitat – Annex I	1230
Species Recording Scale	Percentage
Relevé Area (m^2)	4
Species total	9
Species	Percentage
Agrostis stolonifera	10
Hedera helix	3
Dactylis glomerata	3
Hypochaeris radicata	10
Plantago lanceolata	0.3
Teucrium scorodonia	1
Festuca rubra	70
Sonchus oleraceus	3
Trichostomum crispulum	0.3
Physical Criteria	Percentage
Bare Soil	15
Rocks	3
Litter	0.3
Surface Water	0
Grazing regime	Ungrazed
Remarks	zone type = coastal grassland on hard cliffs; plot Fossitt - GS1; cliff section number = 11; relevé above high tide mark; bedrock here is cambrian greywacke, slate and quartzite; median vascular plant height = 31 cm

PQ 16	
Feature	**Value**
Date	09/09/2023
Recorder	AF
Grid Reference (ITM Easting, ITM Northing)	728355.000, 736561.000
Longitude, Latitude	-6.07161100, 53.36363000
Relevé Reference	Howth_16
Aspect	NE
Slope	80°
Habitat - Fossitt	CS1
Habitat – Annex I	1230
Species Recording Scale	Percentage
Relevé Area (m^2)	4
Species total	6
Species	Percentage
Festuca rubra	5
Aster tripolium	7
Spergularia rupicola	0.3
Beta vulgaris subsp. *maritima*	1

Tripleurospermum maritimum	1
Crithmum maritimum	15
Physical Criteria	Percentage
Bare Soil	0
Rocks	75
Litter	0.1
Surface Water	0
Grazing regime	Ungrazed
Remarks	zone type = crevice and ledge (hard cliffs); plot Fossitt - CS1, 1230; cliff section number = 11; relevé above high tide mark; bedrock here is cambrian greywacke, slate and quartzite; median vascular plant height = 19 cm

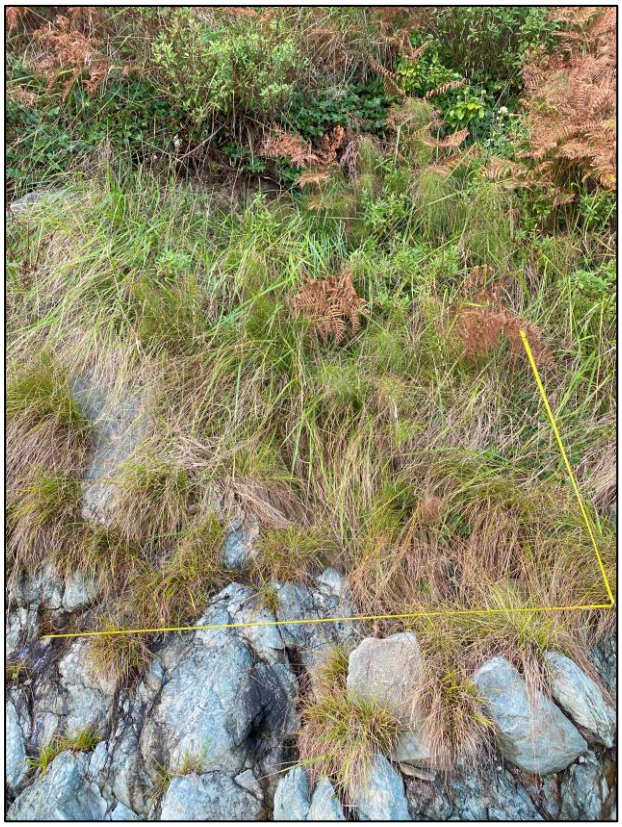


PQ 17	
Feature	**Value**
Date	09/09/2023
Recorder	AF
Grid Reference (ITM Easting, ITM Northing)	728446.000, 736638.000
Longitude, Latitude	-6.07010300, 53.36438000
Relevé Reference	Howth_17

Aspect	S
Slope	60°
Habitat - Fossitt	CS1
Habitat – Annex I	1230
Species Recording Scale	Percentage
Relevé Area (m^2)	4
Species total	9
Species	Percentage
Agrostis stolonifera	7
Hedera helix	70
Rubus fruticosus agg.	3
Daucus carota	5
Beta vulgaris subsp. *maritima*	5
Festuca arundinacea	10
Prunus spinosa	75
Silene uniflora	0.5
Solanum dulcamara	1
Physical Criteria	Percentage
Bare Soil	0
Rocks	0
Litter	0.1
Surface Water	0
Grazing regime	Ungrazed
Remarks	zone type = n/a; plot Fossitt - WS1; cliff section number = 10; relevé above high tide mark; bedrock here is cambrian greywacke, slate and quartzite; median vascular plant height = 131 cm

PQ 18	
Feature	**Value**
Date	09/09/2023
Recorder	AF
Grid Reference (ITM Easting, ITM Northing)	728569.000, 736641.000
Longitude, Latitude	-6.06819100, 53.36437000
Relevé Reference	Howth_18
Aspect	S
Slope	60°
Habitat - Fossitt	CS1
Habitat – Annex I	1230
Species Recording Scale	Percentage
Relevé Area (m^2)	4
Species total	11
Species	Percentage
Equisetum telmateia	10
Hedera helix	5
Centranthus ruber	10
Dactylis glomerata	5

Sonchus oleraceus	0.1
Festuca arundinacea	30
Carex distans	30
Juncus articulatus	0.1
Juncus effusus	5
Pteridium aquilinum	3
Samolus valerandi	0.1
Physical Criteria	Percentage
Bare Soil	0.5
Rocks	15
Litter	0.5
Surface Water	0
Grazing regime	Ungrazed
Remarks	zone type = n/a; plot Fossitt - GS4; cliff section number = 10; relevé above high tide mark; bedrock here is cambrian greywacke, slate and quartzite; median vascular plant height = 88 cm; diffuse fresh water moving down the slope in this area

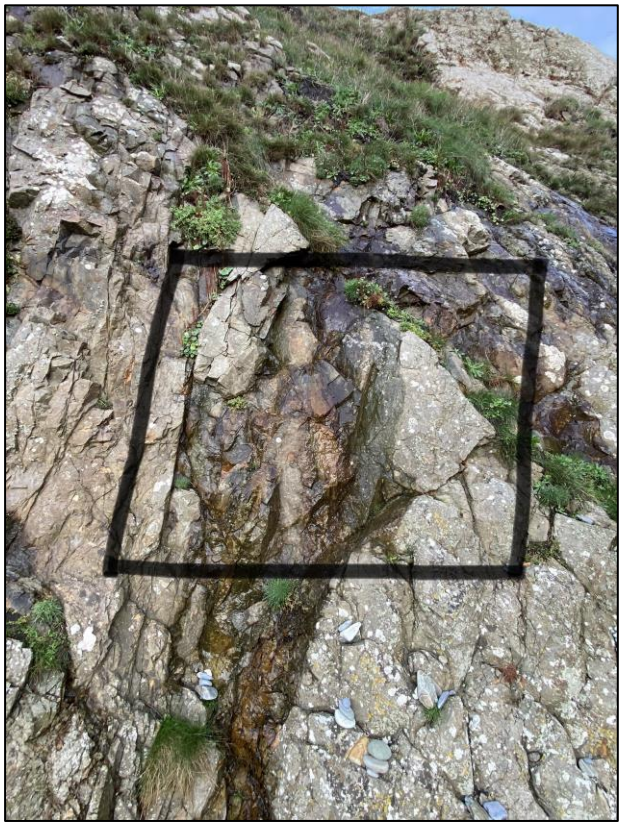


PQ 19	
Feature	**Value**
Date	21/10/2023
Recorder	AF
Grid Reference (ITM Easting, ITM Northing)	728111.000, 736260.000
Longitude, Latitude	-6.07525700, 53.36104000
Relevé Reference	Howth_19
Aspect	S
Slope	60°
Habitat - Fossitt	CS1
Habitat – Annex I	1230
Species Recording Scale	Percentage
Relevé Area (m^2)	4
Species total	9
Species	Percentage
Trichostomum brachydontium	0.1
Festuca rubra	3
Armeria maritima	0.7
Aster tripolium	0.3

Spergularia rupicola	0.1
Limonium binervosum agg.	0.1
Ramalina species	15
Inula crithmoides	5
Xanthoria species	10
Physical Criteria	Percentage
Bare Soil	0.5
Rocks	70
Litter	0.1
Surface Water	0
Grazing regime	Ungrazed
Remarks	zone type = spray zone; plot Fossitt - CS1, 1230; cliff section number = 11; relevé above high tide mark; bedrock here is cambrian greywacke, slate and quartzite; median vascular plant height = 15 cm

PQ 20	
Feature	**Value**
Date	21/10/2023
Recorder	AF

Grid Reference (ITM Easting, ITM Northing)	727741.000, 736260.000
Longitude, Latitude	-6.08056400, 53.36142000
Relevé Reference	Howth_20
Aspect	SW
Slope	60°
Habitat - Fossitt	CS1
Habitat – Annex I	1230
Species Recording Scale	Percentage
Relevé Area (m^2)	4
Species total	7
Species	Percentage
Hypochaeris radicata	0.1
Festuca rubra	3
Armeria maritima	3
Spergularia rupicola	1
Ramalina species	3
Xanthoria species	0.1
Umbilicus rupestris	5
Physical Criteria	Percentage
Bare Soil	0.5
Rocks	85
Litter	0
Surface Water	0.3
Grazing regime	Ungrazed
Remarks	zone type = crevice and ledge zone; plot Fossitt - CS1, 1230; cliff section number = 11; relevé above high tide mark; bedrock here is cambrian greywacke, slate and quartzite; median vascular plant height = 11 cm



Appendix II: Criteria for Ecological Evaluations[1]

International Importance:

- 'European Site' including Special Area of Conservation (SAC), Site of Community Importance (SCI), Special Protection Area (SPA) or proposed Special Area of Conservation.
- Proposed Special Protection Area (pSPA).
- Site that fulfils the criteria for designation as a 'European Site' (see Annex III of the Habitats Directive, as amended).
- Features essential to maintaining the coherence of the Natura 2000 Network.
- Site containing 'best examples' of the habitat types listed in Annex I of the Habitats Directive.
- Resident or regularly occurring populations (assessed to be important at the national level) of the following:
    - Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive; and/or
    - Species of animal and plants listed in Annex II and/or IV of the Habitats Directive.
- Ramsar Site (Convention on Wetlands of International Importance Especially Waterfowl Habitat 1971).
- World Heritage Site (Convention for the Protection of World Cultural & Natural Heritage, 1972).
- Biosphere Reserve (UNESCO Man & The Biosphere Programme).
- Site hosting significant species populations under the Bonn Convention (Convention on the Conservation of Migratory Species of Wild Animals, 1979).
- Site hosting significant populations under the Berne Convention (Convention on the Conservation of European Wildlife and Natural Habitats, 1979).
- Biogenetic Reserve under the Council of Europe.
- European Diploma Site under the Council of Europe.
- Salmonid water designated pursuant to the European Communities (Quality of Salmonid Waters) Regulations, 1988, (S.I. No. 293 of 1988).

National Importance:

- Site designated or proposed as a Natural Heritage Area (NHA).
- Statutory Nature Reserve.
- Refuge for Fauna and Flora protected under the Wildlife Acts.
- National Park.
- Undesignated site fulfilling the criteria for designation as a Natural Heritage Area (NHA); Statutory Nature Reserve; Refuge for Fauna and Flora protected under the Wildlife Act; and/or a National Park.
- Resident or regularly occurring populations (assessed to be important at the national level) of the following:
    - Species protected under the Wildlife Acts; and/or
    - Species listed on the relevant Red Data list.
- Site containing 'viable areas' of the habitat types listed in Annex I of the Habitats Directive.

County Importance:

- Area of Special Amenity.
- Area subject to a Tree Preservation Order.
- Area of High Amenity, or equivalent, designated under the County Development Plan.
- Resident or regularly occurring populations (assessed to be important at the County level) of the following:
    - Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive;
    - Species of animal and plants listed in Annex II and/or IV of the Habitats Directive;
    - Species protected under the Wildlife Acts; and/or
    - Species listed on the relevant Red Data list.
- Site containing area or areas of the habitat types listed in Annex I of the Habitats Directive that do not fulfil the criteria for valuation as of International or National importance.
- County important populations of species, or viable areas of semi-natural habitats or natural heritage features identified in the National or Local BAP, if this has been prepared.
- Sites containing semi-natural habitat types with high biodiversity in a county context and a high degree of naturalness, or populations of species that are uncommon within the county.
- Sites containing habitats and species that are rare or are undergoing a decline in quality or extent at a national level.

[1] Framework and table is taken and adapted from: National Roads Authority (2009). *Guidelines for Assessment of Ecological Impacts of National Roads Schemes*. Report for National Roads Authority.

Local Importance (higher value):

- Locally important populations of priority species or habitats or natural heritage features identified in the Local BAP, if this has been prepared;
- Resident or regularly occurring populations (assessed to be important at the Local level) of the following:
  - Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive;
  - Species of animal and plants listed in Annex II and/or IV of the Habitats Directive;
  - Species protected under the Wildlife Acts; and/or
  - Species listed on the relevant Red Data list.
- Sites containing semi-natural habitat types with high biodiversity in a local context and a high degree of naturalness, or populations of species that are uncommon in the locality;
- Sites or features containing common or lower value habitats, including naturalised species that are nevertheless essential in maintaining links and ecological corridors between features of higher ecological value.

Local Importance (lower value):

- Sites containing small areas of semi-natural habitat that are of some local importance for wildlife;
- Sites or features containing non-native species that are of some importance in maintaining habitat links.