

**North Western Inshore Fisheries and Conservation Authority
(NWIFCA)**

Cumbrian Shore Survey 2013



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INTRODUCTION

Surveys of the Cumbrian shore have been conducted since 1993 at 11 transect sites, which were identified as being representative of the type of shore ecology present on the Cumbrian Coast, and/or as sites with a history of, or potential for, anthropogenic impacts (for example sites near industrial outfalls). The data collected through this survey has now built up into an extremely valuable time series of data on the Cumbrian coast spanning 21 years. The information collected has identified long term changes on the coast as well as characterising the species and habitats present.

The Cumbrian coastline boasts an extremely wide variety of habitats, from the sand flats of the Solway Firth to the rocky headland at St. Bees. This variety of habitats has allowed colonisation by an equally diverse array of species and the intertidal areas along this coastline provide a fascinating insight into the marine life of the north east Atlantic.

One of the most diverse intertidal habitats is the rocky shore. These areas provide a multitude of habitats for marine organisms to colonise, such as rock pools, crevices and overhangs. The term 'rocky shore' can however be used to describe a number of different habitat types, each providing a niche environment

for different groups of species, hence this survey concentrates on rocky shores.



Figure 1: Rocky shore at Cuning Point.

On the Cumbrian coastline a number of different rocky shore habitats can be found. Between Harrington and St Bees is an area of true rocky shore (i.e. platforms made of bedrock (Figure 1)).

The predominant type of rocky shore found on the Cumbrian coast is the remains of glacial deposits left over from the end of the ice age. These areas of pebbles, boulders and cobbles are known locally as scar ground (Figure 2). These habitats can be ephemeral in nature due to the frequent sand movements in the Solway and further down the coast, while other scar grounds are permanent.



Figure 2 (Above): Cobble scar at Maryport.

The final type of rocky shore found on the Cumbrian coast is slagcrete (Figure 3), and is found between Maryport and Whitehaven. Slagcrete was originally formed as the result of blast furnaces waste being dumped on the shore in the last century. Over time this artificial substrate has become colonised by marine life.

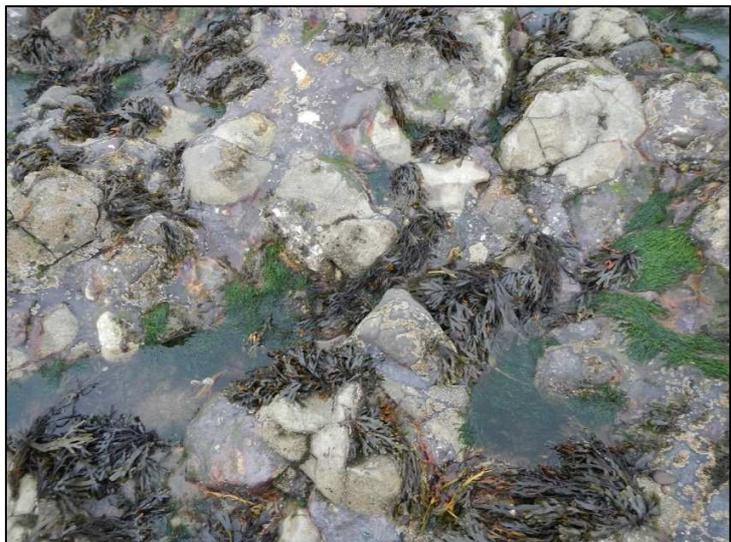


Figure 3 (Below): Slagcrete reef at Moss Bay.

The Cumbrian coast is home to two species which can dominate in the intertidal zone – *Mytilus edulis*, the edible mussel, and *Sabellaria alveolata*, the honeycomb worm (from here on referred to as *Sabellaria*). When growing in colonies or dense aggregations these species create structures which provide a surface for attachment for other organisms, known as biogenic reefs. Additionally the reefs stabilise an otherwise unstable shore, thereby giving other organisms chance to establish.

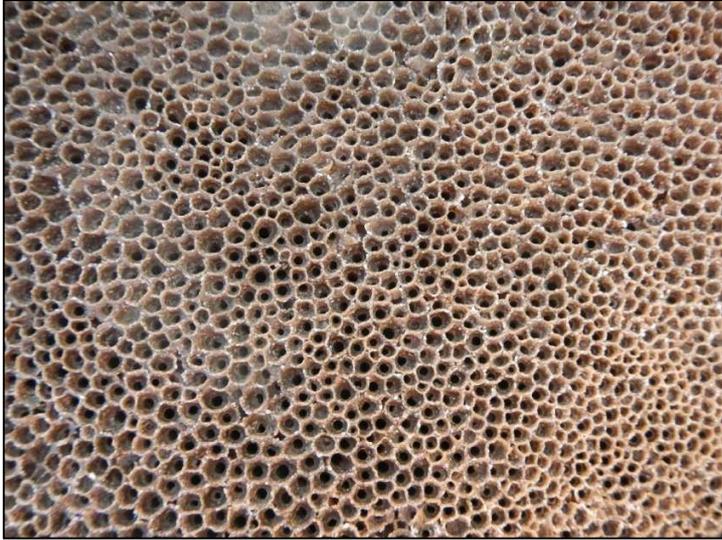


Figure 4: Close up of *Sabellaria* tubes.

Sabellaria is a polychaete worm which forms tubes made from sand particles and shell fragments (Figure 4). In a colony these tubes can form structures which can take a number of different forms, from individual hummocks to platforms. The tubes can also form a crust like covering on other surfaces. In its reef form it has

been known to cover hundreds of meters of shoreline, particularly

along the southern sections of the Cumbrian coast. These reef structures also have a huge impact on the drainage of the shore, often trapping water on the upper reaches of the shore during low tide. This effectively extends the marine influence further up the shore for a longer period of time, allowing fully marine creatures to exploit otherwise unavailable resources. *Sabellaria* reefs are nationally scarce and the Solway Firth is the northerly limit of distribution for this species. *Sabellaria* reef is designated as a priority Biodiversity Action Plan (BAP) species and is also protected as an Annex I Habitat under the Habitats Directive.

The second of these species, the edible mussel, can be found on the majority of Cumbrian beaches and, in the upper Solway, edible mussels form large enough beds to be used for commercial exploitation. Mussels can settle in astonishingly high numbers on any beach where there is hard substrate for them to attach.

These two species appear to be in constant competition for space on some Cumbrian shores, and further research was carried out this year into the effects of changing weather systems on the relative dominance of these species

METHOD

Surveys were completed between April and August 2013. Exact transects were located using GPS coordinates (Table 1; Figure 5) and previously assigned visual reference points. The length of transect varies from site to site due to the differing topography of the shores though each extended from extreme high water spring tide level (EHWS) to the extreme low water spring tide level (ELWS). Each shore was divided into upper, mid and lower shore heights, distinctions between which were made utilising the presence or absence of biological indicators of differing degrees of exposure (Ballantine, 1961).

Table 1: The coordinates of the sampling site, dates visited and height of tide (Whitehaven tide timetable) in 2013

Site	Date	GPS position of transect (digital minutes)	Height of tide (m)
Dubmill	26/4/13	Top shore - 54 27 118, 003 34 226 Low water - 54 47 588, 003 27 262	0.6
Maryport	27/4/13	Top shore - 54 43 848 003 28 874 Low water - 54 44 262 003 29 162	1.2
Siddick	21/8/13	Top shore - 54 40 057, 003 33 174 Low water - 54 40 176, 003 33 579	0.8
Moss Bay	21/8/13	Top shore – 54 37 994, 003 34 463 Low water – 54 38 000, 003 34 621	0.8
Cunning Point	29/8/13	Top shore - 54 34 998 003 34 972 Low water - 54 34 895 003 35 049	0.7
Byerstead	23/8/13	Top shore – 54 31 508, 003 36 772 Low water - 54 31 539, 003 88 575	0.5
St. Bees	22/8/13	Top shore - 54 29 426, 003 36 680 Low water - 54 29 355, 003 36 913	0.6
Nethertown	25/4/13	Top shore - 54 27.194, 003 33 828 Low water - 54 27.117, 003 34226	0.8
Sellafield	22/8/13	Top shore - 54 24 870, 003 30 686 Low water - 54 24 765, 003 31114	0.7
Drigg	26/4/13	Top shore - 54 22 346, 003 28 069 Low water - 54 22 135, 003 28 910	0.7
Stub Place	28/4/13	Top shore - 54 17 728, 003 25 253 Low water - 54 17 627, 003 25 696	0.8

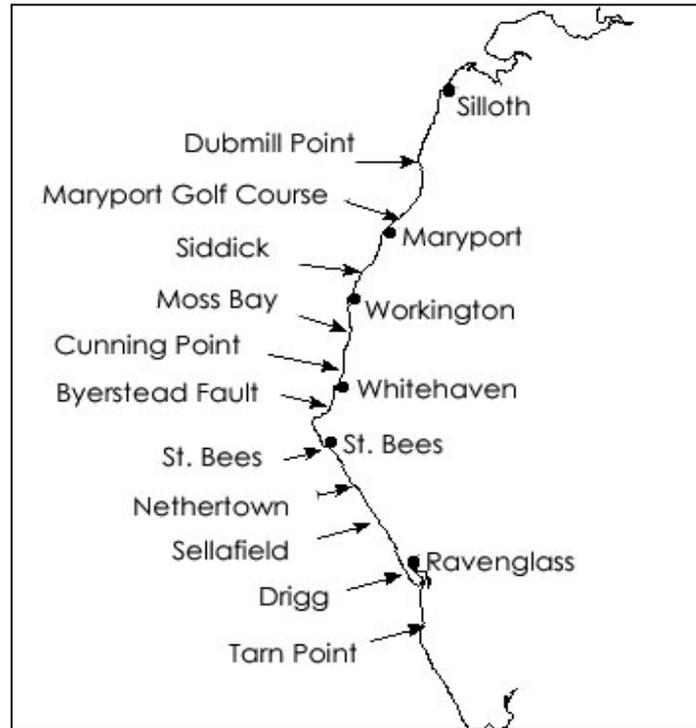


Figure 5: Locations of the 11 survey sites along the Cumbrian coast.

Within each shore height, abundance estimates were made of species immediately visible on the transect and within 10 meters either side (measured using previously calculated strides). Additionally, at least 10 observations of overturned boulders, or pools were made within each conspicuous habitat type on the transect, distinguished using Level 3 Marine Habitats Classifications (Connor *et al.*, 2004). These observations were continued until no new species were identified. Relative abundance (A = abundant, F = frequent, C = common, O = occasional, R = rare) was assigned to each observed species within each shore height using the classification system derived by Crisp and Southward (1958).

Any organisms considered to be new to the survey were photographed and then identified using appropriate keys. Due to the non-destructive nature of the walk over survey, i.e. without the removal of species from the beach, identification to species level was not always possible. In this case organisms were identified to family or genus level, e.g. amphipod spp. (species). Species not previously recorded within the surveys were subsequently added to the existing database.

GENERAL FINDINGS OF THE 2013 SURVEY

The transect sites along the Cumbrian coast remain healthy and diverse in 2013, with an abundance of species recorded (some examples are shown in Figure 6), despite the unseasonably cold weather in spring when some of the surveys were undertaken.. Continued improvements in the ecological health of shores which have historically been affected by anthropogenic impacts have also been recorded, such as Byerstead and Moss bay.

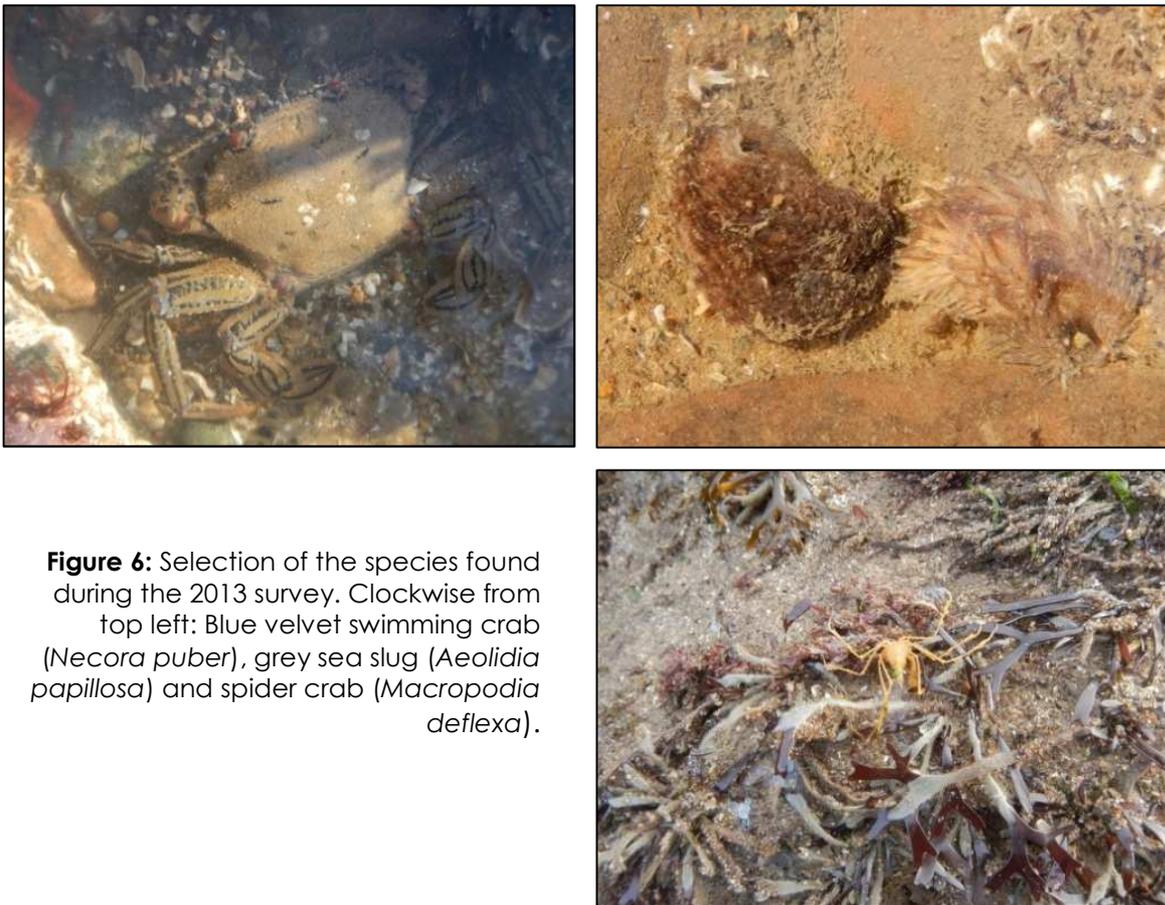


Figure 6: Selection of the species found during the 2013 survey. Clockwise from top left: Blue velvet swimming crab (*Necora puber*), grey sea slug (*Aeolidia papillosa*) and spider crab (*Macropodia deflexa*).

The effects of sand movement along the coast has been a key influence on the species found in this year's survey, with some newly exposed areas of cobble scar observed along with other areas inundated with sand. Recent exposure of new grounds is often evidenced by the presence of opportunistic species of algae such as gutweed which is able to colonise areas quickly. This periodic uncovering and covering of the scar

ground is one of the features of these habitats, and exposure of new scar ground was evident this year at Dubmill, Moss Bay and Barn Scar.

Exposure of new areas of peat at Maryport (Figure 7) was one of the most interesting finds this year with the unmistakable form of tree stumps now visible. The raising of global temperatures at the end of the last Ice Age c. led to the inundation of vast areas of low lying land causing the isolation of Britain from the rest of Europe. The peat we see in the intertidal zones generally dates from between c.3500 and 5500 years ago.

The overall decline in the mussel population at the transect sites was still evident this year with no newly settled mussels found on some transects, such as Barn Scar, Drigg, and Siddick (Figure 8) where previously high spat fall has been recorded. This year an MSc project examined the decline of mussels in the shore survey data and correlated it with slight increases in sea temperature and wind direction, although the report concluded that more factors are undoubtedly involved.



Figure 7: Peat platforms exposed at Maryport.



Figure 8: Stony bed (previously mussel bed) at Siddick.

In contrast, while some areas of *Sabellaria* were denuded and had been subjected to storm damage, the seaward and landward extension of *Sabellaria* colonisation was seen at a number of shores. At Dubmill and Nethertown for example, it now extends into the extreme low water. Additionally, on the very top of mid shore scar at Sellafield new *Sabellaria* platforms were seen to be forming and older mounds were regenerating. Further extension was seen at Moss Bay (Figure 9) and Barn Scar, where in the mid shore there was a large increase in mounds.



Figure 9:
Sabellaria
mounds
growing
seaward of
the old pipe
at Moss Bay.

There now follows a detailed account of each beach surveyed.

DUBMILL POINT

Dubmill Scar is the most northerly stable scar ground surveyed along the Cumbrian coast and extends over a mile into the Solway Firth. The scar has extensive *Sabellaria* mounds extending from the mid shore zone to the extreme low water's edge. Due to the gently sloping topography and the large tidal range in this region, vast areas of the shore are exposed at low tide allowing a tantalising glimpse of the sublittoral communities of the Solway Firth.



Figure 10: View from the mid shore at Dubmill scar.

Beneath the pebbly bank of the upper shore patches of sand were colonised with a combination of juvenile lugworms (*Arenicola marina*), with gutweed (*Ulva intestinalis*) on any loose pebbly scar ground present. The main mid shore scar ground is separated by a small sandy gap after which an assortment of

bare pebbles and cobbles had been recently uncovered (Figure

10). Initially the main scar was dominated by periwinkles (*Littorina littorea*), acorn barnacles (*Semibalanus balanoides*), dog whelks (*Nucella lapillus*) and beadlet anemones (*Actinia equina*). Further into the mid shore scar juvenile (seed) mussels became more abundant on the rocks. In 2013 the sand inundation into the scar ground had remained with many rocks being covered with a thin veneer of sand. Seed mussels of 7-10mm occupied only 60% of the ground at their most abundant. No newly settled mussels (i.e. < 5mm) were found and adult mussels were scarce.

Also present within the mid shore scar was a multitude of pools where water is trapped at low water. The red pool algae *Ceramium virgatum* and hydroids (*Dynamena pumila*) were found commonly around the edges on boulders of these large pools. This year no

gobies or shrimp were found within the pools, most likely due to colder weather as the 2013 surveys took place in spring.

In the mid shore scar there is a transitional zone between the mussels and *Sabellaria* which begins by the oyster lays, which mark the beginning of *Sabellaria* crust. Progressing further down the scar a few hundred metres from the oyster lays the *Sabellaria* crust becomes mounds of up to 33 cm in height (Figure 11), and these dominate the shore.



Figure 11: Beginning of *Sabellaria* mounds in the mid shore scar.

Between the *Sabellaria* mounds pebbly pools formed containing Irish moss (*Chondrus crispus*), sugar kelp (*Saccharina latissima*), dulse (*Palmaria palmata*) and the red pool algae *Ceramium virgatum*. Sea lettuce (*Ulva lactuca*) was also found within this area; mostly on the *Sabellaria* mounds or on larger boulders.

As the scar progresses into the lower shore *Sabellaria* continues to dominate and bind up the sand and rocks with impressive 60cm high mounds. An abundance of encrusting breadcrumb sponge (*Halichondria panicea*) covered the bases of these large mounds. The *Sabellaria* mounds form small pools within the gaps which were colonised by a conglomeration of sugar kelp, the red pool algae *Ceramium virgatum*, and sea lettuce. Where rocks and boulders were present between the *Sabellaria* mounds baked bean ascidians (*Dendrodoa grossularia*) and dog whelks could be found.

The last two years of the shore survey reported *Sabellaria* mounds continuing into the extreme low water zone, and these are still found within the area during the 2013 surveys. The *Sabellaria* mounds were smaller here than those in the mid shore and lower shore, but they are still healthy and growing around the water's edge. Sugar kelp and oar weed (*Laminaria digitata*) were common throughout the standing water with a

frequent occurrence of dahlia anemones (*Urticina felina*). Between the *Sabellaria* mounds there was an abundance of dead adult mussel shells covered in barnacles (*Semibalanus balanoides*, *Balanus crenatus* and *Balanus balanus*) (Figure 12).

Boulders along the bank at the extreme water's edge were covered with barnacles and dog whelks; with large colonies of breadcrumb sponge, occasionally finger sponges (*Haliclona oculata*) and horn wrack (*Flustra foliacea*) encrusting the lower edges of the boulders, as well as the hydroid *Dynamena pumila* covering the surface of the rock. Within the water, patchy distributions of the red branching algae *Polyides rotundus* and red encrusted algae (*Lithophyllum/Lithothamnion* sp.) were present, with dahlia anemones dispersed throughout.



Figure 12: *Sabellaria* mounds with dead mussels and barnacles between the mounds and within pools.

Table 2: Species found at Dubmill Point in April 2013

Latin Name	English Name/description	Lower Shore	Mid Shore	Upper Shore
<i>Halichondria panicea</i>	Breadcrumb sponge	F		
<i>Haliclona oculata</i>	Finger sponge	O-R		
<i>Dynamena pumila</i>	Hydroid	O	O	
<i>Actinia equina</i>	Beadlet anemone		R	
<i>Urticina felina</i>	Dahlia anemone	F-A		
<i>Arenicola marina</i>	Lugworm		O	
<i>Eulalia viridis</i>	Green leaf worm (egg mass)		R	
<i>Lanice conchilega</i>	Sand mason worm	R		
<i>Sabellaria alveolata</i>	Honeycomb worm (mounds)	A	A	
<i>Littorina littorea</i>	Edible periwinkle	C	C	
<i>Mytilus edulis</i>	Edible mussel	O		
<i>Mytilus edulis</i>	Seed mussel		F-A	
<i>Nucella lapillus</i>	Dog whelk	C	C	
<i>Nucella lapillus</i>	Dog whelk eggs	C	C	
<i>Semibalanus balanoides</i>	Acorn barnacle		O	
<i>Balanus crenatus</i>	Barnacle	O-C	O	
<i>Balanus balanus</i>	Large barnacle	O-R		
<i>Palaemon serratus</i>	Rock prawn	O		
<i>Asterias rubens</i>	Common starfish	O		
<i>Electra pilosa</i>	Hairy sea mat	R		
<i>Flustra foliacea</i>	Horn wrack (bryozoan)	R		
<i>Dendrodoa grossularia</i>	Sea gooseberry (Baked bean ascidians)	O		
<i>Ulva intestinalis</i>	Gutweed			O
<i>Ulva lactuca</i>	Sea lettuce	F	C	
<i>Laminaria digitata</i>	Oar weed	F		
<i>Saccharina latissima</i>	Sugar kelp	F		
<i>Ceramium virgatum</i>	Red pool algae	F	O	
<i>Chondrus crispus</i>	Irish moss		O	
<i>Hildenbrandia rubra</i>	Red encrusting algae	R		
<i>Lithothamnion</i> or <i>Lithophyllum</i> sp.	Red encrusted algae	O		
<i>Palmaria palmata</i>	Dulse	O		
<i>Porphyra umbilicalis</i>	Laver		R	
<i>Polyides rotundus</i>	Red branching algae	R		

MARYPORT GOLF COURSE

This transect site is located next to the Maryport Golf Course just north of Maryport. The beach is primarily sandy with patches of cobbled scar ground. Maryport has a diversity of habitats including peat platforms, *Sabellaria* mounds and mussel beds.

The survey began in the upper shore scar. Patches of sand and cobbles were intermixed throughout the upper shore (Figure 13). Rocks were covered in laver (*Porphyra umbilicalis*), gutweed, and the green algae *Ulva linza*. Barnacles (*Balanus crenatus*) could be seen on the rock surfaces. Juvenile lugworm casts found on the patches of sand were an indicator of these organisms' presence beneath the sand.

This year new peat platforms had been exposed in the mid shore area, with the remains of ancient tree roots and stumps still visible (Figure 14). The peat platforms did not have any algae settlement indicating that these were newly exposed, however piddock holes were present. Around these peat platforms are



Figure 13: Upper shore scar of Maryport illustrating the mosaic of sand, pebbles and cobbles present with various algae.



Figure 14: Peat platforms with tree roots exposed.

areas of newly exposed pebbly scar barren of any kind of settlement.

Continuing onto the main section of the mid shore scar an abundance of seed mussels were found to be settled onto the rocks. Most of the seed mussels were only 1mm, however some mussels present were found to be up to 20mm most likely from the previous year's settlement. Some of the rocks were covered with a thin encrusting veneer of denuded *Sabellaria* crust.



Figure 15: *Sabellaria* mounds along the lower mid shore.

Impressive *Sabellaria* mounds, ~60cm, were abundant throughout the lower mid shore scar. These were covered with sea lettuce and pool algae, including *Ceramium virgatum* and *Polysiphonia elongata*, while silty pebbles were found between the mounds (Figure 15). Sand mason worms (*Lanice*

conchilega) were found throughout the mid shore, a

species which helps to bind up any loose sand in the area. Other species found within the mid shore included barnacles (*Balanus crenatus*) and the green algae *Ulva linza*. Within the lower shore zone *Sabellaria* mounds were still abundant although slightly smaller at ~30cm in height. Pools between mounds were home to various algae in damp patches (e.g. *Ceramium virgatum*, Irish moss, and the encrusting species *Lithophyllum* sp.). Rocks were found to be encrusted with breadcrumb sponge, while sugar kelp, dahlia anemones and the red encrusting algae *Hildenbrandia rubra* were found covering the rocks. Progressing further towards the water's edge the *Sabellaria* crust started to denude with toothed wrack (*Fucus serratus*) and oar weed as dominant canopy forming algae, and understory algae comprising of Irish moss and red encrusted algae *Lithophyllum* spp. The surface of rocks within the area was quite barren except for the denuded *Sabellaria*. Although rocks could be easily moved, the high

levels of suspended silty sediment underneath the rocks meant there was limited diversity. The under boulder communities mainly comprised of brittle stars (*Amphipholis squamata*), long clawed crabs (*Pisidia longicornis*), broad clawed crabs (*Porcellana platycheles*), saddle oysters (*Monia patelliformis*) and starfish (*Asterias rubens*). Unusual finds found in this year's surveys include several edible whelks (*Buccinum undatum*) and a sunstar (*Crossaster papposus*) (Figure 16).



Figure 16: Sunstar (*Crossaster papposus*)

Table 3: Species found at Maryport in April 2013

Latin Name	English Name/description	Lower Shore	Mid Shore	Upper Shore
<i>Halichondria panicea</i>	Breadcrumb sponge	○		
<i>Dynamena pumila</i>	Hydroid	○		
<i>Actinia equina</i>	Beadlet anemone	○	○	
<i>Urticina felina</i>	Dahlia anemone	○		
<i>Arenicola marina</i>	Lugworm	○	C	F
<i>Lanice conchilega</i>	Sand mason worm		○	
<i>Sabellaria alveolata</i>	Honeycomb worm (mounds)	F	F	
<i>Sabellaria alveolata</i>	Honeycomb worm (crust)	F		
<i>Lepidochitona cinerea</i>	Chiton			R
<i>Littorina littorea</i>	Edible periwinkle		C	○
<i>Monia patelliformis</i>	Saddle oyster	○		
<i>Mytilus edulis</i>	Seed mussel		A	
<i>Nucella lapillus</i>	Dog whelk		C	
<i>Nucella lapillus</i>	Dog whelk eggs		○	

Latin Name	English Name/description	Lower Shore	Mid Shore	Upper Shore
<i>Buccinum undatum</i>	Edible whelk	R		
<i>Buccinum undatum</i>	Edible whelk live egg mass	R		
<i>Balanus crenatus</i>	Barnacle	C	C	C
<i>Pisidia longicornis</i>	Long clawed crab	O		
<i>Porcellana platycheles</i>	Broad clawed crab	O		
<i>Asterias rubens</i>	Common starfish	O-C		
<i>Crossaster papposus</i>	Common sunstar	R		
<i>Amphipholis squamata</i>	Brittle star	O		
<i>Ulva intestinalis</i>	Gutweed			O
<i>Ulva linza</i>	Green algae			O
<i>Ulva lactuca</i>	Sea lettuce		O	
<i>Cladostephus spongiosus</i>	Brown seaweed	O		
<i>Ectocarpus siliculosus</i>	Maiden's hair (brown filamentous algae)	O		
<i>Fucus serratus</i>	Toothed wrack	F		
<i>Laminaria digitata</i>	Oar weed	C		
<i>Saccharina latissima</i>	Sugar kelp	O		
<i>Ralfsia verrucosa</i>	Red encrusting algae	O		
<i>Ceramium virgatum</i>	Red pool algae	O	C	
<i>Polysiphonia elongate</i>	Red pool algae		O	
<i>Chondrus crispus</i>	Irish moss	C	O	
<i>Hildenbrandia rubra</i>	Red encrusting species		O	
<i>Lithothamnion</i> or <i>Lithophyllum</i> sp.	Red encrusted algae	O		
<i>Porphyra umbilicalis</i>	Laver			O
<i>Phycodrys rubens</i>	Leafy sea oak		O	

SIDDICK

The Siddick transect runs in parallel to the Iggesund Paper Board Factory outfall pipe which crosses the beach from the upper shore to the extreme low waters' edge. This survey crosses a number of different habitats such as the rock sea defences on the very top shore, sand, areas of slagcrete and cobble scar, with the pipe itself providing an additional surface for colonisation.

On the large sea defences a splash zone of the green filamentous algae *Blidingia* sp. and yellow lichen (*Caloplaca marina*) could be seen. This year the upper shore cobbles were dominated by spiral wrack (*Fucus spiralis*) (Figure 17), with a small amount of bladder wrack (*Fucus vesiculosus*) also present. The acorn barnacle was found on the tops of rocks, and under the loose cobbles, limpets (*Patella vulgata*) and the occasional gammarid shrimp (*Gammaridae* sp.) were found.

The slagcrete reef in the upper mid shore area, which provides a stable substrate for colonisation, was covered in bladder wrack. *Sabellaria* mounds were found to the sides, and barnacles (*Balanus crenatus*) and limpets were found under the bladder wrack. As in previous years' surveys, periwinkles are still common in this slagcrete area and the red algae *Mastocarpus stellatus* was found in crevices.



Figure 17: Spiral wrack on upper shore slagcrete with the Igggesund Paper Board Factory outfall pipe visible (top left).



Figure 18: Stony mid shore with compacted cobbles.

moss. Notably no mussels were found this year, however the odd *Sabellaria* mound was found within the mid shore. Very few pools were found in this zone and as a result very little Irish moss was found. Under the rocks there was the odd beadlet anemone and gammarid shrimp and clusters of dog whelk eggs. The section of pipe adjacent to this area was covered in barnacles (*Semibalanus balanoides* and *Balanus crenatus*), limpets and bladder wrack.

A sandy patch separated the mid shore stony bank from the lower shore this year, before the *Sabellaria* mounds were found on the lower shore. The pipe in this zone had less *Sabellaria* crust than previously seen and was predominantly covered in macro algae including juvenile fucus, laver, along with limpets and dog whelks. Some *Sabellaria* mounds were visible on the pipe supports.

Continuing down the shore a sandy patch separates the slagcrete reef and the main scar ground. Not many lugworms were seen on the sandy patch this year. In the puddle in the lower region of the sandy patch however there was an abundance of Irish moss and tiny *Sabellaria* mounds.

At the top of the mid shore scar (Figure 18), before the bank, the cobbles were small and more consolidated and for the first time there were patches of bladder wrack settling. Evidence of lugworms could be seen in any sandy areas.

The mid shore scar ground itself was dominated by barnacles, periwinkles and dog whelks along with the patch of Irish

The rocks on the extreme lower shore were covered in barnacles (*Balanus crenatus*) and *Sabellaria* crust with frequent Irish moss. Dog whelk eggs, saddle oysters and grey topshells (*Gibbula cineraria*) were found under the moveable rocks and the hydroid *Dynamena pumila* was found on the sides of the rocks. In this zone the pipe itself was covered in *Sabellaria* crust, dog whelks, the odd patch of adult mussels, and algae including Irish moss, sea lettuce and toothed wrack (Figure 19).



Figure 19: Outfall pipe on the lower shore at Siddick.

On the day of the survey, due to the large tide, the opening of the pipe was visible and white, warm water could be seen gushing from it. A stiff southerly wind kept the tide in so it wasn't possible to look around (i.e. under) the boulders by the edge of the pipe, although the tops of the lower shore rocks were covered in barnacles (*Balanus crenatus*), *Sabellaria* crust, Irish moss, dog whelks and periwinkles.

Table 4: Species found at Siddick in August 2013

Latin Name	English Name/description	Lower Shore	Mid Shore	Upper Shore
<i>Dynamena pumila</i>	Hydroid	○		
<i>Actinia equina</i>	Beadlet anemone		○	
<i>Arenicola marina</i>	Lugworm		○	○
<i>Sabellaria alveolata</i>	Honeycomb worm (mounds)	O-C	○	○
<i>Sabellaria alveolata</i>	Honeycomb worm (crust)	F-A		
<i>Gibbula cineraria</i>	Grey top shell	○		
<i>Littorina littorea</i>	Edible periwinkle	F	F-A	
<i>Monia patelliformis</i>	Saddle oyster	○		
<i>Mytilus edulis</i>	Edible mussel	○		
<i>Nucella lapillus</i>	Dog whelk	C	F	
<i>Nucella lapillus</i>	Dog whelk eggs	○		
<i>Patella vulgata</i>	Common limpet	○	○	
<i>Semibalanus balanoides</i>	Acorn barnacle			F
<i>Balanus crenatus</i>	Barnacle	F-A	A	
<i>Gammaridae sp.</i>	Gammarid shrimp		○	○
<i>Crangon crangon</i>	Brown shrimps		R	
<i>Carcinus maenas</i>	Shore crab		R	
<i>Blidingia sp.</i>	Green filamentous algae			○
<i>Ulva linza</i>	Green algae	○		
<i>Ulva lactuca</i>	Sea lettuce	○		
<i>Fucus serratus</i>	Toothed wrack	○		
<i>Fucus spiralis</i>	Spiral wrack			F
<i>Fucus vesiculosus</i>	Bladder wrack		O-F	
<i>Fucus sp.</i>	Juvenile fucus	○		
<i>Ceramium virgatum</i>	Red pool algae	○		
<i>Chondrus crispus</i>	Irish moss	C	○	
<i>Corallina officinalis</i>	Coral weed		R	
<i>Mastocarpus stellatus</i>	Red algae		R	
<i>Porphyra umbilicalis</i>	Laver	○		
<i>Tephromela atra var. Atra</i>	Black shields			○
<i>Verrucaria mucosa</i>	Intertidal black lichen			○
<i>Caloplaca marina</i>	Yellow/orange lichen			○

MOSS BAY

Moss bay (figure 20) was once home to a British Steel outfall pipe which released oily discharge onto the upper mid shore. The presence of the outfall pipe was the primary reason for the shore being chosen as a survey site – surveys which have allowed the recovery of the beach to be monitored. The steel works and the outfall are no longer present and the shore has undergone significant change over the course of the shore surveys.



Figure 20: Slagcrete cliffs and boulders at Moss Bay.



Figure 21: The slagcrete reef on the upper shore - looking down the Moss Bay transect.

There is almost no trace of the old steel works' outfall, and the slagcrete reef around it is healthy and covered in bladder wrack, laver, the green algae *Ulva linza* and sea lettuce along with periwinkles, barnacles, *Sabellaria* and limpets. In 2012 a new area of scar had opened up in the lower down shore which has persisted and is now covered in *Sabellaria* mounds, barnacles, and algae including bladder wrack and the green algae *Ulva linza*.

The actual transect site is slightly further north of the old outfall as previously it discharged onto a sandy area. On the very top shore of this transect there is an area of coarse sand in front of the large white sea defences, followed by an area of pebbles. After this pebbled area the

slagcrete reef begins (Figure 21). The slagcrete was initially dominated by spiral wrack with a small amount of bladder wrack. Underneath the fucus canopy there was the occasional barnacle (*Semibalanus balanoides*), limpet, and small green algae such as *Ulva linza* and unicellular algae could be seen in pools, alongside patches of gutweed.

On the mid shore section of the reef bladder wrack could be seen frequently with acorn barnacles often found underneath (Figure 22). Green algae (such as gutweed and *Ulva linza*) were again common in the pools in this region. Limpets were occasionally spotted and some juvenile fucus was seen to be settling on the rocks. Some areas of the slagcrete were



Figure 22: Mid shore section of the slagcrete reef.

metallic looking and bare, whereas other areas had patches of barnacle-limpet community. Other organisms found on the slagcrete were keel worms (*Spirobranchus lamarcki* (previously known as *Pomatoceros lamarcki*)), dog whelks and laver. Further down the slagcrete was home to the occasional *Sabellaria* mounds, beadlet anemones, flat winkles (*Littorina obtusata*) and toothed wrack. There were also lots of green algae (*Ulva linza*) on the lower sections of slagcrete.

Leaving the slagcrete behind, the transect then crosses a sandy patch with no scar ground. There is still a large amount of coal dust on this shore and no lugworms were found this year.

Further down the shore there was evidence of lower shore scar ground, however most of it had been buried under sand and seaweed could be seen poking out of the sand, anchored to the cobbles below. Slightly further north of the transect there were some rocks around the lower shore. There the boulders were covered in juvenile toothed

wrack, laver and the green algae *Ulva linza*, with a crust of *Sabellaria*, barnacles (*Balanus crenatus*) and keel worms. Watery pools between boulders were sandy with lots of red pool algae *Ceramium virgatum* and sugar kelp. Lots of washed up oar weed could be seen here, followed by a sandy patch which extends to the low water's edge. Some kelp fronds were visible sticking out of the water but these were not fully exposed.

Table 5: Species found at Moss Bay in April 2013

Latin Name	English Name/description	Lower Shore	Mid Shore	Upper Shore
<i>Cyanea capillata</i>	Lions' mane jelly	R		
<i>Actinia equina</i>	Beadlet anemone		○	
<i>Spirobranchus lamarcki</i> (was <i>Pomatoceros lamarcki</i>)	Keel worm	○	○	
<i>Sabellaria alveolata</i>	Honeycomb worm (mounds)		○	
<i>Sabellaria alveolata</i>	Honeycomb worm (crust)	○		
<i>Littorina obtusata</i>	Flat periwinkle		R	
<i>Nucella lapillus</i>	Dog whelk		○	
<i>Patella vulgata</i>	Common limpet		○	○
<i>Semibalanus balanoides</i>	Acorn barnacle		F	○-C
<i>Balanus crenatus</i>	Barnacle	○		
<i>Asterias rubens</i>	Common starfish	R		
<i>Blidingia minima</i>	Green algae			○
<i>Ulva intestinalis</i>	Gutweed		C-F	○
<i>Ulva linza</i>	Green algae	C	C-F	○
<i>Chlorophyta sp.</i>	Unicellular green algae			○
<i>Ectocarpus siliculosus</i>	Maiden's hair (brown filamentous algae)		○	
<i>Fucus serratus</i>	Toothed wrack	C-F	○-C	
<i>Fucus spiralis</i>	Spiral wrack			A
<i>Fucus vesiculosus</i>	Bladder wrack		F	○
<i>Fucus sp.</i>	Juvenile fucus		○	
<i>Saccharina latissima</i>	Sugar kelp	C		
<i>Ceramium virgatum</i>	Red pool algae	F		
<i>Porphyra umbilicalis</i>	Laver	C	○	

CUNNING POINT

The Cunning Point survey site offers one of the few examples of true rocky shore (i.e. platforms made of bedrock) on the Cumbrian coastline and the rock formations provide a magnificent back drop to the transect. With numerous deep surge gullies, overhangs and wave cut rocks, Cunning Point is always an interesting place to explore.



Figure 23: Evidence of acid run off in the low water boulder zone.

This shore was originally chosen as a transect site because of the acid runoff from old mine working which turn sections of the shore, and the periwinkles that inhabit it, red/orange (Figure 23).

On the upper reaches of this shore large boulders and rocks have been piled up in an attempt to protect the coastal railway line. These massive boulders have been moved



Figure 24: Egg wrack growing on upper mid shore rocks.

by the actions of the sea over time and now piles of shingle can be seen next to the railway line. Within the upper shore boulder zone spiral wrack was frequently seen along with occasional bladder and egg wrack (*Ascophyllum nodosum*) (Figure 24). On the surfaces of the rocks some barnacles (*Semibalanus balanoides*) and keel worms were found amongst laver, and the green filamentous algae *Blidingia*

sp. was noted.

Moving further down the shore spiral wrack and gutweed became more dominant and covered the rocky platforms. Any large pools on the surface of the platforms were found to be sandy and shallow this year, but full of small pool algae including Irish moss, *Ceramium virgatum*, coral weed (*Corallina officinalis*), and sea lettuce. The smaller



Figure 25: Bedrock and boulders at Cunning Point.

pools contained large amounts of red encrusting algae (such as *Hildenbrandia rubra* and *Lithothamnion* sp.), *Dumontia contorta*, coral weed and sugar kelp. On the lower reaches of these platforms the rocks were covered in barnacles (*Semibalanus balanoides*), limpets and egg wrack (which was covered in the red epiphytic algae *Vertebrata lanosa*).

Much less sand inundation was seen in the boulder zone between the mid and lower shores this year compared to the 2012 survey and the shore had become more diverse as a result. The under boulder community in this region comprised of periwinkles, beadlet anemones and dog whelks, and this year shore crabs, starfish, saddle oysters, and grey sea slugs (*Aeolidia papillosa*) were also found. Toothed wrack was frequently seen and the rock platforms were colonised by barnacle-limpet communities, with tiny seed mussels covering any gaps on the rock surface. The occasional mound of *Sabellaria* was found on the leeward side of rocks, and any damp patches between the boulders contained small red algae.

Beyond the boulder community, reaching the lower shore, the rock platform habitat was found. The tops of these platforms were also less sandy than in previous years and were home to a mosaic of barnacle-limpet communities. Tiny mussels (3mm) were

found in the gaps between the barnacles whereas the vertical surfaces of platforms were covered in *Sabellaria* crust. Other species colonising the walls were barnacles (*Balanus crenatus*), dulse, Irish moss, and red encrusting algae (*Rhodothamniella floridula* and *Ralfsia verrucosa*). In this zone any watery pools were found to be full of small algae including *Ceramium virgatum*, Irish moss, dulse and coral weed, *Hildenbrandia rubra* and *Ralfsia verrucosa*. The walls of the surge gullies were encrusted with *Sabellaria*, seed mussels, and red algae (*Mastocarpus stellatus*).

Leaving the platforms behind, the low water boulders are exposed once more with no sand beneath the low shore rocky platforms. Toothed wrack, Irish moss, and dulse were found on top of the boulders with red algae (*Rhodothamniella floridula*) and a crust of barnacles (*Balanus crenatus*) and keel worms underneath the rocks and boulders. Many of the boulders had been recently exposed and were therefore still bare. Underneath the boulders the beginnings of under-boulder communities was evident with beadlet anemones, chitons (*Lepidochitona cinerea*), keel worms, and flat top shells (*Gibbula umbilicalis*) occasionally found, however the sea state at the time of the survey was too rough to allow for a thorough examination.

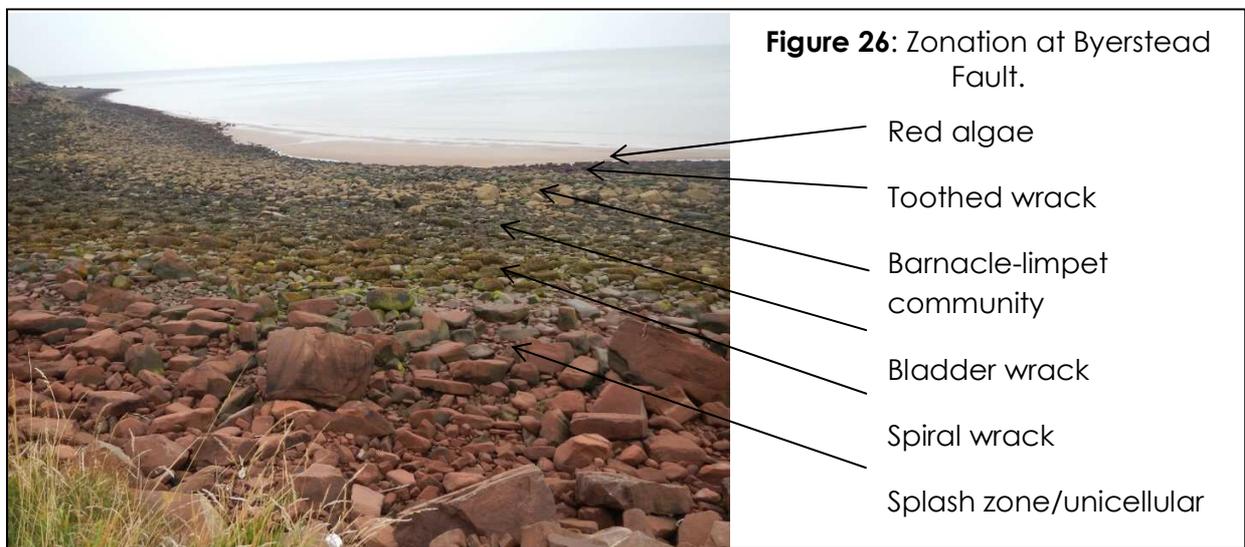
Table 6: Species found at Cunning Point in April 2013

Latin Name	English Name/description	Lower Shore	Mid Shore	Upper Shore
<i>Actinia equina</i>	Beadlet anemone	O-C	O	
<i>Lanice conchilega</i>	Sand mason worm	O		
<i>Spirobranchus lamarcki</i> (was <i>Pomatoceros lamarcki</i>)	Keel worm	C	O	O
<i>Sabellaria alveolata</i>	Honeycomb worm (mounds)	O	O	
<i>Sabellaria alveolata</i>	Honeycomb worm (crust)	F		
<i>Lepidochitona cinerea</i>	Chiton	O		
<i>Gibbula umbilicalis</i>	Flat top shell	O		
<i>Littorina littorea</i>	Edible periwinkle	O	C	
<i>Monia patelliformis</i>	Saddle oyster	R		
<i>Mytilus edulis</i>	Seed mussel	C		
<i>Nucella lapillus</i>	Dog whelk	O	O	
<i>Nucella lapillus</i>	Dog whelk eggs		O	
<i>Aeolidia papillosa</i>	Grey sea slug	R		
<i>Balanus balanus</i>	Large barnacle	F		
<i>Patella vulgata</i>	Common limpet	C	F	

Latin Name	English Name/description	Lower Shore	Mid Shore	Upper Shore
<i>Semibalanus balanoides</i>	Acorn barnacle	F-A	A	○
<i>Balanus crenatus</i>	Barnacle	F		
<i>Carcinus maenas</i>	Shore crab	○		
<i>Pisidia longicornis</i>	Long clawed crab			
<i>Asterias rubens</i>	Common starfish	R		
<i>Asciidiella aspersa</i>	Large clear sea squirt	R		
<i>Blidingia sp.</i>	Green filamentous algae			○
<i>Cladophora rupestris</i>	Green algae		○	
<i>Ulva intestinalis</i>	Gutweed		C	
<i>Ulva lactuca</i>	Sea lettuce		C	
<i>Ascophyllum nodosum</i>	Egg wrack		F	○
<i>Fucus serratus</i>	Toothed wrack	F		
<i>Fucus spiralis</i>	Spiral wrack		○	F
<i>Fucus vesiculosus</i>	Bladder wrack			○
<i>Laminaria digitata</i>	Oar weed	○	R	
<i>Saccharina latissima</i>	Sugar kelp	○		
<i>Ralfsia verrucosa</i>	Red encrusting algae	○		
<i>Ceramium virgatum</i>	Red pool algae	○	C	
<i>Chondrus crispus</i>	Irish moss	F	C	
<i>Corallina officinalis</i>	Coral weed	○	F	
<i>Dumontia contorta</i>	Red algae		C	
<i>Hildenbrandia rubra</i>	Red encrusting species	○	○	
<i>Lithothamnion or Lithophyllum sp.</i>	Red encrusted algae	○	○	
<i>Mastocarpus stellatus</i>	Red algae	C		
<i>Palmaria palmata</i>	Dulse	F		
<i>Vertebrata lanosa</i>	Red epiphytic algae		○	
<i>Polysiphonia spp.</i>	Filamentous red algae	○		
<i>Porphyra umbilicalis</i>	Laver			○
<i>Rhodothamniella floridula</i>	Red encrusted algae	F-A	○	
<i>Verrucaria mucosa</i>	Intertidal black lichen		○	

BYERSTEAD FAULT

Of the 11 shores visited during the surveys Byerstead Fault has perhaps undergone the most dramatic change over the past 21 years. Leaching of chemicals into the freshwater stream which crosses the shore had previously been seen to be impacting the diversity and health of the rocky shore community present. In recent years however, following a cessation in activity at the chemical plant on the cliffs above the shore, an increase in biodiversity has been observed. Indicators of a healthy rocky shore community are now evident and this year the zonation of the shore could be seen clearly from the cliff top and from the top shore (Figure 26).



The transect begins in the rock fall area near the cliff base. Black tar lichen (*Verrucaria maura*) was seen settling on the upper shore rocks, as well as rough periwinkles (*Littorina saxatilis*) and sea bristletails (*Petronius maritimus*) were also found. The top shore rocks were slimy with unicellular algae due to run off from the cliffs, a feature which is also observed on the top shore at St Bees. Further into the upper shore the boulders were dominated by spiral wrack.

At the top of the mid shore region furoid algae continued to dominate the shore, with bladder wrack, egg wrack and even toothed wrack in this zone. Barnacles and limpets were found on the larger rocks, under the furoid fronds. Lots of juvenile fucus could also

be seen settling on these rocks. The gaps in between the boulders were silty, with gammarid shrimps and keel worms were found under the movable cobbles.

The centre of the shore is now dominated by a barnacle-limpet community. Previously, algae had dominated in this zone as grazers hadn't been able to establish, hence this barnacle-limpet zone is a good indicator that the shore has now largely recovered from its polluted past. Periwinkles were also common in the barnacle-limpet zone, with fucoids in the gaps between rocks. The barnacle-limpet zone extends to the lower region of the mid shore with toothed wrack replacing bladder wrack in any gaps. Fewer flat winkles and periwinkles were found here than further up the shore.

Toothed wrack dominates the first part of the lower shore, gradually giving way to an area teeming with red algae. In this zone a number of varieties could be seen on the surface of the rocks. Irish moss, *Ceramium virgatum*, *Mastocarpus stellatus*, and the encrusting *Rhodothamniella floridula* were found frequently, with the filamentous



Figure 27: Lower shore algal dominated rocks

Polysiphonia spp. also seen (Figure 27).

Barnacles (*Balanus crenatus*) were found underneath the algae, and between the boulders dog whelks and *Sabellaria* mounds were found. Keel worms were found underneath the rocks.

At the time of visit the tide was big enough to expose the low water sand patch where one washed up bi-valve was seen.

To the north of sand patch, where the boulders reach the water's edge (Figure 28), the lower shore was also covered in red algae such as *Ceramium virgatum* and *Rhodothamniella floridula*, with a crust of barnacles (*Balanus crenatus*) and *Sabellaria* underneath the algae which was

also covered in bryozoans. Sugar kelp and oar weed were attached along the edge of boulders.

Some sponge and beadlet anemones were seen attached to the sides of rocks. All of the boulders on the lower shore were anchored down and therefore not mobile. It was noticed that there were a lot of washed up bi-valves which could be seen in the gaps between the boulders in this area.



Figure 28: Boulders in the extreme low water zone colonised by red algae *Ceramium virgatum*.

The fresh water stream which exits mid shore was seen to be clean looking. Although some white foam was found and there was a slight chemical smell, there was no noticeable effect of the stream on the boulder life, beyond the usual influence of fresh water on a marine habitat.

Table 7: Species found at Byerstead in April 2013

Latin Name	English Name/description	Lower Shore	Mid Shore	Upper Shore
<i>Halichondria panicea</i>	Breadcrumb sponge	○		
<i>Kirchenpaueria pinnata</i>	Hydroid	○		
<i>Grantia compressa</i>	Purse sponge	R		
<i>Actinia equina</i>	Beadlet anemone	○		
<i>Pomatoceros lamarcki</i>	Keel worm	○-F	○	
<i>Sabellaria alveolata</i>	Honeycomb worm (mounds)	○		
<i>Sabellaria alveolata</i>	Honeycomb worm (crust)	F		
<i>Sabellaria alveolata</i>	Honeycomb worm (tubes)	○		
<i>Littorina littorea</i>	Edible periwinkle	○	○	○
<i>Littorina obtusata</i>	Flat periwinkle		○	
<i>Littorina saxatilis</i>	Rough periwinkle		○	○
<i>Nucella lapillus</i>	Dog whelk	○		
<i>Patella vulgata</i>	Common limpet	○-F	C-F	

Latin Name	English Name/description	Lower Shore	Mid Shore	Upper Shore
<i>Semibalanus balanoides</i>	Acorn barnacle	C	A	
<i>Balanus crenatus</i>	Barnacle	C-F	C	
<i>Balanus balanus</i>	Large barnacle	O		
<i>Gammaridae sp.</i>	Gammarid		O	O
<i>Petrobius maritimus</i>	Sea bristletails			O
<i>Carcinus maenas</i>	Shore crab		O	
<i>Membranipora membranacea</i>	Sea mat	O		
<i>Electra pilosa</i>	Hairy sea mat	F		
<i>Blidingia sp.</i>	Green filamentous algae			C
<i>Cladophora rupestris</i>	Green algae	O		
<i>Ulva intestinalis</i>	Gutweed	O		
<i>Ulva linza</i>	Green algae	O	C-F	
<i>Ulva lactuca</i>	Sea lettuce	O		
<i>Chlorophyta sp.</i>	Unidentified unicellular green algae			O
<i>Ascophyllum nodosum</i>	Egg wrack		O	
<i>Fucus serratus</i>	Toothed wrack	F	C	
<i>Fucus spiralis</i>	Spiral wrack			A
<i>Fucus vesiculosus</i>	Bladder wrack		F-A	
<i>Fucus sp.</i>	Juv. fucus		C	
<i>Laminaria digitata</i>	Oar weed	O		
<i>Saccharina latissima</i>	Sugar belt	C		
<i>Ralfsia verrucosa</i>	Red encrusting algae	C		
<i>Rhodochorton purpureum</i>	Red filamentous algae		O	
<i>Ceramium virgatum</i>	Red pool algae	A-F		
<i>Chondrus crispus</i>	Irish moss	F		
<i>Hildenbrandia rubra</i>	Red encrusting species			O
<i>Mastocarpus stellatus</i>	Red algae	F	O	
<i>Polysiphonia spp.</i>	Filamentous red algae	R		
<i>Porphyra umbilicalis</i>	Laver	O		
<i>Rhodothamniella floridula</i>	Red encrusted algae	F-A	O	
<i>Verrucaria maura</i>	Black tar lichen			O
<i>Xanthoria parietina</i>	Yellow lichen			O

ST. BEES HEAD

The rocky shore at St. Bees Head comprises of large boulders and bedrock around the base of the cliffs of the headland (Figure 29). This site is exposed to the prevailing south-westerly winds and the large boulders provide shelter and create many habitats, producing a diverse shore.



Figure 29: St. Bees head and the surrounding rocky shore.

As a result of the exposed nature of this site the splash zone is pronounced on this shore and

home to an array of lichens with black shields (*Tephromela atra* var. *Atra*), yellow lichen, black tar lichen, and sea ivory (*Ramalina siliquosa*) all found on the rocks. The upper shore rocks were quite slimy this year with green unicellular algae due to the fresh water runoff from the cliffs. Moving down the upper shore toothed wrack was frequently seen, with gutweed found in the gaps between boulders. The rock surface was covered in patches of red filamentous algae *Rhodochorton purpureum*, as well as the black algae *Catenella caespitosa*, limpets and periwinkles.

In the upper reaches of the mid shore there were lots of furoid algae in the gaps between rocks, particularly egg wrack with its epiphyte, *Vertebrata lanosa*. Further down the mid shore the boulders were predominantly colonised by barnacle-limpet communities, with some patches of bladder wrack in gaps. Some seed mussels, beadlet anemones, gutweed and red algae (*Rhodothamniella floridula* and *Mastocarpus stellatus*) were found on the sides of rocks.

Continuing down the shore, there was a zone where the tops of the rocks were covered in large adult mussels (50 mm) with seed mussels between them. Gradually the adult mussels diminish with more algae becoming visible. The rocks in the lower mid shore

were home to a covering of seed mussels, dulse and laver. Patches of the rocks were white due to the calcareous bases of dead barnacles (*Balanus crenatus*). Newly settling barnacles were also found in this region.



Figure 30: Boulders in the mid shore with oar weed in between them.

Rocks in the lower shore were covered in toothed wrack. Many of the rocks were manoeuvrable, with a good under-boulder community including beadlet anemones, broad clawed crabs, keel worms, edible crabs (*Cancer pagurus*) and butterfish (*Pholis gunnellus*).

The rocks in the extreme low water were dominated by small red algae, predominantly the *Polyides rotundus*, Irish moss, *Ceramium*

virgatum and cockscomb (*Plocamium cartilagineum*) (Figure 30). All of the red algae were covered in tiny mussels and bryozoans (*Electra pilosa*). On the rocks a crust of *Sabellaria* tubes and seed mussels was seen, as well as patches of encrusting red algae (*Lithothamnion* sp. and *Ralfsia verrucosa*). Around the edges of rocks was a lot of breadcrumb sponge and hydroids and between boulders burrowing dahlia anemone, oar weed and red rags (*Dilsea carnososa*) could be seen. Under the rocks which could be moved plumose anemones, keel worms and gammarid shrimps were found. The boulders became more anchored down towards the low water, and most were impossible to lift. Where they could be moved however, keel worms, beadlet anemones, topshells, sea squirts (*Molgula manhattensis*), starfish (especially juveniles) (Figure 31), long clawed crabs, spider crabs and even a Montague's sea snail (*Liparis montagu*) (Figure 32) were found. This is the first time a Montague's sea snail has been found on this coast.



Figure 31: Under-boulder community at low water with juvenile starfish.



Figure 32: Montague's sea snail (*Liparis montagu*) on toothed wrack.

Table 8: Species found at St Bees Head in April 2013

Latin Name	English Name/description	Lower Shore	Mid Shore	Upper Shore
<i>Halichondria panicea</i>	Breadcrumb sponge	O-C		
<i>Dynamena pumila</i>	Hydroid	O		
<i>Kirchenpaueria pinnata</i>	Hydroid	O		
<i>Actinia equina</i>	Beadlet anemone	O-F	O	
<i>Metridium senile</i>	Plumose anemone	O		
<i>Sagartia troglodytes</i>	Burrowing anemone	O		
<i>Urticina felina</i>	Dahlia anemone	O-C		
<i>Pomatoceros lamarcki</i>	Keel worm	C		
<i>Sabellaria alveolata</i>	Honeycomb worm crust	F		
<i>Gibbula cineraria</i>	Grey top shell/silver tommy	O		
<i>Littorina littorea</i>	Edible periwinkle		O	O
<i>Mytilus edulis</i>	Edible mussel	C		
<i>Mytilus edulis</i>	Seed mussel	F	C-O	
<i>Nucella lapillus</i>	Dog whelk	O	C	
<i>Patella vulgata</i>	Common limpet	O	C-F	O
<i>Semibalanus balanoides</i>	Acorn barnacle		F-A	O
<i>Balanus crenatus</i>	Barnacle	C	C-F	
<i>Gammaridae sp.</i>	Gammarid	O	O	
<i>Cancer pagurus</i>	Edible crab	O		
<i>Macropodia deflexa</i>	Spider crab	R		
<i>Pisidia longicornis</i>	Long clawed crab	O		
<i>Porcellana platycheles</i>	Broad clawed crab	O		

Latin Name	English Name/description	Lower Shore	Mid Shore	Upper Shore
<i>Asterias rubens</i>	Common starfish	C	○	
<i>Amphipholis squamata</i>	Brittlestar	R		
<i>Membranipora membranacea</i>	Sea mat	○		
<i>Electra pilosa</i>	Hairy sea mat	F		
<i>Molgula manhattensis</i>	Brown sea squirt	R		
<i>Liparis montagu</i>	Montague's sea snail	R		
<i>Pholis gunnellus</i>	Butterfish	R		
<i>Ulva intestinalis</i>	Gutweed		○	○
<i>Ulva linza</i>	Green algae		F	
<i>Chlorophyta sp.</i>	Green unicellular algae			C
<i>Ascophyllum nodosum</i>	Egg wrack		O-C	
<i>Fucus serratus</i>	Toothed wrack	○	○	
<i>Fucus spiralis</i>	Spiral wrack			F
<i>Fucus vesiculosus</i>	Bladder wrack		O-C	
<i>Fucus sp.</i>	Juvenile fucus		○	
<i>Laminaria digitata</i>	Oar weed	C		
<i>Ralfsia verrucosa</i>	Red encrusting algae	C		
<i>Rhodochorton purpureum</i>	Red filamentous algae			○
<i>Catenella caespitosa</i>	Stunted black algae			○
<i>Ceramium virgatum</i>	Red pool algae	F-A		
<i>Chondrus crispus</i>	Irish moss	F-A		
<i>Dilsea carnosa</i>	Red rags	O-C		
<i>Lithothamnion or Lithophyllum sp.</i>	Red encrusted algae	C		
<i>Vertebrata lanosa</i>	Red epiphytic algae		○	
<i>Mastocarpus stellatus</i>	Red algae		○	
<i>Osmundea pinnatifida</i>	Pepper dulse	C	○	
<i>Palmaria palmata</i>	Dulse	C		
<i>Plocamium cartilagineum</i>	Cockscomb	C		
<i>Porphyra umbicalis</i>	Laver	○	○	
<i>Polyides rotundus</i>	Red branching algae	F		
<i>Rhodothamniella floridula</i>	Red encrusted algae		○	
<i>Plumaria plumosa</i>	Red algae		○	
<i>Tephromela atra var. Atra</i>	Black shields			○
<i>Verrucaria maura</i>	Black tar lichen			○
<i>Verrucaria mucosa</i>	Intertidal black lichen		○	
<i>Ramalina siliquosa</i>	Sea ivory			○
<i>Caloplaca marina</i>	Yellow/orange lichen			○

NETHERTOWN

Nethertown beach is a typical example of the southern beaches in Cumbria. The beach is home to expansive *Sabellaria* settlements extending from the upper shore zone to the lower shore zone creating a multitude of pools throughout the area (Figure 33). The Nethertown surveys are usually the most diverse of all the survey sites along the Cumbrian coast being host to a variety of organisms and habitat types.



Figure 33: Pools on the upper shore at Nethertown.

The survey began on a sunny and dry evening beneath the upper shore pebbly bank. The upper shore scar ground was damp and rocks and cobbles were covered in spiral wrack, barnacles (*Semibalanus balanoides*) and periwinkles. On this shore the *Sabellaria* reef traps water on the upper shore resulting in pools which contain a surprising array of marine life so far up the shore.

Pools were full of common pool

algae such as Irish moss, *Dumontia contorta*, bleached coral weed the green algae *Spongomorpha arcta*, Encrusting algae (*Hildenbrandia rubra* and *Lithothamnion* or *Lithophyllum* sp.) could be seen on the rock surface within the pools, and beadlet anemones and prawns (*Palaemon elegans*) were also found. In this damp upper shore zone the surfaces of pebbles and cobbles were covered in egg wrack, which in turn was covered in its epiphyte, *Vertebrata lanosa*. An abundance of spiral wrack was also found and barnacles (*Semibalanus balanoides*), black tar lichen and red encrusting algae made up the understory on the rock surface. Underneath the boulders keel worms and brittle stars (*Amphipholis squamata*) were found, along with the shells of dead mussels. There was an abundance of periwinkles (both *Littorina littorea* and *Littorina saxatilis*) in this zone, and the occasional limpets were found.

The *Sabellaria* reef began within the upper shore as a thin low crust binding the rocks and sand together into a low platform (Figure 34), with barnacles, limpets, periwinkles and egg wrack on any rocks protruding with *Sabellaria* crust. Further down the upper shore, moving into the mid shore, the reef becomes elevated in the characteristic platform formation.

The transition zone between the upper shore and mid shore scar was identified by the presence of bladder wracks on the *Sabellaria* platforms. In addition the *Sabellaria* reef had gutweed and sea lettuce attached, however most of the platform was healthy and growing with little to no algal cover. Pools had formed between the platforms and had an assortment of algae

including maiden's hair (*Ectocarpus siliculosus*), *Cladophora rupestris*, Irish moss, *Dumontia contorta*, *Spongomorpha arcta*, coral weed, as well as beadlet anemones, limpets, dulse and keel worms and saddle oysters colonising pebbles within the pools.



Figure 34: *Sabellaria* platform on Nethertown beach.

The *Sabellaria* platforms extended into the lower shore and the ecology was similar to the mid shore; however within this zone the reef is covered with toothed wrack, rather than bladder wrack. Pools forming between the reefs contained mainly *Ceramium virgatum* and sea lettuce. Most of the *Sabellaria* reef was healthy with dispersed patches of denuded reef, evidence of a recent storm, which was covered with red filamentous algae (*Rhodothamniella floridula*) (Figure 35). Unlike previous years the platforms extended far down into the lower shore, although recent storm damage had resulted in areas of the platform being broken into large mounds with silt covered boulders in between the mounds. Patches of bare rock were present with an abundance of white scars left by barnacles (*Balanus crenatus*). Newly

settled *Sabellaria* crust was also found in these patches. Tiny seed mussels (~3mm) were found to have recently settled around the tubes of *Sabellaria* and barnacles (*Balanus crenatus*).

The *Sabellaria* diminished as the extreme low water zone was reached and instead the tops of cobbles were covered in an abundance of breadcrumb sponge (which was in many places bleached white), red pool algae, Irish moss, with some occasional red rags. Here there was an excellent under-boulder community with a plethora of species, including grey sea slugs,



Figure 35: *Sabellaria* mound on Nethertown beach.

juvenile starfish, edible crab, shore crabs, top shells, long clawed and broad clawed crabs, sea squirts (*Asciidiella aspersa*), brittle stars (*Amphipholis squamata*), spider crabs, large barnacles (*Balanus balanus*) and a butterflyfish.

Table 9: Species found at Nethertown in 2013

Latin Name	English Name/description	Lower Shore	Mid Shore	Upper Shore
<i>Halichondria panicea</i>	Breadcrumb sponge	C-F		
<i>Dynamena pumila</i>	Hydroid	○		
<i>Sertularia argentea</i>	Hydroid	R		
<i>Actinia equina</i>	Beadlet anemone		○	○
<i>Sagartia elegans</i>	Orange and White Anemone	R		
<i>Urticina felina</i>	Dahlia anemone	○		
<i>Arenicola marina</i>	Lugworm			R

Latin Name	English Name/description	Lower Shore	Mid Shore	Upper Shore
<i>Eulalia viridis</i>	Green leaf worm (egg mass)	R		
<i>Lanice conchilega</i>	Sand mason worm	O		O
<i>Spirobranchus lamarcki</i> (was <i>Pomatoceros lamarcki</i>)	Keel worm	O	O	O
<i>Sabellaria alveolata</i>	Honeycomb worm (mounds)	A	A	C
<i>Sabellaria alveolata</i>	Honeycomb worm (individual tubes)			O
<i>Lepidochitona cinerea</i>	Chiton			O
<i>Gibbula cineraria</i>	Grey top shell	O		
<i>Gibbula umbilicalis</i>	Flat top shell	O	O	
<i>Littorina littorea</i>	Edible periwinkle		F	F
<i>Littorina saxatilis</i>	Rough periwinkle			F
<i>Monia patelliformis</i>	Saddle oyster		R	
<i>Mytilus edulis</i>	Edible mussel			R
<i>Mytilus edulis</i>	Seed mussel	O		
<i>Nucella lapillus</i>	Dog whelk	O	C	
<i>Nucella lapillus</i>	Dog whelk eggs	O		
<i>Onchidoris bilamellata</i>	Sea slug	R		
<i>Aeolidia papillosa</i>	Grey sea slug	O		
<i>Patella vulgata</i>	Common limpet		O	C
<i>Semibalanus balanoides</i>	Acorn barnacle		C	F
<i>Balanus crenatus</i>	Barnacle	C		
<i>Balanus balanus</i>	Large barnacle	O		
<i>Gammaridae sp.</i>	Gammarid shrimp			O
<i>Palaemon elegans</i>	Common prawn			O
<i>Cancer pagurus</i>	Edible crab	O		
<i>Carcinus maenas</i>	Shore crab	O	R	
<i>Hyas araneus</i>	Spider crab	R		
<i>Pagurus bernhardus</i>	Hermit crab	R		
<i>Pisidia longicornis</i>	Long clawed crab	O		
<i>Porcellana platycheles</i>	Broad clawed crab	O		
<i>Asterias rubens</i>	Common starfish	O-C		
<i>Ophiothrix fragilis</i>	Common brittle star	R		
<i>Amphipholis squamata</i>	Brittle star			R
<i>Ascidia aspersa</i>	Large clear sea squirt	O-C		
<i>Pholis gunnellus</i>	Butterfish	R		
<i>Cladophora rupestris</i>	Green algae		O	R
<i>Ulva intestinalis</i>	Gutweed		C	
<i>Ulva linza</i>	Green algae		O	
<i>Spongomorpha arcta</i>	Green algae		O	O

Latin Name	English Name/description	Lower Shore	Mid Shore	Upper Shore
<i>Ulva lactuca</i>	Sea lettuce	C	C	
<i>Ascophyllum nodosum</i>	Egg wrack		C	O-C
<i>Ectocarpus siliculosus</i>	Maiden's hair (brown filamentous algae)		O	
<i>Fucus serratus</i>	Toothed wrack	C-F		
<i>Fucus spiralis</i>	Spiral wrack			C-A
<i>Fucus vesiculosus</i>	Bladder wrack		F	
<i>Ralfsia verrucosa</i>	Red encrusting algae	O		
<i>Ceramium virgatum</i>	Red pool algae	F-C	O-C	
<i>Chondrus crispus</i>	Irish moss	C	C	C
<i>Corallina officinalis</i>	Coral weed			O
<i>Dilsea carnosa</i>	Red rags	O		
<i>Dumontia contorta</i>	Red algae		O	O
<i>Hildenbrandia rubra</i>	Red encrusting species	O		O
<i>Lithothamnion</i> or <i>Lithophyllum</i> sp.	Red encrusted algae		O	O
<i>Mastocarpus stellatus</i>	Red algae		R	
<i>Palmaria palmata</i>	Dulse		O	
<i>Vertebrata lanosa</i>	Red epiphytic algae		O	R
<i>Rhodothamniella floridula</i>	Red encrusted algae		O	
<i>Verrucaria mucosa</i>	Intertidal black lichen	O		O

SELLAFIELD

The Sellafield transect was chosen because of its location adjacent to the Sellafield Nuclear Reprocessing Plant. It is a relatively low diversity shore, primarily due to the type of substrate and the position of the scar on the shore, as it is only present in the mid shore.

The top shore at Sellafield comprises mostly of sand, which is only inhabited by lugworms. There is a pebble bank



Figure 36: Boulders in the mid shore zone.

beyond the sand patches; however the scar ground doesn't start until the mid-shore (Figure 36).



Figure 37: Boulders and *Sabellaria* mounds.

At the very top of mid shore scar new *Sabellaria* platforms were seen to be forming and older mounds were regenerating. This year there were lots more fish in pools amongst the Irish moss. Bladder wrack and the green algae *Ulva linza* were found to be growing on the *Sabellaria* mounds (Figure 37).

The upper mid shore comprises of the denuded *Sabellaria* mounds surrounded by sandy pools which were full of cobbles. Some of the pools were also full of Irish moss. The mid shore scar ground was dominated by *Sabellaria* mounds which were noted as being frequent this year. Barnacles (*Semibalanus balanoides*), laver and green algae (*Ulva linza*) were seen on rocks, along with an encrusting bryozoan (Figure 38).

The upper mid shore comprises of the denuded *Sabellaria* mounds



Figure 38: Encrusting bryozoan on mid shore rock.



Figure 39: Sand inundation on the lower shore.

There was much less *Sabellaria* on the mid shore scar ground in the 2013 survey, and it was very denuded in places. The old reef either had been buried by sand or was covered in a mixture of gutweed and sea lettuce. There were big sand patches in the reef, and a large area of loose pebbles which were covered in laver and barnacles, with some tiny seed mussels on the rocks.

The sea ward edge of the scar ground had seen a lot of sand inundation this year (Figure 39). Lugworms (or their casts) were the only species found on the sand of the lower shore.

Table 10: Species found at Sellafield in 2013

Latin Name	English Name/ description	Lower Shore	Mid Shore	Upper Shore
<i>Actinia equina</i>	Beadlet anemone		O	
<i>Urticina felina</i>	Dahlia anemone		R	
<i>Arenicola marina</i>	Lugworm	O	O	C
<i>Pomatoceros lamarcki</i>	Keel worm		O	
<i>Sabellaria alveolata</i>	Honeycomb worm (mounds)		F-A	
<i>Littorina littorea</i>	Edible periwinkle		O	
<i>Mytilus edulis</i>	Seed mussel		O	
<i>Nucella lapillus</i>	Dog whelk		C	
<i>Semibalanus balanoides</i>	Acorn barnacle		O	
<i>Balanus crenatus</i>	Barnacle		F	
<i>Carcinus maenas</i>	Shore crab		O	
<i>Molgula manhattensis</i>	Brown sea squirt		O	
<i>Osteichthyes sp.</i>	Unidentified fish		O	
<i>Ulva intestinalis</i>	Gutweed		O	
<i>Ulva linza</i>	Green algae		F	
<i>Bryozoa sp.</i>	Unidentified bryozoan		R	
<i>Ulva lactuca</i>	Sea lettuce		C-F	
<i>Ectocarpus siliculosus</i>	Maiden's hair (brown filamentous algae)		C	
<i>Fucus serratus</i>	Toothed wrack		O	
<i>Fucus vesiculosus</i>	Bladder wrack		O	
<i>Ceramium virgatum</i>	Red pool algae		O-C	
<i>Chondrus crispus</i>	Irish moss		C	
<i>Hildenbrandia rubra</i>	Red encrusting species		O	
<i>Porphyra umbilicalis</i>	Laver		A	
<i>Fucus vesiculosus</i>	Bladder wrack		C	
<i>Ceramium virgatum</i>	Red pool algae		O	
<i>Chondrus crispus</i>	Irish moss		C	
<i>Dumontia contorta</i>	Red algae		O	
<i>Hildenbrandia rubra</i>	Red encrusting species		O	
<i>Porphyra umbilicalis</i>	Laver		O	
<i>Verrucaria mucosa</i>	Intertidal black lichen		O	

BARN SCAR, DRIGG

Barn scar on the Drigg coast provides one of the most stable areas of scar ground on the Cumbrian Coast which extends out into the Irish Sea. The topography of this scar is somewhat confusing as the centre of the scar is elevated and characteristic of the mid shore, yet this central zone is surrounded by lower shore area.



Figure 40: Peat platforms on the beach at Barn Scar.

The scar begins in the mid shore, and is made up of a mosaic of recently exposed scar and more stable scars. The recently exposed scars were typically barren with the exception of gutweed and laver, while more stable scars that had been exposed for longer were home to the red algae *Dumontia contorta*, periwinkles, barnacles (*Balanus crenatus*) and limpets. Further

down the mid shore this year there was a large increase in *Sabellaria* mounds covered in bladder wrack, with Irish moss and coral weed, as well as sand mason worms. In pools between the mounds, the under boulder community was not particularly diverse and was restricted to gammarid shrimps. An impressive discovery of recently exposed black peat platforms was found this year (Figure 40).

On this shore there is an area of lower shore, where water floods in behind Barn Scar. On previous surveys this area tended not to dry out at low water due to water pouring of the more elevated sections of Barn Scar. This year however, there appeared to have been a large amount of work undertaken on the fish traps which are found on this scar, whereby boulders have been placed to restrict drainage and create large pools (Figure 41). This resulted in less water on this lower shore zone and subsequently less algae than normal. Despite this the area was still diverse including an abundance of



Figure 41: Large pools created by work on the fish traps.

Sabellaria crust, and periwinkles as well as Irish moss, the red algae *Dumontia contorta*, coral weed, keel worms, edible crabs and saddle oysters.

The centre of the scar is elevated and therefore has mid shore ecology. Once again this year mussels were absent and instead an abundance of periwinkles and barnacles (*Balanus crenatus*) were found.

mussels, rocks were easily moved and had a diverse under-boulder community including gammarid shrimps, beadlet anemones, limpets (both *Patella vulgata* and *Testudinalia testudinalis*), starfish, dog whelks, and sea squirts. Damp pools between the mounds had a variety of algae (including *Spongomorpha arcta*, *Polysiphonia* spp.), red encrusting algae (*Lithothamnion* sp. and *Hildenbrandia rubra*) as well as green leaf worm egg mass (*Eulalia viridis*).

The western lower shore zone (i.e. the seaward edge) of Barn Scar was initially dominated by barnacles (*Balanus crenatus*) with a rich under-boulder community comprising of brittle stars (*Amphipholis squamata*), sea squirts, bryozoans (both *Membranipora membranacea* and *Electra pilosa*), breadcrumb sponge, broad clawed crabs and edible crabs. Tiny seed mussels (~3mm) were found to be



Figure 42: Bryozoans covering the fronds of toothed wrack.

settling on the barnacles. Further into the lower shore toothed wrack dominated the shore with colonies of bryozoans covering the fronds (Figure 42). Under the fucoid canopy Irish moss, sea beach (*Delesseria sanguinea*) and red encrusting algae were found to make up the understory. Beneath the understory, most surfaces of the rocks were covered in the white calcareous bases of detached *Balanus crenatus* barnacles. At the low water's edge there was a kelp zone (oar weed), with dulse and red rags also interspersed. The under-boulder community within this zone was even more diverse than the previous zones with additional species found, including green sea urchins (*Psammechinus miliaris*), saddle oyster, blue velvet crabs (*Necora puber*) and even a squat lobster (*Galathea squamifera*).

Table 11: Species found at Barn Scar, Drigg in 2013

Latin Name	English Name/description	Lower Shore	Mid Shore	Upper Shore
<i>Halichondria panicea</i>	Breadcrumb sponge	○		
<i>Dynamena pumila</i>	Hydroid	○-C		
<i>Actinia equina</i>	Beadlet anemone		○	
<i>Urticina felina</i>	Dahlia anemone	○		
<i>Arenicola marina</i>	Lugworm		○	○
<i>Eulalia viridis</i>	Green leaf worm		R	
<i>Eulalia viridis</i>	Green leaf worm (egg mass)	○		
<i>Lanice conchilega</i>	Sand mason worm		○	
<i>Spirobranchus lamarcki</i> (was <i>Pomatoceros lamarcki</i>)	Keel worm	C-F	○	
<i>Sabellaria alveolata</i>	Honeycomb worm (mounds)	C	○	
<i>Sabellaria alveolata</i>	Honeycomb worm (crust)	F		
<i>Littorina littorea</i>	Edible periwinkle	A	F-A	
<i>Monia patelliformis</i>	Saddle oyster	C		
<i>Nucella lapillus</i>	Dog whelk	C	C	
<i>Nucella lapillus</i>	Dog whelk eggs		○	
<i>Patella vulgata</i>	Common limpet		○	
<i>Testudinalia testudinalis</i>	Common tortoiseshell limpet	○	○	
<i>Balanus crenatus</i>	Barnacle	F-A	A	
<i>Gammaridae sp.</i>	Gammarid shrimp		○	
<i>Talitridae sp.</i>	Sandhopper			○
<i>Cancer pagurus</i>	Edible crab	○	○	
<i>Carcinus maenas</i>	Shore crab		○	
<i>Necora puber</i>	Blue velvet swimming crab	○		

Latin Name	English Name/description	Lower Shore	Mid Shore	Upper Shore
<i>Porcellana platycheles</i>	Broad clawed crab	○		
<i>Galathea squamifera</i>	Squat lobster	R		
<i>Asterias rubens</i>	Common starfish		○	
<i>Amphipholis squamata</i>	Brittle star	○		
<i>Psammechinus miliaris</i>	Green sea urchin	R		
<i>Membranipora membranacea</i>	Sea mat	○		
<i>Electra pilosa</i>	Hairy sea mat	○		
<i>Asciidiella aspersa</i>	Large clear sea squirt		○	
<i>Ulva intestinalis</i>	Gutweed		○	
<i>Spongomorpha arcta</i>	Green algae		○	
<i>Fucus serratus</i>	Toothed wrack	F-A		
<i>Fucus vesiculosus</i>	Bladder wrack		○	
<i>Laminaria digitata</i>	Oar weed	F		
<i>Saccharina latissima</i>	Sugar kelp	○		
<i>Chondrus crispus</i>	Irish moss	C	○	
<i>Corallina officinalis</i>	Coral weed	F	○	
<i>Delesseria sanguinea</i>	Sea beach	○		
<i>Dilsea carnosa</i>	Red rags	○		
<i>Dumontia contorta</i>	Red algae	F	○	
<i>Hildenbrandia rubra</i>	Red encrusting species		○	
<i>Lithothamnion</i> or <i>Lithophyllum</i> sp.	Red encrusted algae	○	○	
<i>Palmaria palmata</i>	Dulse	○		
<i>Polysiphonia</i> spp.	Filamentous red algae		○	
<i>Porphyra umbilicalis</i>	Laver		○	
<i>Polyides rotundus</i>	Red branching algae	○		
<i>Phycodrys rubens</i>	Leafy sea oak	○		

STUB PLACE, TARN POINT

The Tarn Point transect is situated at Stub Place and is the most southerly of the survey transects. It should be noted that the 2013 survey took place under atrocious weather conditions (horizontal hail), making species observation particularly difficult, therefore the low diversity found this year does not accurately reflect the ecological state of this shore.

The transect begins in the upper shore beneath a pebble bank, where a large amount of litter was found this year. In the upper shore zone of this beach the cobbles were covered with a large amount of channel wrack (*Pelvetia canaliculata*) and scattered patches of spiral wrack (Figure 43). At low water the water is trapped in this part of the shore forming frequent damp pools containing a diversity of



Figure 43: Channel wrack and spiral wrack colonising the upper shore cobbles.

algae including gutweed, maiden's hair, coral weed, Irish moss, *Cladophora rupestris* and *Hildenbrandia rubra*. On the surface of rocks barnacles (*Balanus crenatus* and *Semibalanus balanoides*) were found with the occasional gammarid shrimp underneath the rocks.

Initially the mid shore is a stony bed with an abundance of barnacles (*Semibalanus balanoides*) and periwinkles. The rocks within the area were covered in bladder wrack with red algae in the pools which formed between the rocks. The *Sabellaria* platform begins within the mid shore and engulfs the beach with a low profile platform. This year approximately 40% of the *Sabellaria* platform was found to be denuded with the rest healthy and growing. The denuded sections of the platform were covered with juvenile fucoid seaweed while bladder wrack covered the healthy growing reef. This year,

longitudinal pools had formed in the denuded reef and these were found to contain coral weed, Irish moss, *Dumontia contorta* and *Ceramium virgatum* as well as hermit crabs (*Pagurus bernhardus*). Rocks protruding from the platform were covered in barnacles and limpets. The *Sabellaria* reef begins to break up towards the lower shore, therefore the transect continued further north along the sandy patch west of the big rock.



Figure 44: Denuded *Sabellaria* mounds. Some toothed wrack and barnacles present around the bottom of the mound.

On the lower shore zone much of the *Sabellaria* reef was found to be eroded and in some cases buried by sand inundation (Figure 44) and the platforms broken up into individual mounds. Sandy denuded mounds were covered with toothed wrack and gutweed. Newly settling *Sabellaria* colonies were found on some of the exposed rocks. At the extreme lower water scar *Sabellaria* crust and low mounds bind the rocks down, eliminating

the under-boulder community. Breadcrumb sponge and toothed wrack were common and often covered in bryozoans.

Table 12: Species found at Stub Place, Tarn Point, in 2013

Latin Name	English Name/description	Lower Shore	Mid Shore	Upper Shore
<i>Halichondria panicea</i>	Breadcrumb sponge	O		
<i>Arenicola marina</i>	Lugworm		R	
<i>Nereis virens</i>	King rag worm	O		
<i>Sabellaria alveolata</i>	Honeycomb worm (mounds)	F	A	
<i>Sabellaria alveolata</i>	Honeycomb worm (crust)	A		
<i>Littorina littorea</i>	Edible periwinkle		F-A	F
<i>Nucella lapillus</i>	Dog whelk	O	R	
<i>Patella vulgata</i>	Common limpet		O	
<i>Testudinalia testudinalis</i>	Common tortoiseshell limpet		R	R
<i>Semibalanus balanoides</i>	Acorn barnacle		F	O
<i>Balanus crenatus</i>	Barnacle	O		O
<i>Gammaridae sp.</i>	Gammarid shrimp			O
<i>Pagurus bernhardus</i>	Hermit crab		O	
<i>Electra pilosa</i>	Hairy sea mat	O		
<i>Cladophora rupestris</i>	Green algae			O
<i>Ulva intestinalis</i>	Gutweed	C		C
<i>Ectocarpus siliculosus</i>	Maiden's hair (brown filamentous algae)			C
<i>Fucus serratus</i>	Toothed wrack	C	F	
<i>Fucus vesiculosus</i>	Bladder wrack		F	
<i>Fucus spiralis</i>	Spiral wrack			O-C
<i>Fucus sp.</i>	Juvenile fucus		C	
<i>Saccharina latissima</i>	Sugar kelp	O		
<i>Pelvetia canaliculata</i>	Channel wrack			C
<i>Ceramium virgatum</i>	Red pool algae	O	O	
<i>Chondrus crispus</i>	Irish moss		C	O
<i>Corallina officinalis</i>	Coral weed		C	O
<i>Dumontia contorta</i>	Red algae		C	O
<i>Hildenbrandia rubra</i>	Red encrusting species	O		O

References

Ballantine, W.J. (1961) 'A Biologically-defined Exposure Scale for the Comparative Description of Rocky Shores' *Field Studies Journal* 1 (3)

Connor, J. H., Golding, A. N., Howell, K. L., Lieberknecht, L. M., Northern, K. O., and Reker, J. B. (2004) *The Marine Habitat Classification for Britain and Ireland Version 04.05 JNCC*, Peterborough ISBN 1 861 07561 8 (internet version)
www.jncc.defra.gov.uk/MarineHabitatClassification.

Crisp, D. J., and Southward, A. J. (1958) 'The distribution of intertidal organisms along the coasts of the English Channel.' *Journal of the Marine Biological Association of the United Kingdom*, 37:157-208.