

The Ecology of Birkdale Green Beach

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Introduction

The Birkdale Green Beach is linear stretch of recently formed salt-marsh and sand-dune habitat on the foreshore between Weld Road roundabout, Birkdale in the north (SD 321 163) to the Ainsdale Beach Barrier in the south (SD 302 136). Its outstanding ecological interest has been apparent for some years; this report updates one produced three years ago (Smith 2003).

Origin & history

Birkdale Green Beach began to form in 1986 as patches of Common Saltmarsh-grass *Puccinellia maritima* colonising the open shore. It is presumed that the seed source came from the extensive saltings of the Ribble Estuary salt-marshes about 4km to the north-east. Sturgess (1988) suggests that the high nutrient content of the water from the Mersey Estuary could assist growth of microbial populations, including blue-green algae, diatoms and euglenids, which would bind surface sediment particles together, providing a more stable substrate for *Puccinellia* colonisation. The patches of grass soon accumulated silt and blown sand to form low hummocks, the outermost of which grew more rapidly to form a line of embryo dunes about 100m west of the original dune frontage.

This type of feature has developed previously on the Sefton Coast, being recorded in the early 1930s at Ainsdale (Allen 1932, and see below).. However it was later washed away by winter storms. Similarly, at Birkdale from 1974, a 200m-long ridge formed in the same way, isolating a 50m-wide lagoon flooded by a surface water drain. This feature persisted and became known as Tagg's Island (Sturgess 1988).. The Green Beach is much larger, being currently about 3.2km long and up to 200m wide. Its area has grown exponentially from about 2ha in 1989 (Edmondson *et al.* 2001) to 62ha in 2005 (Fig. 1). Growth has taken place westwards by the development of a series of parallel embryo dune ridges, between which are areas of salt-marsh and freshwater marsh, the latter being fed by three surface-water drains. Extensive flooding takes place from autumn to spring but the lagoons usually dry up during the summer.

In spring 2005, the Ainsdale Beach Barrier was moved about 400m south towards Ainsdale to compensate for a similar area of foreshore at Southport treated with herbicide to remove colonising vegetation. Preventing the driving and parking of cars on this area resulted in a spectacular growth of *Puccinellia maritima* and the development of three parallel ridges up to 30cm high within six months. At the time of writing, patches of *P. maritima* are still establishing on the foreshore west of the Green Beach so its growth may continue for some time.

The long-term survival of Tagg's Island and the Green Beach seems to be attributable to accretion of sand and silt on the foreshore which, as a result, has become progressively wider over recent decades. Thus, wave-energy is largely dissipated as the tide floods and is insufficient, even in winter storms, to erode away the *Puccinellia* hummocks and, later, the embryo dunes. Indeed, most tides barely reach the frontal ridge and, although exceptionally high equinoxial spring tides of 10.4m O..D.. in September 2005 flooded the Green Beach to depths of up to 50cm, very little scouring occurred.

Habitats

The westernmost part of the study area consists of sparse, hummocky salt-marsh on the open beach, consisting almost entirely of Common Saltmarsh-grass.. This is backed by a strand-line of washed up tidal debris, partly colonised in summer by salt-tolerant annuals, especially Spear-leaved Orache *Atriplex prostrata*, but also including Sea Rocket *Cakile maritima*, Red Goosefoot *Chenopodium rubrum*, Sea Beet *Beta vulgaris* ssp. *maritima* and Prickly Saltwort *Salsola kali*.. This habitat also extends along the front of the embryo dunes in the section recently protected by the new Beach Barrier. Here may also be found such species as Frosted Orache *Atriplex laciniata*, Grass-leaved Orache *A. littoralis* and Ray's Knotgrass *Polygonum oxyspermum* ssp. *raii*. Very occasionally, the native strand-line plants are accompanied by escapes from cultivation, such as Potato *Solanum tuberosum* and Tomato *Lycopersicon esculentum*.

The outer embryo dune ridge follows, formed, initially, around stems of *Puccinellia maritima* but later colonised by the more effective sand-trappers, Sand Couch *Elytrigia juncea* and Lyme-grass *Elymus arenarius*. Only in a few places is the ridge high enough to support the less salt-tolerant Marram *Ammophila arenaria*. Sand supply to the embryo

ridge has been curtailed by the growth of further vegetation to the west which has intercepted the blowing sand.. As a result, its maximum height is only about 1m in a few places and often much less. However, the embryo dune ridge along the back of the newly protected stretch south of the original Green Beach is beginning to exceed that height and, remarkably, is formed almost entirely by Common Saltmarsh-grass.

East of the embryo dunes along most of the Green Beach, the habitat is a maturing hummocky salt-marsh. When newly formed, this is dominated by coalescing patches of Common Saltmarsh-grass. Later colonists include a wide variety of halophytes, including Sea Aster *Aster tripolium*, English Scurvy-grass *Cochlearia anglica*, Sea Milkwort *Glaux maritima*, Sea Plantain *Plantago maritima*, Sea Arrowgrass *Triglochin maritimum* and Red Fescue *Festuca rubra* ssp. *littoralis*. There are also occasional small patches of Common Cord-grass *Spartina anglica*, while bare mud is variously colonised by Glasswort *Salicornia* spp., Frog Rush *Juncus ambiguus*, Lesser Sea-spurrey *Spergularia marina* and Greater Sea-spurrey *S. media*. The older areas of salt-marsh support Long-bracted Sedge *Carex extensa*, Saltmarsh Rush *Juncus gerardii*, Sea Rush *J. maritima* and Parsley Water-dropwort *Oenanthe lachenalii*, among many others, within a sward of Red Fescue with large patches of Hard-grass *Parapholis strigosa*.

Former embryo-dune ridges behind the salt-marsh have now become semi-fixed dunes colonised by a great diversity of plants which do not tolerate burial in sand. More open areas support ruderals, such as thistles *Cirsium* spp. and Common Ragwort *Senecio jacobaea*. Closed swards are dominated by Red Fescue and other grasses with a range of legumes, such as Kidney-vetch *Anthyllis vulneraria*, Bird's-foot-trefoil *Lotus corniculatus* and various clovers *Trifolium* spp.

Finally, there is a series of seasonally-flooded freshwater lagoons which resemble sand-dune slacks. The older parts of this system, particularly to the north, support large stands of Sea Club-rush *Bolboschoenus maritimus* and Common Reed *Phragmites australis* together with occasional Bulrush *Typha latifolia*, Grey Bulrush *Schoenoplectus tabernaemontani* and much Creeping Bent *Agrostis stolonifera*, while younger areas are much more diverse, being characterised by such species as Strawberry Clover *Trifolium fragiferum*, Knotted Pearlwort *Sagina nodosa*, Lesser Water-parsnip *Berula erecta*,

Jointed Rush *Juncus articulatus*, willowherbs *Epilobium* spp., Marsh Pennywort *Hydrocotyle vulgaris*, Water Mint *Mentha aquatica* and marsh-orchids *Dactylorhiza* spp.

Backing the lagoons, on what seem to be old strand-lines, are rows of Alder *Alnus glutinosa* bushes, now beginning to form a wet-woodland/scrub habitat. Currently, the bushes reach a maximum height of about 1.75m and show signs of wind/salt-spray damage with dye-back of leading shoots. Thus, they may not reach a much higher stature. Other shrub species present on the Green Beach are the introduced Sea Buckthorn *Hippophae rhamnoides* (being rigorously controlled by pulling and spraying) and several willows *Salix*, of which Creeping Willow *S. repens* and Grey Willow *S. cinerea* are the most frequent. However, these mainly consist of isolated small bushes which, as yet, hardly constitute a habitat.

Vegetation classification

A National Vegetation Classification survey in 2002 by Gateley & Michell deduced that the dominant vegetation type in the northern sector of the Green Beach was S21c (Sea Club-rush swamp, Creeping Bent sub-community) while, to the south, this was largely replaced by SM13 (Common Saltmarsh-grass salt-marsh). In the central sector they mapped a strip of S4d (Common Reed swamp, Spear-leaved Orache sub-community), while the embryo dunes were considered to be a mosaic of SD4 (Sand Couch fore-dune) and SD6 (Marram mobile-dune).

Vascular plants

The number of vascular taxa found on the Green Beach has increased progressively from two in 1986 to 246 in 2005 (Fig. 2; Appendix 1). Only 32 (13%) are non-native or introduced native plants, this being a small proportion compared with the 33% aliens for the Sefton Coast sand-dune system as a whole (Smith 2005a).

Thirty-five nationally or regionally notable taxa have been recorded: three Nationally Rare, six Nationally Scarce, one Vulnerable, one Near Threatened (some in more than one category) and 26 Species of Conservation Importance in North West England (SCIs) not included in any other category (Appendix 1) (Hill *et al.* 2004; Regional Biodiversity Steering Group 1999).

The Nationally Rare taxa comprise two extremely rare willow hybrids and the Sharp Club-rush *Schoenoplectus pungens*. The latter was discovered on the Green Beach in 1999 by Dan Wrench, having presumably spread naturally from a translocation site in the nearby Tagg's Island Marsh. This plant, which has its only British locality at Birkdale, covered an area of about 90m² in 2004 (Smith 2005b).

One of the Nationally Scarce taxa is the Baltic Rush *Juncus balticus*, which in England is known only from the Birkdale sand-dunes. Originally found on the Green Beach in 2000 as a single small patch, this species has colonised quite widely and, by 2004, was represented by 12 patches covering an area of 4.3m² (Smith 2006a). Also included in this category are Seaside Centaury *Centaureum littorale*, the coastal form of Early Marsh-orchid *Dactylorhiza incarnata* ssp. *coccinea*, Yellow Glasswort *Salicornia fragilis*, Dune Fescue *Vulpia fasciculata* and the introduced Galingale *Cyperus longus*, which is also listed as Near Threatened.

SCIs that are particularly well represented on the site include Wild Celery *Apium graveolens*, Yellow-wort *Blackstonia perfoliata*, Lesser Centaury *Centaureum pulchellum*, Sea Spurge *Euphorbia paralias*, Frog Rush, Parsley Water-dropwort, Brookweed *Samolus valerandi*, Grey Bulrush, Strawberry Clover and Marsh Arrowgrass *Triglochin palustre*.

Bryophytes

In a 2004 survey, David Holyoak recorded one liverwort and nine species of moss on the Green Beach (Table 1). The mosses include two Nationally Rare taxa, *Bryum dyffrynense* and *B. warneum*, the latter being a UK BAP Priority Species. The population of *B. warneum* here is much larger than all its other British localities combined and was used as the source of material for a reintroduction to Braunton Burrows, north Devon, in 2005.

Mammals

The only mammal recorded for the Green Beach is the Rabbit, whose grazing has a major impact on vegetation, mainly in the northern third. Warrens are in the older dunes east

of the beach and grazing takes place mostly at night. The southern part of the site seems little affected by this species.

Birds

In winter, the Green Beach is of some value to Snipe (18 in 2004) and Jack Snipe (8 in 2004), while up to two Short-eared Owls and two Peregrines have been seen. There is usually a wintering flock of about 100 Linnets, while small flocks of Snow Buntings may also occur infrequently. Spring passage brings Wheatears (up to 27 in 2004), Whinchat (3), White Wagtail (17 in 2005) and Yellow Wagtail (1). Regular breeding species include a few pairs of Mallard, Ringed Plover, Lapwing and Skylark. A Pectoral Sandpiper from North America was recorded in September 2003.

Reptiles

Both Common Lizard and Sand Lizard have been recorded in tide-line timber at the back of the Green Beach. A Sand Lizard was once seen to be taken by a Kestrel.

Amphibians

Several Smooth Newts have been recorded under timber on the Green Beach. Common Toads breed in relatively small numbers in the drain outfalls and lagoonal areas immediately adjacent to these. The Natterjack Toad now has an important breeding population here. In spring 2005 about 140 spawn strings were counted at six localities along the full length of the site, a majority being at the south end, where over 100 males were estimated to be calling at night. Most adults were relatively small; probably only two to three years old. Although there was high mortality of tadpoles due to drought, many toadlets metamorphosed successfully, over 100 well-grown young being counted under timber during the summer.

Invertebrates

The Green Beach seems to be rich in invertebrates but relatively little systematic recording has been carried out. J. M. Newton found 10 species of spiders and harvestmen in 2003 (Table 2). N.A. Robinson has visited twice in July 2004 and August

2005 to record aculeate Hymenoptera. He found five species of bumblebee, six solitary bees, seven solitary wasps and one ant (Table 3). Most notable are the solitary bees *Colletes marginatus* and *Megachile maritimus* (both near their northern limit here), *Andrena nigriceps*, a mostly southern species, and the solitary wasp *Anoplius infuscatus*, which also has a mainly southern distribution. In a study of carabid beetles in 2004, M.P. Wilcox identified nine species, one (*Stenolophus mixtus*) being new to the Sefton Coast (Table 4)..

Orthoptera have been studied by P.H. Smith. Three species of grasshopper (Common Green *Omocestus viridulus*, Field *Chorthippus brunneus* and Mottled *Myrmeleotettix maculatus*) are fairly common, especially along the eastern edge. The Short-winged Conehead *Conocephalus dorsalis* was discovered on the Green Beach in 2005, about 40 individuals being counted over a distance of about 1.75km, mainly in dense Sea Club-rush.. Having a mainly southern and eastern distribution in Britain, this species was also found recently at Marshside and at Warton Marsh on Morecambe Bay. Previously, its nearest known locality was on Anglesey (Smith & Newton, in prep.).

The Green Beach is visited by several of the common butterflies of the sand-dunes, such as Common Blue, Small Copper, Small Skipper, Large Skipper, Small Heath, Meadow Brown, Gatekeeper, Wall Brown, Grayling, Small Tortoiseshell, Peacock, Red Admiral, Painted Lady and Green-veined White. No doubt several of these breed.

Dragonflies recorded on the Green Beach include the Blue-tailed Damselfly *Ischnura elegans*, Emperor Dragonfly *Anax imperator*, Migrant Hawker *Aeshna mixta*, Broad-bodied Chaser *Libellula depressa* and Common Darter *Sympetrum striolatum*. Some of these may breed in the drain outfalls but most are probably just using the site for feeding.

Several other groups, such as flies (Diptera) and bugs (Hemiptera), would no doubt repay study.

Comparison with earlier features

Allen (1932) gives a vivid description of a “sea-beach flora” which developed between Ainsdale and Freshfield in the early 1930s. It was first noticed in September 1930 by W.G. Travis but grew rapidly in 1931 about 10 yards from the base of the frontal dunes. By early May, a strip of vegetation consisting entirely of Common Saltmarsh-grass was

150 yards long and 5 yards wide. A month later, it was 300 yards long and much broader; a second, parallel strip 6 or 7 yards nearer the sea had appeared and seedlings of Sea Plantain were then present. By mid-June 1931, the original strip was 400 yards long and showed “an uprising of regular little hillocks.” These were measured as 4 inches high. Sea Aster was well-established and the second strip was 200 yards long.

During the next two weeks a large number of new colonists was identified (Table 5), consisting both of salt-marsh and freshwater (slack) species and some ruderals, almost all of which are found on the present Green Beach. By then, the hillocks were up to 5 feet in diameter and a third line of *Puccinellia* was appearing 10 yards seaward of the second strip. Over the 1931/32 winter, it was noted that the first and second strips were separated by a “large pool of practically fresh water”, in which various algae could be found.

Clearly, this feature has close similarities with the origin and early development of the current Green Beach, the occurrence of the same mix of plant species, the formation of parallel vegetation strips and the presence of a seasonal “slack” being particularly interesting.

Tagg’s Island began to form in 1974, also as a strip of Common Saltmarsh-grass about 200m long and about 50m west of the frontal dunes at Birkdale. By 1978, embryo dunes were quite well developed and the following year brushwood was used to encourage the accretion of sand. At this time, cars were still driving along the shore inland of the new ridge but the deposition of silt created increasingly muddy conditions and it was decided to close off the route by adding sand and beach cleanings to both ends of the ridge, joining these to the adjacent fore-dunes. Discharge from a surface-water drain flooded the lagoon thus formed and the site soon became a Natterjack Toad breeding pool. Vascular plant lists were compiled in 1981 and 1988 (Sturgess 1988). The first list for the marsh area comprised 38 taxa, including several maritime species, such as Sea Aster, Spear-leaved Orache, Saltmarsh Rush, Reflexed Saltmarsh-grass *Puccinellia distans*, Common Saltmarsh-grass, Glasswort, Sea Club-rush, Common Cord-grass and Sea Arrowgrass. By 1988, the plant community was dominated by Sea Club-rush, Creeping Bent, Common Reed and rushes *Juncus* spp.; the total list had increased to 79 species, Glasswort and Common Cord-grass having disappeared. Sturgess (1988) remarked that

the site had changed from a brackish marsh to more freshwater conditions as the tide had not breached the island since 1983.

A study in 2003 showed that the plant list had declined to 64 taxa (Smith 2006b). Presently, the northern part of Tagg's Island marsh is dominated by a dense bed of Common Reed while the southern end has much Sea Club-rush and a more diverse plant community associated with the fringes of a scrape dug in 1986. These changes resemble those that are currently taking place in the northern and central sectors of the Green Beach, especially the increase with time of Common Reed and Sea Club-rush.

Assessment

The accretion of the Birkdale Green Beach is important in balancing erosion losses from Formby Point (Edmondson *et al.* 2001) and is making an outstanding contribution to the biodiversity of the Sefton Coast. In particular, it provides a significant area of pioneer habitat in a dune system which has suffered from over-maturity in recent decades (Smith 1999). This is reflected in a high species-richness, especially of vascular plants; the 246 taxa recorded represent 23% of the entire sand-dune flora.. It may be surmised that this diversity is, in part, due to the presence of bare/disturbed sites for plant colonisation; about 33% of vascular taxa on the coast is associated with disturbed ground (Smith 2005a). As a locality for the rare moss *Bryum warneum*, the Green Beach is internationally important.

The site has also recently become important for the nationally endangered and specially protected Natterjack Toad, a UK Biodiversity Action Plan Priority Species. The Sefton Coast supports one of the highest populations of this species in the British Isles. Breeding birds include Skylark, which is on the Red List of species of conservation concern in the UK, while Lapwing and Ringed Plover are Amber listed.

The Green Beach lies within the Sefton Coast SSSI and is proposed as an extension to the Ainsdale & Birkdale Sandhills Local Nature Reserve. It is also protected under the EU Birds and Habitats Directives as part of the Sefton Coast Special Protection Area and Special Area of Conservation within the Natura 2000 network.

Conservation

Despite its recent origin, parts of the Green Beach are already beginning to show signs of increasing maturity with dense beds of Sea Club-rush and Common Reed dominating and replacing the more diverse vegetation in the northern and central sectors. This process may be slowed to some extent by Rabbit grazing. Similarly, in recent years, there has been a rapid development of Alder scrub in the central sector, although this could become an important habitat in its own right. A potential problem with invasive Sea Buckthorn is being kept in check by active management but, as yet, no attempt has been made to control the Alder as this is a natural colonist. The continuing westwards growth of the Green Beach should maintain the representation of pioneer communities for at least the foreseeable future. Fore-dune development around Common Saltmarsh-grass, especially in the southern sector, is of inherent scientific interest as it seems not to have been described in the standard texts on dune formation (e.g. Packham & Willis 1997; Ranwell 1972).

In an attempt to retain water for breeding Natterjacks, in spring 2005, sand-dams were erected across the freshwater outflows near the southern end of the Green Beach. This was successful in promoting some successful metamorphosis in an otherwise very dry spring.

N.A. Robinson (pers. comm.) has drawn attention to the importance for invertebrates of the large barks of timber and tree trunks washed up from time to time. As they age and weather, these are increasingly used as nesting and basking sites by solitary bees and wasps, while such debris is also useful as hiding places for Natterjacks and lizards as well as invertebrates.

Although visitor interest in the Green Beach has been encouraged in the north by the development of a way-marked footpath, the Velvet Trail, and the construction of a board-walk, much of the site remains relatively quiet, this being crucial to its continuing importance for breeding birds.

Acknowledgements

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Fig. 1. Changes in the area of Birkdale Green Beach, 1986 to 2005.

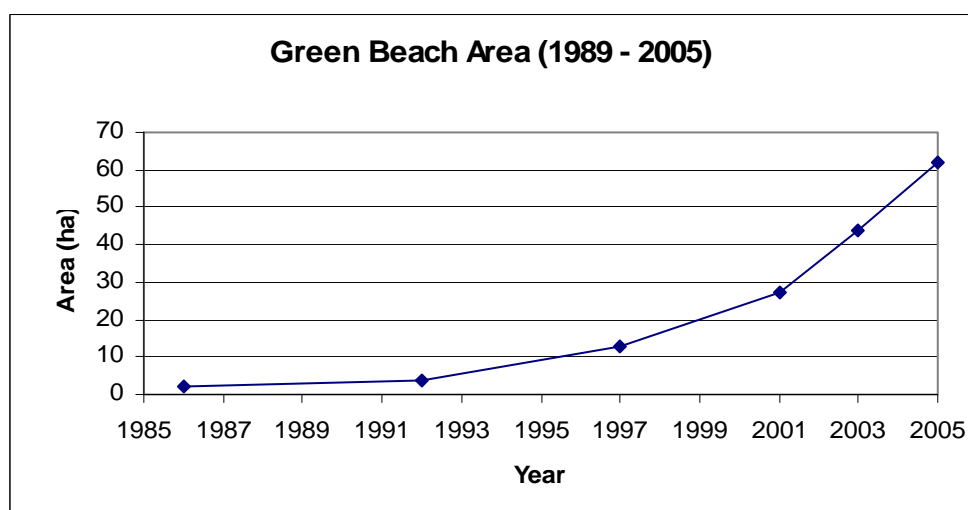


Fig. 2. Changes in the number of vascular plant taxa, 1986 to 2005.

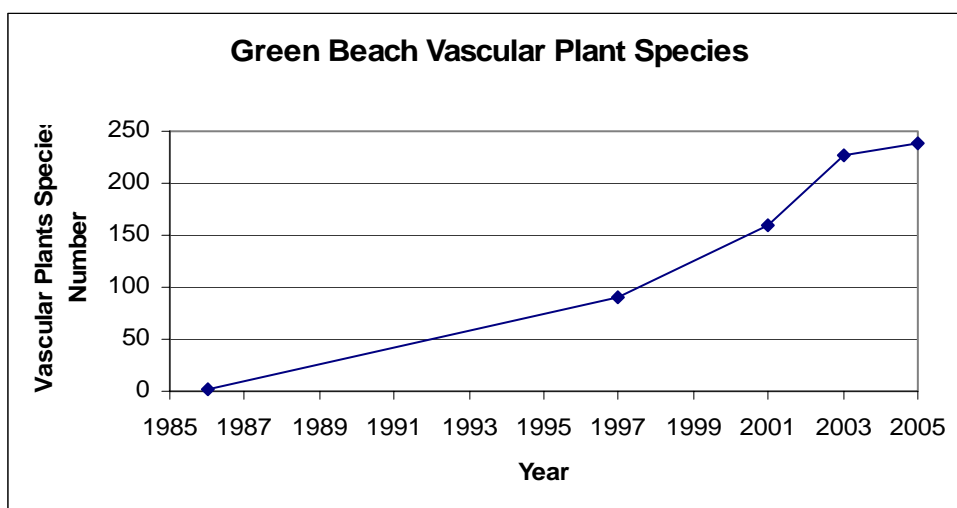


Table. 1. Bryophytes of the Birkdale Green Beach

Taxon	Comments
Liverworts	
<i>Aneura pinguis</i>	
Mosses	
<i>Henidiella heimii</i>	Almost entirely coastal
<i>Didymodon tophaceus</i>	
<i>Funaria hygrometrica</i>	
<i>Ceratodon purpureus</i>	
<i>Bryum trichotomum</i>	Local and scarce but increasing
<i>Bryum gemmiferum</i>	
<i>Bryum dyffrynense</i>	Nationally Rare
<i>Bryum warneum</i>	Nationally Rare; UK BAP Priority
<i>Bryum algovicum</i> var. <i>rutheanum</i>	

Table.. 2. Harvestmen and spiders of Birkdale Green Beach

Harvestmen
<i>Phalangium opilio</i>
Spiders
<i>Erigione atra</i>
<i>Bathyphantes gracilis</i>
<i>Lepthyphantes tenuis</i>
<i>Larinioides cornutus</i>
<i>Pardosa pullata</i>
<i>Trochosa terricola</i>
<i>Arctosa perrita</i>
<i>Pirata paraticus</i>
<i>Heliophanes flavipes</i>

Table 3. Ants, bees and wasps of Birkdale Green Beach

Taxon	Comments
Ants	
<i>Myrmica rubra</i>	Common
Bees	
<i>Bombus lucorum</i>	Common
<i>Bombus terrestris</i>	Common
<i>Bombus pascuorum</i>	Common
<i>Bombus lapidarius</i>	Common
<i>Psithyrus campestris</i>	Common
<i>Hylaeus brevicornis</i>	Local
<i>Colletes fodiens</i>	Common
<i>Colletes marginatus</i>	Notable; near northern limit
<i>Epeolus variegatus</i>	Common
<i>Andrena nigriceps</i>	Notable; mainly southern
<i>Megachile maritimus</i>	At northern limit
Wasps	
<i>Crossocerus wesmaeli</i>	Common in dunes
<i>Ectemius continuus</i>	Common
<i>Diodontus minutus</i>	Common in sandy places
<i>Pemphredon inornata</i>	Common
<i>Pompilius cinereus</i>	Common
<i>Anoplius infuscatus</i>	Mainly southern
<i>Omalus auratus</i>	Widespread but not common

Table 4. Carabid beetles of Birkdale Green Beach

Taxon	Comments
<i>Nebria brevicollis</i>	Common
<i>Notiophilus biguttatus</i>	Frequent
<i>Elaphrus cupreus</i>	
<i>Broscus cephalotes</i>	Coastal
<i>Pterostichus nigrita</i>	
<i>Calathus erratus</i>	
<i>Calathus mollis</i>	
<i>Agonum marginatum</i>	
<i>Stenolophus mixtus</i>	New to Sefton Coast

Table 5. Vascular plants recorded for the Freshfield “sea-beach flora” in 1931/32.

Salt-marsh species	
<i>Aster tripolium</i>	Sea Aster
<i>Atriplex prostrata</i>	Spear-leaved Orache
<i>Bolboschoenus maritimus</i>	Sea Club-rush
<i>Cochlearia anglica</i>	English Scurvy-grass
<i>Glaux maritima</i>	Sea Milkwort
<i>Plantago maritima</i>	Sea Plantain
<i>Puccinellia distans</i>	Reflexed Saltmarsh-grass
<i>Puccinellia maritima</i>	Common Saltmarsh-grass
<i>Rumex crispus</i>	Curled Dock
<i>Salicornia</i> sp..	Glasswort
<i>Suaeda maritima</i>	Annual Sea-blite
<i>Triglochin maritimum</i>	Sea Arrowgrass
Freshwater species	
<i>Agrostis stolonifera</i>	Creeping Bent
<i>Alisma plantago-aquatica</i>	Water-plantain
<i>Alopecurus geniculatus</i>	Marsh Foxtail
<i>Apium nodiflorum</i>	Fool’s Water-cress
<i>Baldellia ranunculoides</i>	Lesser Water-plantain
<i>Callitriche stagnalis</i>	Common Water-starwort
<i>Juncus articulatus</i>	Jointed Rush
<i>Myosotis laxa</i>	Tufted Forget-me-not
<i>Phalaris arundinacea</i>	Reed Canary-grass
<i>Phragmites australis</i>	Common Reed
<i>Ranunculus aquatilis</i>	Common Water-crowfoot
<i>Ranunculus sceleratus</i>	Celery-leaved Buttercup
<i>Ranunculus trichophyllus</i>	Thread-leaved Water-crowfoot
Others	
<i>Juncus bufonius</i>	Toad Rush
<i>Lolium multiflorum</i>	Italian Rye-grass
<i>Lolium perenne</i>	Perennial Rye-grass
<i>Poa annua</i>	Annual Meadow-grass
<i>Potentilla anserina</i>	Silverweed
<i>Rumex obtusifolius</i>	Broad-leaved Dock
<i>Tripleurospermum inodorum</i>	Scentless Mayweed

Appendix 1. A vascular plant list for the Birkdale Green Beach

This list is based on those completed in 2000 and 2003, with additions for 2004 and 2005.

Nr = Nationally Rare; NS = Nationally Scarce; SCI = Species of Conservation

Importance in North West England; VU = Vulnerable; NT = Near Threatened.

* = non-native or introduced native taxon.

Frequency is given using the DAFOR scale. Parentheses indicate taxon only recorded in 2000. Nomenclature follows Stace's *New Flora of the British Isles*.

Taxon	English name	2004	2005	Freq.	Rarity
<i>Aesculus hippocastaneum</i> *	Horse-chestnut			r	
<i>Agrimonia eupatoria</i>	Agrimony			r	
<i>Agrostis capillaris</i>	Common Bent			lf	
<i>Agrostis stolonifera</i>	Creeping Bent			ld	
<i>Aira caryophyllea</i>	Silver Hair-grass			vlf	
<i>Alisma plantago-aquatica</i>	Water Plantain			r	
<i>Alnus glutinosa</i>	Alder			la	
<i>Ammophila arenaria</i>	Marram			vla	
<i>Angelica archangelica</i> *	Garden angelica			lo	
<i>Angelica sylvestris</i>	Wild Angelica			o	
<i>Anthyllis vulneraria</i>	Kidney Vetch			la	
<i>Antirrhinum majus</i> *	Snapdragon			r	
<i>Apium graveolens</i>	Wild Celery			lf	SCI
<i>Apium nodiflorum</i>	Fool's Water-cress			la	
<i>Arctium minus</i>	Lesser Burdock			r	
<i>Arenaria serpyllifolia</i>	Thyme-leaved Sandwort			lo	
<i>Armeria maritima</i>	Thrift			r	
<i>Arrhenatherum elatius</i>	False Oat-grass			lf	
<i>Artemisia vulgaris</i>	Mugwort			r	
<i>Asparagus officinalis</i> *	Garden Asparagus			r	SCI
<i>Aster novi-belgii</i> *	Confused Michaelmas-daisy			r	
<i>Aster tripolium</i>	Sea Aster			f	
<i>Atriplex glabriuscula</i>	Babington's Orache			r	
<i>Atriplex laciniata</i>	Frosted Orache			r	SCI
<i>Atriplex littoralis</i>	Grass-leaved Orache			r	
<i>Atriplex portulacoides</i>	Sea Purslane			r	
<i>Atriplex prostrata</i>	Spear-leaved Orache			lf	
<i>Bellis perennis</i>	Daisy			r	
<i>Berula erecta</i>	Lesser Water-parsnip			la	
<i>Beta vulgaris maritima</i>	Sea Beet			r	
<i>Bidens tripartita</i>	Trifid Bur-marigold			r	
<i>Blackstonia perfoliata</i>	Yellow-wort			o	SCI
<i>Bolboschoenus maritimus</i>	Sea Club-rush			ld	
<i>Brassica napus</i> *	Rape			r	

<i>Cakile maritima</i>	Sea Rocket			o	
<i>Calystegia sepium roseata</i>	Hedge Bindweed			r	
<i>Carex arenaria</i>	Sand Sedge			lf	
<i>Carex distans</i>	Distant Sedge			r	
<i>Carex extensa</i>	Long-bracted Sedge			f	
<i>Carex flacca</i>	Glaucous Sedge			o	
<i>Carex otrubae</i>	False Fox-sedge			o	
<i>Carex ovalis</i>	Oval Sedge	+		r	
<i>Carex pendula</i>	Pendulous Sedge			r	
<i>Carex remota</i>	Remote Sedge			r	
<i>Centaurea nigra</i>	Common Knapweed	+		r	
<i>Centaureum erythraea</i>	Common Centaury			r	
<i>Centaureum x intermedium</i>	Hybrid Centaury			r	
<i>Centaureum littorale</i>	Seaside Centaury			o	NS
<i>Centaureum pulchellum</i>	Lesser Centaury			a	SCI
<i>Cerastium fontanum</i>	Common Mouse-ear			f	
<i>Chamerion angustifolium</i>	Rosebay Willowherb			o	
<i>Chenopodium album</i>	Fat-hen			r	
<i>Chenopodium rubrum</i>	Red Goosefoot			lf	SCI
<i>Cirsium arvense</i>	Creeping Thistle			o	
<i>Cirsium vulgare</i>	Spear Thistle			o	
<i>Cochlearia anglica</i>	English Scurvy-grass			lf	
<i>Conyza canadensis*</i>	Canadian Fleabane			lf	
<i>Crepis capillaris</i>	Smooth Hawk's-beard			o	
<i>Cruciata laevipes</i>	Crosswort			r	
<i>xCupressocyparis leylandii*</i>	Leyland Cypress			r	
<i>Cyperus longus*</i>	Galingale			r	NS NT
<i>Dactylis glomerata</i>	Cock's-foot			r	
<i>Dactylorhiza incarnata coccinea</i>	Early Marsh-orchid			lf	NS
<i>Dactylorhiza praetermissa</i>	Southern Marsh-orchid			lf	
<i>Daucus carota</i>	Wild Carrot			r	
<i>Dipsacus fullonum</i>	Teasel			r	
<i>Eleocharis palustris</i>	Common Spike-rush	+		la	
<i>Eleocharis quinqueflora</i>	Few-flowered Spike-rush			r	SCI
<i>Elytrigia juncea</i>	Sand Couch			la	
<i>Elytrigia x laxa</i>	Hybrid Couch			r	
<i>Elytrigia repens</i>	Common Couch			o	
<i>Epilobium hirsutum</i>	Great Willowherb			o	
<i>Epilobium ciliatum*</i>	American Willowherb			r	
<i>Epilobium montanum</i>	Broad-leaved Willowherb			o	
<i>Epilobium palustre</i>	Marsh Willowherb			lf	
<i>Epilobium parviflorum</i>	Hoary Willowherb			o	
<i>Epilobium tetragonum</i>	Square-stalked Willowherb			r	

<i>Epipactis palustris</i>	Marsh Helleborine			lo	SCI
<i>Erigeron acer</i>	Blue Fleabane			lf	
<i>Eriophorum angustifolium</i>	Common Cottongrass			r	
<i>Erodium cicutarium</i>	Common Stork's-bill			r	
<i>Eryngium maritimum</i>	Sea Holly			lo	SCI
<i>Eupatorium cannabinum</i>	Hemp-agrimony			r	
<i>Euphorbia paralias</i>	Sea Spurge			lf	SCI
<i>Euphorbia portlandica</i>	Portland Spurge			r	SCI
<i>Euphrasia</i> sp..	Eyebright			lf	
<i>Euphrasia tetraquetra</i>	Eyebright		+	o	SCI
<i>Festuca arundinacea</i>	Tall Fescue			o	
<i>Festuca rubra</i>	Red Fescue			la	
<i>Festuca rubra juncea</i>	Red Fescue			r	
<i>Festuca rubra litoralis</i>	Red Fescue			la	
<i>Filipendula ulmaria</i>	Meadow-sweet			r	
<i>Galeopsis tetrahit</i>	Common Hemp-nettle			(r)	
<i>Galium aparine</i>	Cleavers			(vlf)	
<i>Galium palustre</i>	Marsh Bedstraw			r	
<i>Glaucium flavum</i>	Yellow-horned Poppy			(r)	SCI
<i>Glaux maritima</i>	Sea Milkwort			la	
<i>Helianthus annuus</i> *	Sunflower			r	
<i>Hippophae rhamnoides</i> *	Sea Buckthorn			o	
<i>Holcus lanatus</i>	Yorkshire-fog			f	
<i>Honckenya peploides</i>	Sea Sandwort			r	
<i>Hordeum</i> sp..*	Barley			(r)	
<i>Hydrocotyle vulgaris</i>	Marsh Pennywort			la	
<i>Hypochaeris radicata</i>	Cat's-ear			lf	
<i>Impatiens glandulifera</i> *	Indian Balsam			r	
<i>Iris pseudacorus</i>	Yellow Iris			o	
<i>Isolepis setacea</i>	Bristle Club-rush			r	
<i>Juncus ambiguus</i>	Frog Rush			lf	SCI
<i>Juncus articulatus</i>	Jointed Rush			f	
<i>Juncus balticus</i>	Baltic Rush			o	NS
<i>Juncus bufonius</i>	Toad Rush			lf	
<i>Juncus effusus</i>	Soft Rush			r	
<i>Juncus gerardii</i>	Saltmarsh Rush			f	
<i>Juncus inflexus</i>	Hard Rush			r	
<i>Juncus maritimus</i>	Sea Rush			o	SCI
<i>Juncus x surrejanus</i>	Hybrid Rush		+	r	
<i>Juncus tenuis</i> *	Slender Rush			r	
<i>Leontodon autumnalis</i>	Autumn Hawkbit			r	
<i>Leontodon saxatilis</i>	Lesser Hawkbit			o	
<i>Leymus arenarius</i>	Lyme-grass			la	
<i>Linum usitatissimum</i> *	Flax			r	
<i>Lobelia erinus</i> *	Garden Lobelia			(r)	

<i>Lolium perenne</i>	Perennial Rye-grass			o	
<i>Lotus corniculatus</i>	Common Bird's-foot-trefoil			la	
<i>Lotus pedunculatus</i>	Greater Bird's-foot-trefoil			r	
<i>Lychnis coronaria</i> *	Rose Campion			r	
<i>Lychnis flos-cuculi</i>	Ragged-Robin	+		r	
<i>Lycopersicon esculentum</i> *	Tomato			lo	
<i>Lycopus europaeus</i>	Gypsywort			o	
<i>Melilotus altissimus</i> *	Tall Melilot			r	
<i>Melilotus officinalis</i> *	Ribbed Melilot			r	
<i>Mentha aquatica</i>	Water Mint			lf	
<i>Myosotis laxa caespitosa</i>	Tufted Forget-me-not			o	
<i>Odontites vernus</i>	Red Bartsia			o	
<i>Oenanthe crocata</i>	Hemlock Water-dropwort			o	
<i>Oenanthe lachenalii</i>	Parsley Water-dropwort			f	SCI
<i>Oenothera fallax</i> *	Intermediate Evening-primrose			o	
<i>Oenothera glazioviana</i> *	Large-flowered Evening-primrose			r	
<i>Ononis repens</i>	Common Restharrow			r	
<i>Panicum miliaceum</i> *	Common Millet			r	
<i>Parapholis strigosa</i>	Hard-grass			la	
<i>Parnassia palustris</i>	Grass-of-Parnassus	+		vlo	SCI
<i>Pastinaca sativa</i>	Wild Parsnip			r	
<i>Phleum arenarium</i>	Sand Cat's-tail			r	SCI
<i>Phleum pratense</i>	Timothy			r	
<i>Persicaria lapathifolia</i>	Pale Persicaria			r	
<i>Persicaria maculosa</i>	Redshank			r	
<i>Phalaris arundinacea</i>	Reed Canary-grass			r	
<i>Phragmites australis</i>	Common Reed			ld	
<i>Pisum sativum</i> *	Garden Pea			(r)	
<i>Plantago coronopus</i>	Buck's-horn Plantain			o	
<i>Plantago lanceolata</i>	Ribwort Plantain			r	
<i>Plantago major</i>	Greater Plantain			lo	
<i>Plantago maritima</i>	Sea Plantain			o	
<i>Poa annua</i>	Annual Meadow-grass			o	
<i>Polygonum arenastrum</i>	Equal-leaved Knotgrass			r	
<i>Polygonum arviculare</i>	Knotgrass			r	
<i>Polygonum hydropiper</i>	Water-pepper			r	
<i>Polygonum oxyspermum raii</i>	Ray's Knotgrass			r	SCI
<i>Populus sp.</i> *	Poplar			r	
<i>Potentilla anserina</i>	Silverweed			la	
<i>Puccinellia distans</i>	Reflexed Saltmarsh-grass			r	SCI
<i>Puccinellia maritima</i>	Common Saltmarsh-grass			ld	
<i>Pulicaria dysenterica</i>	Common Fleabane			la	

<i>Quercus petraea</i>	Sessile Oak			r	
<i>Ranunculus acris</i>	Meadow Buttercup			r	
<i>Ranunculus flammula</i>	Lesser Spearwort			o	
<i>Ranunculus lingua</i>	Greater Spearwort	+		r	
<i>Ranunculus repens</i>	Creeping Buttercup			o	
<i>Ranunculus sceleratus</i>	Celery-leaved Buttercup			lf	
<i>Raphanus raphanistrum maritimum</i>	Sea Radish			r	SCI
<i>Rhinanthus minor</i>	Yellow-rattle			o	
<i>Rorippa nasturtium-aquaticum</i>	Water-cress			vla	
<i>Rorippa palustris</i>	Marsh Yellow-cress			(r)	
<i>Rorippa sylvestris</i>	Creeping Yellow-cress			r	
<i>Rosa rugosa*</i>	Japanese Rose			r	
<i>Rubus caesius</i>	Dewberry			r	
<i>Rumex conglomeratus</i>	Clustered Dock			r	
<i>Rumex crispus</i>	Curled Dock			r	
<i>Rumex obtusifolius</i>	Broad-leaved Dock			r	
<i>Rumex sanguineus</i>	Wood Dock			r	
<i>Sagina apetala</i>	Annual Pearlwort			o	
<i>Sagina maritima</i>	Sea Pearlwort			o	
<i>Sagina nodosa</i>	Knotted Pearlwort			la	
<i>Sagina procumbens</i>	Procumbent Pearlwort			o	
<i>Salicornia europaea</i>	Common Glasswort			r	
<i>Salicornia dolichostachya</i>	Long-spiked Glasswort			lo	
<i>Salicornia fragilis</i>	Yellow Glasswort			lo	NS
<i>Salicornia ramosissima</i>	Purple Glasswort			lo	
<i>Salix alba</i>	White Willow		+	o	
<i>Salix x angusensis</i>	Hybrid Willow			r	NR
<i>Salix caprea</i>	Goat Willow			r	
<i>Salix cinerea</i>	Grey Willow			f	
<i>Salix x friesiana</i>	Hybrid Willow			r	NR
<i>Salix repens argentea</i>	Creeping Willow			lf	
<i>Salix repens repens</i>	Creeping Willow			r	
<i>Salix x rubens</i>	Hybrid Crack-willow			o	
<i>Salix x sericans</i>	Broad-leaved Osier			r	
<i>Salix x subsericia</i>	Hybrid Willow	+		r	
<i>Salix viminalis</i>	Osier			r	
<i>Salsola kali kali</i>	Prickly Saltwort			lo	SCI VU
<i>Samolus valerandi</i>	Brookweed			la	SCI
<i>Schoenoplectus pungens</i>	Sharp Club-rush			vla	NR
<i>Schoenoplectus tabernaemontani</i>	Grey Bulrush			o	SCI
<i>Scrophularia auriculata</i>	Water Figwort			r	

<i>Sedum acre</i>	Biting Stonecrop			lo	
<i>Senecio jacobaea</i>	Common Ragwort			lf	
<i>Senecio squalidus</i> *	Oxford Ragwort			r	
<i>Senecio vulgaris</i>	Groundsel			lo	
<i>Silene dioica</i>	Red Campion			r	
<i>Silene latifolia</i>	White Campion			r	
<i>Sisymbrium officinale</i>	Hedge Mustard			r	
<i>Sisyrinchium californicum</i> *	Yellow-eyed Grass			r	
<i>Solanum dulcamara</i>	Bittersweet			r	
<i>Solanum nigrum</i>	Black Nightshade			r	
<i>Sonchus arvensis</i>	Perennial Sow-thistle			lf	
<i>Sonchus asper</i>	Prickly Sow-thistle			o	
<i>Sonchus oleraceus</i>	Smooth Sow-thistle			r	
<i>Sparganium erectum</i>	Branched Bur-reed			r	
<i>Spartina anglica</i> *	Common Cord-grass			lo	
<i>Spergularia marina</i>	Lesser Sea-spurrey			lf	
<i>Spergularia media</i>	Great Sea-spurrey			lf	
<i>Stachys palustris</i>	Marsh Woundwort			r	
<i>Stellaria media</i>	Common Chickweed			r	
<i>Suaeda maritima</i>	Annual Sea-blite			lo	
<i>Taraxacum</i> sect. <i>Erythrosperma</i>	Dandelion			r	
<i>Taraxacum</i> sect. <i>Ruderalia</i>	Dandelion			o	
<i>Trifolium dubium</i>	Lesser Trefoil			lo	
<i>Trifolium fragiferum</i>	Strawberry Clover			la	SCI
<i>Trifolium hybridum</i> *	Alsike Clover			la	
<i>Trifolium pratense</i>	Red Clover			o	
<i>Trifolium repens</i>	White Clover			la	
<i>Triglochin maritimum</i>	Sea Arrow-grass			o	
<i>Triglochin palustre</i>	Marsh Arrow-grass			lf	SCI
<i>Tripleurospermum maritimum</i>	Sea Mayweed			o	
<i>Triticum aestivum</i> *	Bread Wheat			r	
<i>Tussilago farfara</i>	Colt's-foot			o	
<i>Typha angustifolia</i>	Lesser Bulrush			vla	
<i>Typha x glauca</i>	Hybrid Bulrush		+	r	
<i>Typha latifolia</i>	Bulrush			lf	
<i>Urtica dioica</i>	Common Nettle			r	
<i>Valeriana officinalis</i>	Common Valerian			r	
<i>Vicia cracca</i>	Tufted Vetch			lf	
<i>Vicia sativa nigra</i>	Common Vetch			r	
<i>Viola tricolor tricolor</i>	Wild Pansy			(r)	
<i>Vulpia fasciculata</i>	Dune Fescue			o	NS

Total taxa = 246; alien = 32 (13%); Total notable = 35 (NR = 3; NS = 6; SCI = 26; VU = 1; NT = 1).