

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

Cumbrian Shore Survey 2012



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INTRODUCTION

Surveys of the Cumbrian shore have been conducted since 1993 at 11 rocky shore 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). On-going monitoring of the sites is intended to provide early warning signs of change within the community as a result of natural or anthropogenic impact.

The Cumbrian coastline is extremely diverse and important to wildlife, with shore habitats varying from the wide sand flats of the upper Solway to the rugged rocky shore around St Bees Head. Rocky shores provide a multitude of habitats for marine organisms to colonise, such as rock pools, crevices and overhangs.

True areas of rocky shore (i.e. platforms made of bedrock) (Figure 1) are restricted to the coastline between Harrington and St. Bees Village, however the Cumbrian coast is home to a variety of other rocky habitats, each allowing colonisation by a unique array of species.

The most common type of rocky shore found on the Cumbrian coast is where the remains of glacial deposits have been left over from the end of the ice age. These areas of pebbles, boulders and cobbles are known locally as scar ground (Figure 2).

Another habitat, called slagcrete, is found between Maryport and Whitehaven, and was originally formed as the result blast furnace waste being dumped on the shore in the last century. Over time this artificial substrate has become colonised by marine life (Figure 3).



Figure 1(above): Wave cut platforms of bedrock at Cuning Point

Figure 2 (below): Scar ground



Figure 3 (left): Boulders of blast furnace waste at Moss Bay

The Cumbrian coast boasts an impressive display of *Sabellaria alveolata* reefs (from hereon referred to as *Sabellaria*). *Sabellaria* reef is formed by the tubes of individual polychaete worms, made from sand particles and shell fragments (Figure 4).

Sabellaria reef can take the form of individual hummocks (mounds) or much more massive formations such as platforms. On some beaches, particularly in the south of the county, *Sabellaria* reefs form extensive platforms which can cover hundreds of metres of the shore. *Sabellaria* reefs can stabilise an otherwise unstable rocky scar ground, and in turn provide a stable habitat for

other marine organisms. Additionally, they impact upon the drainage of the shore, and at low tide water is trapped in and around the structures, effectively leading to an extension of the marine environment. *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 are also protected as an Annex 1 Habitat under the Habitats Directive.



Figure 4: Close up of *Sabellaria* reef showing individual tubes

Another prolific species on the Cumbrian Coast is the edible mussel (*Mytilus edulis*). In the upper Solway edible mussels form large enough beds to be used for commercial exploitation though smaller mussel beds can be found on the majority of Cumbrian beaches. Mussels can settle in astonishingly high numbers on any beach where there is hard substrate to which they can attach (Figure 5). It seems that on the Cumbrian coast mussels and *Sabellaria* are in constant competition for dominance of the shore.



Figure 5: Dense settlement of seed mussels

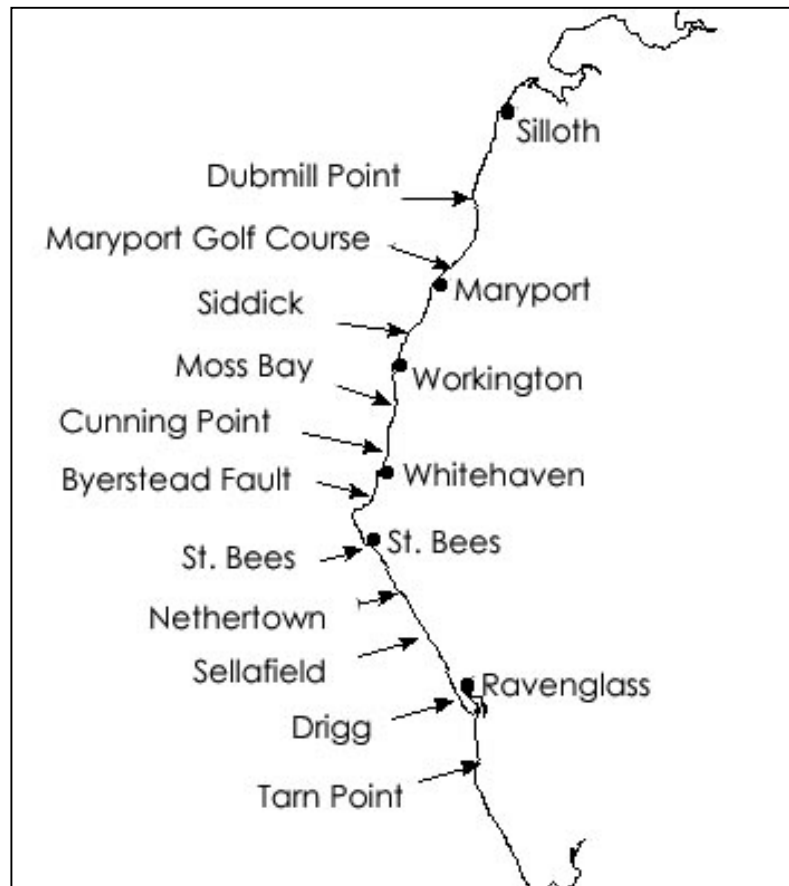
METHOD

Surveys were completed between May and October 2012, and exact transects were located using GPS coordinates (Table 1; Figure 6), and previously assigned visual reference points. The length of transect varies from site to site due to the differing topography of the shores, however, 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 2012

Site	Date	GPS position of transect (digital minutes)	Height of tide (m)
Dubmill	8/5/2012	Top shore - 54 47 487, 003 26 161 Low water - 54 47 629, 003 27 596	0.5m
Maryport	6/5/2012	Top shore - 54 43 991, 003 28 632 Low water - 54 44 227, 003 28 896	0.7m
Siddick	9/5/2012	Top shore - 54 40 057, 003 33 174 Low water - 54 40 176, 003 33 579	0.6m
Moss Bay	10/5/2012	Top shore - 54 38 020, 003 34 487 Low water - 54 38 057, 003 34 616	0.8m
Cunning Point	7/5/2012	Top shore - 54 35 023, 003 34 971 Low water - 54 34 986, 003 35 129	0.6 m
Byerstead	15/10/2012	Top shore - 54 31 487, 003 36 822 Low water - 54 31 517, 003 36 875	1.0 m
St. Bees	8/5/2012	Top shore - 54 29 414, 003 36 672 Low water - 54 29 354, 003 36 942	0.7m
Nethertown	6/5/2012	Top shore - 54 27 182, 003 33 808 Low water - 54 27 154, 003 34 204	0.6m
Sellafield	9/5/2012	Top shore - 54 24 918, 003 30 722 Low water - 54 24 834, 003 31 103	0.6m
Drigg	5/5/2012	Top shore - 54 22 343 003 28 098 Low water - 54 22 162, 003 28 910	1.0m
Stub Place	7/5/2012	Top shore - 54 17 710, 003 25 300 Low water - 54 17 761, 003 25 663	0.6m

Figure 6: 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 10 meters either side (measured using previously calculated strides). Additionally, at least 10 observations of overturned boulders or in 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 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.

KEY FINDINGS OF THE 2012 SURVEY

One of the most unusual findings of the 2012 survey was the large number of *Coryphella gracilis* sea slugs found (Figure 7). These beautiful and tiny (1cm) creatures were found in relatively large numbers on the lower shores at Nethertown, Drigg and Dubmill. They were often found in pairs producing their spirals of egg on the rocks at low water

Figure 7 (right): A pair of *Coryphella gracilis* sea slugs and their egg mass on the lower shore at Nethertown



Another attractive species of sea slug was found at Drigg this year. The grey sea slug *Aeolidia papillosa* (Figure 8) is a large species (7cm) and was found for the first time this year on the Cumbrian coast.

Figure 8 (right): The grey sea slug *Aeolidia papillosa* at Drigg



The beach which had experienced the most change this year was Moss Bay. This site was originally chosen as it was the location of Workington Steelworks outfall pipe, although the transect took place just north of the pipe as the mid and lower shore were sandy by the outfall. This year this sandy beach had been replaced by a boulder field as a result of massive natural sand movement exposing a previously buried scar. The sand movement had also exposed some peat platforms on the lower shore which have never been seen on this survey on the Workington coast. These peat platforms are the remains of the prehistoric forest which occupied the Solway at the last ice age.



Figure 9: Peat platforms at Workington exposed at Moss Bay

The decline of mid shore mussel beds on some of the transect sites first reported in 2011 has continued. Previously many shores including Dubmill, Maryport, Siddick, Nethertown, Drigg and Stub Place all had mid shore mussel beds, however over the years many of these have diminished in size and quantity in some cases being replaced by *Sabellaria* or stony scar ground (e.g. Drigg: Figure 10).

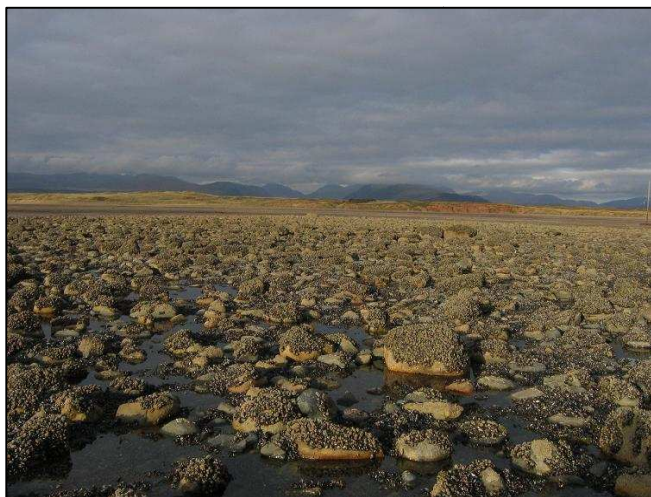


Figure 10a: Mid shore scar at Drigg (2007)



Figure 10b: Mid shore scar at Drigg (2012)

In order to examine this trend in diminishing mussel beds the shore survey data was statistically analysed in order to assess the decline and to investigate the population dynamics between *Sabellaria* and mussels. The past 20 years' data was examined by Newcastle University student Amy Walker for her MSc thesis (Figure 11). The trends in abundance of the species were analysed at 5 sites (Dubmill, Maryport, Nethertown, Drigg and Stub place) where both *Sabellaria* reef and mussel beds are present.

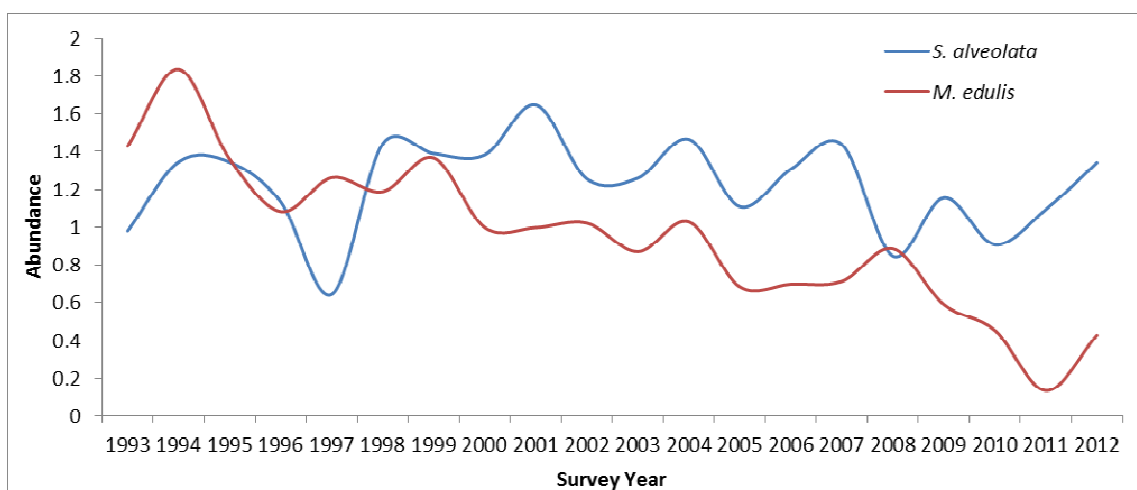


Figure 11: Trends in the abundance of mussels and *Sabellaria* 1993-2012

The result of the data analysis confirmed the gradual decline in the mussel population at the 5 study sites studied, with peaks in abundance observed every 4-5 years. This decline contrasts with the fluctuations in *Sabellaria* abundance which has slightly increased in abundance overall (Figure 11).

The reason behind the decline in mussels may be climatic, for example due to factors such as changing wind patterns along the Cumbrian coast impacting upon transport of larvae at a crucial spat settlement time. Combining the abundance data with climatic data would make an interesting and valuable topic for further study.

There now follows a detailed account of each beach surveyed.

DUBMILL

Dubmill Scar is one of the most northerly areas of stable scar ground on the Cumbrian Coast. As a result of the shallow gradient and large tidal range this huge area of cobbles and boulders extends out over a mile into the Solway. This scar offers a rare insight into the sublittoral communities of the upper Solway which this year was dominated by a vast expanse of *Sabellaria* mounds (Figure 12).

Figure 12: *Sabellaria* mounds at Dubmill Scar



The transect begins on the upper shore scar, which was colonised by the usual opportunistic species, including the algae gutweed (*Ulva intestinalis*), laver (*Porphyra umbilicalis*), periwinkles (*Littorina littorea*) and some tiny acorn barnacles (*Semibalanus balanoides*) which had recently settled on the cobbles, as well as juvenile lugworms (*Arenicola marina*) in the sandy patches.



Figure 13: Seed mussels on the mid shore scar at Dubmill Point

A sandy gap separates the upper shore scar from the main scar ground. This year sand had inundated into the mid shore section, with only larger cobbles protruding from the sand in the upper mid shore. Further into the scar there was less sand and seed mussel (1-2mm) found settling between barnacles, as well as older 10-12mm mussels from an earlier settlement (Figure 13). Moving down the scar, seed mussel cover gradually increased from approximately 10% on the upper mid shore to 80% although sand had covered some of the seed. Within this part of the scar larger, older mussels were commonly found on the tops of larger rocks, along with dog whelks (*Nucella lapillus*) and periwinkles.

This year it was noted that there was not much algae within the pools of the mussel bed and there were lots of overturned rocks, possibly due to crabbers.

Continuing down the shore, about 100m past the oyster lays, the *Sabellaria* mounds began. Initially the mounds were around 45cm tall and were quite battered looking, but were obviously growing (evidenced by clear, open tubes). In this zone there were many periwinkles on the mounds and sand mason worms (*Lanice conchilega*) and red algae (*Polysiphonia* sp.) in the sandy gaps between them. Sandy patches between these mounds are also colonised by more red algae. There was less algae present on the mounds themselves than in previous years with the exception of the largest mounds which were home to red pool algae, *Ceramium virgatum*, and sea lettuce (*Ulva lactuca*). This year it was difficult to distinguish between mid shore and lower shore as the *Sabellaria* mounds dominated both zones (Figure 12) trapping water on the shore and there was not much macro algae present. *Sabellaria* mounds up to 60cm tall dominated the lower shore zone and extended into the extreme low water zone.

In the extreme low water, smaller *Sabellaria* mounds were abundant amongst the kelp (oar weed *Laminaria digitata* and sugar kelp *Saccharina latissima*), mounds of breadcrumb sponge (*Halichondria panacea*) and Dalia anemones (*Urticina felina*). This year there was an abundance of hydroids in this zone including *Dynamena pumila*, sea beard or white weed (*Nemertesia antennina*) hydroids (Figure 14) and the robust feather-like *Abietinaria abietina* recorded for the first time in the shore surveys. Interesting species found this year were pink shrimps (*Pandalus montagui* Figure 15), *Coryphella gracilis* sea slugs and finger sponge (*Haliclona oculata*). This year throughout the low water zone the majority of rocks were too anchored down to be moved, therefore the under boulder community was lacking. The bank at the extreme low water's edge was covered in small *Sabellaria* mounds with large adult mussels (>45mm) between them.



Figure 14: Sea beard or white weed hydroids (*Nemertesia antennina*)



Figure 15: Pink shrimp (*Pandalus montagui*)

Table 2: Species present at Dubmill Point, May 2012

Latin Name	English Name/description	Lower Shore	Mid Shore	Upper Shore
<i>Halichondria panicea</i>	Breadcrumb sponge	F	R	
<i>Haliclona oculata</i>	Finger sponge	R		
<i>Abietinaria abietina</i>	Hydroid	R		
<i>Dynamena pumila</i>	Hydroid	F	O-C	
<i>Hydrallmania falcata</i>	Hydroid	R		
<i>Nemertesia antennina</i>	Sea beard / white weed	C		
<i>Actinia equina</i>	Beadlet anemone		R	
<i>Sagartia troglodytes</i>	Light pink / nude anemone		R	
<i>Urticina felina</i>	Dahlia anemone	C		
<i>Arenicola marina</i>	Lugworm		F	C
<i>Eulalia viridis</i>	Green leaf worm (egg mass)	R	O	
<i>Lanice conchilega</i>	Sand mason worm	C	C	
<i>Sabellaria alveolata</i>	Honeycomb worm (mounds)	A	A	
<i>Lepidochitona cinerea</i>	Chiton		R	
<i>Littorina littorea</i>	Edible periwinkle	C	C-F	C
<i>Monia patelliformis</i>	Saddle oyster	R		
<i>Coryphella gracilis</i>	Sea slug	R		
<i>Mytilus edulis</i>	Edible mussel	O		
<i>Mytilus edulis</i>	Seed mussel		A	
<i>Nucella lapillus</i>	Dog whelk	C	C	
<i>Nucella lapillus</i>	Dog whelk eggs	O	O	
<i>Buccinum undatum</i>	Edible whelk	R		
<i>Semibalanus balanoides</i>	Acorn barnacle			O
<i>Balanus crenatus</i>	Barnacle	O	C	
<i>Pandalus montagui</i>	Pink shrimp	O		
<i>Asterias rubens</i>	Common starfish	O		
<i>Membranipora membranacea</i>	Sea mat	O		
<i>Electra pilosa</i>	Hairy sea mat	O		
<i>Pomatoschistus minutus</i>	Sand goby		R	
<i>Teleost sp.</i>	Flat fish sp	R		
<i>Ulva intestinalis</i>	Gutweed (Enteromorpha)			C
<i>Spongomorpha arcta</i>	Green algae		O	
<i>Ulva lactuca</i>	Sea lettuce	O	O	
<i>Laminaria digitata</i>	Oar weed	F		
<i>Saccharina latissima</i>	Sugar Belt	F		
<i>Ceramium virgatum</i>	Red pool algae	C	O	
<i>Chondrus crispus</i>	Irish moss	O	R	
<i>Lithothamnion</i> or <i>Lithophyllum</i> spp.	Pink encrusted algae	O	O	
<i>Palmaria palmata</i>	Dulse	R		

Latin Name	English Name/description	Lower Shore	Mid Shore	Upper Shore
<i>Polysiphonia spp.</i>	Filamentous red algae		C	
<i>Porphyra umbilicalis</i>	Laver	O	O	O
<i>Polyides rotundus</i>	Red branching algae	R		

MARYPORT

The Maryport survey site (Figure 16) consists of a predominantly sandy beach with patches of cobble scar ground, typical of the Cumbrian coast between Flimby and Dubmill point. Maryport also hosts a variety of habitat types, with peat platforms, *Sabellaria* mounds and a variety of scar patches, each home to its own distinct community of intertidal species. Coupled with an accessible low shore area, it is an excellent site for finding an interesting array of creatures.



Figure 11: *Sabellaria* mounds at Maryport

This survey began at the extreme low water's edge where the kelp bed was visible, but not fully exposed. This year much of lower shore was dominated by a dense settlement of seed mussels (4mm in length), competing for space with other species. At the low water's edge rocks were colonised by a mixture of seed mussels, tiny *Sabellaria* tubes and sea grape sea squirts (*Molgula manhattensis*) (Figure 17) as well as Irish moss (*Chondrus crispus*) in the gaps between boulders. Away from the extreme low water edge toothed wrack (*Fucus serratus*) was common and covered in an array of bryozoans (*Alcyonidium diaphanum*, *M. membranacea*, *Electra pilosa*, *Flustrellidra hispida*), hydroids (*Dynamena pumila*) and barnacles (*Balanus crenatus*), to such a degree that not much photosynthetic area was left on the algae fronds (Figure 18).



Figure 17: Sea grape sea squirts and seed mussel on the lower shore boulders



Figure 18: Seed mussels and toothed wrack at low water

Within this zone rocks were anchored down by the seed mussels, hence not much under boulder community was found, however where rocks could be moved, edible crabs (*Cancer pagurus*), starfish (*Asterias rubens*), ragworms (*Hediste diversicolor*), dog whelk eggs, burrowing anemones (*Actinaria* spp.) and sea squirts were found. Dog whelks were common on this part of the shore and as is typical of this shore many were large with heavily netted shells.

Further up the lower shore *Sabellaria* mounds became more common (Figure 16 above). Initially these were covered in seed mussels, with Dahlia anemones and sand mason worms colonising the sandy gaps between the mounds. Towards the upper limit of the lower shore *Sabellaria* mounds were seed free and in good condition, with few epibionts. Breadcrumb sponge was found around the base of *Sabellaria* mounds. Beadlet anemones (*Actinia equina*), red encrusting algae (*Hildenbrandia rubra*) and sea lettuce were found on rocks between mounds.

Into the mid shore mussel seed was once again dominant, covering 70-80% of the scar ground. The only other organisms found here were shore crabs and beadlet anemones under rocks. The mid shore mussel bed scar ground now continues up to peat platforms as a new scar area has been exposed by the shifting of sand. This new scar ground has been colonised by mussels. This year the exposed peat platforms were covered in seed mussels and green algae (*Ulva linza*) with piddocks (*Pholas dactylus*) burrowing into the fossilised wood (Figure 19). *P. dactylus* has phosphorescent properties, the outlines of the animal glowing with a green-blue light, a shame for them to be hidden away within the platforms! The peat platforms on the mid shore are now more elevated than in previous years, due to sand erosion around the base. Newly exposed scar landward of the peat platforms was covered in more mussel seed and gutweed.



Figure 19: Piddocks boring into exposed peat platform

Beyond this new scar, there is a sandy gap with frequent lugworm casts before the upper shore scar is found. This scar is covered in the usual opportunistic seaweeds, including *U. linza*, laver, maidens hair (*Ectocarpus siliculosus*), with some spiral wrack (*Fucus spiralis*) as well as barnacles (*S. balanoides*) and rough periwinkles (*Littorina saxatilis*). Green algae, *Blidingia minima*, was found on top shore rocks.

Table 3: Species found at Maryport Golf Course Transect, May 2012

Latin Name	English Name/Description	Lower Shore	Mid Shore	Upper Shore
<i>Halichondria panicea</i>	Breadcrumb sponge	O		
<i>Dynamena pumila</i>	Hydroid	O		
<i>Actinia equina</i>	Beadlet anemone	O	O	
<i>Urticina felina</i>	Dahlia anemone	F		
<i>Actinaria spp.</i>	Unidentified pale burrowing anemone	R		
<i>Arenicola marina</i>	Lugworm	O	C	C
<i>Eulalia viridis</i>	Green leaf worm (egg mass)		O	
<i>Lanice conchilega</i>	Sand mason worm	O		
<i>Hediste diversicolor</i>	Rag worm	R		
<i>Sabellaria alveolata</i>	Honeycomb worm (mounds)	A		
<i>Sabellaria alveolata</i>	Honeycomb worm (crust)	O		
<i>Lepidochitona cinerea</i>	Chiton	R		R
<i>Littorina saxatilis</i>	Rough Periwinkle			O
<i>Mytilus edulis</i>	Seed mussel	A	A	
<i>Nucella lapillus</i>	Dog whelk	F	C	
<i>Nucella lapillus</i>	Dog whelk eggs	O		
<i>Pholas dactylus</i>	Piddock		O	
<i>Semibalanus balanoides</i>	Acorn barnacle		O	O
<i>Balanus crenatus</i>	Barnacle	O		
<i>Gammaridae sp.</i>	Gammarid	R		
<i>Cancer pagurus</i>	Edible crab	O		
<i>Carcinus maenas</i>	Shore crab		O	
<i>Asterias rubens</i>	Common starfish	O		
<i>Alcyonidium diaphanum</i>	Sea Chervil	O		
<i>Alcyonidium sp</i>	Encrusting bryozoan	O		
<i>Membranipora membranacea</i>	Sea mat	O		
<i>Electra pilosa</i>	Hairy sea mat	O		
<i>Flustrellidra hispida</i>	Hairy sea mat	O		
<i>Asciidiella aspersa</i>	Large clear sea squirt	R		
<i>Molgula manhattensis</i>	Sea grape sea squirt	F		
<i>Blidingia minima</i>	Green algae			O
<i>Chaetomorpha linum</i>	Green algae	O		
<i>Cladophora rupestris</i>	Green algae	O		
<i>Ulva linza</i>	Green algae		O	F
<i>Ulva lactuca</i>	Sea lettuce	O		
<i>Chlorophyta sp.</i>	Unidentified filamentous green algae	O		
<i>Ectocarpus siliculosus</i>	Maiden's hair (brown filamentous algae)			O
<i>Fucus serratus</i>	Toothed wrack	C		

Latin Name	English Name/Description	Lower Shore	Mid Shore	Upper Shore
<i>Fucus spiralis</i>	Spiral wrack			○
<i>Laminaria digitata</i>	Oar weed	○		
<i>Ceramium virgatum</i>	Red pool algae	C		
<i>Chondrus crispus</i>	Irish moss	C-F		
<i>Hildenbrandia rubra</i>	Red encrusting species	○		
<i>Lithothamnion</i> or <i>Lithophyllum</i> spp.	Red encrusting algae	○		
<i>Polysiphonia</i> spp.	Filamentous red algae	R		
<i>Porphyra umbilicalis</i>	Laver			○
<i>Caloplaca marina</i>	Yellow / orange lichen			○

SIDDICK

The Siddick beach transect was originally chosen due to the location of the Iggesund Paper Board factory and its outfall pipe which runs from the upper shore down the beach (Figure 20a), where it discharged onto the extreme lower shore (Figure 20b). On the day of the visit the end of the pipe was visible with a white sulphurous smelling discharge flowing from it. The water surrounding the end of the pipe was luke warm this year, but not overly so and there was no visible emulsion on the surface of the water.



Figure 20a: Transect site at Siddick



Figure 20b: The Iggesund outfall pipe

The Siddick transect covers a variety of habitats, the first of which is found on the very top shore. In an attempt to slow coastal erosion rock sea defences have been placed on the upper most part of the shore (Figure 20a). As a result of the encroachment of the sea, marine life can now be found colonising these rocks. This year green algae, *Blidingia* spp. was found on the lower parts of the rocks as well as intertidal lichens higher up.

Beneath the sea defences, an extensive slagcrete reef can be found on the upper shore. This artificial reef offers a variety of habitats, by providing a stable substrate for colonisation, and trapping water, effectively extending the liveable space available to the marine creatures up into the frequently exposed upper shore. This year the reef was covered in spiral wrack, with an abundance of periwinkles and the occasional dog whelk found underneath the canopy. There is a sandy gap between the slagcrete reef and main scar ground which was again full of lugworm casts, as well as watery pools which were found to be teeming with juvenile plaice (*Pleuronectes platessa*) approximately 2cm long.

Reaching the upper part of the mid shore scar, tiny periwinkles were found to be extremely abundant on the cobbles while the pools under the discharge pipe were home to *Sabellaria* mounds and small pool algae such as coral weed (*Corallina officinalis*), *C. virgatum* and the hollow red algae, *Dumontia contorta*. On the top of mid shore bank there was an abundance of newly settled tiny (1-2mm) mussels, so small they were

hardly visible despite their abundance. This covering of mussels continued well into the mid shore scar, where *Sabellaria* crust, beadlet anemones and barnacles (*S. balanoides*) were also found. The seed mussels were less abundant towards the seaward edge of the mid shore, and instead the scar ground here was dryer and stony, with the small rocks covered in barnacles (*B. crenatus*), periwinkles and dog whelks.

The scar ground of the lower shore was covered with low *Sabellaria* mounds especially under the outfall pipe, as well as frequent dog whelks and periwinkles (Figure 21). Towards the extreme lower shore the *Sabellaria* mounds gave way to *Sabellaria* crust and barnacles. The crust was seen to dominate the ground with cover up to approximately 60%, with barnacles contributing the other 40%. Sand mason worms, dog whelks and their eggs, periwinkles, some Irish moss on larger rocks with hydroids were also found in this zone, as well as beadlet anemones and burrowing anemones (*Sagartia troglodytes*), although in general the rocks were too anchored down in anoxic mud for there to be much under boulder community.

This year the pipe was relatively algae-free compared to other years and was covered in barnacles, limpets and dog whelks on the mid and lower shore, and *Sabellaria* crust, hydroids (*D. pumila*), adult mussels, green algae, Irish moss, breadcrumb sponge and even plumose anemones (*Metridium senile*; Figure 22) in the extreme lower shore.



Figure 21: (above): *Sabellaria* on the lower shore at Siddick

Figure 22: (below): Plumose anemones on the underside of the Iggesund pipe



Table 4: Species Found at Siddick, May 2012

Latin Name	English Name/description	Lower Shore	Mid Shore	Upper Shore
<i>Halichondria panicea</i>	Breadcrumb sponge	R		
<i>Dynamena pumila</i>	Hydroid	O		
<i>Actinia equina</i>	Beadlet anemone	R	O	O
<i>Metridium senile</i>	Plumose anemone	O		
<i>Sagartia troglodytes</i>	Burrowing anemone	R		
<i>Arenicola marina</i>	Lugworm	O	O-C	
<i>Eulalia viridis</i>	Green leaf worm (egg mass)	R		
<i>Lanice conchilega</i>	Sand mason worm	O	O	
<i>Sabellaria alveolata</i>	Honeycomb worm (mounds)	C	O	O
<i>Sabellaria alveolata</i>	Honeycomb worm (crust)	A	O	
<i>Gibbula cineraria</i>	Grey top shell/ Silver Tommy	R		
<i>Littorina littorea</i>	Edible periwinkle	C	F-A	F
<i>Mytilus edulis</i>	Edible mussel	O		
<i>Mytilus edulis</i>	Seed mussel		A	
<i>Nucella lapillus</i>	Dog whelk	C-F	C	C
<i>Nucella lapillus</i>	Dog whelk eggs	O		
<i>Patella vulgata</i>	Common limpet	O	O	C
<i>Semibalanus balanoides</i>	Acorn barnacle		F	A
<i>Balanus crenatus</i>	Barnacle	A	F	
<i>Gammaridae sp.</i>	Gammerid		O	
<i>Idotea sp.</i>	Sea slater		R	
<i>Decapod sp.</i>	Unidentified tiny shrimps	R		
<i>Carcinus maenas</i>	Shore crab	R	R	
<i>Pagurus bernhardus</i>	Hermit crab	R		
<i>Porcellana platycheles</i>	Broad clawed crab	R		
<i>Asterias rubens</i>	Common starfish	O		
<i>Electra pilosa</i>	Hairy sea mat	O		
<i>Pleuronectes platessa</i>	Plaice		O	
<i>Blidingia sp.</i>	Green filamentous algae			O
<i>Spongomorpha arcta</i>	Green algae		O	
<i>Ulva linza</i>	Green algae	O		
<i>Ulva lactuca</i>	Sea lettuce	O		
<i>Fucus serratus</i>	Toothed wrack	R		
<i>Fucus spiralis</i>	Spiral wrack			F
<i>Fucus vesiculosus</i>	Bladder wrack			C
<i>Laminaria digitata</i>	Oar weed	R		
<i>Ceramium virgatum</i>	Red pool algae	R	O	
<i>Chondrus crispus</i>	Irish moss	O	O	

Latin Name	English Name/description	Lower Shore	Mid Shore	Upper Shore
<i>Dumontia contorta</i>	Hollow red algae	R	O	
<i>Hildenbrandia rubra</i>	Red encrusting species	R	O	
<i>Lithothamnion</i> or <i>Lithophyllum</i> spp.	Red encrusted algae	O		
<i>Mastocarpus stellatus</i>	Red algae	O		C
<i>Porphyra umbilicalis</i>	Laver		O	
<i>Tephromela atra</i> var. <i>Atra</i>	Black shields			O
<i>Verrucaria mucosa</i>	Intertidal Black lichen			O
<i>Caloplaca marina</i>	Yellow / orange lichen			O

MOSS BAY

Moss Bay has seen a great deal of change over the years. The site was originally chosen in order to monitor the impact of the old British Steel outfall, which used to empty oily discharge onto the upper mid shore, however the steel works and outfall are now completely gone (Figure 23). The slagcrete reef on the upper shore is now home to an array of marine life. The reef was covered in furoid algae (bladder wrack and spiral wrack), and *Sabellaria* crust (all recorded as frequent), as well as black tar lichen (*Verrucaria mucosa*), *U. linza*, limpets and periwinkles. Some seed mussels had recently settled on the top of the *Sabellaria* mounds.

The beach below the outfall pipe was sandy, hence the transect is actually undertaken several hundred meters north (see below), however this year as a result of sand movement rocky shore had been exposed down-shore of the old outfall pipe. Most of the rocks were bare, with the exception of some green and brown filamentous algae, suggesting the exposure was relatively recent. In addition to the exposed scar ground the sand movement had also exposed peat platforms at extreme low water for the first time in the history of these shore surveys (Figure 24).

At the start of the actual transect the white sea defence boulders on the top shore had a slight covering of the green algae, *B. minima*. Further down the slagcrete reef was covered in spiral wrack, and any pools in the upper mid shore reef were full of green filamentous algae and the opportunistic brown filamentous algae, *E. siliculosus*. Further down the shore the surface of the slagcrete was home to barnacles (*S. balanoides*), limpets and patches of seed mussels. Pools in this area were full of gutweed, the hollow red algae *D. contorta* and rarely coral weed. Further still down the slagcrete, seed mussels and barnacles became more frequent and pools were

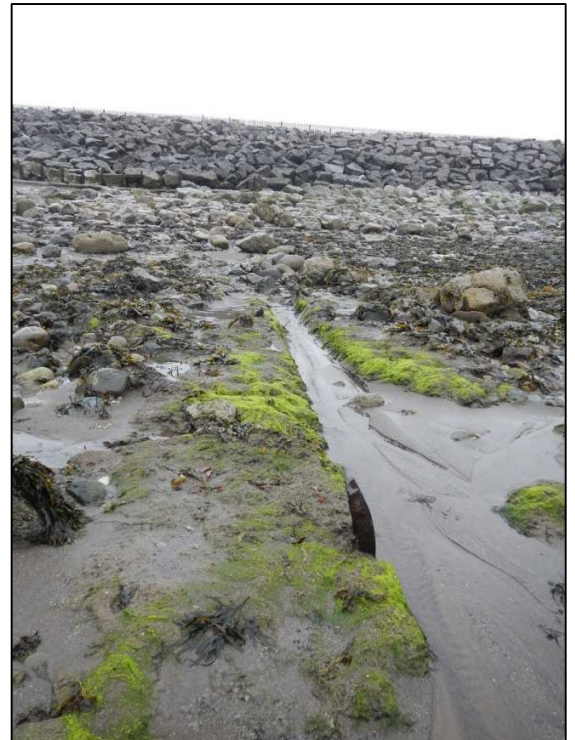
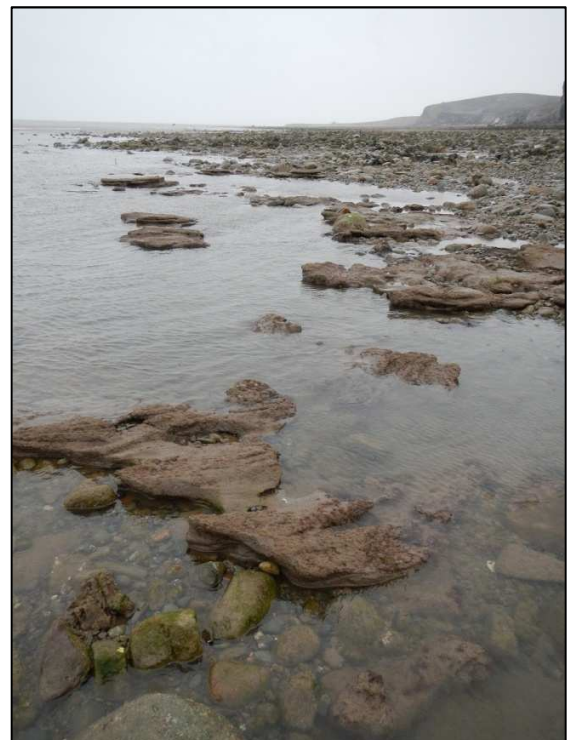


Figure 23: (above): Site of the old British Steel pipe at Moss Bay

Figure 24: (below): Peat platforms exposed at extreme low water's edge.



full of the fucoids - bladder wrack and toothed wrack (Figure 25). On the lower edge of the slagcrete reef there was a crust of *Sabellaria* and even the odd mound. The slagcrete reef breaks up into rocks and boulders here and on this edge of the mid shore scar the big rocks were covered with a mixture of barnacles, (*S. balanoides*), bladder wrack, green filamentous algae, seed mussels and the odd beadlet anemone.



Figure 25: Pools on the slagcrete reef

Leaving the slagcrete reef, there is a sandy gap before the lower shore scar begins, which was quite sandy hence only scour resistant species were present. The most common species found was green filamentous algae. There were some also *Sabellaria* mounds but most rocks were covered with mixture of barnacles (*S. balanoides*), 1mm seed mussels, the red encrusting algae *H. rubra*, and some young fucoid algae (*Fucus* sp.). Some toothed wrack and red encrusting algae (*Lithothamnion* spp.), were also found, with the odd dog whelk found in amongst the algae. Rocks on this scar were very sand scoured.

There is then a lagoon, created by a lower shore sand bar. Large boulders found within the lagoon were frequently covered in red pool algae *C. virgatum* and some of the red algae, *Polysiphonia elongata*. On the very low shore any rocks present were generally silty and bare, although there were barnacles, seed mussels, keel worms (*Pomatoceros lamarcki*), *C. virgatum*, beadlet anemones and green leaf worm eggs found. Starfish and sea mat (*Membranipora membranacea*) were occasionally found under the rocks.

Table 5: Species found at Moss Bay, May 2012

Latin Name	English Name/description	Lower Shore	Mid shore	Upper shore
<i>Dynamena pumila</i>	Hydroid			
<i>Actinia equina</i>	Beadlet anemone	O	R	
<i>Sabellaria alveolata</i>	Honeycomb worm (mounds)	O	O	
<i>Sabellaria alveolata</i>	Honeycomb worm (crust)		C	
<i>Pomatoceros lamarcki</i>	Keel worm	O		
<i>Mytilus edulis</i>	Seed mussel	O	C-F	
<i>Nucella lapillus</i>	Dog whelk	O	O	
<i>Patella vulgata</i>	Common limpet		C	
<i>Semibalanus balanoides</i>	Acorn barnacle	C	C-F	
<i>Balanus crenatus</i>	Barnacle			
<i>Decapod sp.</i>	Unidentified tiny shrimps	O		
<i>Cancer pagurus</i>	Edible crab	R		
<i>Asterias rubens</i>	Common starfish	O		
<i>Membranipora membranacea</i>	Sea mat			
<i>Electra pilosa</i>	Hairy sea mat			
<i>Pholis gunnellus</i>	Butterfish	R		
<i>Blidingia minima</i>	Green algae			O
<i>Ulva intestinalis</i>	Gutweed (<i>Enteromorpha</i>)		O	
<i>Ulva linza</i>	Green algae			
<i>Chlorophyta sp.</i>	Unidentified filamentous green algae	C	F	
<i>Ectocarpus siliculosus</i>	Maiden's hair (brown filamentous algae)		C	
<i>Fucus serratus</i>	Toothed wrack	O	O	
<i>Fucus spiralis</i>	Spiral wrack			C
<i>Fucus vesiculosus</i>	Bladder wrack		F	
<i>Fucus sp.</i>	Juvenile fucus	O		
<i>Ceramium virgatum</i>	Red pool algae	F		
<i>Polysiphonia elongata</i>	Red algae	O		
<i>Corallina officinalis</i>	Coral weed		R	
<i>Dumontia contorta</i>	Hollow red algae		O	
<i>Hildenbrandia rubra</i>	Red encrusting species	O		
<i>Lithothamnion</i> or <i>Lithophyllum</i> spp.	Red encrusted algae	O		
<i>Porphyra umbilicalis</i>	Laver		O	
<i>Verrucaria mucosa</i>	Intertidal black lichen		O	

CUNNING POINT

The Cunning Point survey site is found on a section of the Cumbrian coast between Harrington and St Bees - an area of true rocky shore. The rock formations and wave cut platforms at this site are remarkable (Figure 26), and the structures provide an array of pools, surge gullies and crevices for colonisation.

The white rocks dumped on the top shore during sea defence work in 2008 have now mostly been covered by a bank of pebbles (Figure 27), although any large rocks protruding from the pebbles were covered in *Blidingia* sp., most of which was bleached due to prolonged exposure. Further down there is a jumble of rocks, which were covered in spiral wrack.

Moving down the shore the mid shore wave cut platforms are reached. The surfaces of the huge pieces of bedrock were covered in barnacles, limpets, black tar lichen, and egg wrack (*Ascophyllum nodosum*). These platforms contain a great number of rock pools of varying shape and size which are home to an array of colourful pool alga including coral weed, Irish moss, gutweed, pepper dulse (*Osmundea pinnatifida*), *D. contorta*, *Cladophora rupestris*, *C. virgatum*, and encrusting species such as *Lithothamnion* spp., and even toothed wrack and oar weed in the deepest pools. Small fish are often found in these pools as well as periwinkles, beadlet anemones, and tubeworms (*Spirorbis spirorbis*) on the fronds of toothed wrack.

This survey found a lot of sand inundation into the boulder area between the mid shore and lower shore wave cut platforms. In this area patches of toothed and bladder wrack were seen sticking up above sand where the rocks to which they are attached have been buried, and any protruding rocks were covered in a limpet/barnacle community. The lagoon which formed several years ago has persisted and was found to be full of rocks covered in an abundance of toothed wrack.



Figure 26 (above): Wave cut platforms at Cunning Point

Figure 27 (below): Pebbly bank covering the sea defence rocks on the top shore



The lower shore wave cut platforms provide a multitude of different habitats and as a result several distinct communities were found on them. The lea side of the rocks were covered in barnacles, limpets, toothed wrack and gutweed (Figure 28), whereas the seaward vertical surfaces were covered in a dense covering of dulse (*Palmaria palmata*) and red algae (*Mastocarpus stellatus*). *Sabellaria* colonies and breadcrumb sponge, beadlet anemones and keel worms were found in the surge gullies.



Figure 28: Lea side of lower shore wave cut platforms

There is a boulder field seaward of the lower shore wave cut platforms. This year there was seen to be less sand on the lower shore at below the platforms, and as a result some boulders were relatively bare as if they had been recently exposed. Other boulders were covered in barnacles (*B. crenatus*), limpets, keel worms, red encrusting algae, black tar lichen, some individual *Sabellaria* tubes and tiny seed mussels (3mm). Further north of the transect seed mussel was much more abundant on the boulders and platforms.

In the extreme low water zone the boulders were caked in a crust of made up of a mosaic of *Sabellaria* tubes, barnacle and seed mussel. Above this crust is a covering of filamentous and fucoid algae including *C. virgatum*, Irish moss and toothed wrack, the algae were in turn covered in bryozoans. At the extreme low water's edge oarweed could be seen sticking out of the water, though this was not exposed. Just south of the transect where the kelp bed was exposed sea beech (*Delesseria sanguinea*) and the red algae *Membranoptera alata* and breadcrumb sponge were found amongst the oar weed. Rocks were generally too anchored down to move, but where they could be long clawed crabs (*Pisidia longicornis*) were found.

Table 6: Species found at Cuning Point, May 2012

Latin Name	English Name/description	Lower Shore	Mid Shore	Upper Shore
<i>Halichondria panicea</i>	Breadcrumb sponge	O		
<i>Dynamena pumila</i>	Hydroid	C		
<i>Actinia equina</i>	Beadlet anemone	C		
<i>Spirorbis spirorbis</i>	Tubeworm		O	
<i>Eulalia viridis</i>	Green leaf worm (egg mass)	R		
<i>Pomatoceros lamarcki</i>	Keel worm	O		
<i>Sabellaria alveolata</i>	Honeycomb worm (mounds)	C	O	

Latin Name	English Name/description	Lower Shore	Mid Shore	Upper Shore
<i>Sabellaria alveolata</i>	Honeycomb worm (tubes)	O		
<i>Littorina littorea</i>	Edible periwinkle		O	
<i>Mytilus edulis</i>	Seed mussel	F	O	
<i>Patella vulgata</i>	Common limpet	C-F	F	
<i>Semibalanus balanoides</i>	Acorn barnacle	F	A	O
<i>Balanus crenatus</i>	Barnacle	C		
<i>Pisidia longicornis</i>	Long clawed crab	R		
<i>Asterias rubens</i>	Common starfish	O		
<i>Flustra foliacea</i>	Horn wrack (bryozoan)	O		
<i>Membranipora membranacea</i>	Sea mat	O		
<i>Osteichthyes sp.</i>	Unidentified fish		O	
<i>Blidingia sp.</i>	Green filamentous algae			F
<i>Cladophora rupestris</i>	Green algae		O	
<i>Ulva intestinalis</i>	Gutweed (<i>Enteromorpha</i>)		C	
<i>Ulva linza</i>	Green algae	O		
<i>Spongomorpha arcta</i>	Green algae	O		
<i>Ascophyllum nodosum</i>	Egg wrack		F	
<i>Fucus serratus</i>	Toothed wrack	F	O	
<i>Fucus spiralis</i>	Spiral wrack			F
<i>Fucus vesiculosus</i>	Bladder wrack		C	
<i>Laminaria digitata</i>	Oar weed	C	O	
<i>Saccharina latissima</i>	Sugar Belt	O		
<i>Ralfsia verrucosa</i>	Red encrusting algae	C		
<i>Ceramium virgatum</i>	Red pool algae	C	C	
<i>Chondrus crispus</i>	Irish moss	C	C	
<i>Corallina officinalis</i>	Coral weed		C	
<i>Delesseria sanguinea</i>	Sea beach	R		
<i>Dilsea carnosa</i>	Red rags	O		
<i>Dumontia contorta</i>	Hollow red algae		C	
<i>Hildenbrandia rubra</i>	Red encrusting species	C	C	
<i>Lithothamnion</i> or <i>Lithophyllum</i> spp	Red encrusted algae	O	C	
<i>Mastocarpus stellatus</i>	Red algae	C		
<i>Membranoptera alata</i>	Red algae	R		
<i>Osmundea pinnatifida</i>	Pepper Dulse		O	
<i>Palmaria palmata</i>	Dulse	C		
<i>Vertebrata lanosa</i>	Red epiphytic algae		C	
<i>Rhodothamniella floridula</i>	Red furry encrusted algae	C		
<i>Verrucaria mucosa</i>	Intertidal Black lichen	O	C-F	

BYERSTEAD FAULT

The Byerstead Fault transect site (Figure 29) has seen vast improvements in its ecological health and biodiversity over the course of the shore surveys, having once been heavily impacted by pollution leaching into the stream which crosses the beach. Improvements in the health of the shore were first seen in 2002, coinciding with reduced activity at the chemical plant situated above the site. This year the stream that crosses the shore seems to have altered course and was seen pouring off the cliffs further north although it still flows through the mid and lower sections of the transect.

The transect begins beneath the vegetated cliffs where boulders from a land slide have now been colonised by a few small splash zone lichens. Beneath these the boulders of the top shore were particularly slippery, being covered in green unicellular algae, *Blidingia* and the filamentous algae *Rhodochorton purpureum*. The next zone down (still on the upper shore) was dominated by spiral wrack, gutweed and occasional egg wrack, with lots of small periwinkles. Barnacles, limpets, and black tar lichen were occasionally found under the fucoid canopy.

The mid shore boulders were dominated by a variety of fucoids, indicating the improved ecological health of the shore. Spiral wrack, toothed wrack, and bladder wrack were all frequently found, and even egg wrack was occasionally found (Figure 30). All these fucoids were found growing over a jumble of rocks with limpet/barnacle communities between them, and an abundance of periwinkles.



Figure 29: The shore around the Byerstead Fault

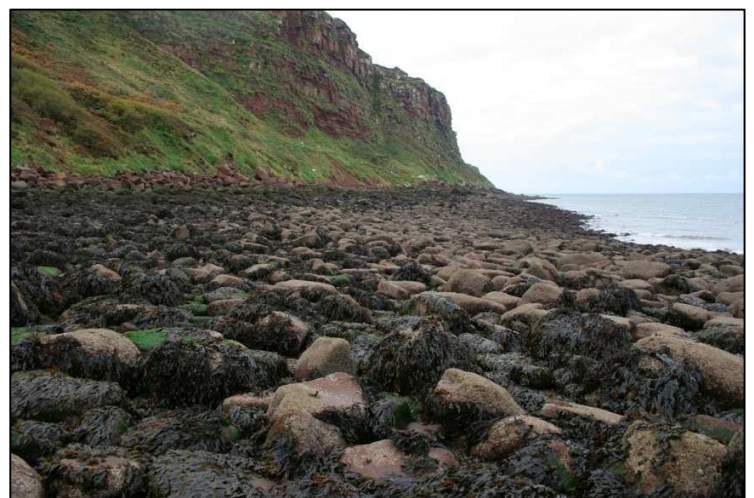


Figure 30: Fucoids in the mid shore

Half way down the mid shore zone the abundance of fucoids declines and the rocks are dominated by barnacle-limpet community (Figure 31) with *Sabellaria*, keel worms and beadlet anemones found under the boulders. Patches of bladder wrack and sea lettuce were also found between boulders. This barnacle limpet community was particularly pronounced around the stream, and continues into the lower shore zone until the mean low water mark. Around the stream there was still a chemical smell.



Figure 31: Barnacle limit zone and lower shore algae zone

In the extreme low water zone the rocks are once more dominated by algae, this time by a dense covering of small red algae, including *Rhodothamniella floridula*, *M. stellatus* and *C. virgatum*, along with some toothed wrack. Barnacles and limpets could be found on the rock surface beneath the seaweed. Keel worms, *Sabellaria*, beadlet anemones were also found between the gaps. The rocks on this shore are particularly anchored down and hard to move, therefore there was not much under boulder community found.

Table 7: Species found at Byerstead Fault, October 2012

Latin Name	English Name/description	Lower Shore	Mid Shore	Upper Shore
<i>Kirchenpaueria pinnata</i>	Hydroid	O		
<i>Actinia equina</i>	Beadlet anemone	O		
<i>Pomatoceros lamarcki</i>	Keel worm	C-F		
<i>Sabellaria alveolata</i>	Honeycomb worm (mounds)	O		
<i>Sabellaria alveolata</i>	Honeycomb worm (crust)	C-F		
<i>Littorina littorea</i>	Edible periwinkle		O	O
<i>Littorina obtusata</i>	Flat periwinkle	O		
<i>Littorina saxatilis</i>	Rough Periwinkle		C	F
<i>Nucella lapillus</i>	Dog whelk	O		
<i>Patella vulgata</i>	Common limpet	O		
<i>Semibalanus balanoides</i>	Acorn barnacle	A	A	
<i>Balanus crenatus</i>	Barnacle	C-F		
<i>Gammaridae sp.</i>	Gammarid		O	
<i>Membranipora membranacea</i>	Sea mat	O		

<i>Blidingia</i> sp.	Green filamentous algae			F
<i>Cladophora rupestris</i>	Green algae	O		
<i>Ulva intestinalis</i>	Gutweed (<i>Enteromorpha</i>)		O	
<i>Ulva linza</i>	Green algae			F
<i>Ulva lactuca</i>	Sea lettuce	O	O	
<i>Chlorophyta</i> sp.	Unidentified unicellular green algae			A
<i>Ascophyllum nodosum</i>	Egg wrack			O
<i>Fucus serratus</i>	Toothed wrack	O	F	
<i>Fucus spiralis</i>	Spiral wrack		F	A-F
<i>Fucus vesiculosus</i>	Bladder wrack		C	
<i>Rhodochorton purpureum</i>	Red filamentous algae			O
<i>Ceramium virgatum</i>	Red pool algae	C		
<i>Chondrus crispus</i>	Irish moss	C		
<i>Hildenbrandia rubra</i>	Red encrusting species			O
<i>Mastocarpus stellatus</i>	Red algae	F		
<i>Rhodothamniella floridula</i>	Red furry encrusted algae	A	O	
<i>Tephromela atra</i> var. <i>Atra</i>	Black shields			O
<i>Verrucaria mucosa</i>	Intertidal Black lichen			O
<i>Verrucaria maura</i>	Black tar lichen			O
<i>Xanthoria parietina</i>	Yellow lichen			R

ST BEES

St Bees shore is one of the most exposed shores of the Cumbrian Coast, located at the foot of the towering cliffs of St Bees head (Figure 32). One of only a handful of true rocky shores on the Cumbrian coast.

This shore has a well defined splash zone of intertidal lichens growing on the cliff face rocks and highest boulders of the top shore which include sea ivory. The rocks of the top shore are also often colonised by patches of bright green gutweed where fresh water runs off from the cliffs as well as green unicellular and filamentous algae from the splash and so much of the top shore is quite silty and slippery.

In the upper shore zone the lea side and gaps between rocks were colonised by spiral and egg wrack. A limpet and barnacle community was found on tops of the rocks and an assortment of pool algae could be seen in the many rock pools present, such as red encrusted algae (*Lithothamnion/Lithophyllum* spp.), maiden's hair, coral weed, as well as the green algae *Stypocaulon scoparium* and *Spongomorpha arcta* (Figure 33).

The barnacle limpet community extends into the mid shore zone, where seed mussels (approximately 4mm in length) had settled amongst the barnacles, as well as the occasional patch of adult mussels towards the lower shore. Bladder wrack and gutweed were common in the gaps between boulders, and the red furry encrusting algae *Rhodochoorton purpureum*, pepper dulse, and egg wrack were found on the leeward side of rocks. The rock pools of this zone had similar algae to the upper shore as well as beadlet anemones. Periwinkles and dog whelks were also found throughout this zone, and there was the occasional stoney patch between rocks where shore crabs were found.

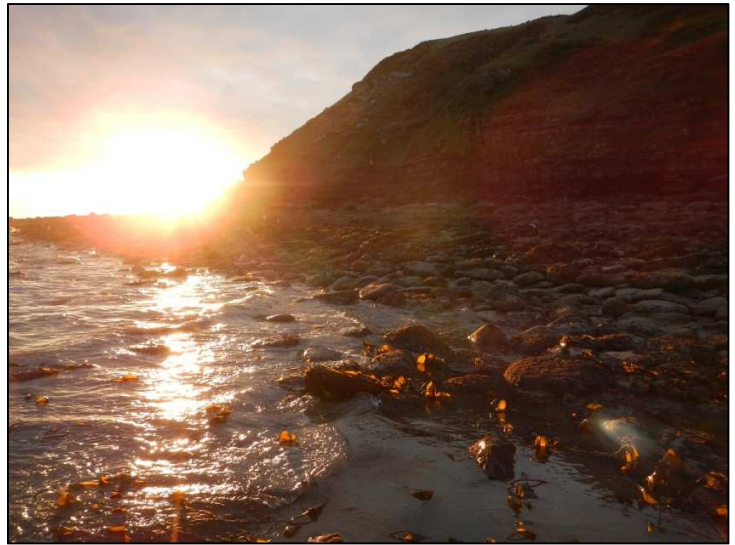


Figure 32: St Bees transect site

Figure 33: Rock pool with pink encrusting and green algae



Entering the lower shore initially there is little change in the species composition, with the exception that the bladder wrack in the gaps between the rocks is replaced by toothed wrack. Adult mussels (40mm long) and green filamentous algae became more abundant further on down the lower shore.

In the extreme lower shore the surfaces of rocks were covered with red algae – Irish moss and *C. virgatum*, which are in turn covered in bryozoans. The kelp bed of oar weed was visible on the day of the visit (Figure 34) under which the surfaces of the rocks were covered in a crust of sand and barnacles as well as red encrusted algae. Dahlia anemones were also found between rocks. Most rocks in the extreme low water zone were too anchored to move, but where they were movable there were edible crabs, broad clawed crabs, long clawed crabs, tiny juvenile starfish, keel worms, and hydroids were found.

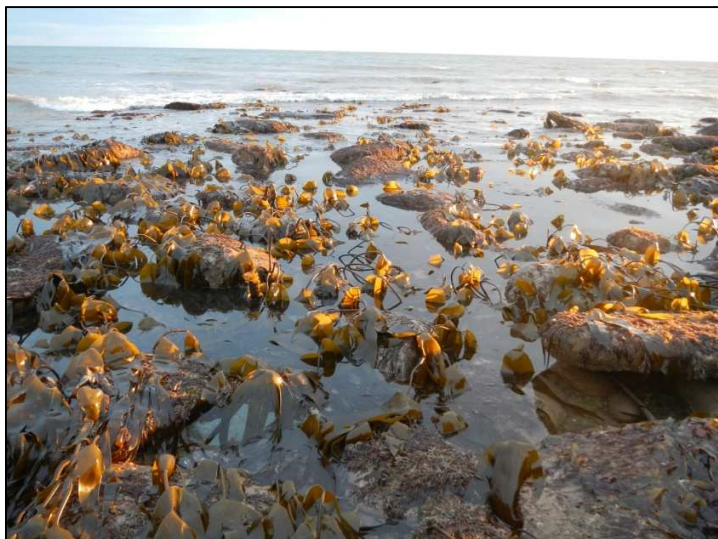


Figure 34: Lower shore kelp zone at St. Bees

Table 8: Species found at St Bees, May 2012

<i>Latin Name</i>	English Name/description	Lower Shore	Mid Shore	Upper Shore
<i>Halichondria panicea</i>	Breadcrumb sponge	O		
<i>Dynamena pumila</i>	Hydroid	O		
<i>Sertularia argentea</i>	Hydroid	O		
<i>Actinia equina</i>	Beadlet anemone	O	O	
<i>Urticina felina</i>	Dahlia anemone	O		
<i>Pomatoceros lamarcki</i>	Keel worm	O		
<i>Lepidochitona cinerea</i>	Chiton		O	
<i>Littorina littorea</i>	Edible periwinkle		C	
<i>Littorina saxatilis</i>	Rough Periwinkle			O
<i>Mytilus edulis</i>	Edible mussel	C	O	
<i>Mytilus edulis</i>	Seed mussel		C	
<i>Nucella lapillus</i>	Dog whelk	O	C	
<i>Patella vulgata</i>	Common limpet	F	F	C
<i>Semibalanus balanoides</i>	Acorn barnacle	F	F-A	O
<i>Balanus crenatus</i>	Barnacle	F		
<i>Cancer pagurus</i>	Edible crab	O		
<i>Carcinus maenas</i>	Shore crab	O	O	

Latin Name	English Name/description	Lower Shore	Mid Shore	Upper Shore
<i>Pisidia longicornis</i>	Long clawed crab	R		
<i>Porcellana platycheles</i>	Broad clawed crab	R		
<i>Decapod sp.</i>	Unidentified tiny shrimps	O		
<i>Asterias rubens</i>	Common starfish	O		
<i>Membranipora membranacea</i>	Sea mat	O		
<i>Electra pilosa</i>	Hairy sea mat	C		
<i>Ulva intestinalis</i>	Gutweed (<i>Enteromorpha</i>)			O
<i>Ulva linza</i>	Green algae		C	
<i>Stypocaulon scoparium</i>	Green algae			O
<i>Spongomorpha arcta</i>	Green algae			O
<i>Chlorophyta sp.</i>	Unidentified filamentous green algae			C
<i>Ascophyllum nodosum</i>	Egg wrack		O	C
<i>Ectocarpus siliculosus</i>	Maiden's hair (brown filamentous algae)			O
<i>Fucus serratus</i>	Toothed wrack	O-C	O	
<i>Fucus spiralis</i>	Spiral wrack		R	O
<i>Fucus vesiculosus</i>	Bladder wrack		C	
<i>Laminaria digitata</i>	Oar weed	F		
<i>Ralfsia verrucosa</i>	Red encrusting algae	O		O
<i>Rhodochorton purpureum</i>	Red filamentous algae			O-C
<i>Catenella caespitosa</i>	Stunted black algae			O
<i>Ceramium virgatum</i>	Red pool algae	F		
<i>Chondrus crispus</i>	Irish moss	F		
<i>Corallina officinalis</i>	Coral weed		O	O
<i>Hildenbrandia rubra</i>	Red encrusting species	O		
<i>Lithothamnion</i> or <i>Lithophyllum</i> spp.	Red encrusted algae	O	O	O
<i>Membranoptera alata</i>	Red algae	R		
<i>Osmundea pinnatifida</i>	Pepper Dulse		O	
<i>Vertebrata lanosa</i>	Red epiphytic algae		O	
<i>Rhodothamniella floridula</i>	Red furry encrusted algae	C		
<i>Tephromela atra</i> var. <i>Atra</i>	Black shields			O
<i>Verrucaria maura</i>	Black tar lichen			O
<i>Verrucaria mucosa</i>	Intertidal Black lichen			O
<i>Ramalina siliquosa</i>	Sea ivory			O
<i>Caloplaca marina</i>	Yellow / orange lichen			O

NETHERTOWN

The Nethertown transect is typical of the southern section of coastline and is one of the most diverse of all the transect sites. This is partly due to the large *Sabellaria* platforms that blanket the beach trapping water in pools (Figure 35) allowing lower shore creatures to extend their range up the shore, and partly to do with the boulder zone in the extreme lower shore which is incredibly diverse. The weather on the day of the 2012 survey was ideal – still and sunny, ensuring excellent visibility into the pools.

Rocks and boulders on the upper shore this year were covered in spiral wrack, hiding beneath which was an abundance of rough periwinkles and edible periwinkles, as well as barnacles (*S. balanoides*), and beadlet anemones. Egg wrack (*Ascophyllum nodosum*), red algae (*Mastocarpus stellatus*) and the intertidal black lichen (*Verrucaria mucosa*) were also abundant on the upper shore. On this shore the *Sabellaria* reef begins on the upper shore, creating huge pools, which themselves were home to *Sabellaria* mounds, and an abundance of small pool seaweeds. This included coral weed, Irish moss, *D. contorta*, *C. virgatum*, and Pepper dulse. Rock prawns (*Palaemon serratus*: Figure 36) were occasionally found in pools in this area, along with hydroids and chitons.

Transition to the mid shore area is only marked by a change from spiral wrack to egg and bladder wrack on the *Sabellaria* platforms. As with the upper shore, mid shore pools were found to be full of an array of seaweeds, with Irish moss, coral weed, pepper dulse, and *D. contorta* and *C. virgatum*. Limpets and barnacles were found on any rocks sticking up from the platform. Further down the mid shore, much of the reef was bright green with the green algae *U. linza*, sea lettuce, and gutweed. Where there was an abundance of green algae growing on the reef, much of the *Sabellaria* was found to be denuded,



Figure 35: *Sabellaria* platforms at Nethertown and water trapped in a *Sabellaria* reef 'rock pool'

Figure 36: Rock Prawn (*Palaemon serratus*) found in pools on the upper and mid shore



although some of it was re-growing. As a result of this gradual disintegration of the platforms in this area there appeared to be more pools this year. Older reefs have been reported as supporting the widest array of species, as the surface becomes more uneven, thus more variety of habitats for other creatures (Dubois *et al.*, 2002). This year there were odd patches of rock found where there was no platform reef. Barnacles, periwinkles, limpets and bladder wrack found on top of the rocks and beadlet anemones, sand shrimps (*Decapod* sp.), chitons (*Lepidochitona cinerea*) and keel worms found underneath them. Towards the lower shore the reef breaks up entirely becoming a collection of mounds interspersed with sand patches and boulders. In this lower shore section of the main barnacles, dog whelks periwinkles and toothed wrack were common, with Irish moss, *C. virgatum*, *Ulva*, *Cladophora rupestris*, *Polysiphonia* spp. and coral weed in any damp pools.

A boulder scar is exposed on this transect on large spring tides, this year this scar was dominated by breadcrumb sponge (Figure 37) and a variety of different seaweeds. Initially the boulders were covered in toothed wrack, with red encrusting algae (*R. purpureum* and *Ralfsia verrucosa*) as well limpets underneath this canopy. Irish moss, *C. virgatum*, periwinkles, the brown seaweed *Cladostephus spongiosus* and hydroids were found in damp crevices, with *B. crenatus* barnacles attached to the rock surfaces. In this area, at the top edge of extreme low water scar, some *Sabellaria* tubes were found settling.

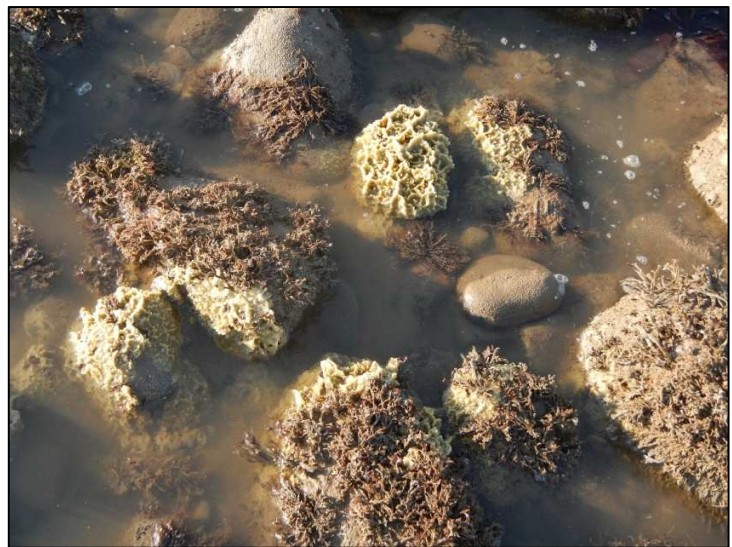


Figure 37: Breadcrumb sponge on the extreme lower shore scar

Further down the extreme low water scar the rocks were very silty. The rocks were covered by the small red algae *C. virgatum* and Irish moss which were covered in bryozoans. Under the algal canopy the rock surface was covered with tiny settling barnacles (*B. crenatus*) and keel worms, along with hydroids *D. pulmina*.

Underneath the rocks a rich under boulder community was found which included beadlet anemones, starfish, the sea mat, *M. membranacea*, saddle oyster (*Monia patelliformis*), long clawed crab, dog whelk eggs, shore crabs, spider crab, brittlestars (*Ophiothrix fragilis*), sea squirts (*Asciidiella aspersa*), and sea spiders (*Nympheri* sp.). A surprising number of the sea slugs *Coryphella gracilis* were recorded this year, these were often found in pairs with egg masses.

Table 9: Species found at Nethertown, May 2012

Latin Name	English Name/Description	Lower Shore	Mid Shore	Upper Shore
<i>Halichondria panicea</i>	Breadcrumb sponge	F		
<i>Dynamena pumila</i>	Hydroid	C		
<i>Abietinaria abietina</i>	Hydroid	O		O
<i>Actinia equina</i>	Beadlet anemone	O	O	O
<i>Urticina felina</i>	Dahlia anemone	O		
<i>Lanice conchilega</i>	Sand mason worm	O		
<i>Pomatoceros lamarcki</i>	Keel worm	C	O	
<i>Sabellaria alveolata</i>	Honeycomb worm (mounds)	A	A	C-F
<i>Sabellaria alveolata</i>	Honeycomb worm (individual tubes)	O		
<i>Lepidochitona cinerea</i>	Chiton		C	O
<i>Littorina littorea</i>	Edible periwinkle	C	F	F
<i>Littorina saxatilis</i>	Rough Periwinkle			F
<i>Monia patelliformis</i>	Saddle oyster	O		
<i>Nucella lapillus</i>	Dog whelk	F	O	
<i>Nucella lapillus</i>	Dog whelk eggs	C	O	
<i>Coryphella gracilis</i>	Seas slug with egg masses	C		
<i>Mollusc sp.</i>	Unidentified mollusc	R		
<i>Patella vulgata</i>	Common limpet	O-F	O	O
<i>Semibalanus balanoides</i>	Acorn barnacle	C-F	F	C
<i>Balanus crenatus</i>	Barnacle	F		
<i>Gammaridae sp.</i>	Gammarid		O	O
<i>Decapod sp.</i>	Unidentified tiny shrimps	C	F	
<i>Palaemon serratus</i>	Rock prawn		C	O
<i>Carcinus maenas</i>	Shore crab	O	O	
<i>Pisidia longicornis</i>	Long clawed crab	O		
<i>Nympheri sp.</i>	Sea spider	O		
<i>Asterias rubens</i>	Common starfish	C	R	
<i>Ophiothrix fragilis</i>	Common brittlestar	O		
<i>Membranipora membranacea</i>	Sea mat	C		
<i>Electra pilosa</i>	Hairy sea mat	O		
<i>Asciidiella aspersa</i>	Large clear sea squirt	R		
<i>Asciidiella scabra</i>	Sea squirt	R		
<i>Osteichthyes sp.</i>	Unidentified fish		R	
<i>Cladophora rupestris</i>	Green algae		O	
<i>Ulva intestinalis</i>	Gutweed (<i>Enteromorpha</i>)		F-A	
<i>Ulva linza</i>	Green algae		F-A	

Latin Name	English Name/Description	Lower Shore	Mid Shore	Upper Shore
<i>Spongomorpha arcta</i>	Green algae	O	C	
<i>Ulva lactuca</i>	Sea lettuce	C	C	
<i>Chlorophyta</i> sp.	Unidentified filamentous green algae		R	
<i>Ascophyllum nodosum</i>	Egg wrack		F	O
<i>Cladostephus spongiosus</i>	Brown ropey seaweed	O		
<i>Fucus serratus</i>	Toothed wrack	O-F	O	
<i>Fucus spiralis</i>	Spiral wrack			A
<i>Fucus vesiculosus</i>	Bladder wrack		F	
<i>Ralfsia verrucosa</i>	Red encrusting algae	O		
<i>Rhodochorton purpureum</i>	Red filamentous red algae			O
<i>Ceramium virgatum</i>	Red pool algae	C-O	F	C
<i>Ceramium</i> sp.	Red algae		O	
<i>Chondrus crispus</i>	Irish moss	C	F	F
<i>Corallina officinalis</i>	Coral weed	C	C	O
<i>Dilsea carnosa</i>	Red rags	C		
<i>Dumontia contorta</i>	Hollow red algae		F	O
<i>Hildenbrandia rubra</i>	Red encrusting species	O		
<i>Lithothamnion</i> or <i>Lithophyllum</i> spp.	Red encrusted algae	O		
<i>Mastocarpus stellatus</i>	Red algae			O
<i>Osmundea pinnatifida</i>	Pepper Dulse		O	O
<i>Vertebrata lanosa</i>	Red epiphytic algae		F	
<i>Polysiphonia</i> spp.	Filamentous red algae	O		
<i>Rhodothamniella floridula</i>	Red furry encrusted algae	O		
<i>Nemalion helminthoides</i>	Sea Noodle	R		
<i>Verrucaria mucosa</i>	Intertidal Black lichen	O		C

SELLAFIELD

The scar ground at the Sellafield transect is limited to the mid shore as a sandy beach is found throughout the lower shore zone. The site is only accessible from the Braystones Caravan Park, several miles to the north of the site.

The transect itself is backed by high dunes and a steep pebbly bank, with the towers of the Sellafield Nuclear Power Plant visible behind (Figure 38). This year the sand patch on the upper shore had extended its range covering the upper parts of the mid shore scar ground. Evidence of this sand inundation was visible in the form of fronds of bladder wrack protruding from the sand, anchored to the rocks beneath

(Figure 39). The mid shore scar ground now starts 50m down the beach. Initially it is covered in bladder wrack, gutweed, barnacles (*B. crenatus*) and periwinkles. Lugworm casts are also visible in the sandy patches between the rocks. Approximately 10m into the scar ground, the *Sabellaria* mounds begin. *Sabellaria* is found particularly high on this shore, which may be due to low numbers of visitors (and therefore lower disturbance) compared to other beaches on the Cumbrian coast.

This year the mounds were round and flat with pebbly gaps between them. In between the mounds where pools of water are retained the usual selection of pool algae was found including Irish moss, *Ulva* species, *S. arcta* and *D. contorta*, alongside beadlet anemones, hydroids, dog whelks, and black tar lichen.



Figure 38 (above): The scar ground of the Sellafield transect.

Figure 39 (below): Bladder wrack protruding from sand, anchored to scar ground beneath



Further down the mid shore scar the *Sabellaria* mounds take on their longitudinal furrow shape characteristic of this site. Here periwinkles and *Sabellaria* were abundant, and further down the shore the occasional mussels and lots of dog whelks were found. Further seaward, but still in the mid shore scar, the *Sabellaria* platforms break up forming rows of mounds, each up to 45cm tall (Figure 40). Here there is brown filamentous algae (*Ectocarpus siliculosus*) and laver covered the platforms. By the seaward edge of the mid shore scar *Sabellaria* occupied only 10% of the scar ground. In this area there were also many bare rocks, most of which appeared to have been recently exposed. Some were covered in tiny seed mussels (*B. crenatus*), keel worms and red encrusting algae.



Figure 40: *Sabellaria* platforms arranged in longitudinal furrows and rows of mounds

This year lugworms were surprisingly rare on the lower shore sand patch.

Table 10: Species found at Sellafeld, May 2012

Latin Name	English Name/description	Lower Shore	Mid Shore	Upper Shore
<i>Actinia equina</i>	Beadlet anemone		O	
<i>Sertularia argentea</i>	Hydroid		R	
<i>Arenicola marina</i>	Lugworm	R	C	
<i>Eulalia viridis</i>	Green leaf worm (egg mass)		O	
<i>Lanice conchilega</i>	Sand mason worm		O	
<i>Pomatoceros lamarcki</i>	Keel worm		O	
<i>Sabellaria alveolata</i>	Honeycomb worm (mounds)		A	
<i>Lepidochitona cinerea</i>	Chiton		R	
<i>Littorina littorea</i>	Edible periwinkle		A-F	
<i>Mytilus edulis</i>	Edible mussel		O	
<i>Mytilus edulis</i>	Seed mussel		O	
<i>Nucella lapillus</i>	Dog whelk		C	
<i>Semibalanus balanoides</i>	Acorn barnacle		C	
<i>Gammaridae</i> sp.	Gammerid		O	

<i>Carcinus maenas</i>	Shore crab		O	
<i>Ulva intestinalis</i>	Gutweed (<i>Enteromorpha</i>)		O	
<i>Ulva linza</i>	Green algae		O	
<i>Spongomorpha arcta</i>	Green algae		O	
<i>Ulva lactuca</i>	Sea lettuce		O	
<i>Ectocarpus siliculosus</i>	Maiden's hair (brown filamentous algae)		O	
<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>	Hollow 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

On the otherwise sandy Drigg coast, Barn Scar is a huge stable scar of boulders which extends out almost a kilometre into the Irish Sea (Figure 41). The topography of this scar is somewhat confusing as the centre of the scar is elevated and characteristic of the mid shore, and this central zone is surrounded by lower shore area as the tide comes in behind the scar. There are also areas of mid shore scar ground on the way down the beach before reaching the scar.



Figure 41: Low water of Barn Scar

The scar is reached by traversing the sandy Drigg beach, hence the upper shore of this transect is sandy. The first areas of scar ground reached are loose pebbly scars which this year were covered with *U. linza*, laver and *E. siliculosus*, barnacles (*B. crenatus*), periwinkles and red encrusting algae (*H. rubra*), with the odd tiny dab (*Limanda limanda*) in damp pools. Further down the mid shore these pebbly scars were dominated by barnacles, periwinkles the red algae *D. contorta* and the occasional *Sabellaria* mounds.

The lower shore zone between the mid shore scar grounds on the way down to the scar and the central elevated mid shore section of Barn scar is made up of many small boulders and pebbles. In this area gaps between rocks were full of the usual pool algae (coral weed, Irish moss, *C. virgatum*) and even kelp (*L. digitata*). The rocks themselves are covered in barnacles with the odd patch of mussels scattered on the tops, and encrusting algae (*R. verrucaria* and *H. rubra*) where the rocks were covered with water. Lots of dog whelks were found in this area. Where water was retained there was an abundance of marine life including keel worms, shrimps (*Gammaridae* sp.), dog whelk eggs, bootlace worms (*Lineus longissimus*), beadlet anemones, limpets, hermit crabs, broad clawed crabs (*Porcellana platycheles*) as well as brittlestars and a grey sea slugs (*Aeolidia papillosa*) (Figure 42).



Figure 42: Grey sea slug, *Aeolidia papillosa*

The central mid shore area of this scar was once a mussel bed, however the numbers of mussels have greatly declined on this scar as they have done on many other Cumbrian shores. This year mussels were restricted to the lower mid shore where adults were found on the tops of rocks and barnacles were the dominant species throughout the centre of the scar (cover shot & Figure 10b in introduction). In this area there were many pools which were found to contain a variety of pool algaees such as *D. contorta*, *S. scoparium*, *S. arcta*, *Irish moss*, and *C. virgatum*. Periwinkles were also abundant, with many heavily netted dog whelks frequently seen.

Moving seaward from the central mid shore area of the scar into the lower shore the rocks this year were dominated by barnacles and an abundance of periwinkles with *Irish moss* and *C. officinalis* in pools. The under boulder community was particularly rich here with many edible crabs, star fish, brittlestars, colonial ascidians, chitons and keel worms found. The extreme low water zone was dominated by algae, mainly serrated wrack and oar weed with an understory of small red seaweeds such as *Irish moss* and *C. virgatum*. Crabs and starfish, brittlestars and other under boulder animals were common under rocks while anemones such as dahlia anemones and the burrowing anemone *Sagartia troglodytes* (Figure 43) were found in gaps between rocks.



Figure 43: Burrowing anemone, *Sagartia troglodytes*

One interesting find this year was hundreds of heart urchin tests washed up on the sandy lower shore of Drigg beach just south of Barn Scar.

Table 11: Species found at Bran Scar, Drigg, May 2012

Latin Name	English Name/description	Lower Shore	Mid Shore	Upper Shore
<i>Halichondria panicea</i>	Breadcrumb sponge	O-R	R	
<i>Dynamena pumila</i>	Hydroid	C		
<i>Kirchenpaueria pinnata</i>	Hydroid		O	
<i>Actinia equina</i>	Beadlet anemone		O	
<i>Sagartia troglodytes</i>	Light pink/nude anemone	R		
<i>Urticina felina</i>	Dahlia anemone	C		
<i>Arenicola marina</i>	Lugworm		F	F
<i>Eulalia viridis</i>	Green leaf worm (egg mass)		O	
<i>Lineus longissimus</i>	Bootlace worm		R	
<i>Lanice conchilega</i>	Sand mason worm		O	
<i>Pomatoceros lamarcki</i>	Keel worm	O-F	O	
<i>Sabellaria alveolata</i>	Honeycomb worm (mounds)	O	O	
<i>Sabellaria alveolata</i>	Honeycomb worm (crust)		O	
<i>Lepidochitona cinerea</i>	Chiton	R		
<i>Littorina littorea</i>	Edible periwinkle	F-A	C-F-A	
<i>Mytilus edulis</i>	Edible mussel	O	R-C	
<i>Nucella lapillus</i>	Dog whelk	C-F	C-F	
<i>Nucella lapillus</i>	Dog whelk eggs	O	C	
<i>Patella vulgata</i>	Common limpet	O	O	
<i>Aeolidia papillosa</i>	Large sea slug	R		
<i>Coryphella gracilis</i>	Seas slug	O		
<i>Semibalanus balanoides</i>	Acorn barnacle		C-F	
<i>Balanus crenatus</i>	Barnacle	F-A	A	
<i>Balanus balanus</i>	Large barnacle	O		
<i>Gammaridae sp.</i>	Gammarid	O	O	
<i>Decapod sp.</i>	Unidentified tiny shrimps		O	
<i>Homarus gammarus</i>	Lobster	R		
<i>Cancer pagurus</i>	Edible crab	O		
<i>Carcinus maenas</i>	Shore crab		O	
<i>Necora puber</i>	Blue velvet swimming crab	O		
<i>Pagurus bernhardus</i>	Hermit crab	O	O	
<i>Pisidia longicornis</i>	Long clawed crab	R		
<i>Porcellana platycheles</i>	Broad clawed crab	O	O	
<i>Asterias rubens</i>	Common starfish	O	O	
<i>Ophiothrix fragilis</i>	Common brittlestar	O	O	
<i>Amphipholis squamata</i>	Brittlestar		R	
<i>Psammechinus miliaris</i>	Green sea urchin	R		
<i>Membranipora membranacea</i>	Sea mat	O-C	O	

Latin Name	English Name/description	Lower Shore	Mid Shore	Upper Shore
<i>Electra pilosa</i>	Hairy sea mat	C		
<i>Flustrellidra hispida</i>	Hairy sea mat	C		
<i>Asciidiella aspersa</i>	Large clear sea squirt	O-R		
<i>Didemnum coriaceum</i>	Colonial ascidian	R		
<i>Limanda limanda</i> (Juv)	Dab		R	
<i>Cladophora rupestris</i>	Green algae		O	
<i>Ulva linza</i>	Green algae		O	
<i>Stypocaulon scoparium</i>	Green algae	O	O	
<i>Spongomorpha arcta</i>	Green algae	O	C	
<i>Ectocarpus siliculosus</i>	Maiden's hair (brown filamentous)		O	
<i>Fucus serratus</i>	Toothed wrack	F-C		
<i>Fucus vesiculosus</i>	Bladder wrack		O	
<i>Halidrys siliquosa</i>	Pod weed	O		
<i>Laminaria digitata</i>	Oar weed	O		
<i>Saccharina latissima</i>	Sugar Belt	O		
<i>Ralfsia verrucosa</i>	Red encrusting algae	O	O	
<i>Ceramium virgatum</i>	Red pool algae	O-A	O	
<i>Chondrus crispus</i>	Irish moss	O-A	C	
<i>Corallina officinalis</i>	Coral weed	O	O	
<i>Delesseria sanguinea</i>	Sea beach	O		
<i>Dilsea carnosa</i>	Red rags	O		
<i>Dumontia contorta</i>	Hollow red algae	O	C	
<i>Hildenbrandia rubra</i>	Red encrusting species	C	O	
<i>Lithothamnion</i> or <i>Lithophyllum</i> spp.	Red encrusted algae	C		
<i>Mastocarpus stellatus</i>	Red algae		O	
<i>Osmundea pinnatifida</i>	Pepper dulse		R	
<i>Porphyra umbilicalis</i>	Laver		O	
<i>Polyides rotundus</i>	Red branching algae	O		

STUB PLACE, TARN POINT

The most southerly of the transect sites, Tarn Point, is typical of the south Cumbrian coast where *Sabellaria* colonies form platforms which bind up the scar ground. As a result of this extensive *Sabellaria* reef water is trapped on the mid and upper shore when the tide is out therefore allowing lower shore organisms to colonise the whole way up the beach (Figure 44).

The upper shore, which is backed by a steep pebble bank, is made up of cobbles and pebbles many of which sit in pools of water. In this zone channel wrack (*Pelvetia canaliculata*) and occasionally spiral wrack were found to colonise the tops of rocks, while small algae including sea lettuce, *S. arcta*, *D. contorta*, Irish moss and black lichen were found in the damp gaps. Periwinkles and rough periwinkles, barnacles (*B. crenatus*), beadlet anemones were also found in pools on this area of shore.

On the mid shore there is a stony mussel bed where small adult mussels were frequent to abundant and small rocks were bound together with byssus threads. Lots of dead shells were also seen amongst the live mussels. The same assortment of barnacles and pool algae which were seen in the mid shore were also recorded in the upper shore pools, but now in greater abundance. The *Sabellaria* reef begins midway down the mid shore in the form of low platforms (Figure 45). It looked as though it has been eroded recently, but it was found to be growing. Initially the platforms were covered in periwinkles and then bladder wrack further down the shore. Within this area *Sabellaria* reef occupied approximately 85% cover of the surface area with the remaining 15% comprising of pools and the odd protruding rock. In the pools Irish moss, *C. virgatum*, and coral weed were all common, as well as lugworms in the sandy patches. Protruding rocks were covered in barnacles (both *B. crenatus*, and *S. balanoides*) and limpets. Underneath the rocks, gammarid shrimp and chitons were seen, with sand mason worms in the gaps between pebbles.

Figure 45: *Sabellaria* platforms in mid shore zone



Figure 44: Damp pebbles on the upper shore at Stub place



Over the past few years this site has suffered a great deal of sand inundation with sand covering the scar ground, where the area of sand around it has grown considerably (Figure 46). As a result there is no hard ground seaward of the large boulder, therefore the remaining section of this transect was relocated 200m north where there is still scar ground present in 2010. In this section the *Sabellaria* reef was found to be broken up into sections with long furrows running perpendicular to the shore. The reef here was covered in bladder wrack. The pools within the furrows of the reef were found to be quite sandy and therefore did not contain much algae. Towards the edge of mid shore, the reef breaks up and the shore is dominated by a jumble of loose cobbles, boulders and *Sabellaria* mounds. Many of the rocks were covered in *B. crenatus* and juvenile toothed wrack, however there were also many bare rocks, seemingly recently exposed.



Figure 46: Sand inundation covering scar ground and *Sabellaria* reef on the mid shore by the big boulder

A sandy patch separates the main scar from the lower shore scar. This year the lower shore scar was found to be made up of small battered looking *Sabellaria* mounds with sand or loose pebbles between them. In this zone dog whelks and serrated wrack, barnacles (*B. crenatus*) were common on rocks with Irish moss, *C. virgatum* and sea lettuce growing on the mounds.

There is then another small sandy strip before the extreme low water area is reached which is made up of silty scar in a lagoon formed by an offshore sand bank. This year this silty scar was initially covered in a *Sabellaria* crust, and as a result of the *Sabellaria* anchoring the rocks down no under boulder community was recorded. At the low water's edge young sugar kelp and *F. serratus* were found, many whose fronds were covered in the bryozoan *Electra pilosa*. Red algae, *Polysiphonia* spp. and *C. virgatum* Breadcrumb sponge, keel worms and encrusting algae (*Lithothamnion* spp.) were also found on the rock surfaces beneath these larger algae.

Table 12 - Species Found at Tarn Point, May 2012

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>Arenicola marina</i>	Lugworm	○	C	

<i>Lanice conchilega</i>	Sand mason worm		O	
<i>Pomatoceros lamarcki</i>	Keel worm	O	O	
<i>Sabellaria alveolata</i>	Honeycomb worm (mounds)	C	A	
<i>Sabellaria alveolata</i>	Honeycomb worm (crust)	A-F		
<i>Lepidochitona cinerea</i>	Chiton		O	
<i>Gibbula cineraria</i>	Grey top shell / Silver Tommy	R	R	
<i>Littorina littorea</i>	Edible periwinkle		F-A	C
<i>Littorina saxatilis</i>	Rough Periwinkle		C	C
<i>Mytilus edulis</i>	Edible mussel		F-A	
<i>Mytilus edulis</i>	Seed mussel		O-R	
<i>Nucella lapillus</i>	Dog whelk	O-F	O	
<i>Patella vulgata</i>	Common limpet	R	O	
<i>Semibalanus balanoides</i>	Acorn barnacle		C	O
<i>Balanus crenatus</i>	Barnacle	O	C-F	
<i>Gammaridae sp.</i>	Gammarid		O	
<i>Membranipora membranacea</i>	Sea mat	R		
<i>Electra pilosa</i>	Hairy sea mat	O		
<i>Spongomorpha arcta</i>	Green algae		C	C
<i>Ulva lactuca</i>	Sea lettuce	O		C
<i>Fucus serratus</i>	Toothed wrack	F		
<i>Fucus spiralis</i>	Spiral wrack			O
<i>Fucus vesiculosus</i>	Bladder wrack		O-F	R
<i>Fucus sp.</i>	Juvenile fucus		C	
<i>Saccharina latissima</i>	Sugar belt	F		
<i>Pelvetia canaliculata</i>	Channel wrack			C
<i>Ceramium virgatum</i>	Red pool algae	C	O	
<i>Chondrus crispus</i>	Irish moss		C	O
<i>Corallina officinalis</i>	Coral weed		C	
<i>Dilsea carnosa</i>	Red rags	R		
<i>Dumontia contorta</i>	Hollow red algae		F	O
<i>Hildenbrandia rubra</i>	Red encrusting species	O	O	
<i>Lithothamnion</i> or <i>Lithophyllum</i> spp.	Red encrusted algae	C		
<i>Mastocarpus stellatus</i>	Red algae			O
<i>Polysiphonia</i> spp.	Filamentous red algae	C		
<i>Polyides rotundus</i>	Red branching algae	R		
<i>Verrucaria maura</i>	Black tar lichen	O		
<i>Verrucaria mucosa</i>	Intertidal Black lichen		C	C

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