Revisiting *Juncus balticus* Willd. in England

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ABSTRACT

In England, the Baltic Rush is confined to a small area of the Birkdale Sandhills on the Sefton Coast, Merseyside. Since 1982, several sites in the north of its range here have been lost but the plant has spread southwards and now occupies a 34% larger area than previously. Likely reasons for these changes are examined. Associated vascular taxa and phyto-sociological affinities are described. Updated information is given on the two *Juncus balticus* hybrids that occur in Merseyside and Lancashire, while the conservation of these plants is discussed.

KEYWORDS: Baltic Rush, hybrids, monitoring, conservation, England.

INTRODUCTION

Baltic Rush *Juncus balticus* Willd. is a nationally scarce plant of sand-dune slacks and other damp areas in maritime sand, mud or peat. In Britain, it is largely confined to the north and north-eastern coasts of Scotland and the Hebrides. Preston *et al.* (2002) record its post-1986 presence as a native plant in 53 hectads, though they remark that it is probably still present in many of the Scottish sites which have no post-1986 records.

In England, the plant is confined to a small area of the Birkdale Sandhills on the Sefton Coast, Merseyside, in v.c. 59 (South Lancashire), where it was discovered in 1913. Its history, distribution and ecology here were studied by Smith (1984). In 1981/82 he recorded *J. balticus* at 10 sites in the dunes, counting 71 patches of the rush with a total area of 137·7 m^2. Most of the sites were wet-slacks, lying east and west of the coastal road at the northern end of Birkdale Sandhills Local Nature Reserve (Fig. 1). Three of the slacks were considered to have originated before World War II but the others were of more recent origin, five having been formed by wind erosion during the 1970s, and therefore only recently colonised by the rush. The availability of this new habitat seemed to account for the improvement in fortunes of the Sefton Coast population as, in 1969/70, Stace (1972) had found only three extant colonies. He predicted the plant's extinction here "in the fairly near future" (Stace 1970).

Two Baltic Rush hybrids, *Juncus balticus* × *J. inflexus* and *J. balticus* × *J. effusus* (= *J.* ×*obotritorum*) also occur in the sand-dunes of Merseyside and Lancashire, the former being endemic to the region (Stace 1972). Both hybrids have been found three times in a wild state as infertile clones but, by 1982, only the three *inflexus* hybrid clones were still extant, the *effusus* hybrid having become extinct in the wild. However, several of the clones were in cultivation at botanical gardens and had been translocated to various slacks in the Sefton Coast sand-dunes, where most had survived (Smith 1984).

Over 20 years on, therefore, it was felt appropriate to revisit the sites for Baltic Rush and its hybrids in England, with the aim of monitoring any changes in their distribution and status. It was hoped that such a study would also have relevance to the North Merseyside Biodiversity Action Plan (Merseyside Biodiversity Group 2001), which includes both *J. balticus* and the hybrids.

METHODS

During the summer of 2003, the whole of the known and potential range of *J. balticus* on the Sefton Coast was the subject of a detailed search. This field work was conducted as part of a separate study to record the vascular plants of the Birkdale frontal slacks and the adjacent Green Beach, the latter comprising about 44 ha of sand-dune, dune-slack and salt-marsh habitat which has formed by accretion on the foreshore since 1986. As a result, several new sites for the rush were found.

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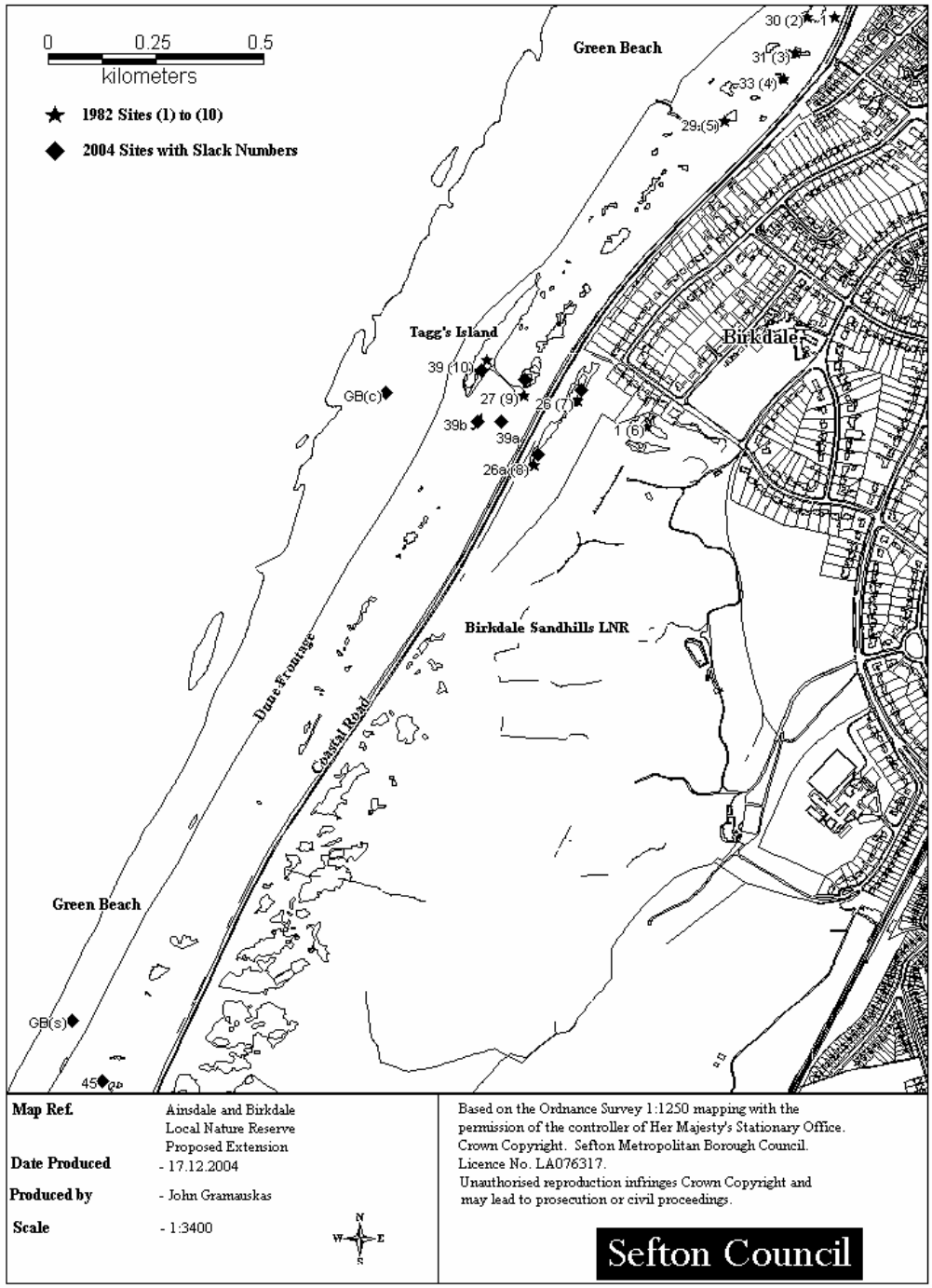

FIGURE 1. Map of Ainsdale and Birkdale Local Nature Reserve. Sites of *Juncus balticus* 1982(★), 2004 (◆).

Also, in that summer, all known wild clones and transplant sites for the hybrids on the Sefton Coast were examined. The locations of patches were determined using a GPS and areas of patches and average heights of shoots were measured. Using, the criteria of Ranwell (1972), the sites were classed as semi-aquatic, wet or dry-slacks. Notes were taken on habitat condition and the need, if any, for conservation management. Information on the Lytham-St Annes (v.c. 60, West Lancashire) clone of the *inflexus* hybrid was obtained from the former LNR warden, Maurice Jones (*in litt.*).

The following summer, 2004, all the Baltic Rush sites found the previous year, together with those east of the coastal road, were visited. The number and areas of patches were recorded using the same methods as Smith (1984). Patch locations were determined using a GPS. In addition, twenty-five 2 × 2 m quadrats were recorded, using N.V.C. methodology (Rodwell 1992), for all large patches at every site. These data were analysed using a TABLEFIT programme and compared with ten samples taken in 1981/82. A list of vascular plant associates with *J. balticus* was drawn up and notes were made in the field on habitat condition and conservation status.

RESULTS

BALTIC RUSH

Eighty-six patches of *J. balticus* were located in ten sites with a total area of 185·0 m^2, an increase of 34% since 1982 (Table 1). By far the most important site for the rush is now slack 27 (site 9 in Smith 1984), where the number of patches has increased from one to 44 and the area covered from 0·7 to 134·6 m^2. Also significant is Tagg's Island marsh (site 10) with an increase from one (0·3 m^2) to 13 patches (20·6 m^2).

However, the distribution of *J. balticus* at Birkdale has changed markedly. It has disappeared from six northern slacks, including the Royal Birkdale Golf Course, but has consolidated and extended its southern range, colonising three new slacks and also the recently formed Green Beach where 12 small patches were found, the first being located in 2000. The southernmost locality (slack 45) is now about 2 km south of that in 1982 (Fig. 1).

There has been a major decline in the old slacks (nos. 26 and 26a) east of the coastal road, where the area occupied by the rush has fallen from 61·5 to 3·5 m^2.

TABLE 1. *JUNCUS BALTICUS* DISTRIBUTION AT BIRKDALE IN 1981/2 AND 2004

Site	Slack no.	1981/82		2004	
		No. patches	Area (m^2)	No. patches	Area (m^2)
1	-	1	0·8	-	-
2	30	1	4·0	-	-
3	31	17	59·7	-	-
4	33	32	4·9	-	-
5	29	1	0·3	-	-
6	RBGC	2	5·5	-	-
7	26	13	60·7	7	3·5
8	26a	2	0·8	2	0·0
9	27	1	0·7	44	134·6
10	Tagg's Is.	1	0·3	13	20·6
-	39a	-	-	3	5·0
-	39b	-	-	4	15·1
-	GB (C)	-	-	10	3·2
-	GB (S)	-	-	2	1·1
-	45	-	-	1	1·9
	Totals	71	137·7	86	185·0

RBGC = Royal Birkdale Golf Course.
GB (C) = Green Beach (central); GB (S) = Green Beach (south).

Associates of *J. balticus* totalled 80 vascular taxa in 2004, compared with 60 in 1981/2. They are all typical wet-slack plants of the Sefton Coast dune system and only two, *Aster novi-belgii* and *Hippophae rhamnoides*, are non-native to the region (Table 2).

The most frequent associates are *Agrostis stolonifera* (23 out of 25 samples), *Holcus lanatus* (19), *Festuca rubra* (17), *Salix repens* (16), *Carex arenaria* (14), *Mentha aquatica* (13) and *Hydrocotyle vulgaris* (11). Of these, *Agrostis stolonifera*, *Festuca rubra* and *Salix repens* were among the commonest associates in 1982, but others included *Carex flacca*, *Dactylorhiza incarnata*, *Eleocharis quinqueflora*, *Equisetum palustre*, *Juncus articulatus*, *Lotus corniculatus*, *Trifolium fragiferum* and *T. pratense* (Smith 1984). The latter species were also listed in 2004 (Table 2).

Phytosociological affinities of *J. balticus* at Birkdale are summarised in Table 3. Unfortunately, of 25 samples taken, 16 were poor or very poor fits to known N.V.C. dune-slack, swamp, salt-marsh or grassland communities. The best results were obtained in the old slack 26, east of the coastal road. Here, good and very good agreements were found

TABLE 2. VASCULAR ASSOCIATES OF *JUNCUS BALTICUS* IN 2004 AND 1982

Taxon	2004	1982	Taxon	2004	1982
Agrostis stolonifera	+	+	*Lathyrus pratensis*	+	+
Alnus glutinosa	+		*Leontodon autumnalis*	+	+
Angelica sylvestris	+		*Leontodon saxatile*	+	+
Apium nodiflorum		+	*Linum catharticum*	+	
Arrhenatherum elatius	+		*Lolium perenne*	+	+
*Aster novi-belgii**	+		*Lotus corniculatus*	+	+
Aster tripolium	+	+	*Lycopus europaeus*	+	
Bellis perennis		+	*Mentha aquatica*	+	+
Blackstonia perfoliata	+		*Myosotis laxa*	+	+
Blysmus compressus	+	+	*Odontites vernus*	+	
Bolboschoenus maritimus	+	+	*Oenanthe crocata*	+	
Calystegia sepium	+		*Ononis repens*	+	
Cardamine pratensis	+		*Ophrys apifera*	+	
Carex arenaria	+	+	*Parapholis strigosa*	+	
Carex extensa	+		*Parnassia palustris*		+
Carex flacca	+	+	*Pastinaca sativa*		+
Carex nigra	+		*Persicaria amphibia*		+
Carex otrubae	+		*Phragmites australis*	+	
Carex viridula viridula	+	+	*Plantago coronopus*	+	
Carlina vulgaris		+	*Plantago lanceolata*	+	+
Centaurium erythraea	+		*Plantago major*	+	+
Centaurium pulchellum	+		*Plantago maritima*	+	
Cerastium fontanum		+	*Poa pratensis*		+
Cirsium arvense	+	+	*Potentilla anserina*		+
Crepis capillaris	+		*Prunella vulgaris*		+
Dactylis glomerata	+		*Pulicaria dysenterica*	+	+
Dactylorhiza incarnata	+	+	*Pyrola rotundifolia*		+
Eleocharis palustris	+		*Ranunculus acris*		+
Eleocharis quinqueflora		+	*Ranunculus flammula*	+	
Elytrigia juncea	+		*Ranunculus repens*	+	
Elytrigia repens	+		*Rhinanthus minor*	+	+
Epilobium palustre	+		*Rosa* sp.	+	
Epilobium parviflorum	+		*Rubus caesius*	+	+
Epipactis palustris	+	+	*Rumex crispus*	+	+
Equisetum arvense	+	+	*Sagina apetala*	+	
Equisetum palustre	+	+	*Sagina nodosa*	+	+
Equisetum variegatum		+	*Salix cinerea oleifolia*	+	+
Equisetum ×litorale	+		*Salix repens*	+	+
Euphrasia nemorosa	+	+	*Salix ×friesiana*		+
Festuca rubra	+	+	*Samolus valerandi*	+	
Filipendula ulmaria	+		*Senecio jacobaea*	+	+
Galium palustre	+	+	*Sonchus arvensis*	+	
Glaux maritima	+	+	*Taraxacum officinale* agg.		+
Hieracium umbellatum	+		*Trifolium fragiferum*	+	+
*Hippophae rhamnoides**	+		*Trifolium pratense*	+	+
Holcus lanatus	+	+	*Trifolium repens*	+	+
Hydrocotyle vulgaris	+	+	*Triglochin maritimum*		+
Hypochaeris radicata		+	*Triglochin palustris*		+
Iris pseudacorus	+		*Tripleurospermum maritimum*	+	+
Juncus articulatus	+	+	*Tussilago farfara*	+	
Juncus bufonius		+	* = non-native taxon		

TABLE 3. N.V.C. ANALYSIS OF *JUNCUS BALTICUS* 2004 SAMPLES

Site	Sample No.	N.V.C. Community/ sub-community	% fit	Assessment of fit
Slack 26	1	SD15	78	Good
	2	SD15	81	Very good
	3	SD16b	45	Very poor
Slack 27	1	MG11	49	Very poor
	2	S19c	44	Very poor
	3	SD15	57	Poor
	4	SD15	60	Fair
	5	SD14a	64	Fair
	6	SD14a	64	Fair
	7	SD15	52	Poor
	8	SD15	69	Fair
Tagg's Is.	1	SD15	34	Very poor
	2	MG11	55	Poor
	3	SD15	65	Fair
	4	SD15	75	Good
	5	SD15	60	Fair
	6	SD15d	44	Very poor
Slack 39a		MG11	55	Poor
Slack 39b		MG11	54	Poor
Green Beach (central)	1	MG12	51	Poor
	2	SM16e	38	Very poor
	3	MG11	41	Very poor
	4	SM16d	48	Very poor
Green Beach (south)		SM13b	13	Very poor
Slack 45		SD16b	46	Very poor

TABLE 4. N.V.C. ANALYSIS OF 1981/82 *JUNCUS BALTICUS* SAMPLES

Sample (Slack)	N.V.C. Community/ sub-community	% fit	Assessment of fit
1	SD8a	46	Very poor
2 (Slack 30)	SM16d	58	Poor
3 (Slack 31)	SD16d	61	Fair
4 (Slack 33)	SD16d	41	Very poor
5 (Slack 29)	SD16d	35	Very poor
6 (Golf Course)	SD17	58	Poor
7 (Slack 26)	MC9	59	Poor
	or SD16d	58	Poor
8 (Slack 26a)	SD14d	41	Very poor
	or SD16d	40	Very poor
	or SD14c	40	Very poor
9 (Slack 27)	SD16d	28	Very poor
10 (Tagg's Is.)	OV19d	43	Very poor

with the SD15 *Salix repens – Calliergon cuspidatum* dune-slack, a community that is characteristic of old slacks kept wet by prolonged flooding with circumneutral ground waters (Rodwell 2000).

Four of the eight samples taken in slack 27 were fair fits to SD14a or SD15 dune-slack communities. According to Rodwell (2000), SD14 (*Salix repens – Campylium stellatum* dune-slack) is a scarce vegetation type found in slacks of young to moderate age where the ground water is quite base-rich." Four samples in drier sites came closest to the MG11 *Festuca rubra – Agrostis stolonifera – Potentilla anserina* grassland, though, again, fits were poor to very poor. This community is characteristic of a wide variety of moist but free-draining circumneutral soils which are, in many cases, frequently inundated with fresh or brackish surface water (Rodwell 1992)." The youngest habitats colonised by *J. balticus* are Tagg's Island marsh and the Green Beach. Table 3 shows that poor or very poor fits to N.V.C. communities were generally obtained, the exception being three samples at Tagg's Island where fair to good agreement with SD15 was achieved. Of the five Green Beach samples, three were attributed to salt-marsh communities.

Analysis of ten samples taken in 1981/92 (Table 4) also shows, in most cases, poor or very poor accordance with N.V.C. communities. A majority of samples is closest to the SD16d, *Salix repens – Holcus lanatus* dune-slack, *Agrostis stolonifera* sub-community. Rodwell (2000) indicates that this is a widespread and common slack vegetation, characteristic of older and drier slacks that are rarely flooded to any great extent, though the *A. stolonifera* sub-community represents the wetter end of the spectrum."

BALTIC RUSH HYBRIDS

Smith (1984) summarised information on the naturally occurring hybrids of *J. balticus* in England up to 1982. Since then, one clone of the *inflexus* hybrid, that at Ainsdale Sand Dunes NNR, has been lost to sand-blow in the late 1980s. Fortunately, it had been taken into cultivation. The two other clones still exist; the one at Birkdale Sandhills (slack 18) has prospered, having increased in area by 450%, from about 450 to 2475 m^2 (Table 5). This clone is particularly vigorous, and has spread up the sides of the slack onto adjacent fixed dunes. The Lytham-St Annes clone is also

TABLE 5. SUMMARY OF INFORMATION ON *JUNCUS BALTICUS* HYBRIDS

JUNCUS BALTICUS × *J. INFLEXUS*

Site & Grid Ref. (SD)	Habitat	Origin of material	Date of transplant	Patch area 1982	Patch area 2003	Av. Ht of stems	Fate in 2003
Ainsdale NNR Large Pond 303112	Semi-aquatic	Birkdale	1976	2	13	-	Extant
Ainsdale NNR Slack 15 286105	Wet-slack	Birkdale	1968	14	14	90	Extant
Ainsdale NNR Slack 13a 286102	Semi-aquatic	Ainsdale	1992	-	7·5	120	Extant
Ainsdale NNR Slack 13c	Semi-aquatic	Ainsdale	1992	-	11·6	140	Extant
Ainsdale LNR Slack 166 294120	Semi-aquatic	Unknown	1992	-	31·5	100	Extant
Birkdale LNR Slack 19 305139	Semi-aquatic	Birkdale	1992	-	-	-	Not found
Birkdale LNR Slack 18 305139	Wet-slack	natural	Pre-1951	450	2475	170	Extant
St Annes LNR 312303	Wet-slack	natural	1966	138	221	115	Extant

JUNCUS BALTICUS × *J. EFFUSUS*

Site & Grid Ref. (SD)	Habitat	Origin of material	Date of transplant	Patch area 1982	Patch area 2003	Av. Ht of stems	Fate in 2003
Ainsdale NNR Slack 15 278106	Wet-slack	Ainsdale	1968	37	60	80	Extant
Ainsdale NNR Slack 13a 286102	Semi-aquatic	Ainsdale	1992	-	-	-	Not found
Ainsdale NNR Slack 56 291113	Semi-aquatic	Ainsdale	1978	0·1	99	80	Extant
Ainsdale NNR Slack 118 286107	Dry-slack	Ainsdale	1968	21	-	-	Not found
Altcar Rifle”Range Slack 8 286050	Wet-slack	Hightown	1977	3	5	75	Extant
Hightown dunes Scrape 1 296022	Semi-aquatic	Hightown	1992	-	9	55	Extant

doing well; its area has gone up from 138 to 221 m^2, representing a 60% increase since 1982 (M. Jones *in litt.*).

By 1982, the Birkdale clone of the *inflexus* hybrid had been transplanted to four sites in the Ainsdale NNR and was still extant at two of these (the Large Pond and slack 15) (Smith 1984). However, in 1992, translocations from both Sefton Coast clones were made to Ainsdale NNR (two sites) and to Birkdale Sandhills LNR (one site), using material grown by Prof. C. A. Stace (Simpson 1992). The Birkdale transplant could not be found in 2003 but the other five are still present (Table 5), representing both the Ainsdale and Birkdale clones. In addition, a transplanted patch of undoubted *J. balticus* × *J. inflexus* was found in Ainsdale Sandhills LNR (slack 166). This had been incorrectly recorded as the *effusus* hybrid by Simpson (1992). Unfortunately, the origin of this material cannot now be established with certainty but it is likely to be from the Ainsdale clone, as Simpson did not relocate Birkdale material to Ainsdale NNR.

Table 5 shows that all but one of the transplanted *inflexus* hybrids have grown considerably. The exception is that in Ainsdale NNR slack 15, which occupies the same area as it did in 1982. Five sites were categorised as semi-aquatic and three as wet-slacks; the single lost clone (at Birkdale) was in semi-aquatic habitat.

Since the earlier study, despite extensive searches, no new clones of the *effusus* hybrid, *Juncus* ×*obotritorum* have been found on the Sefton Coast. Smith (1984) reported that, up to 1978, six attempts had been made to translocate this hybrid and four were still extant in 1982. Using material from Prof. Stace, Simpson (1992) organised two further transplants to Hightown and to Ainsdale (slack 13a). The latter seems to have failed, as there was no sign of it in 2003. However, all the others have done well, especially the 1978 transplant to Ainsdale NNR (slack 56) which has increased from 0·1 to 99 m^2 in 21 years (Table 5). Both the 1933 Ainsdale clone and the 1973 Hightown clone are represented in these translocations, the only one entirely lost being the 1966 clone found in a Hightown dune-slack by V. Gordon (Smith 1984).

Table 5 shows that three samples of *J.* ×*obotritorum* have been transplanted to semi-aquatic habitat, two to wet-slack and one to dry-slack. Losses have occurred from semi-aquatic (one) and dry-slack (one).

The mean height of stems of the *inflexus* hybrid was 122·5 cm, that of the less robust *effusus* hybrid being only 72·5 cm (Table 5). The data collected were insufficient to distinguish between the stem heights of the different clones.

DISCUSSION

This study has shown that *Juncus balticus* is still well established at Birkdale in its only English locality and occupies an encouragingly larger area than it did in 1982. However, it has seriously declined in the northern and eastern part of its range here. The reasons for this are not hard to find. First, Smith (1984) concluded that the plant is a good coloniser of young, sparsely vegetated wet-slacks and may then persist for many years, before declining as the habitat becomes drier and more heavily vegetated. Slacks 26 and 26a, east of the coastal road, originated about 1884 (Smith 1984) so it is not surprising that the Baltic Rush is now much reduced in quantity here. Similarly, the golf-course site now supports a dense sward of waist-high *Bolboschoenus maritimus* and *Carex acutiformis*, which is clearly unsuitable for *J. balticus* (personal observations).

The northern slacks, which are of more recent origin, have suffered badly from scrub invasion over the last 20 years. Observations in the early/mid-1980s showed that, although there were few large clumps, *Hippophae rhamnoides* was well-established and spreading. It soon dominated these slacks. Unfortunately, it was not until the mid-1990s that the site managers were able to secure funding to control the plant. The northernmost slacks in the Birkdale frontal dunes were not cleared until 2002/03, by which time only small areas of slack vegetation survived. Also, it was noted in the mid-1990s that the remaining patches of *J. balticus* in these slacks were being heavily grazed by Rabbits (personal observations).

D. E. Allen (*in litt.*) knew of another population in the 1950s. It was "In a remote slack roughly midway between Ainsdale Beach and Hillside Station". The exact locality cannot be traced but the general area has been searched many times without success. The plant seems unlikely to have survived, because the slacks here are now very mature and much colonised by scrub.

Fortunately, suitable young slack habitat in the south of its range has allowed the Baltic

Rush to spread to new sites. Currently, the largest area of the rush is in slack 27. Photographs taken in 1984 show that the floor of this slack was almost completely churned up by illegal motorcycle scrambling (personal observations). Smith (1984) commented on the apparent resistance of the rush to mechanical damage and the fact that it had spread, under similar circumstances, in site 4 (slack 33). This seems to be a satisfactory explanation for the plant's present abundance in slack 27.

Tagg's Island marsh began to form in 1978, while the Green Beach dates back only to 1986, so these two areas provide the immature, open vegetation that the Baltic Rush seems to prefer. The first patch of *J. balticus* on the Green Beach was found in 2000, due west of the colonies in slacks 39a and 39b. Similarly, another nine small patches on the central Green Beach appeared in 2003/04 just to the west of the first one (Fig. 1), suggesting that they may have arisen from propagules carried by pedestrians from the older dune sites (Smith 1984). Smith (1984) found that many patches of Baltic Rush were associated with informal footpaths, implying that propagules (especially seeds) could be transported by pedestrians. This association is still apparent, especially in slack 27, where many of the rush patches lie on the routes of lightly-used paths and some are suppressed by localised heavier trampling. Similarly, the cluster of small patches which appeared in 2003/04 on the central Green Beach are on or close to an old 4-wheel-drive track which is often used by walkers." The Green Beach is extensive and is still developing westwards (personal observations), so this should ensure suitable habitat for *J. balticus* is present at Birkdale for at least several decades.

From the N.V.C. data, it is difficult to determine the preferred vegetation type for *J. balticus* at Birkdale. What can be deduced is that the plant is capable of growing in a wide variety of dune-slack, salt-marsh, damp mesotrophic grassland, maritime grassland, ephemeral and swamp communities under varying water-table and base status conditions.

CONSERVATION OF *J. BALTICUS* AND ITS HYBRIDS

All the sites for Baltic Rush and its hybrids on the Sefton Coast are statutorily protected by Site of Special Scientific Interest and candidate Special Area of Conservation designations. Many of the hybrid transplant locations also lie within the Ainsdale Sand Dunes National Nature Reserve, while most of the *J. balticus* populations are in the Birkdale Sandhills Local Nature Reserve. The Birkdale Green Beach, which is likely to become increasingly important for the rush, is a proposed extension to the LNR.

Past losses of parts of the Baltic Rush population and some of the hybrid clones has been attributed to building development, coastal erosion, sand-blow and competition from maturing vegetation (Smith 1984). The future of these plants should be assured by protection of their habitats and, more importantly, by sympathetic management regimes within the reserve structures of the coast. For example, a major programme of scrub control by all land-managers since the early1990s is crucial to the maintenance of open plant communities. Similarly, extensive winter-grazing by sheep on the Ainsdale NNR and parts of the Ainsdale Sandhills LNR, introduced from 1990 onwards, is also making a significant contribution to holding back succession. It is hoped that grazing will soon be extended to the Birkdale Sandhills. Sefton Council's proactive policy towards dune accretion along the foreshores is playing an important role in reversing the trend towards a stable and over-mature dune system (Smith 1999), and can only be beneficial to Baltic Rush and its hybrids.

This study has shown that conservation by translocation has worked well for the hybrid clones, particularly when they are planted in semi-aquatic or wet-slack habitats with sparse vegetation. Both their origins and their subsequent fate have generally been well monitored. There are no imminent plans for further transplantation, though this could be justified for the Hightown *J. balticus* × *J. effusus* clone which is confined to two small patches.

Smith (1984) concluded by stating: "*Juncus balticus* is still restricted to a small part of an otherwise large dune system. However, its recent increase, ability to colonise and persist in a wide variety of slack types and its apparent resilience to public pressure indicate that it should survive as an interesting and important component of the Merseyside sand-dune flora in the foreseeable future." These sentiments seem as valid today as they did twenty years ago.

ACKNOWLEDGMENTS

I am grateful to English Nature (Ainsdale) for access permission to parts of the NNR and for providing 4WD transport and assistance in the reserve. John Gramauskas of Sefton Council's Coast & Countryside Service was extremely helpful in the production of maps of the study areas. Christine Bennett of the Environmental Advisory Service at Maghull, Merseyside, kindly allowed me to use a TABLEFIT programme to determine N.V.C. communities. Maurice Jones and Frank Walsh measured the patch of *Juncus balticus* × *J. inflexus* at Lytham-St. Annes Local Nature Reserve. Thanks are also due to Royal Birkdale Golf Club for access to the course and to Mike Wilcox who made helpful and detailed comments on a draft of the manuscript.

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(*Accepted February 2005*)