

Some notes on the shore vegetation of Iceland

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ABSTRACT: A classification is suggested for the phanerogam vegetation of the Icelandic seashores. Eighteen plant sociations are described, and represented in tables based on some 56 field analyses.

The shore vegetation is poorly represented in the Icelandic botanical literature, except for scattered observations included in regional botanical descriptions (cfr. the list of references). Since no general survey on the subject is available, I think the stray observations given below may be of some value, even though made many years ago.

The Icelandic shore vegetation falls naturally into four zones:

1. The foreshore (fjara)
2. The salt marshes (fitjar)
3. The shingle ridges (malarkambar)
4. The dunes (sandhólar)
5. The seacliffs (sjávarklettar)

The seacliffs have no topographical connection to the other zones, but are influenced by some of the same biological factors, and therefore omitted here.

I. THE FORESHORE (FJARA).

Tables I and IX.

The part of the beach, which is more or less exposed to the action of waves and sea spray, is called foreshore (Icelandic: fjara). As a rule, the foreshore is gently sloping or almost flat. The lowest part of the foreshore, periodically submerged by the daily tidewater, is devoid of vegetation and covered with sand and gravel.

The upper part of the foreshore on the whole is either sandy, or more or less covered with shingle or boulders. The vegetation is generally poor, the plant species are few and spread. The sand is devoid of vegetation, except where sheltered against wind and sand drift by some stones, or where there are accumulations of algal debris and other organic drifts from the sea.

The foreshore is found all around the coasts of Iceland, but it varies in different regions. Along the southern coast of Iceland the foreshore is almost everywhere sandy. The same type of foreshore is found along the broader bays and near the river mouths in the other regions of the country.

The vegetation of the foreshore is usually very open, and the plant individuals are so scattered, that it is difficult to describe the sociations. The species composition of the communities varies often from one year to another on account of the many therophytes. The most frequent species are *Atriplex patula*,*) *Honckenya peploides*, *Polygonum aviculare*, *Festuca rubra*, *Potentilla anserina*, *Mertensia maritima* and *Cakile edentula*, which is quite common along the south and west coasts, where it predominates in wide areas and occasionally forms a continuous carpet of considerable size. The other species are usually very scattered.

In the upper part of the foreshore, a community occurs, which may be called foredunes or perhaps embryonic dunes. The most common and dominant species are *Elymus arenarius* and *Festuca rubra*. The following sociations of the foreshore will be described here:

- 1.-2. *Honckenya peploides* - *Festuca rubra* soc. (Std. 1974, 3) Tab. Ix, 4. *Honckenya peploides* - *Atriplex patula* soc. (Std. 1974, 5) Tab. Ix, 5.

Only one analysis is given from each of the sociations. They are both from the same locality along Steingrímsfjörður, where the two closely related sociations grow side by side. The vegetation is discontinuous. Soc. 2 appears only where algal debris and other organic sea drifts are accumulated.

3. *Atriplex patula* - *Polygonum aviculare* soc. (Std. 1974, 7). Tab. I, 1-2.

The vegetation is scattered and the surface between the plant individuals is covered by sand. Analysis 1 is from Stakkhamarsnes, where there are great accumulations of decaying algae drifted from the sea. Analysis 2 is from Bolungavík, a locality characterized by much less drifted sea material and by less pronounced growth of *Atriplex*.

4. *Mertensia maritima* soc. (Std. 1974, 10) Tab. Ix, 1-2.

The two analyses are from Aðalvík, on a sandy foreshore with scattered vegetation. *Mertensia* is almost the only species growing there, covering more or less extensive patches interspersed by pure sand.

*) The determination of *Atriplex* is somewhat doubtful, but I follow here Flóra Islands.

5. *Cakile edentula* soc. (Std. 1974, 11) Tab. Ix, 3.

The analysis is from Aðalvík, the same locality as soc. 4. *Cakile* is almost the only species, just a few individuals of *Elymus arenarius* are present, probably deriving from creeping shoots of an *Elymus* sociation situated nearby.

6. *Cakile edentula* - *Potentilla anserina* - *Poa pratensis* soc. (Std. 1975, 12). Tab. I, 3.

The analysis is from Skógarnes, where the sociation is rather common. The three character species have about equal covering, but *Cakile* is dominating in physiognomy.

7. *Elymus arenarius* - *Festuca rubra* soc. (Std. 1974, 15). Tab. I, 4-13; tab. Ix, 7-8.

Further up than the true foreshore communities, there is often a belt of rather dry, mobile sand, which forms the typical site of this sociation. *Elymus arenarius* is predominant, although *Festuca rubra* has generally a high frequency. The vegetation is so open, that the sand is exposed everywhere between the plant individuals, and the total covering of the phanerogams is hardly more than 50-60%, and sometimes even less. The sand forms as a rule low ridges, but not real dunes. These are the typical foredunes. The fore-dune-belt is never submersed by the tides, but is influenced by the action of sea spray caused by storms.

The analyses I, 4-9 are from Stakkhamarsnes in Snæfellsnessýsla. The conditions are very similar to those described above. *Elymus arenarius* is predominant as well in covering as in physiognomy. *Festuca rubra* has low covering, hardly more than 5% and sometimes still less. In analyses 6 and 7 *Galium verum* is conspicuous. Analyses 10 and 11 are from Miðhús in Mýrasýsla, 10 is made where the *Elymus*-belt closely touches the *Cakile* sociation, and scattered tufts of *Elymus* are found within the *Cakile* sociation. Analysis 11 is from a high sand ridge. Analyses 12 and 13 are from Bolungavík in a fence made to protect the sand area from grazing. Analysis 12 is from a shallow depression, where the sand is slightly moist. The site of analysis 13 is higher and drier, and the vegetation is characterized by poor development of *Festuca rubra* in spite of its high frequency.

Analyses Ix, 7 and 8 are from Aðalvík. The *Honckenya* is so conspicuous in analysis 8, that this might perhaps be regarded as a separate sociation. Analysis Ix, 9 is from a narrow belt situated between the true *Elymus* community and a relatively dry mire community. The sand surface has become firm and moist. The *Elymus* has disappeared, and *Festuca rubra* and *Equisetum* spp. are predominant. This is a transitional stage between the foreshore and the mire.

Analysis Ix, 6 is made in a narrow zone, adjacent to the site of analysis 5, but a little higher. The predominant species, *Hierochloë odorata* and *Equisetum palustre*, do not belong to any shore sociation. It may be regarded as a transitional form to any community of true land vegetation.

The sociations described above are either the same, or closely related to the seashore communities described in the following papers (cfr. the list of references):

- Soc. 1-2, JÓNSSON 1900, STEINDÓRSSON 1936.
Soc. 3, STEINDÓRSSON 1936.
Soc. 5-6, JÓNSSON 1900, TUXEN 1968.
Soc. 7, JÓNSSON 1900, TUXEN 1968.

BÜCHER (1954) describes sociations closely related to Soc. 4 and 7 from Greenland, and TUXEN (1969) from Southwest Norway.

II. THE SALT MARSHES (FITJAR).

Tables II and III.

TANSLEY (1953) gives the following description of salt marshes in his book on the vegetation of the British Isles: "In tidal estuaries, where sand and mud are carried by the tide and laid down on the flat shores, where wave action is at minimum, a phanerogamic vegetation with associated algae is developed. This vegetation is generally known as *salt marsh*, its flora, like the factors of its habitat, is extremely distinct, and it constitutes a well-defined plant formation. The master factor, which differentiates this from other formations, is the saltwater which bathes the whole plant body during the periodic immersions and forms the soil solution (though varying in concentration) at all times. Hence the plants are said to be *halophytes* or *halophilous*, many of them growing well only when supplied with salt water, though others can do without it".

As far as I can see, this definition of Tansley can fully be used for the Icelandic salt marshes with the following remarks: True halophytes are very few, the only ones are *Puccinellia maritima* and *Carex subspathacea*. Almost all other species growing in the salt marshes are halophilous, but grow also in other communities.

The topographical conditions in Iceland on the whole, are rather unfavourable to the formation of salt marshes. These will be formed only, where the shore is low and flat, and even though the shore is low, it often rises high enough above the sea level, that it can not be reached by the tides. In some places the formation of salt marshes is prevented by mobile sand. This is the case to a great extent along the southern coast of Iceland, and at the rivermouths in general.

The region in Iceland, which has by far the most advanced salt marsh development, is along the eastern and northern sides of Faxaflói, West-Iceland, from Borgarfjörður to the southern coast of Snæfellsnes. The shore is low and flat in this area, and the tidal range wide, or about 4 meters, and the shore is open out to the sea. It should also be mentioned, that one of the environmental factors influencing the salt marsh development in the Faxaflói region, is the sinking of the shore. As a consequence, the high tide reaches progressively farther inland, and thereby changing the adjacent mire communities into salt marshes, as the salinity of the soil increases (JÓNSSON 1913).

At the southeastern coast, in the district of Austur-Skaftafellsýsla, a considerable area of salt marshes has been formed, which will be dealt with later.

The vegetation of the salt marsh is usually continuous, and the

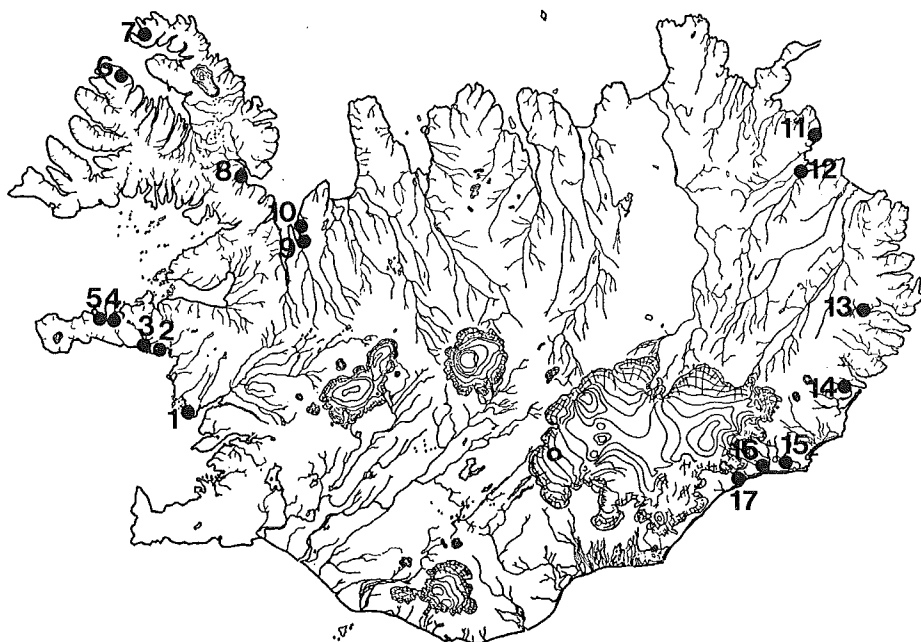


Fig. 1. Map of localities. 1. Miðhús. — 2. Skógarnes. — 3. Stakkhamarsnes. 4. Kolgrafarfjörður. — 5. Grundarfjörður. — 6. Bolungavík. — 7. Aðalvík. — 8. Steingrímsfjörður. — 9. Kárastaðir. — 10. Ánastaðir. — 11. Strandhöfn. — 12. Vopnafjörður. — 13. Fáskrúðsfjörður. — 14. Geithellnar. — 15. Höfn. — 16. Mýrar. — 17. Hestgerði.

substrate is muddy and often very compact. The vegetation is somewhat influenced by grazing of cattle and sheep. It is usually composed of different sociations according to the surface level of the high tides, the distance from the sea, and other factors. Since the plant components are of different colours, a characteristic colour zonation appears in the salt marsh, with light green, dark green, yellowish, gray and brown tints.

1. *Puccinellia maritima* soc. (Std. 1974, 24). Tab. II, 1-5.

The observations of this sociation are all from the shore of Faxaflói at Miðhús, except no. 4, which is at Stakkhamarsnes. Here is an extensive salt marsh of a typical form. The marshland is so close above the sea level, that it gets immersed by every tide, except the upper part of it, which is most distant from the sea, and gets submersed only by the highest tides. The salt marsh is bordered by *Carex Lyngbyei* mire on the landward side, often without any distinct limits between the communities. Waterfilled channels with brackish water run through the marsh. The *Puccinellia maritima* sociation grows in the lowest part of the salt marsh, close to the

Grundarfjörður, West Iceland (Loc. 5). *Puccinellia maritima* soc., *Agrostis stolonifera* - *Plantago maritima* soc., *Carex glareosa* - *Agrostis stolonifera* soc. (Std. 1974, 35).

Lárós, West Iceland (Loc. 5, Grundarfjörður) *Puccinellia maritima* - *Agrostis stolonifera* soc. Additional species were *Carex maritima* and *Plantago maritima*.

Fáskrúðsfjörður, East Iceland (Loc. 13). *Carex subspathacea* - *Agrostis stolonifera* soc. (Std. 1974, 31). A very small spot of salt marsh is situated at the head of the fiord. *Triglochin maritima* is scattered in the sociation, other species were not observed.

Geithellnar, East Iceland (Loc. 14). *Plantago maritima* - *Festuca rubra* - *Agrostis stolonifera* soc. (Std. 1974, 45), *Puccinellia maritima* - *Carex subspathacea* soc. In the eastern fiords (Austfirðir) the topographical conditions prevent the development of salt marshes of any extension. The formation occurs mainly as small patches or a narrow zone above the foreshore, where it can be immersed by the tides. The most common plants are *Puccinellia maritima* and *Carex subspathacea*.

Höfn, Hornafjörður, Southeast Iceland (Loc. 15). Around Höfn there is a considerable salt marsh area, though not of the extension found along Faxaflói. These sociations were observed there: *Puccinellia maritima* soc., *Puccinellia maritima* - *Agrostis stolonifera* soc. (Std. 1974, 28), *Agrostis stolonifera* soc. (soc. nov.), *Carex glareosa* - *Agrostis stolonifera* soc. (Std. 1974, 33), *Triglochin palustris* - *T. maritima* soc. (Std. 1974, 36), *Catabrosa aquatica* soc. (Std. 1974, 42), *Puccinellia maritima* - *Triglochin palustris* soc. (Std. 1974, 27).

A short description of the salt marsh at Höfn (loc. 15), from two sites is given below: In the first site, a rather broad salt marsh is situated between mudflats and a low hill. The mudflat is partially grown with *Agrostis stolonifera*. Next to the mudflat is a narrow zone dominated by *Puccinellia maritima*, followed by a complex of the sociations mentioned above. On the landward side of the salt marsh, it graduates into pure *Carex lyngbyei* mire, without any distinct limits. Besides the character species of the sociations, the following species were noted: *Carex lyngbyei*, *Plantago maritima*, *Festuca rubra*, *Potentilla anserina*, *Eriophorum scheuchzeri*, *Montia rivularis*, *Leontodon autumnale*, *Cerastium fontanum*, *Epilobium palustre* and *Rhinanthus minor*.

The second marsh is somewhat drier than the first one, and the zonation of the sociations more distinct. Next to the sea is a *Puccinellia maritima* belt with *Triglochin*. Additional species were: *Stellaria humifusa*, *Agrostis stolonifera*, *Juncus bufonius* and *Carex mackenziei*. Following this is a zone without *Puccinellia*, where *Agrostis stolonifera* dominates.

Mýrar, Southeast Iceland (Loc. 16). Along the coast of Austur-Skaftafellssýsla, there is a series of lagoons, bordered by long bars of sand and shingle on the seaside. The lagoons are connected to the sea by outlets, where the tides move in and out. The water in the lagoons is more or less brackish, since they are fed by many river streams. On the landward side of the lagoons, salt marshes have been formed. Only where the salt content of the water is quite low, mire communities may reach the open water directly.

The shallow lagoons form in many places closed stands of *Scirpus palustris* sociation (Soc. nov.) on the landward side. Other species noted there were *Sparganium hyperboreum* and *Myriophyllum alterniflorum*. I have not observed this sociation outside Skaftafells-sýsla.

Near the farm Einholt there is a salt marsh grown with *Carex nigra* - *Scirpus uniglumis* soc. (Soc. nov.). Additional species seen there were *Ranunculus reptans*, *Festuca rubra*, *Triglochin maritima*, *Carex glareosa*, *Stellaria crassifolia* and *Eriophorum scheuchzeri*. As indicated by the plant list, this is a transitional stage from a true salt marsh to mire communities.

Hestgerði, Southeast Iceland (loc. 17). A small salt marsh is found at the landward side of the lagoon. The lagoon is bordered by *Puccinellia maritima* soc. (Soc. nov.). Other species represented in the sociation were *Agrostis stolonifera* and *Catabrosa aquatica*.

The salt marsh sociations described or mentioned above, and other closely related ones, are described in the following papers:

Soc. 1-2: JÓNSSON 1900 and 1913, STEINDÓRSSON 1936.

Soc. 5: STEINDÓRSSON 1954.

The salt marsh communities described by NORDHAGEN 1954 from Finmark, Norway, and GILLNER 1955 from North Norway are either the same as described here, or closely related to them. The zonation which NORDHAGEN describes is in all main features the same as in Iceland, only the limits of the zones appear to be more distinct in Norway than in Iceland.

III. THE SHINGLE RIDGES AND THE DUNES VEGETATION (MALARKAMBAR AND SANDHÓLAR). Table IV.

Along the coast just above the foreshore, some ridges are usually formed, which either consist of more or less vegetated sand dunes, or stones and shingle thrown up on the shore by the heavy waves. The ridges are so high, that the normal tides do not reach them, but in heavy storms they will be washed over by the strongest waves, which then add new material to them. Both stones and pieces of wood and other drift material is occasionally passed over the ridges. The land is lower behind the ridges, often with lakes and pools, which are frequently fringed with salt marsh. In many cases the ridges are originally formed as bars or spits between the sea and the inlets.

These elevations are always more or less vegetated, as a rule with grass and grasslike plants mixed with some herbs and occasionally low shrubs. On the dunes the pioneer plant is always *Elymus arenarius* but as the dunes become fixed, the *Elymus* degenerates by and by, until finally the dune is changed into grassland.

On the whole the vegetation of the ridges is rather variable, and the main sociations will be described below.

1. *Plantago maritima* - *Armeria vulgaris* soc. (Std. 1974, 44). Tab. IV, 1-2.

The vegetation is continuous, and the two character species pre-

dominate in covering and physiognomy together with *Festuca rubra*. This sociation is very common along the coasts of Iceland. Analysis 1 is from Strandhöfn, East Iceland, and analysis 2 from Steingrímsfjörður, Northwest Iceland.

2. *Plantago maritima* - *Agrostis stolonifera* - *Leontodon autumnalis* soc. (Std. 1974, 46). Tab. IV, 3-4.

These two sociations, 1 and 2, are very closely related, so they might perhaps as well be treated as one sociation. Soc. 2 has generally higher number of species than soc. 1. *Agrostis stolonifera* has more covering, and *Leontodon autumnalis* is very conspicuous. Analysis 3 is from Kárastaðir, and analysis 6 from Ánastaðir, both localities on the west coast of the Vatnsnes Peninsula, North Iceland.

3. *Juncus balticus* - *Festuca rubra* - *Potentilla anserina* soc. (Std. 1974, 51). Tab. IV, 5-8.

This sociation is very common on shingle ridges along the coasts of Iceland, especially those which are formed by vegetated sand dunes, or where the shingle is mixed with sand. Sometimes *Potentilla anserina* is absent, as in analyses IV, 7-8, and perhaps is its presence an indication of a certain stage of development of the ridges. It appears to be more abundant on the younger ridges and disappears gradually as the density of grasses increases. *Juncus balticus* is always the most predominant species in physiognomy, but covers hardly more than the other character species. *Festuca rubra* and *Galium verum* are frequently conspicuous.

The analyses 5-6 are from Stakkhamarsnes and 7-8 from Miðhús.

4. *Kobresia myosuroides* - *Festuca rubra* - *Thymus arcticus* soc. (Std. 1974, 52). Tab. IV, 9.

The only analysis present is from Miðhús, and it is made near the top of a high dune. The substrate is sandy and dry. *Kobresia* is predominant in covering and physiognomy, other conspicuous species are *Festuca rubra* and *Thymus arcticus*. The sociation is common both on dunes and on shingle ridges.

5. *Thymus arcticus* - *Festuca rubra* - *Galium verum* soc. (Std. 1974, 53). Tab. IV, 11-12.

The analyses are from Stakkhamarsnes in Snæfellsnessýsla, a long and narrow spit of sand mixed with shingle. The spit is separated from land by a rather broad inlet, which is dry at low tides and covered with mud without any vegetation. At the seaward side of the spit there is a sandy foreshore, hardly with any vegetation. Neither *Cakile* nor *Elymus* sociations are present, but some scattered *Atriplex patula* and *Polygonum viviparum* are found, where decaying algae are accumulated.

From the foreshore the dune rises abruptly and forms a steep erosion's brink. The dune is several meters high, and gently sloping towards the inlet, or the mudflats. Next to the inlet is a salt marsh with *Puccinellia* sociations. *Ruppia spiralis* ssp. *longirostris* grows abundantly in deep, waterfilled channels.

The top of the dune is overgrown with *Elymus arenarius* sociation, besides the *Elymus* some scattered individuals of *Festuca rubra* and *Galium verum* are present. The *Elymus* disappears where the sand has become firm, and the *Elymus* sociation is substituted by *Thymus - Festuca - Galium* sociation. All the three character species are very conspicuous, and the flowers of *Thymus arcticus* give the stand a red colour, and the community forms a mosaic of red *Thymus* alternating with yellow *Galium* spots.

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TABLE I: A. The foreshore vegetation.

Atriplex patula - *Polygonum aviculare* soc. 1-2, *Cakile edentula* - *Potentilla anserina* - *Poa pratensis* soc. 3, *Elymus arenarius* - *Festuca rubra* soc. 4-13.

Localities: 1, 4-9 Stakkhamarsnes, Snæf. (loc. 3). 2, 12-13 Bolungavík, N.-Ísaf. (loc. 6). 3 Skógarnes, Snæf. (loc. 2). 10-11 Miðhús, Mýr. (loc. 1).

		1	2	3	4	5	6	7	8	9	10	11	12	13
<i>Atriplex patula</i>	Th E	100	10	20	-	-	-	-	-	-	-	-	-	-
<i>Cakile edentula</i>	Th E	50	10	80	-	-	-	-	-	20	20	-	-	-
<i>Elymus arenarius</i>	G E	20	60	-	100	100	100	100	100	100	100	100	100	100
<i>Festuca rubra</i>	H E	60	10	-	80	100	100	100	20	-	60	100	100	90
<i>Poa pratensis</i>	G E	-	-	100	-	-	-	-	-	-	-	-	-	-
<i>Polygonum aviculare</i>	Th E	100	100	-	-	-	-	-	-	-	-	-	-	-
<i>Potentilla anserina</i>	H E	-	-	100	100	30	-	10	100	10	-	-	20	-
<i>Agrostis stolonifera</i>	H E	-	-	10	-	-	-	-	-	-	-	-	-	-
<i>Armeria vulgaris</i>	H A	-	-	-	-	-	-	-	-	-	-	10	-	-
<i>Cerastium fontanum</i>	Ch E	-	-	10	-	-	-	-	-	-	-	-	-	-
<i>Equisetum arvense</i>	G E	-	-	-	-	-	-	-	-	-	-	90	-	-
<i>Galium verum</i>	H E	-	-	-	10	-	100	10	-	-	-	60	-	-
<i>Honckenya peploides</i>	H E	30	60	-	40	10	-	40	20	-	-	-	-	90
<i>Kobresia myosuroides</i>	H A	-	-	-	-	-	-	-	-	-	-	30	-	-
<i>Matricaria maritima</i>	H E	-	-	10	-	-	-	-	-	-	-	-	-	-
<i>Silene maritima</i>	H A	-	-	-	-	10	30	10	-	-	30	60	-	-

B. The biological spectra of the foreshore.

	1	2	3	4	5	6	7	8	9	10	11	12	13
Points sum	360	250	330	330	250	330	270	240	130	210	590	220	280
Number of species	6	6	7	5	5	4	6	4	3	4	8	3	3
Density of species	3.6	2.5	3.3	3.3	2.5	3.3	2.7	2.4	1.3	2.1	5.4	2.2	2.8
A (Arctic group)	-	-	-	-	4.0	9.1	3.7	-	-	14.3	35.2	-	-
E (European group)	100.0	100.0	100.0	100.0	96.0	90.9	96.3	100.0	100.0	85.7	69.8	100.0	100.0
Ch	-	-	3.0	-	-	-	-	-	-	-	16.6	-	-
H	25.0	28.0	36.4	69.7	60.0	69.7	63.0	58.3	7.7	42.9	48.2	54.5	64.2
G	5.5	24.6	30.3	40.0	30.3	30.3	37.0	41.7	76.9	47.6	35.2	45.5	35.8
Th	69.5	48.0	30.3	-	-	-	-	-	15.4	9.5	-	-	-

TABLE II: A. The salt marsh vegetation.

Puccinellia maritima soc. 1-5, *Puccinellia maritima* - *Plantago maritima* soc. 6-11, *Puccinellia maritima* - *Carex subspathacea* soc. 12-13.

Localities: 1-3, 5-6, 12-13 Miðhús, Mýr. (loc. 1). 4, 8-11 Stakkhamarsnes, Snæf. (loc. 3). 7 Skógarnes, Snæf. (loc. 2).

		1	2	3	4	5	6	7	8	9	10	11	12	13
<i>Puccinellia maritima</i>	H E	100	100	100	100	100	100	100	100	100	100	100	100	100
<i>Plantago maritima</i>	H E	-	-	-	10	30	100	100	90	100	100	80	-	100
<i>Carex subspathacea</i>	G A	-	-	-	-	-	-	-	-	-	-	-	100	100
<i>Agrostis stolonifera</i>	H E	-	20	40	50	-	-	-	100	-	90	90	-	20
<i>Armeria vulgaris</i>	H A	-	-	-	-	-	-	-	-	30	40	40	-	-
<i>Carex lyngbyei</i>	HH E	-	30	-	-	-	-	-	-	-	-	-	-	-
<i>Carex mackenziei</i>	H A	-	70	-	-	-	-	-	-	-	-	-	-	-
<i>Euphrasia frigida</i>	Th A	-	-	-	-	-	-	-	10	-	-	-	-	-
<i>Festuca rubra</i>	H E	-	20	50	20	20	-	-	30	40	100	100	-	-
<i>Gentiana detonsa</i>	H A	-	-	-	-	-	-	-	10	-	10	-	-	-
<i>Glaux maritima</i>	H E	-	-	30	10	-	-	-	-	20	60	70	-	-
<i>Stellaria humifusa</i>	Ch A	-	-	-	50	-	-	-	40	-	-	-	-	-

B. The biological spectra of the salt marshes

	1	2	3	4	5	6	7	8	9	10	11	12	13
Points sum	100	240	220	240	150	200	200	380	290	500	490	200	320
Number of species	1	5	4	6	3	3	2	7	5	7	6	2	4
Density of species	1.0	2.4	2.2	2.4	1.5	2.0	2.0	3.8	2.9	5.0	4.9	2.0	3.2
A (Arctic group)	-	29.2	-	20.8	-	-	-	15.8	10.3	10.0	12.0	50.0	31.2
E (European group)	100.0	70.8	100.0	79.2	100.0	100.0	100.0	84.2	89.7	90.0	88.0	50.0	68.8
Ch	-	-	-	20.8	-	-	-	10.6	-	-	-	-	-
H	100.0	87.5	100.0	79.2	100.0	100.0	100.0	86.8	100.0	100.0	100.0	50.0	68.8
G	-	-	-	-	-	-	-	-	-	-	-	50.0	31.2
HH	-	12.5	-	-	-	-	-	-	-	-	-	-	-
Th	-	-	-	-	-	-	-	2.6	-	-	-	-	-

TABLE III: A. The salt marsh vegetation.

Agrostis stolonifera - *Potentilla anserina* soc. 1-4, *Agrostis stolonifera* - *Festuca rubra* - *Poa pratensis* soc. 5-7, *Carex maritima* - *Carex salina* soc. 8.

Localities: 1-3, 8 Stakkhamarsnes, Snæf. (loc.3). 4 Bolungavík, N.-Ísaf. (loc. 6). 5-6 Skógarnes, Snæf. (loc.2). 7 Vopnafjörður, N.-Múl. (loc.12).

		1	2	3	4	5	6	7	8
<i>Agrostis stolonifera</i>	H E	100	100	100	100	100	100	100	40
<i>Potentilla anserina</i>	H E	40	100	80	30	-	30	-	70
<i>Festuca rubra</i>	H E	-	-	-	-	100	70	-	100
<i>Poa pratensis</i>	G E	-	-	-	-	70	10	-	50
<i>Carex maritima</i>	G A	-	50	100	10	20	-	-	90
<i>Carex salina</i>	G A	-	-	-	-	-	-	-	90
<i>Agrostis tenuis</i>	H E	-	-	-	-	-	100	-	-
<i>Atriplex patula</i>	Th E	-	-	-	-	-	-	10	-
<i>Cardamine pratensis</i>	H E	-	-	-	60	-	-	-	50
<i>Carex bigelowii</i>	G A	-	-	30	-	-	-	-	80
<i>Carex glareosa</i>	H A	-	-	-	-	60	-	-	-
<i>Cerastium fontanum</i>	Ch A	-	-	-	-	20	100	-	-
<i>Equisetum arvense</i>	G E	-	-	-	40	-	-	-	-
<i>Euphrasia frigida</i>	Th A	-	-	-	-	50	-	-	-
<i>Galium verum</i>	H E	-	-	-	-	-	90	-	10
<i>Gentiana detonsa</i>	H A	-	-	-	-	20	-	-	-
<i>Juncus alpinus</i>	H E	-	-	70	30	-	-	30	-
<i>Juncus balticus</i>	G A	-	-	10	60	-	-	-	-
<i>Juncus bufonius</i>	Th E	-	-	-	-	-	-	20	-
<i>Montia rivularis</i>	Th E	-	-	-	-	70	-	-	-
<i>Parnassia palustris</i>	H E	-	-	10	-	-	-	-	40
<i>Plantago maritima</i>	H E	-	-	-	-	30	-	-	-
<i>Puccinellia maritima</i>	H E	10	-	-	-	20	-	-	-
<i>Sagina nodosa</i>	H E	-	30	-	-	-	-	-	10
<i>Scirpus pauciflorus</i>	H E	-	-	80	-	-	-	-	-
<i>Stellaria crassifolia</i>	H A	-	-	30	20	20	-	10	-

B. The biological spectra of the salt marshes.

	1	2	3	4	5	6	7	8
Points sum	150	280	510	350	580	500	170	630
Number of species	3	4	9	9	12	7	5	11
Density of species	1.5	2.8	5.1	3.5	5.8	5.0	1.7	6.3
A (Arctic group)	-	-	33.3	25.7	29.3	-	5.9	41.8
E (European group)	100.0	100.0	66.7	74.3	70.7	100.0	94.1	58.7
Ch	-	-	-	-	3.5	20.0	-	-
H	100.0	82.1	72.6	68.6	60.3	78.0	82.3	50.8
G	-	17.9	27.4	31.4	15.5	2.0	-	49.2
Th	-	-	-	-	20.7	-	17.7	-

TABLE IV: A. The shingle ridges and the dune vegetation:

Plantago maritima - *Armeria vulgaris* soc. 1-2, *Plantago maritima* - *Agrostis stolonifera* - *Leontodon autumnalis* soc. 3-4, *Juncus balticus* - *Festuca rubra* - *Potentilla anserina* soc. 5-8, *Kobresia myosuroides* - *Festuca rubra* - *Thymus arcticus* soc. 9, *Thymus arcticus* - *Festuca rubra* - *Galium verum* soc. 10-11, *Carex lyngbyei* soc. 12, *Equisetum palustre* - *Carex nigra* soc. 13.

Localities: 1 Strandhöfn, Vopnafirði (Loc. 11). 2 við Steingrímsfjörð (Loc. 8). 3 Ánastaðir (Loc. 10). 4 Kárastaðir, V.-Hún. (Loc. 11). 5-6, 10-11 Stakkhamarsnes, Snæf. (Loc 3). 7-9, 12-13 Miðhús, Mýr. (Loc.1).

		1	2	3	4	5	6	7	8	9	10	11	12	13
<i>Plantago maritima</i>	H E	100	40	100	90	-	-	20	20	20	10	10	-	-
<i>Armeria vulgaris</i>	H E	100	80	60	30	-	-	-	-	-	-	-	-	-
<i>Festuca rubra</i>	H E	60	100	100	30	100	100	100	100	100	70	100	70	90
<i>Agrostis stolonifera</i>	H E	100	20	90	50	50	60	50	80	70	-	-	80	-
<i>Leontodon autumnalis</i>	H E	-	-	100	100	-	-	-	-	-	-	-	-	-
<i>Potentilla anserina</i>	H E	-	-	-	-	100	90	-	-	-	-	40	-	-
<i>Juncus balticus</i>	G A	-	-	-	-	100	100	100	70	-	-	-	-	20
<i>Kobresia myosuroides</i>	H A	-	-	-	40	-	-	-	-	100	-	-	-	-
<i>Thymus arcticus</i>	Ch A	-	50	-	60	-	-	-	20	100	100	-	-	-
<i>Galium verum</i>	H E	-	-	-	70	30	-	90	30	-	70	100	-	-
<i>Elymus arenarius</i>	G E	-	-	-	-	-	-	-	-	-	50	40	-	-
<i>Carex lyngbyei</i>	HH E	-	-	-	-	-	-	-	-	-	-	-	100	10
<i>Equisetum palustre</i>	G E	-	-	-	-	-	10	100	100	10	-	-	-	100
<i>Alechemilla alpina</i>	H A	-	-	-	10	-	-	-	-	-	-	-	-	-
<i>Botrychium lunaria</i>	H E	-	-	-	-	-	-	-	-	10	-	-	-	-
<i>Calamagrostis neglecta</i>	H E	-	-	-	-	-	-	-	-	-	-	-	-	10
<i>Carex bigelowii</i>	G A	-	100	-	90	10	20	40	-	50	-	-	-	-
<i>Carex capillaris</i>	H A	-	-	-	30	-	-	-	-	-	-	-	-	-
<i>Carex maritima</i>	G A	-	-	-	-	30	70	-	-	-	-	-	-	-
<i>Carex nigra</i>	G E	-	-	-	-	-	-	-	-	-	-	-	-	100
<i>Carex rariflora</i>	G A	-	-	-	-	-	-	-	-	-	-	-	-	20
<i>Carex salina</i>	G A	-	-	-	-	50	-	-	-	-	-	-	-	-
<i>Cerastium alpinum</i>	Ch A	50	10	-	-	-	-	-	-	-	-	-	-	-
<i>Cerastium fontanum</i>	Ch A	-	-	40	70	-	50	-	-	-	-	-	-	20
<i>Deschampsia caespitosa</i>	H E	-	-	10	20	-	-	-	-	-	-	-	-	-
<i>Draba incana</i>	H A	-	-	-	-	-	-	-	30	-	-	-	-	-
<i>Empetrum nigrum</i>	Ch E	10	-	-	-	-	-	-	-	-	-	-	-	-
<i>Equisetum arvense</i>	G E	-	-	10	-	10	10	-	-	50	-	-	-	-
<i>Equisetum variegatum</i>	H A	-	-	-	30	-	-	-	80	90	-	-	-	-

<i>Euphrasia frigida</i>	Th A	-	-	-	10	-	-	-	-	-	-	10	10
<i>Festuca vivipara</i>	H E	-	100	-	100	-	-	-	-	-	-	-	-
<i>Galium normanii</i>	H E	-	-	-	30	10	-	-	-	-	-	-	-
<i>Gentiana campestris</i>	Th E	40	-	-	10	-	-	-	-	-	-	-	-
<i>Gentiana detonsa</i>	H A	-	-	-	-	-	10	-	-	-	-	10	-
<i>Habenaria hyperborea</i>	G E	-	-	-	-	-	10	-	-	-	-	-	20
<i>Honckenya peploides</i>	H E	-	-	-	-	-	-	-	-	-	10	-	-
<i>Juncus alpinus</i>	H E	-	-	-	-	-	10	-	-	-	-	-	-
<i>Lomatogonium rotatum</i>	Th A	-	-	-	-	-	40	-	-	-	-	-	-
<i>Luzula multiflora</i>	H E	-	-	-	40	-	-	10	-	-	-	-	40
<i>Parnassia palustris</i>	H E	-	-	-	-	40	40	20	100	-	-	30	30
<i>Pinguicula vulgaris</i>	H E	-	-	-	-	-	60	-	-	-	-	-	-
<i>Poa pratensis</i>	G E	-	20	10	-	30	40	-	-	-	-	-	20
<i>Polygonum viviparum</i>	G A	-	-	70	100	-	-	50	-	-	-	-	100
<i>Potentilla crantzii</i>	H A	-	-	-	50	-	-	-	-	-	-	-	-
<i>Rhinanthus minor</i>	Th E	-	-	-	30	20	30	-	-	-	-	20	70
<i>Rumex acetosa</i>	H E	-	-	-	20	-	-	-	-	-	-	-	-
<i>Sagina nodosa</i>	H E	10	-	-	-	-	20	-	-	-	-	-	-
<i>Salix herbacea</i>	Ch A	-	-	-	10	-	-	10	-	10	-	-	-
<i>Salix lanata</i>	Ch A	-	-	-	-	-	-	70	-	-	-	-	-
<i>Silene acaulis</i>	Ch A	70	20	-	20	-	-	-	-	-	-	-	-
<i>Silene maritima</i>	H A	-	-	-	-	-	-	-	-	50	10	-	-
<i>Stellaria crassifolia</i>	H A	-	-	-	-	-	70	-	-	-	-	-	-
<i>Thalietrum alpinum</i>	H A	-	-	-	100	-	-	-	-	-	-	-	20
<i>Triglochin maritima</i>	H E	-	-	-	-	-	-	-	-	-	-	10	-
<i>Triglochin palustris</i>	G E	-	-	-	-	-	-	-	-	-	-	10	-

B. The biological spectra of the shingle ridges.

	1	2	3	4	5	6	7	8	9	10	11	12	13
Points sum	540	540	590	1240	570	830	670	630	660	350	310	340	680
Number of species	9	10	10	26	12	18	13	10	13	6	7	9	16
Density of species	5.4	5.4	5.9	12.4	5.7	8.3	6.7	6.3	6.6	3.5	3.1	3.4	6.8
A (Arctic group)	48.1	48.1	22.0	46.8	33.3	36.1	41.8	31.7	59.1	28.6	3.2	11.7	35.3
E (European group)	51.9	51.9	78.0	53.2	66.7	63.9	58.2	68.3	40.9	71.4	96.8	88.3	64.7
Ch	24.1	14.8	6.8	12.9	-	6.0	12.0	3.2	16.6	28.6	-	-	2.9
H	75.9	62.9	78.0	67.8	56.1	54.2	44.7	69.8	66.8	57.1	87.1	58.8	27.9
G	-	22.3	15.2	15.3	40.3	31.3	43.3	27.0	16.6	14.3	12.9	2.7	55.9
HH	-	-	-	-	-	-	-	-	-	-	-	29.7	1.5
Th	-	-	-	4.0	3.6	8.5	-	-	-	-	-	8.8	11.8