Greater Dublin Drainage Project Addendum

Environmental Impact Assessment Report Addendum: Volume 3A Part B of 6

Appendix A9.2 Ireland's Eye Sublittoral Biotope Survey Report

Uisce Éireann

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Abbreviations

Abbreviation	Meaning
ASML	Aquatic Survey and Monitoring Limited
BSL	Benthic Solutions Limited
CR.HCR.XFa.ByErSp.Cyl	'Mixed turf of bryozoans and erect sponges with *Cylista elegans* on tide-swept circalittoral rock' (in 2023)
CR.HCR.XFa.ByErSp.Sag	Mixed turf of bryozoans and erect sponges with *Sagartia elegans* on tide-swept ciraclittoral rock (in 2015)
CR.HCR.XFa.FluCoAs	*Flustra foliacea* and colonial ascidians on tide-swept moderately wave-exposed circalittoral rock
GDD	Greater Dublin Drainage
CR.HCR.XFa.FluCoAs.Paur	*Polyclinum aurantium* and *Flustra foliacea* on sand-scoured tide-swept moderately wave-exposed circalittoral rock
IR.HIR.KFaR.FoR	Foliose red seaweeds on exposed lower infralittoral rock
IR.HIR.KFaR.FoR.Dic	Foliose red seaweeds with dense *Dictyota dichotoma* and/or *Dictyopteris membranacea* on exposed lower infralittoral rock
IR.MIR.KR.Ldig	*Laminaria digitata* on moderately exposed sublittoral fringe rock
IR.MIR.KR.Ldig.Ldig	*Laminaria digitata* on moderately exposed sublittoral fringe bedrock
MDS	Multi-Dimensional Scaling
MERC	Marine and Environmental Resource Conservation Consultants
MNCR	Marine Nature Conservation Review
MDS	Multi-Dimensional Scaling
NPWS	National Parks & Wildlife Service
ODM	Ordnance Datum Malin
PRIMER	Plymouth Routines In Multivariate Ecological Research
RIB	Rigid-Inflatable Boat
SAC	Special Areas of Conservation
SACFOR	Superabundant, Abundant, Common, Frequent, Occasional and Rare
SD	Standard Deviation

Executive Summary

Ireland's Eye is a small uninhabited island located to the north of Howth Head, within the Rockabill to Dalkey Island Special Area of Conservation (SAC) (site code 3000), and is designated for Annex 1 qualifying interest, Reefs. As the site is within close proximity to the proposed outfall pipeline route (marine section), these interests may be subject to plume effects from suspended sediment during parts of the construction phase that involve dredging or by the proposed outfall plume itself.

An Environmental Impact Assessment Report (EIAR) was prepared for the Proposed Project and submitted for planning in 2018. Chapter 9 (Biodiversity (Marine)) of the EIAR in the 2018 planning application considered marine biodiversity. As detailed in Chapter 1A (Introduction) in Volume 2A of the Environmental Impact Assessment Report (EIAR) Addendum Report, we have reviewed the Chapter 9 (Biodiversity (Marine)) and the associated appendices of the EIAR submitted with the original 2018 planning application, in the light of:

- Changes to the baseline environment;
- The requirement for updated surveys; and
- Any changes to the law, policy, or industry standards and guidance in the intervening period.

The data has been compared with the relevant baseline in Chapter 9 (Biodiversity (Marine)) in Volume 3 Part A of the EIAR in the 2018 planning application to identify any material changes to the baseline conditions in the intervening period.

The survey undertaken in March 2023 is a re-evaluation of the sublittoral environment along four repeated transects. These were based on a generic assessment of biotopes using the standard Marine Nature Conservation Review (MNCR) style format. Identification and abundance of conspicuous fauna and flora were scaled on-site using the SACFOR scheme (e.g. superabundant, abundant, common, frequent, occasional and rare)); (Hiscock 1996).

The sublittoral stations were characterised by *Laminaria digitata* forests in the shallower part (*IR.MIR.KR.Ldig.Ldig*) and were usually replaced by the biotope 'Foliose red seaweeds with dense *Dictyota dichotoma* and/or *Dictyopteris membranacea* on exposed lower infralittoral rock' (*IR.HIR.KFaR.FoR.Dic)*. The deeper extent was dominated by a 'Mixed turf of bryozoans and erect sponges with *Sagartia elegans* on tide-swept circalittoral rock' (*CR.HCR.XFa.ByErSp.Sag, in 2015*) updated to 'Mixed turf of bryozoans and erect sponges with *Cylista elegans* on tide-swept circalittoral rock' (*CR.HCR.XFa.ByErSp.Cyl* in 2023), or in the case of Sublittoral Station 2, '*Flustra foliacea* and colonial ascidians on tide-swept moderately wave-exposed circalittoral rock' (*CR.HCR.XFa.FluCoAs*). The deeper biotope at Sublittoral Station 4 was categorised as a possible '*Polyclinum aurantium* and *Flustra foliacea* on sand scoured tide-swept moderately wave-exposed circalittoral rock' (*HCR.XFa.FluCoAs.Paur*), probably due to the increased sedimentation noted at this station.

Univariate analyses showed clear differences between the littoral and sublittoral stations in terms of species richness with twice as many species recorded from the sublittoral area (88.3±19.2SD in 2015 and 62.8±6.82SD in 2023) as opposed to 44.7±11.6SD). Both littoral and sublittoral environments indicated moderately high species diversity. Multivariate analyses revealed statistical separation of biotopes with the vertical zonation of the fauna (by water depth or height on the foreshore) constituting the dominant community patterns observed. of the sublittoral surveys indicated a notable reduction in diversity between survey years, predominantly due to the reduction in over-wintering algal species recorded during the winter survey in 2023.

No species of particular nature conservation interest were noted during any of the surveys and no rare or particularly fragile biotopes were recorded. However natural siltation levels were high in the sublittoral environment (for both survey years and seasons), a fact that has not appeared to have had

a significant impact to the biological diversity in this area. Whilst siltation levels are high in the sublittoral environment, a significant increase in suspended sediment, particularly during the summer months during peak algal growth, might cause some damage to the algal biotopes present through reduced light penetration and availability. However, the moderately strong tidal currents experienced in this area are sufficient to prevent the deposition of significant silt material which might degrade the sublittoral benthic biotopes through smothering and burial of the infralittoral and circalittoral communities..

1. Introduction

Benthic Solutions Limited (BSL) was commissioned to complete updated surveys to inform the Greater Dublin Drainage Project (hereafter referred to as the Proposed Project) Environmental Impact Assessment Report (EIAR) Addendum Report.

An Environmental Impact Assessment Report (EIAR) was prepared for the Proposed Project and submitted for planning in 2018. Chapter 9 (Biodiversity (Marine)) of the EIAR in the 2018 planning application considered marine biodiversity.

As detailed in Chapter 1A (Introduction) in Volume 2A of the Environmental Impact Assessment Report (EIAR) Addendum Report, we have reviewed the Chapter 9 (Biodiversity (Marine)) and the associated appendices of the EIAR submitted with the original 2018 planning application, in the light of:

- Changes to the baseline environment;
- The requirement for updated surveys; and
- Any changes to the law, policy, or industry standards and guidance in the intervening period.

In updating the baseline ecology information for the Proposed Project this was completed cognisant of the Chartered Institute of Ecology and Environmental Management (CIEEM) Guidelines for Ecological Impact Assessment in the UK and Ireland – Terrestrial, Freshwater, Coastal and Marine (hereafter referred to as the CIEEM Guideline) (CIEEM 2018), with respect to the validity of baseline data.

This Appendix is a factual account of the update surveys which have been completed for the Proposed Project; documenting the methodology and findings of these surveys.

Field operations were completed via a dedicated dive survey, undertaken in March 2023 to acquire a detailed assessment of the qualifying habitats at sublittoral stations.

In addition, the data has been compared with the relevant baseline in Chapter 9 (Biodiversity (Marine)) in Volume 3 Part A of the EIAR in the 2018 planning application to identify any material changes to the baseline conditions in the intervening period. Any identified material changes have then been used to inform Chapter 9A (Biodiversity (Marine)) in Volume 3A Part A of the EIAR addendum.

2. Conservation Objectives

The proposed outfall pipeline route (marine section) will terminate at the proposed marine diffuser location, approximately 1km (kilometre) north-east of Ireland's Eye, and will fall within the Rockabill to Dalkey Island Special Area of Conservation (SAC). The conservation objectives of the Rockabill to Dalkey Island SAC include Annex I qualifying Reefs (Figure 2-1). To maintain the favourable conservation conditions of these Reefs within the SAC, the following criteria are proposed by the National Parks and Wildlife Service (NPWS) .

Table 2-1: Rockabill to Dalkey Island SAC Conservation Objectives

Attribute	Measure	Target	Notes
Habitat area	Hectares	The permanent area is stable or increasing, subject to natural processes. See Figure 2-1	Habitat area estimated as 182ha (hectares) using 2010 and 2011 intertidal and subtidal reef survey data (MERC 2010; 2012a; 2012b), InfoMar bathymetry and the Arklow to Skerries Islands Admiralty Chart (1468_0)
Habitat distribution	Occurrence	Distribution is stable or increasing, subject to natural processes. See Figure 2-1	Distribution derived from 2010 and 2011 intertidal and subtidal reef survey data (MERC 2010; 2012a; 2012b), InfoMar bathymetry and the Arklow to Skerries Islands Admiralty Chart (1468_0).
Community structure	Biological composition	Conserve the following community types in a natural condition: Intertidal reef community complex; and Subtidal reef community complex. See Figure 2-1	Reef community mapping based on 2010 and 2011 intertidal and subtidal reef survey data (MERC 2010; 2012a; 2012b).

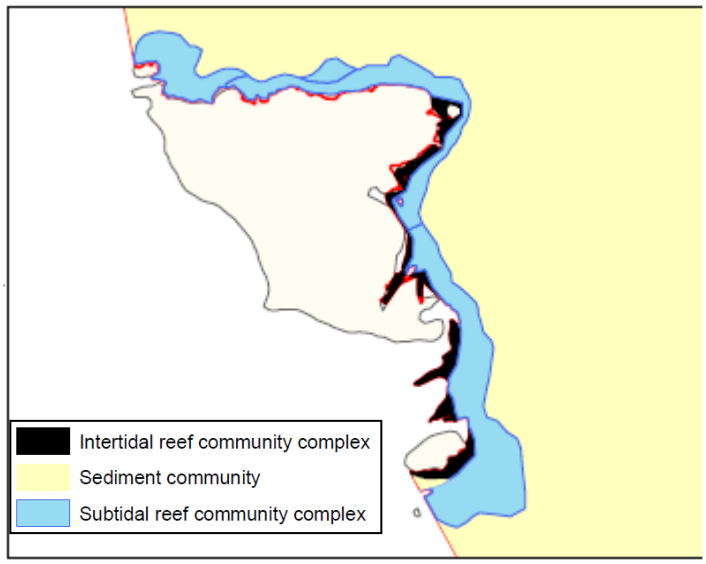


Figure 2-1: Ireland's Eye Marine Community Types Designated by Rockabill to Dalkey Island SAC (NPWS, 2013)

3. Historical Data

Within the Rockabill to Dalkey Island SAC, two community types were recorded within the Annex I habitat, namely the Intertidal reef community complex and the Subtidal reef community complex (Reefs 1170). Intertidal and subtidal surveys were undertaken in 2010 and 2011 (MERC 2010; MERC 2012a and MERC 2012b). These data were used to determine the physical and biological nature of the Annex I habitat. Estimated areas of each community type within the Annex I habitat, are based on interpolation, and are shown in Figure 2-1. Both complexes were surveyed via a dedicated dive survey team undertaken in 2015, whilst the sublittoral complex was repeated as part of the current survey.

SUBTIDAL REEF COMMUNITY COMPLEX

This reef community complex was initially recorded off the northern, eastern and southern shores of Ireland's Eye immediately south of the proposed outfall pipeline route (marine section) and proposed marine diffuser location. The substrate ranged from that of flat and sloping bedrock, to bedrock with boulders and also a mosaic of cobbles and boulders. Vertical rock walls occurred on the north and east of Ireland's Eye, whilst the northern reaches of the island both show sediment scouring and a thin veneer of silt on the reefs.

In general, previous surveys (MERC 2010; MERC 2012a; MERC 2012b and BSL 2015a) noted that where the reef was subjected to the effects of sediment, either through scouring or settlement of silt, low numbers of species and individuals were found. The later dive survey (BSL 2015b and the current survey) confirmed that natural siltation levels were high in the sublittoral environment, although this fact had not appeared to have had a significant impact on biological diversity in this area.

4. Site Selection

A total of four sublittoral locations were established for survey operations in 2015 and repeated in the current study (outlined in Table 4-1, and presented in Figure 4-1).

Table 4-1: Proposed Sublittoral Locations in 2015 and 2023 Assessments

Site	Transect	Easting	Northing	Description	Depth (ODM)
Sublittoral sites (2015 and 2023)					
S1	Start	728470.3	741625.0	Sublittoral: Northwest stack and discrete sublittoral reef feature	-9.5m
	End	728369.1	741589.2		
S2	Start	728745.5	741626.2	Sublittoral: Standard slope with boulder field at base	-17.2m
	End	728752.9	741526.2		
S3	Start	729161.4	740937.5	Sublittoral: Exposed southeast island pinnacles	-13.8m
	End	729060.2	740969.6		
S4	Start	729187.4	740556.2	Sublittoral: Exposed southeast islet pinnacles	-14.9m
	End	729102.2	740624.0		

Geodesy based on Irish National Grid and vertical datum of Ordnance datum Malin Head (ODM)

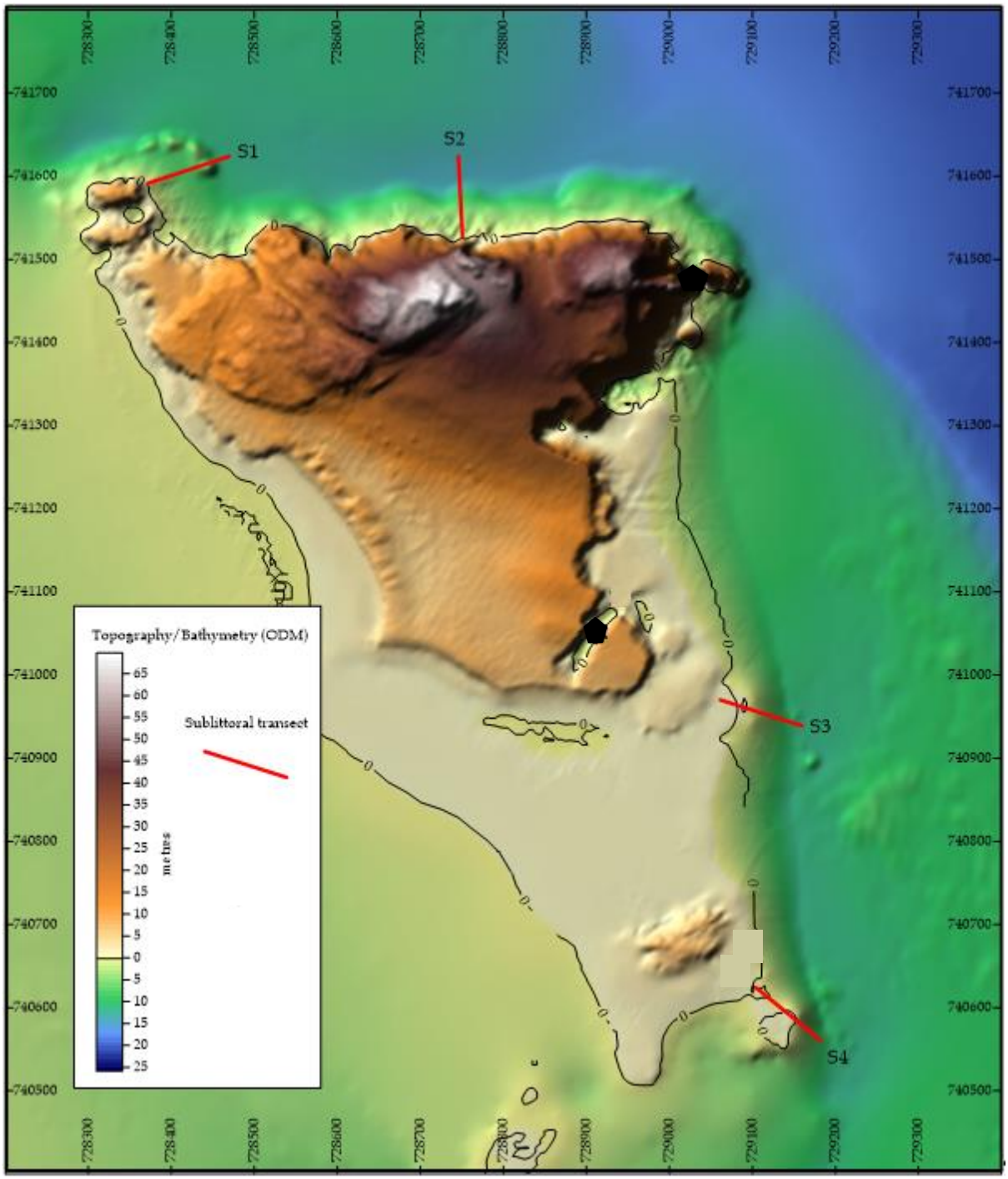


Figure 4-1: Composite Topography/Bathymetry of Irelands Eye with Proposed Survey Locations for Sublittoral Transects (lines)

5. Field Operations Summary Observations 2023

Field survey operations were completed successfully at all sublittoral locations between 30 and 31 March 2023. A four man dive team, made up from representatives from both MERC and ASML, was mobilised to site on 29 March 2023, with operations carried out from a 10m Offshore 105 work vessel mobilised from the West Pier in Howth. Weather was marginal on the first day but became good for the remainder of the survey period. Transects S1 and S2 were completed on the first day, with transects S3 and S4 concluded on the second. Operational visibility was poor at less than one metre throughout.

A summary of the field operations is outlined in Table 5-1.

Table 5-1: Chronological Sequence of Field Operations

Day	Date	Operations	Comment
1	29/03/23	Mobilisation to Howth	ASML and MERC mobilised. Vessel supplied by Commercial Charters awaiting arrival on Wet Pier Howth..
2	30/03/23	Ops: Diving survey	2 diving sites completed (S1 and S2)
3	31/03/23	Ops: Diving survey	2 diving sites completed (S3 and S4)
4	01/04/23	Demobilisation from Howth	ASML team demobilised back to the UK.

Operations were carried out using a pair of divers. The survey involved the divers descending to the seabed, locating the sediment reef interface and then proceeding along the pre-determined bearing, ascending the reef towards the shore (Figure 5-1). The diver pairs consisted of a recorder and a photographer. As with the 2015 survey, the recorder surveyed the seabed for both fauna and flora along the transect with a width of approximately 5m. All taxa observed were recorded in terms of their abundance values as assessed on the Marine Nature Conservation Review (MNCR) Abundance Scale (SACFOR); (Hiscock 1996). If the identification was in doubt, then taxa were either photographed for later identification, or a specimen was collected for identification with the aid of keys and microscopes back at the survey base. The photographer endeavoured to create a digital photographic record of the faunal and floral component along each transect and within each biotope. Due to the winter timing of the survey, some of the floral and faunal component of the biotopes that are annual species were missing as they had not had time to grow large enough to be observed. However, perennial taxa and many small individuals of annual species were recorded and so gross biotopes were still identifiable.

North shore of Ireland Eye

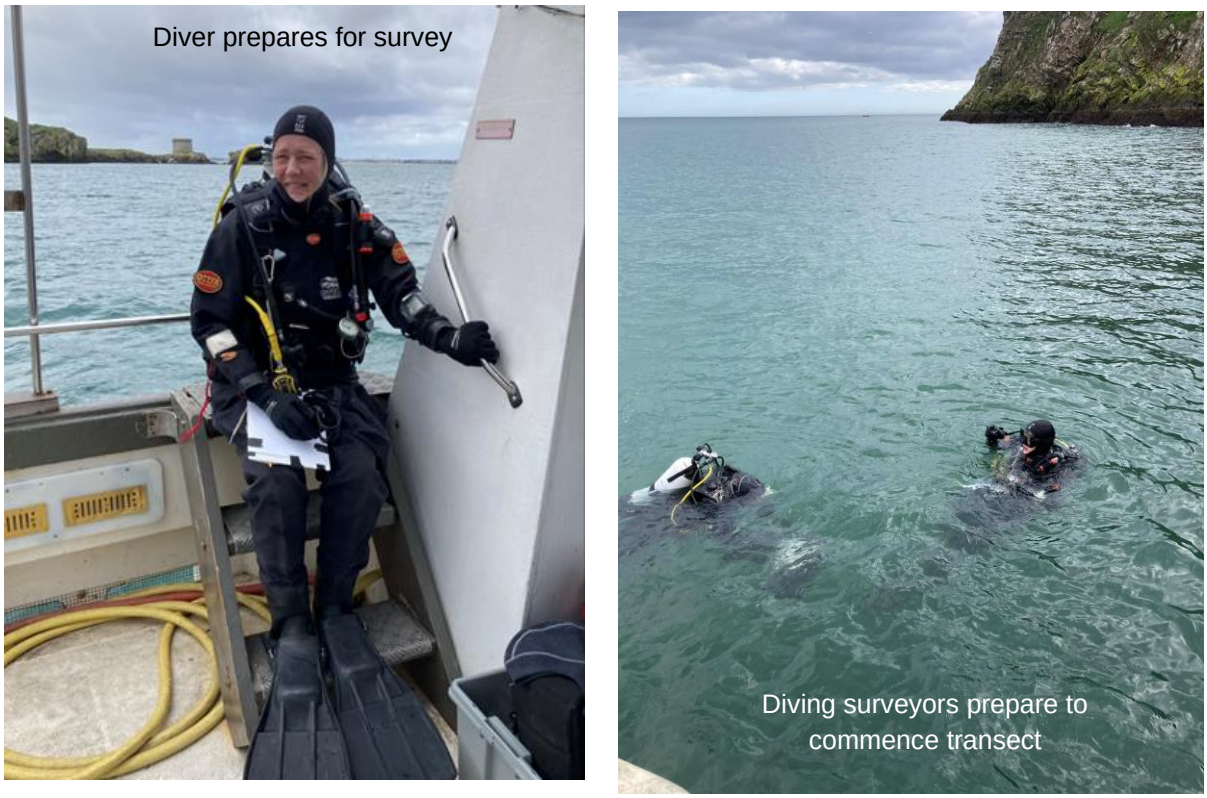


Figure 5-1: Operational Images of 2023 Diving Survey

6. Results and Discussion

This survey has collected semi-quantitative data from the sublittoral zone, four stations (S1 to S4) of which all were found to be heavily silted, but were moderately diverse. The photographs and data presented herein may act as a comparison, against which future gross changes could be qualitatively assessed. Some comparisons have been drawn with dive data acquired in 2015.

In order to determine any significant differences between the stations surveyed, the SACFOR scale was additionally categorised from 1 (rare) to 6 (superabundant). Basic statistical analyses as well as multi-dimensional statistical techniques were applied to the dataset to present the data as a cluster diagram and MDS plot. While useful to present general trends within the datasets, due to the semi quantitative nature of the SACFOR classifications, not too much reliance should be placed on the statistical analyses.

6.1. Biotope Classification

6.1.1. Sublittoral Station S1 (2015 and 2023 Comparison)

This site lies off the north-west corner of Ireland's Eye and the reef here runs on to the muddy gravel at approximately 10.7m ODM. The rock surface in this vicinity was found to be considerably silted as in 2015. Just above the sediment interface (9.5 to 6.7m ODM – biotope iii), the biotope was found to be dominated by the feather-star *Antedon bifida*, the plumose anemone *Metridium senile*, common starfish and the barnacle *Balanus crenatus*. Other anemones such as *Cylista elegans*, *Alcyonium digitatum* and *Urticina felina* were also frequently encountered along with several sponge species (Halic*lona oculata, Hymeniacidon perleve, Suberites ficus, Halichondria panicea* and *Amphilectus fucorum*). The hydroids (*Obelia dichotoma*) and bryozoans (*Flustra foliacea, Chartella papyracea* and *Scrupocellaria* spp) were also common and the overall biotope make-up was still similar to the *CR.HCR.XFa.ByErSp.Cyl* which is a biotope of a 'Mixed turf of bryozoans and erect sponges with *Cylista elegans* on tide-swept circalittoral rock' (this was *CR.HCR.XFa.ByErSp.Sag* in 2015).

Above this community, the next biotope (ii) lay between 6.7 to 4.9 Ordnance Datum Malin (ODM) approximately. Here the foliose algae began to colonise the rock surface. This biotope was also heavily silted.

Biotope ii was previously characterised in the summer by the foliose brown algae *Dictyota dichotoma* and *Dictyopteris polypodioides*, but at this time of year these were only visible as minute brown sporelings. Some of the foliose red algae had over-wintered, in particular *Delesseria sanguinea, Phyllophora crispa* and *Hypoglossum hypoglossoides* were seen. Numerous other small foliose red algal species were also noted. Occasional sugar kelp, *Saccharina latissima* was present on the more sheltered rock.

The faunal component of this biotope was characterised by the anemones *Urticina felina*, *Cylista elegans* and *Anemonia viridis* with abundant feather-stars *Antedon bifida*. Obe*lia* spp., *Balanus crenatus, Aplidium punctum*, and *Spirobranchus* spp. were all found within the silty turf, along with large patches of *Cliona celata* which is the yellow boring sponge. The biotope was still found to be close to *IR.HIR.KFaR.FoR.Dic*, as recorded in 2015 (i.e. Foliose red seaweeds with dense *Dictyota dichotoma* on exposed lower infralittoral rock).

The final sublittoral biotope encountered at S1 from 4.9 to 2.7 above the foliose algal zone, was a zone of stunted *Laminaria digitata* and *L. hyperborea* kelp plants, with several other foliose red algae, such as *Palmaria palmata* and *Delesseria sanguinea*. Beneath these algae were crusts of barnacles and sparse mussels, with frequent common starfish (*Asterias rubens*). Abundant kelp sporelings were

seen in the sward with Ur*ticina felina, Halichondria panicea* and *Alcyonium digitatum*. A probable pair of biotopes for this assemblage is *IR.MIR.KR.Ldig.Ldig* above a band of *IR.HIR.-KFaR.LhypR.Ft Laminaria hyperborea* forest with dense foliose red seaweeds on exposed upper infralittoral rock i.e. similar to 2015.

The final biotope encountered at S1 above the foliose algal zone, was a zone of stunted *Laminaria digitata* kelp plants, with several other foliose red algae, such as *Palmaria palmata* and *Delesseria sanguinea.* Beneath these algae, crusts of mussels and barnacles were found, often being predated by the common starfish, *Asterias rubens*. A probable biotope for this assemblage is *IR.MIR.KR.Ldig.Ldig*.

Photographs from each sublittoral zone / biotope are shown in Figure 6-1, while a full species list with SACFOR classification is presented in Table 6-1.

iii: CR.HCR.XFa.ByErSp.Cyl (2023)

iii: *CR.HCR.XFa.ByErSp.Sag (2015)*

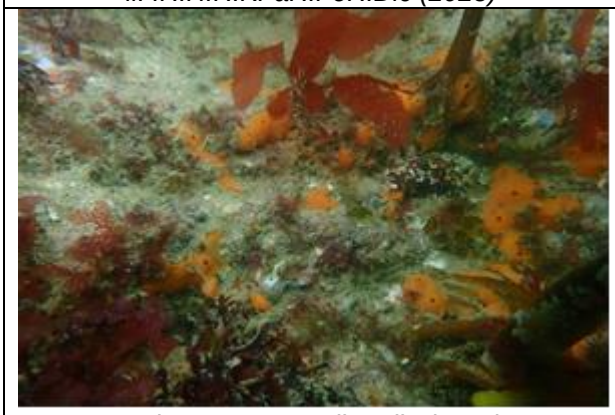
iii: *CR.HCR.XFa.ByErSp.Sag (2015)*

ii: IR.HIR.KFaR.FoR.Dic (2023)

ii: *IR.HIR.KFaR.FoR.Dic (2015)*

ii: IR.HIR.KFaR.FoR.Dic (2023)

ii: *IR.HIR.KFaR.FoR.Dic (2015)*



i: IR.MIR.KR.Ldig.Ldig (2023)

i: *IR.MIR.KR.Ldig.Ldig*

Figure 6-1 Sublittoral Zones and Biotopes for Station S1 (2015 and 2023)

Table 6-1: Species List for Station S1 with SACFOR Abundance Classifications for Each Biotope (2015 and 2023)

MCS Code	Taxa	2015 S1			2023 S1		
		i	ii	iii	i	ii	iii
C00350	*Scypha ciliata*	F	R		R		
C02210	*Suberites ficus*			R		R	O
C04840	*Halichondria panicea*	R	O	O	F	O	O
C05230	*Hymeniacidon perleve*						R
C05960	*Esperiopsis fucorum*		O	O			
C07750	*Hemimycale columella*				R	R	R
C08600	*Haliclona oculata*					R	O
C08630	*Haliclona simulans*		F	O			
D01440	*Tubularia indivisa*			O		R	O
D06690	*Sertularella polyzonias*				R		R
D06760	*Sertularia argentea*			O			R
D07300	*Obelia dichotoma*		O	O		R	R
D07310	*Obelia geniculata*	F	O	R	O	R	R
D10240	*Alcyonium digitatum*		C	C	R	C	C
D11580	*Anemonia viridis*		F			F	R
D11680	*Urticina felina*	O	C	A	C	C	A
D12250	*Metridium senile*		C	C		O	F
D12310	*Cylista elegans*	O	C	C	R	F	R
D13700	*Caryophyllia smithii*			R			R
P23020	*Spirobranchus*				F	O	O
P23040	*Spirobranchus triqueter*	F	O				
R01090	*Balanus balanus*					R	O
R01100	*Balanus crenatus*		C	S		C	S
S25020	*Pisidia longicornis*		R	R		R	R
S25750	*Inachus sp.*					R	R
S26460	*Cancer pagurus*		F			F	O
S26720	*Necora puber*	F	A	C	F	A	A
W12740	*Doto coronata*		O	O			
W14030	*Archidoris pseudoargus*	R			R	R	
W16500	*Mytilus edulis*	S	R		O	R	
W18130	Anomiidae				R	A	C
Y00030	Crisiidae				F	F	C
Y06640	*Membranipora membranaceae*	F			R		
Y06780	*Electra pilosa*	F			O		
Y06940	*Flustra foliacea*			O			O
Y07050	*Chartella papyracea*					R	O
Y08360	*Scrupocellaria sp.*			F	R	F	F
Y08720	*Bugula flabellata*			R		R	R
ZB00110	*Antedon bifida*		C	S		C	A
ZB01900	*Asterias rubens*	C	A	C	C	C	C
ZB02350	*Ophiothrix fragilis*			O	R		O
ZB02680	*Ophiactis balli*			R			
ZB03000	*Amphipholis squamata*		R				
ZD00060	*Clavelina lepadiformis*	O	R	C		R	R
ZD00340	*Polyclinum aurantium*					O	O
ZD00460	*Morchellium argus*	O	R	R	R	R	R
ZD00640	*Aplidium punctum*	O	R	R	F	F	O
ZD01940	*Dendrodoa grossularia*	O	O				
ZD02090	*Botryllus schlosseri*		R				
ZG01500	Gadidae	R	R		R		R
ZG04380	*Taurulus bubalis*	R	R				
ZG07050	*Gobiidae*	R					
ZM02080	*Bonnemaisonia asparagoides*	O	O				
ZM03230	*Callophyllis laciniata*	O					
ZM04040	*Corallina officinalis*	R			R		
ZM06310	*Plocamium cartilagineum*	O	O		R		
ZM06820	*Calliblepharis ciliata*	R	R				
ZM06880	*Cystoclonium purpureum*	O	F		R		
ZM06930	*Rhodophyllis divaricata*	O	F				
ZM08070	*Ceramium sp.*	O	O				

MCS Code	Taxa	2015 S1			2023 S1		
		i	ii	iii	i	ii	iii
ZM08460	*Halurus flosculosus*		R				
ZM09500	*Cryptopleura ramosa*	F	R		R	R	
ZM09550	*Delesseria sanguinea*	F	F		R	R	
ZM09850	*Hypoglossum hypoglossoides*	O	O		R	R	
ZM09900	*Membranoptera alata*	R					
ZM10120	*Phycodrys rubens*	R	F				
ZM10180	*Erythroglossum laciniatum*		R				
ZM11050	*Polysiphonia elongata*		R				
-	*Brogniartella byssoides*	O					
-	Red sponge crust		R				
ZR04570	*Dictyota dichotoma*	R	C		R	R	
ZR04780	*Taonia atomaria*		R				
ZR04970	*Desmarestia aculeata*	R					
ZR04990	*Desmarestia ligulata*	R					
ZR06320	*Laminaria digitata*	S			F		
ZR06330	*Laminaria hyperborea*				O		
ZR06360	*Saccharina latissima*	O	R			R	
ZS02400	*Ulva* (flat)	R					
ZS03920	*Bryopsis plumosa*	R					

6.1.2. Sublittoral Station S2 (2015 and 2023 Comparison)

This site is situated in the middle of the north coast of Ireland's Eye and begins where the steep boulder slope meets the muddy gravel plain at approximately 15.7m ODM. The broken reef is pockmarked with deposits of muddy gravel which are frequently inhabited by the holothurian *Thyone fusus*. The biotope on the reef of boulders and bedrock outcrops is dominated by the erect hydroids and bryozoans *Flustra foliacea, Nemertesia* sp. and *Obelia geniculata* and the rock surface is colonised by crustose bryozoans, young hydroids, the polychaete worm *Sabellaria spinulosa* and occasional sponge crusts and tunicates.

Other dominant taxa of note were the barnacles *Balanus crenatus* and the anemone *Alcyonium digitatum*, and frequent sponges, *Hymeniacidon perleve*, *Haliclona oculata* and *Hemimycale columella* were seen. Both the hydroids *Nemertesia antennina* and *Nemertesia ramosa* were present as was the cup coral *Caryophyllia smithii*. Whilst the tunicate *Clavelina lepadiformis* was seen but was still very small. The colonial tunicate *Aplidium punctum* was prominent in the community. The biotope tag for this assemblage is therefore still consistent with the findings of the 2015 survey (i.e. *CR.HCR.XFa.FluCoAs*, or *Flustra foliacea* and colonial ascidians on tide-swept moderately wave-exposed circalittoral rock).

Above biotope iii, at 8.7m ODM, biotope ii was found to still be the *Dictyota* and foliose red algal biotope, as in 2015. However, the algal sward was fairly thin due to the lack of seasonal growth found in March. The dominant visible algae seen were *Delesseria sanguinea* and *Hypoglossum hypoglossoides* and possibly very small *Rhodymenia holmesii. Dictyota dichotoma* and / or *Dictyopteris membranacea* can be seen in the plates below to be no more than minute brown sporelings. The tiny tunicate, *Pycnoclavella aurilucens*, can also be seen in the surface of the silt, and where the urchin *Echinus esculentus* was present, coralline crusts were visible on the rock in the grazed track.

Hence, the biotope was found to be close to *IR.HIR.KFaR.FoR.Dic* or Foliose red seaweeds with dense *Dictyota dichotoma* and / or *Dictyopteris membranacea* on exposed lower infralittoral rock, as in 2015.

As with Sublittoral Station 1, above the foliose algal zone, there was again a zone of stunted *Laminaria digitata* kelp plants, with numerous small foliose red algae. Many of the kelp plants had been lost to winter weather and foliose algae were also sparse. However the biotope *IR.MIR.KR.Ldig.Ldig* or *Laminaria digitata* on moderately exposed sublittoral fringe rock was seen to be still valid. Photographs from each littoral zone/biotope are shown in Figure 6-2, while a full species list with SACFOR classification is presented in Table 6-2.

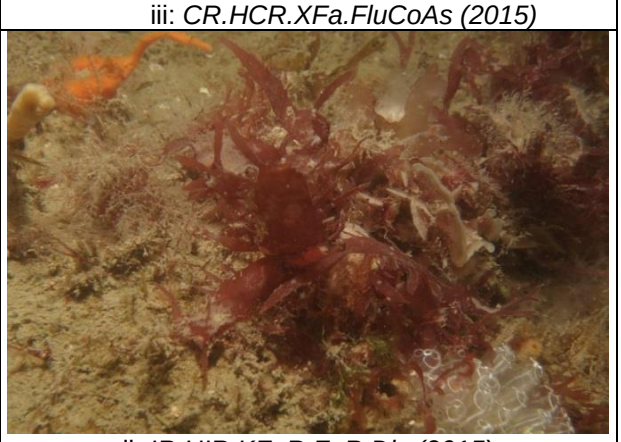
iii: *CR.HCR.XFa.FluCoAs (2023)*

iii: *CR.HCR.XFa.FluCoAs (2015)*

iii: *CR.HCR.XFa.FluCoAs (2023)*

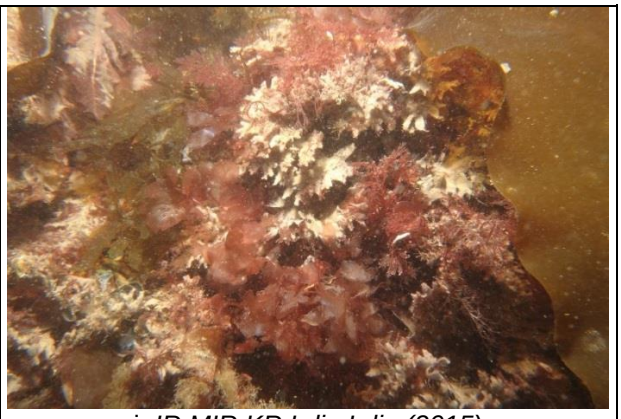
iii: *CR.HCR.XFa.FluCoAs (2015)*

ii: *IR.HIR.KFaR.FoR.Dic (2023)*



ii: *IR.HIR.KFaR.FoR.Dic (2015)*

i: *IR.MIR.KR.Ldig.Ldig(2023)*



i: *IR.MIR.KR.Ldig.Ldig (2015)*

Figure 6-2:Sublittoral Zones and Biotopes for Station S2 (2015 and 2023)

Table 6-2: Species List for Station S2 with SACFOR Abundance Classifications for each Biotope (2015 and 2023)

MCS Code	Taxa	2015 S2			2023 S2		
		i	ii	iii	i	ii	iii
C00350	*Sycon ciliatum*				O		
C00350	*Scypha ciliata*	F		F			
C02210	*Suberites ficus*		R	R		R	R
C04810	*Halichondria bowerbanki*			O			
C04840	*Halichondria panicea*	F			F	R	
C05230	*Hymeniacidon perleve*	O	F	F	O	O	
C05960	*Esperiopsis fucorum*	O	F	F		O	O
C06420	*Myxilla sp.*	R		R			R
C06840	*Iophon hyndmani*		O				
C08630	*Haliclona simulans*		F	F		R	R
D01440	*Tubularia indivisa*			R			R
D05260	*Halecium halecinum*		O	O		R	R
D05500	Aglaophenia		R	R	R	R	
D05780	*Halopteris catharina*			F			
D05970	*Nemertesia antennina*		F	F		O	F
D05990	*Nemertesia ramosa*		O	R		F	R
D06690	*Sertularella polyzonias*			O			
D06760	*Sertularia argentea*	R			R	R	
D07300	*Obelia dichotoma*	O	F	F			
D07310	*Obelia geniculata*	F			F	O	R
D07320	*Obelia longissima*			O			
D10240	*Alcyonium digitatum*	F	C	F	O	C	O
D11680	*Urticina felina*			R	R	R	R
D12310	*Cylista elegans*		R	R		R	R
D13700	*Caryophyllia smithii*						R
P23020	*Spirobranchus*			F	O	O	F
P23040	*Spirobranchus triqueter*	F	R				
R01090	*Balanus balanus*		R	O		R	O
R01100	*Balanus crenatus*	C	F	O	C	F	O
S01660	Amphipoda	C	C	F	O	O	R
S10700	Caprellidae	C	C				
S22100	*Palaemon serratus*	O	F	F	O	F	F
S23220	*Pandalus montagui*	F					
S23600	*Homarus gammarus*			R			R
S24650	*Pagurus bernhardus*			R	R	R	R
S25850	*Macropodia rostrata*	O	O				
S26460	*Cancer pagurus*	R	O	O		O	O
S26720	*Necora puber*	O	O	O	F	F	O
S26900	*Carcinus maenas*	O					
W12720	*Doto sp*		R	R			
W16500	*Mytilus edulis*	C			O		
Y00030	Crisiidae	F	O	O	F	O	O

MCS Code	Taxa	2015 S2			2023 S2		
		i	ii	iii	i	ii	iii
Y01370	*Alcyonidium diaphanum*		F	F		O	O
Y06640	*Membranipora*	C			O		
Y06780	*Electra pilosa*	A	F		F	F	
Y06940	*Flustra foliacea*		F	C		F	C
Y07050	*Chartella papyracea*		R	O	R	O	O
Y07100	*Securiflustra securifrons*		R				
Y08360	*Scrupocellaria sp.*	F	C				
Y08410	*Scrupocellaria scruposa*			A			
Y08530	*Bicellariella ciliata*			O			O
Y08720	*Bugula flabellata*	R	O	C	R	R	O
Y08750	*Bugula plumosa*			R			
ZB00110	*Antedon bifida*	R	O	O	R	F	F
ZB01900	*Asterias rubens*	C	C	C	O	O	F
ZB02350	*Ophiothrix fragilis*	C		O	R	R	O
ZB03620	*Echinus esculentus*	R	R	O		O	O
ZB04740	*Pawsonia saxicola*					O	
ZB04950	*Thyone fusus*		O			O	O
ZD00060	*Clavelina lepadiformis*	R	F	F	R	R	O
ZD00640	*Aplidium punctum*	R	O	O	O	F	F
ZD01880	*Polycarpa scuba*			O	R	O	O
ZD01940	*Dendrodoa grossularia*		R	R		R	R
ZD02090	*Botryllus schlosseri*	R	R		R	R	
ZG01500	Gadidae		R	R			
ZG01960	*Molva molva*		R				
ZG03760	*Syngnathus acus*		R				
ZG04340	*Myoxocephalus scorpius*			R			
ZG04380	*Taurulus bubalis*						R
ZG06050	*Ctenolabrus rupestris*		R				
ZG07000	*Callionymus lyra*		R	O			
ZG07050	Gobiidae			R			
ZG07230	*Gobius niger*		R	R			
ZG07440	*Pomatoschistus pictus*			R			
ZM02080	*Bonnemaisonia asparagoides*	O	R				
ZM02420	*Palmaria palmata*	O					
ZM02560	*Dilsea carnosa*	O	R		R	R	
ZM03230	*Callophyllis laciniata*	O	R				
ZM03840	Corallinaceae (enc)	F	O		F	O	
ZM05840	*Phyllophora crispa*	F	O		R	R	
ZM05860	*Phyllophora pseudoceranoides*	C					
ZM06110	*Chondrus crispus*	C					
ZM06310	*Plocamium cartilagineum*	F	O				
ZM06820	*Calliblepharis ciliata*	F	A				
ZM06880	*Cystoclonium purpureum*		O		R	R	
ZM06930	*Rhodophyllis divaricata*		F			R	
ZM07230	*Rhodymenia holmesii*		C				
ZM07530	*Lomentaria orcadensis*	R	R				
ZM07860	*Aglaothamnion byssoides*		R				
ZM08239	*Ceramium secundatum*		R				
ZM08460	*Halurus flosculosus*	R					
ZM09230	*Sphondylothamnion multifidum*		R				
ZM09400	*Apoglossum ruscifolium*		R				
ZM09500	*Cryptopleura ramosa*	F	C		R	R	
ZM09550	*Delesseria sanguinea*	F	F		R	R	
ZM09850	*Hypoglossum hypoglossoides*		C			R	
ZM09900	*Membranoptera alata*	O					
ZM10120	*Phycodrys rubens*	F	F				
ZM10180	*Erythroglossum laciniatum*		F				
ZM10390	*Heterosiphonia plumosa*	R	R				
ZM11050	*Polysiphonia elongata*		R				
ZM11170	*Polysiphonia fucoides*		R				
ZM11370	*Pterosiphonia parasitica*		R				

MCS Code	Taxa	2015 S2			2023 S2		
		i	ii	iii	i	ii	iii
-	*Diapharodoris luteocincta*			R			
-	*Brogniartella byssoides*	O	O				
ZR04570	*Dictyota dichotoma*	F	C				
ZR04780	*Taonia atomaria*		R				
ZR04970	*Desmarestia aculeata*	O					
ZR04990	*Desmarestia ligulata*	F					
ZR06310	*Laminaria sporelings*		R			R	
ZR06320	*Laminaria digitata*	S			F		
ZR06330	*Laminaria hyperborea*	A			O		
ZR06360	*Saccharina latissima*	C			O		

6.1.3. Sublittoral Station S3 (2015 and 2023 Comparison)

This site lies off the south-east corner of Ireland's Eye. It is exposed to the easterly winds and onshore swell and is therefore moderately exposed to wave action. The reef appears out of the sediment at approximately 13.7m ODM and initially slopes gently up towards the island then a gulley dissects this first reef, before it rises steeply up to the intertidal. The reef was heavily silted and the initial biotope (iii) was found to be similar to the findings of the 2015 survey, being dominated by erect sponges, tunicates, bryozoans and hydroids, with species of note being *Aplidium punctum, Haliclona oculata, Cliona celata, Halichondria panicea* and *Nemertesia antennina*. Also abundant were the hydroid *Halecium halecinum* and the anemones *Alcyonium digitatum, Cylista elegans* and *Urticina felina,* whilst the decapods, *Palaemon serratus, Cancer pagurus* and *Necora puber* were also a common constituent.

The silty turf was home to several other tunicate taxa, namely, Po*lyclinum aurantium/ Synoicum incrustatum, Lissoclinum perforatum, Ascidia mentula* and *Clavelina lepadiformis* and several sponges such as *Pachymatisma johnstonia, Dysidea fragilis, Raspalia hispida*. In March 2023, the taxonomic make-up of this biotope was similar to *CR.HCR.XFa.ByErSp.Cyl* (or *CR.HCR.XFa.ByErSp.Sag*; an earlier version of this classification) recorded in June 2015. This is a 'Mixed turf of bryozoans and erect sponges with *Cylista elegans* on tide-swept circalittoral rock'. This suggests that there had been no significant change in the reef community at depth on the east coast of Ireland's Eye.

Above this biotope at approximately 8.7m to 6.7m ODM was Biotope (ii) the foliose red algal assemblage found in 2015, *IR.HIR.KFaR.FoR* - Foliose red seaweeds on exposed lower infralittoral rock. Here the silt still formed a thick covering and the algae were possibly even more sparse than at S1 and S2. The brown alga *Dictyota dichotoma* was barely showing as a sporeling through the silt cover, though the green alga, *Ulva* species, were obvious amongst the barnacles and the faunal turf. These specimens had probably over-wintered. Other algae that were visible were *Hypoglossum hypoglossoides* and *Cystoclonium purpureum*, as well as occasional patches of better developed *Delesseria sanguinea* and *Rhodophyllis divaricata*. Small *Schottera nicaeensis* sporelings were also noted in the turf.

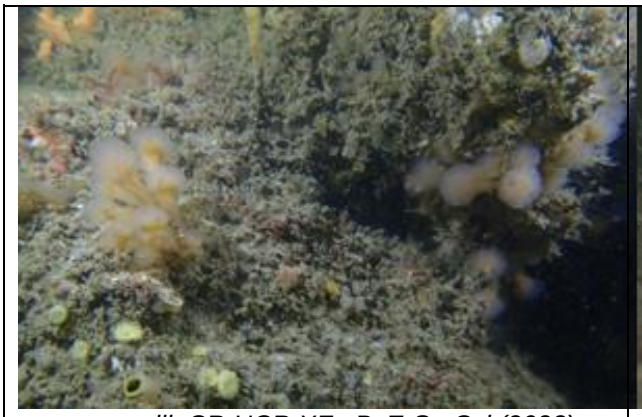
Prominent faunal species in the biotope were the sponges *Hymeniacidon perleve* and *Dysidea fragilis,* as well as the tunicates *Clavelina lepadiformis* and *Aplidium punctum.* Also the decapod crabs *Necora puber* and *Cancer pagurus* were also well represented. The foliose bryozoan *Bicellariella ciliata* was common amongst the *Balanus crenatus* barnacle crusts.

Finally at site S3, from 6.7m ODM upwards, there was a kelp zone with the beginnings of a seasonal understory growth of foliose red algae and barnacles. Prominent red algae in March 2023 included, *Delesseria sanguinea* and *Rhodophyllis divaricata*, whilst the dominant brown alga was *Laminaria digitata* and sparse *L. hyperborea. Dictyota dichotoma* sporelings were again visible species amongst

the silt and fauna turf. The biotope was therefore still consistent with S1 and S2, being *IR.MIR.KR.Ldig.Ldig* or *Laminaria digitata* on moderately exposed sublittoral fringe rock.

Dominant faunal taxa were the tunicates *Synoicum incrustatum / Polyclinum aurantium Dendrodoa grossularia* and *Polycarpa scuba,* the sponge *Halichondria panicea* and the barnacle *Balanus crenatus*.

Photographs from each sublittoral zone / biotope are shown in Figure 6-3, while a full species list with SACFOR classification is presented in Table 6-3.

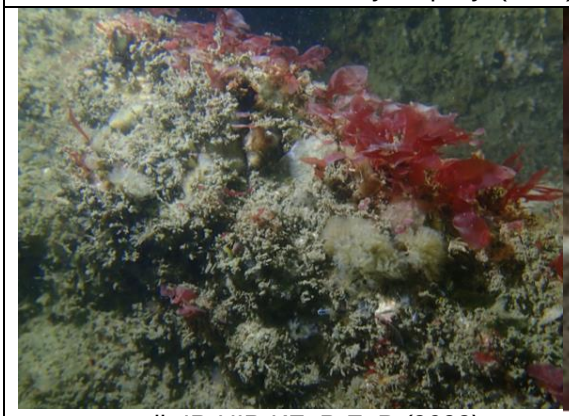


iii: CR.HCR.XFa.ByErSp.Cyl (2023)

iii: *CR.HCR.XFa.ByErSp.Sag (2015)*

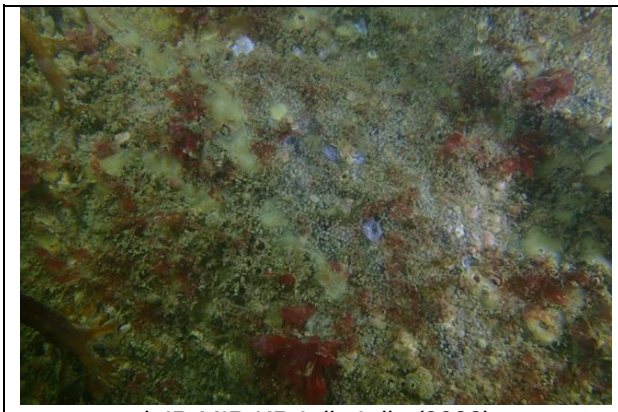
iii: CR.HCR.XFa.ByErSp.Cyl (2023)

iii: *CR.HCR.XFa.ByErSp.Sag (2015)*

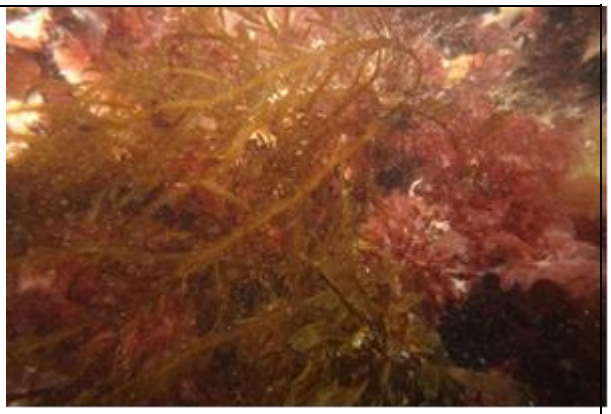


ii: *IR.HIR.KFaR.FoR (2023)*

ii: *IR.HIR.KFaR.FoR (2015)*



i: IR.MIR.KR.Ldig.Ldig (2023)



i: *IR.MIR.KR.Ldig.Ldig (2015)*

Figure 6-3: Sublittoral Zones and Biotopes for Station S3 (2015 and 2023)

Table 6-3: Species List for Station S3 with SACFOR Abundance Classifications for Each Biotope (2015 and 2013)

MCS Code	Taxa	2015 S3			2023 S3		
		i	ii	iii	i	ii	iii
C00350	*Sycon ciliatum*						R
C00350	*Scypha ciliata*			R			
C01670	*Pachymatisma johnstonia*						O
C02210	*Suberites ficus*		R	R		R	R
C04250	*Raspailia hispida*						O
C04810	*Halichondria bowerbanki*			R			
C04840	*Halichondria panicea*	O	R	O	O	R	O
C05230	*Hymeniacidon perleve*	O			O		
C05960	*Esperiopsis fucorum*		R	R			
C06450	*Myxilla incrustans*		R		R	R	
C06780	*Iophonopsis nigricans*		R	R	R	R	
C08630	*Haliclona simulans*		R	A			
C08900	*Dysidea fragilis*					O	O
D01440	*Tubularia indivisa*	R	R		R	R	
D05260	*Halecium halecinum*		R	O		R	O
D05970	*Nemertesia antennina*	R	R	C	R	O	C
D05990	*Nemertesia ramosa*		R	R		R	O
D06760	*Sertularia argentea*		R				
D07300	*Obelia dichotoma*		R			R	
D07310	*Obelia geniculata*	F		O	R	R	R
D07430	*Rhizocaullus verticillatus*		R	R	R	R	
D10240	*Alcyonium digitatum*		F	C	R	O	O
D11580	*Anemonia viridis*	O			R		
D11680	*Urticina felina*		R	F	R	R	O
D12310	*Cylista elegans*	O	F	C	O	R	O
D13700	*Caryophyllia smithii*						R
G00780	*Lineus longissimus*			R			
P23020	*Spirobranchus*				R	O	O
P23040	*Spirobranchus triqueter*	O	F	O			
R01090	*Balanus balanus*	R	R	R		R	R
R01100	*Balanus crenatus*	C	C	R	C	F	O
S01660	Amphipoda			O	F	F	O
S22100	*Palaemon serratus*	O	C	C		O	C
S23220	*Pandalus montagui*	R					
S23600	*Homarus gammarus*	R		R			
S25020	*Pisidia longicornis*		O				

MCS Code	Taxa	2015 S3			2023 S3		
		i	ii	iii	i	ii	iii
S25850	*Macropodia rostrata*	O	C	A			
S26460	*Cancer pagurus*	C	F	R		F	F
S26720	*Necora puber*	A	C	A	F	F	F
S26900	*Carcinus maenas*	C					
W16500	*Mytilus edulis*	R	O		O	R	
Y00001	Bryozoa		O	O	O	O	O
Y01370	*Alcyonidium diaphanum*		C	C		C	C
Y06640	*Membranipora*	O			O		
Y06780	*Electra pilosa*	O			O		
Y06940	*Flustra foliacea*		O	R		O	R
Y07050	*Chartella papyracea*		O		R	O	R
Y08530	*Bicellariella ciliata*				R	O	R
Y08720	*Bugula flabellata*					R	O
Y08790	*Bugula turbinata*			O			
ZB00110	*Antedon bifida*	R	O	C	R	F	F
ZB01900	*Asterias rubens*	C	C	C	C	F	C
ZB02350	*Ophiothrix fragilis*	R					
ZD00060	*Clavelina lepadiformis*		F	F	R	F	F
ZD00460	*Morchellium argus*			R	R		R
ZD00640	*Aplidium punctum*	R	R	O	R	F	F
ZD01500	*Ascidia mentula*						R
ZD01880	*Polycarpa scuba*				F		
ZD01940	*Dendrodoa grossularia*	R	F	C	F	F	R
ZG02080	*Pollachius pollachius*	R	R	R	R	R	R
ZG04380	*Taurulus bubalis*	R	R	R	R	R	R
ZG07050	Gobiidae	R	O	R			
ZG07400	*Pomatoschistus*		R	R			
ZM02420	*Palmaria palmata*	O			R		
ZM03840	Corallinaceae (enc)	F	O		F	O	
ZM04040	*Corallina officinalis*	R			R		
ZM05940	*Schottera nicaeensis*				R	R	
ZM06310	*Plocamium cartilagineum*	C					
ZM06820	*Calliblepharis ciliata*	R			R		
ZM06880	*Cystoclonium purpureum*	R			R	R	
ZM06930	*Rhodophyllis divaricata*				R	R	
ZM07230	*Rhodymenia holmesii*		R				
ZM07260	*Rhodymenia ardissonei*		R				
ZM07510	*Lomentaria articulata*	R					
ZM08239	*Ceramium secundatum*		R				
ZM09400	*Apoglossum ruscifolium*		R				
ZM09500	*Cryptopleura ramosa*	A	R		R	R	
ZM09550	*Delesseria sanguinea*	A	R		R	R	
ZM09850	*Hypoglossum hypoglossoides*	R	R		R	R	
ZM09900	*Membranoptera alata*	R					
ZM10120	*Phycodrys rubens*		R				
ZM10180	*Erythroglossum laciniatum*	F					
ZM11050	*Polysiphonia elongata*	R	R				
-	Chrysophyceae	A					
ZR00030	Ectocarpaceae indet.	C					
ZR04570	*Dictyota dichotoma*	O	F		R	R	
ZR04970	*Desmarestia aculeata*	R					
ZR04990	*Desmarestia ligulata*	O					
ZR06320	*Laminaria digitata*	A			F		
ZR06330	*Laminaria hyperborea*	R			O		

MCS Code	Taxa	2015 S3			2023 S3		
		i	ii	iii	i	ii	iii
ZS02400	*Ulva* (flat)				R		

6.1.4. Sublittoral Station S4 (2015 and 2023 Comparison)

This site is located off the south-east corner of Ireland's Eye, refer Figure 4-1. This site was much more current swept and subject to swell during the March 2023 survey than the other three sites, and consequently the visibility was poorer. The reef emerges out of the sediment at approximately 14.7m ODM and rises at a shallow angle towards the shore. Initially the reef slopes shore-wards relatively smoothly and latterly in a series of steep ridges and gullies. The silt covering was significant and responsible for the poor visibility. Where the rock was exposed to the current, the community was a relatively rich encrusting assemblage of hydroids and bryozoans with frequent erect sponges and anemones. The community on this deepest reef (biotope (iii)) was dominated by a faunal turf of *Flustra foliacea, Securiflustra securifrons, Scrupocellaria* spp., whilst the sponges *Amphilectus fucorum, Haliclona oculata* and *Haliclona simulans* were also present. The anemones *Alcyonium digitatum, Urticina felina* and *Cylista elegans* were frequently encountered along with the erect hydroid *Nemertesia antennina*.

Ascidians form a major constituent of the biotope and as at the other sites, the colonial ascidians *Aplidium punctum, Synoicum incrustatum / Polyclinum aurantium* were noted in the turf on the rock surface along with the solitary ascidians *Polycarpa scuba* and *Dendrodoa grossularia*.

The biotope can still, therefore, be designated as similar to the 2015 survey label of *HCR.XFa.FluCoAs.Paur - Polyclinum aurantium* and *Flustra foliacea* on sand scoured tide-swept moderately wave-exposed circalittoral rock.

Above this biotope, at 9.2m ODM, was the *Dictyota dichotoma* and foliose red algal assemblage which were also found at S1 and S2, as in 2015. Generally here the silt still formed a really thick covering on any surfaces out of the direct current, but the *Dictyota* sporelings were still just visible in the sward. Again, the accompanying small foliose red algal species visible were, *Hypoglossum hypoglossoides, Schottera nicaeensis, Cryptopleura 25ivari*, *Rhodophyllis 25ivaricate* and *Delesseria sanguinea*, but they were very sparse. Occasional ragged specimens of over-wintered *Phyllophora crispa* were seen in the turf, heavily colonised by epiphytes. Beneath the silt, the solitary ascidian *Dendrodoa grossularia* and the ever-present barnacles *Balanus crenatus* formed a faunal crust with frequent clumps of crustose, massive and erect sponges, as well as colonial ascidians, hydroids and bryozoans.

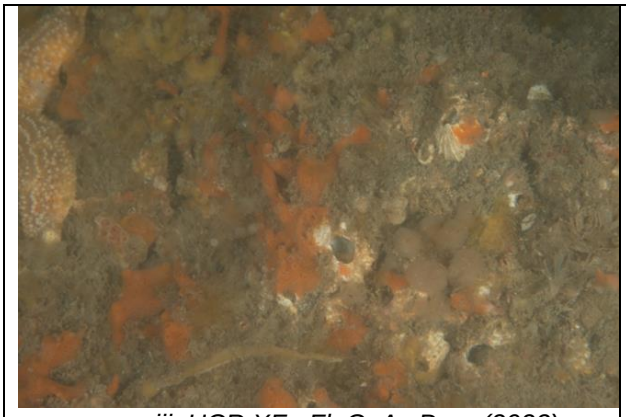
The sponges seen in the surge were both *Haliclona oculata* and *H. simulans*, as well as *Halichondria panicea, Hymeniacidon perleve* and *Hemimycale columella.* Hydroids included *Obelia* species, and Nemertesia antennina and *Aplidium punctum* was the ever present dominant colonial ascidian.

As with the 2015 survey, the water movement in the shallower depths at S4 made photography more difficult during the March 2023 survey and no useable photos were obtained in the kelp zone.

This sublittoral fringe biotope encountered at S4, from 5.2m ODM above the foliose algal zone, was another zone of stunted *Laminaria digitata and L. hyperborea* kelp plants, with several other sparse foliose red algae, such as *Phyllophora crispa* and *Delesseria sanguinea*. Beneath these algae were crusts of barnacles and sparse mussels, with frequent common starfish (*Asterias rubens*) feeding on the mussels. *Urticina felina*, *Halichondria panicea* and *Alcyonium digitatum* were all noted in the surge. The bryozoans *Electra pilosa* and *Membranipora membranacea* were seen on the kelp fronds, whilst *Asterias rubens* was also present, feeding on the mussels. The biotope would still be

designated as *IR.MIR.KR.Ldig.Ldig* or *Laminaria digitata* on moderately exposed sublittoral fringe rock.

Photographs from each sublittoral zone / biotope are shown in Figure 6-4, while a full species list with SACFOR classification is presented in Table 6-4.



iii: HCR.XFa.FluCoAs.Paur (2023)

iii: *HCR.XFa.FluCoAs.Paur (2015)*

iii: HCR.XFa.FluCoAs.Paur (2023)

iii: *HCR.XFa.FluCoAs.Paur (2015)*

ii: *IR.HIR.KFaR.FoR.Dic (2023)*

ii: *IR.HIR.KFaR.FoR.Dic (2015)*

ii: *IR.HIR.KFaR.FoR.Dic (2023)*

ii: IR.HIR.KFaR.FoR.Dic (2015)

Figure 6-4: Sublittoral Zones and Biotopes for Station S4 (2015 and 2023)

Table 6-4: Species List for Station S4 with SACFOR Abundance Classifications for Each Biotope (2015 and 2023)

MCS Code	Taxa	2015 S4			2023 S4		
		i	ii	iii	i	ii	iii
C00350	*Sycon ciliatum*				R	O	
C00350	*Scypha ciliata*	O	O				
C02210	*Suberites ficus*		R	R			
C04810	*Halichondria bowerbanki*		O	O			
C04840	*Halichondria panicea*	F	O		O	O	
C05230	*Hymeniacidon perleve*	F			O	R	
C05960	*Amphilectus fucorum*						O
C05960	*Esperiopsis fucorum*		O	O			
C06450	*Myxilla incrustans*	R					
C06780	*Iophonopsis nigricans*		O	O	R	O	R
C07750	*Hemimycale columella*		R		O	O	
C08600	*Haliclona oculata*						O
C08630	*Haliclona simulans*		F	F		O	O
C08900	*Dysidea fragilis*			R		R	R
C09100	*Halisarca dujardini*				R	R	
D05260	*Halecium halecinum*			O		R	O
D05780	*Halopteris catharina*		O	O			
D05970	*Nemertesia antennina*		O	F		O	F
D05990	*Nemertesia ramosa*		O	O			R
D06690	*Sertularella polyzonias*			O			
D06760	*Sertularia argentea*			R			
D07300	*Obelia dichotoma*	O	F	F	R	R	
D07310	*Obelia geniculata*	O			O	O	R
D07430	*Rhizocaullus verticillatus*			O		R	O
D10240	*Alcyonium digitatum*	O	C	F	O	F	O
D11070	*Epizoanthus couchii*					R	R
D11680	*Urticina felina*	R	F	C	R	O	C
D12250	*Metridium senile*		O	C		R	
D12310	*Cylista elegans*	R	F	F	R	O	O
D12480	*Sagartiogeton undatus*			R			
P20310	*Lanice conchilega*		O	O			
P23020	*Spirobranchus*				R	O	O
P23040	*Spirobranchus triqueter*	R					
P23090	*Serpula vermicularis*		O				
R01090	*Balanus balanus*		R	C		R	C
R01100	*Balanus crenatus*	C	F	C	F	F	F
S01660	Amphipoda		F	F	R	O	O
S23600	*Homarus gammarus*			R		R	R
S24650	*Pagurus bernhardus*			O			
S25750	*Inachus sp.*					R	F
S25850	*Macropodia rostrata*			F			
S26460	*Cancer pagurus*	O	F	F	R	O	F
S26690	*Liocarcinus depurator*			O		R	O

MCS Code	Taxa	2015 S4			2023 S4		
		i	ii	iii	i	ii	iii
S26720	*Necora puber*	F	C	C	O	O	O
W07380	*Trivia monacha*					R	R
W14030	*Archidoris pseudoargus*		R			R	R
W16500	*Mytilus edulis*	F		O	F		
Y00030	Crisiidae	F	F	F	R	O	O
Y01370	*Alcyonidium diaphanum*	F	F	F	O	O	O
Y06640	*Membranipora membranaceae*				O		
Y06640	*Membranipora*	F					
Y06780	*Electra pilosa*	C	O		F	R	
Y06940	*Flustra foliacea*		O	O		O	O
Y07100	*Securiflustra securifrons*					F	O
Y08360	*Scrupocellaria sp.*		F	F	O	O	O
Y08530	*Bicellariella ciliata*			O	R	O	O
Y08720	*Bugula flabellata*		O	F		O	F
ZB00110	*Antedon bifida*	O	F	R		O	O
ZB01900	*Asterias rubens*	C	C	C	F	F	O
ZB02350	*Ophiothrix fragilis*			O		R	O
ZB02680	*Ophiactis balli*		O	O			
ZB02780	*Ophiopholis aculeata*		O	O			
ZB03000	*Amphipholis squamata*		O	R	O	O	R
ZB04950	*Thyone fusus*					R	O
ZD00060	*Clavelina lepadiformis*	O	O	O	O	R	R
ZD00340	*Polyclinum aurantium*			O			
ZD00640	*Aplidium punctum*	F	O	O	O	F	F
ZD00680	Didemnidae indet.			R			
ZD01090	*Lissoclinum perforatum*					R	R
ZD01880	*Polycarpa scuba*		R	R		O	R
ZD01940	*Dendrodoa grossularia*		F	O	O	F	O
ZD02090	*Botryllus schlosseri*	O	R		O	R	
ZD02140	*Botrylloides leachi*	R			R	R	
ZM02080	*Bonnemaisonia asparagoides*		O				
ZM02420	*Palmaria palmata*	F					
ZM02560	*Dilsea carnosa*		O		R	R	
ZM03230	*Callophyllis laciniata*	O	O				
ZM03840	Corallinaceae (enc)	F			O	O	
ZM04040	*Corallina officinalis*	O			R		
ZM05840	*Phyllophora crispa*	F	F		R	R	
ZM05860	*Phyllophora pseudoceranoides*	F					
ZM05940	*Schottera nicaeensis*		O		R	R	
ZM06110	*Chondrus crispus*	F			R		
ZM06310	*Plocamium cartilagineum*	F	O				
ZM06820	*Calliblepharis ciliata*		R				
ZM06880	*Cystoclonium purpureum*	F	F		R	R	
ZM06930	*Rhodophyllis divaricata*		F			R	
ZM07230	*Rhodymenia holmesii*		F	R			
ZM07530	*Lomentaria orcadensis*		R				
ZM08070	*Ceramium sp.*	O	O				
ZM08460	*Halurus flosculosus*		R				
ZM09500	*Cryptopleura ramosa*	O	F		R	R	
ZM09550	*Delesseria sanguinea*	F	F		R	R	
ZM09850	*Hypoglossum hypoglossoides*		F		R	R	
ZM10120	*Phycodrys rubens*	F					
ZM10180	*Erythroglossum laciniatum*		F				
ZM11160	*Polysiphonia nigra*		R				
-	Chrysophyceae	A					
-	Red sponge crust		O			O	
-	*Brogniartella byssoides*	O	F				
ZR00030	*Ectocarpaceae indet.*	C					
ZR04570	*Dictyota dichotoma*	C	C		R	R	
ZR04780	*Taonia atomaria*		R				
ZR04970	*Desmarestia aculeata*	O	R				

MCS Code	Taxa	2015 S4			2023 S4		
		i	ii	iii	i	ii	iii
ZR04990	*Desmarestia ligulata*	R					
ZR05000	*Desmarestia viridis*	R	R				
ZR06310	*Laminaria* sporelings		O	R		R	R
ZR06320	*Laminaria digitata*	S			O		
ZR06330	*Laminaria hyperborea*	O			R		
ZR06360	*Saccharina latissima*	F			R		
ZS03920	*Bryopsis plumosa*		R				

6.2. Univariate Analyses

The addition of the 2023 winter study provides an additional seasonal dimension to the sublittoral transects, with notably fewer species recorded at all sites, although the majority of these were due to reduced algae, in particular Rhodophya and Ochrophyta. A net loss of approximately 26 taxa was recorded during the winter study.

Table 6.5: Number of Species per Phyla and Station

Phylum	Sublittoral Station (2015)				Sublittoral Station (2023)			
	S1	S2	S3	S4	S1	S2	S3	S4
Porifera	6	9	9	12	6	7	9	11
Cnidaria	10	14	12	14	11	11	12	11
Nemertea	0	0	1	0	0	0	0	0
Annelida	1	2	1	3	1	1	1	1
Arthropoda	4	12	11	9	6	8	6	8
Mollusca	3	3	1	2	3	1	1	3
Bryozoa	5	12	7	8	11	8	8	9
Echinodermata	5	5	3	6	3	6	3	5
Chordata	7	14	8	8	5	6	9	8
Rhodophyta	17	30	18	25	6	8	9	11
Ochrophyta	7	8	7	11	4	4	4	5
Chlorophyta	2	0	0	1	0	0	1	0
Ascomycota	0	0	0	0	0	0	0	0
Tracheophyta	0	0	0	0	0	0	0	0
TOTAL	**67**	**109**	**78**	**99**	**56**	**60**	**63**	**72**
Average	**88.3**				**62.8**			
Standard Deviation	**19.2**				**6.8**			

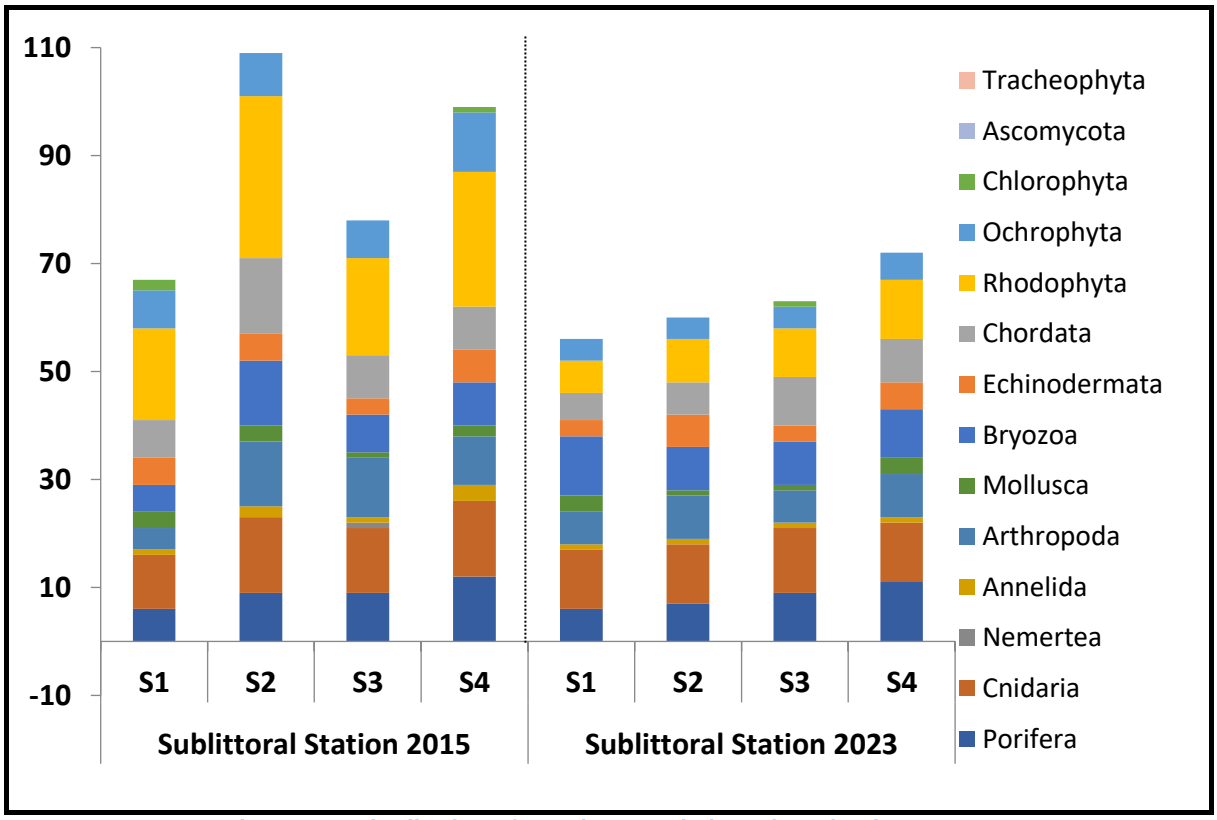


Figure 6.5: Distribution of Species per Phyla and Station by Survey

6.3. Multivariate Analyses

6.3.1. Sublittoral Stations (2015 and 2023 Comparison)

All four stations (S1, S2, S3 and S4) in the sublittoral areas were characterised by *Laminaria digitata* forest in the shallows (*IR.MIR.KR.Ldig.Ldig*). Below this zone, three of the four stations recorded the biotope *IR.HIR.KFaR.FoR.Dic* (S1, S2 and S4). The deepest extent of the reef was the most variable, with three different biotopes recorded at the four stations, with only Sublittoral S1 and S3 characterised by the same biotope of 'Mixed turf of bryozoans and erect sponges with *Sagartia elegans* on tide-swept circalittoral rock'. The repeated survey in 2023, undertaken during the winter, indicated no significant changes in the biotopes recorded, despite the slightly reduced number of over-wintering species identified. It should also be noted that the biotiope *CR.HCR.XFa.ByErSp.Cyl* of a 'Mixed turf of bryozoans and erect sponges with *Cylista elegans* on tide-swept circalittoral rock' recorded at depth at S1 has been renamed from *CR.HCR.XFa.ByErSp.Sag*, as was used in the 2015 survey report.

The cluster and MDS plot for the sublittoral stations indicated some statistical separation of biotopes, most notably that of *IR.MIR.KR.Ldig.Ldig*, with all four occurrences being statistically indistinguishable from both years (Figure 6.6). S2 and S4 showed statistical similarities to each other and also between years, although the winter survey remained closely associated with the summer populations. Both sites separated from S3 which indicated a similarity between the survey years. A presentation of the MDS plot indicates similar patterns of distribution between transects but with a separation by survey year (or season), with the 2023 dataset generally separating from the 2015 cluster due to the reduced over-wintering algal populations. The only variable to this was recorded in 2015 at S1_biotope iii, observed from the deepest layer, which clustered within the 2023 transects Figure 6-6As with all of the deeper layers, the variation between seasons was less due to the increased depth and reduced

influence from the algal population. The deepest part of transect S1 was also slightly degraded due to the high silt content at this site and depth.

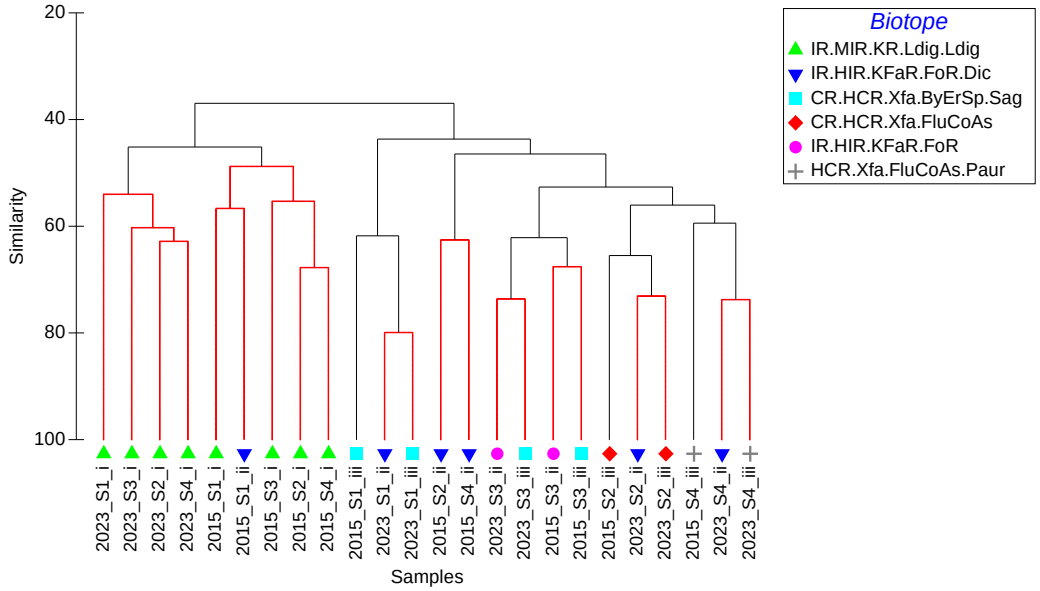


Figure 6-5: Dendrogram of Biotopes Recorded at the Sublittoral Stations (2015 and 2023)

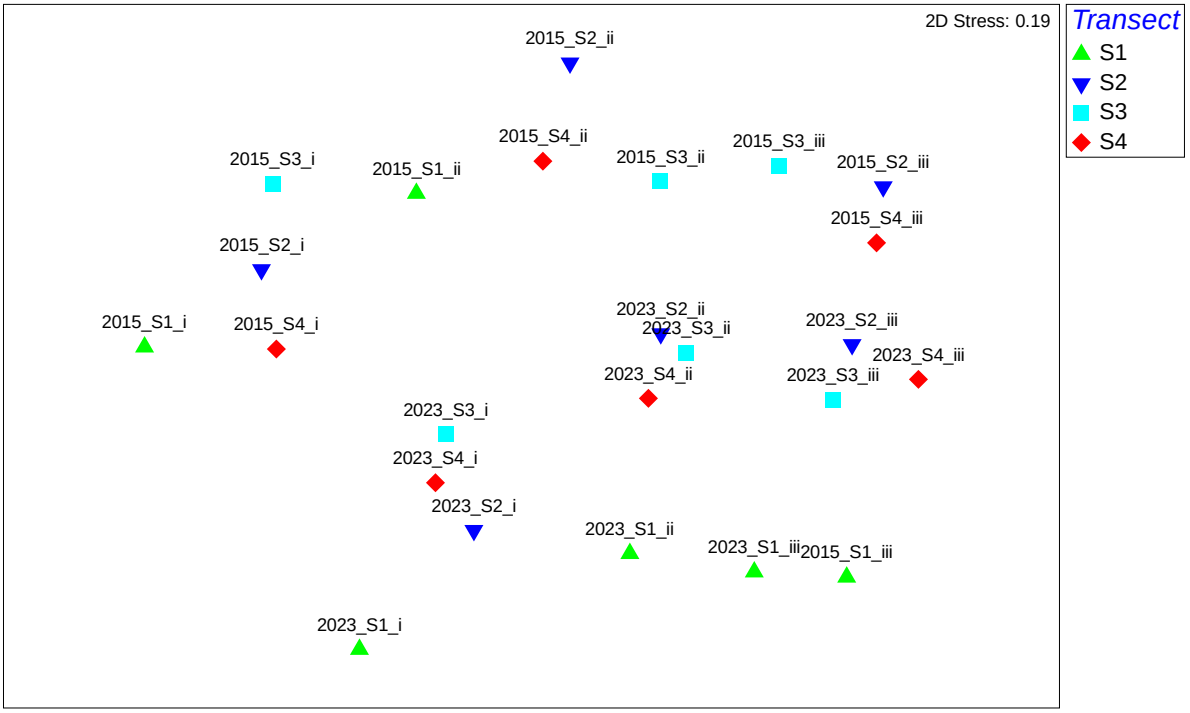


Figure 6-6: MDS of Biotopes Recorded at the Sublittoral Stations (2015 and 2023)

7. Conclusion

Four sites were surveyed in the sublittoral zone and similar semi-quantitative data collected along with photographs in both summer 2015 and winter 2023 surveys. Overall, all sublittoral environments indicated the presence of significant siltation in the deeper zones. However, the faunal populations in each of the station transects showed well represented and moderately diverse habitats containing many of the common species found along the Irish Sea coastline. In the summer (2015), stations S2 and S4 indicated greater habitats similarity recorded within their vertical zonation, which continue during the winter(2023), although the winter population varied at all sites due to reduced numbers of over-wintering algal populations.

The result of a moderately high diversity is similar to that recorded in the macro-invertebrate population previously recorded within the soft sediments north of Ireland's Eye as part of the proposed outfall pipeline route (marine section) baseline surveys (BSL 2013; 2017), and is probably indicative for the survey area as a whole. The presence of significant siltation at all locations within the surveys would indicate that this phenomenon is ubiquitous in the waters surrounding this island and has subsequently created a habitat with limited sensitivity to suspended sediments in this area. Whilst siltation levels are high in the sublittoral environment, a significant increase in suspended sediment, particularly during the summer months during peak algal growth, might cause some damage to the algal biotopes present through reduced light penetration and availability. However, the moderately strong tidal currents experienced in this area are sufficient to prevent the deposition of significant silt material which might degrade the sublittoral benthic biotopes through smothering and burial of the infralittoral and circalittoral communities. No species of particular conservational interest were noted during the surveys and no rare or fragile biotopes recorded.

8. References

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