

Dispersal of Seed by Snow Buntings  
to Surtsey in 1967

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Distant islands must to a great extent owe their plant and animal life to long distance dispersal of living material. The role played by birds in such a transport has been a matter of some dispute among biologists.

It was suggested that the almost sterile habitat of the new volcanic island of Surtsey might offer an unique opportunity for studying the possible role birds play in transporting plants and lower animals across wide stretches of ocean.

Surtsey being the southernmost dryland of Iceland might become the first landing place for migratory birds arriving in the spring from other European countries. As the island is almost void of life there would be a minimal possibility for such migratory birds to consume any amount of food from terrestrial plants or animals on Surtsey. If such birds were to be captured on the island and shown to carry living organisms it would be extremely reasonable to conclude that such organisms had been transported by the birds to Surtsey over the ocean.

For this reason two assistants were given the task of recording migration of birds to the island and to collect a variety of birds on Surtsey as they arrived during the period March 31 to May 12 1967. The ornithological work was supervised by Dr. Finnur Gudmundsson who will report separately on the migration of the birds.

The birds caught by the assistants were identified, sexed, and weighed. They were then closely searched for any possible seeds or other organisms which might be attached to the exterior of the body, after which the birds were dissected and their alimentary tract cleaned of content. This content was then measured by volume and

weight and inspected for organisms: if there were seeds present they might be identified and tested for germination. Finally, the grit from the gizzard was inspected as its minerals or rocktypes might reveal its origin and thus the location where the last intake of food had occurred.

## Results

From the total number of 97 birds of 14 different species, none of the birds carried seed or other organisms on their exterior. A few birds, however, carried nematodes or other parasites which are not of direct interest in the transport of colonizing organisms.

Two waders had, when shot, obviously been feeding on Euphausiids which are regularly being washed upon the shore. In three birds dead insects were found in upper parts of the alimentary tract. Most bird stomachs were practically empty, in others there was only some grit in gizzards.

Of the 32 snow buntings caught, ten individuals of the nominate race had, in addition to grit, seeds in their gizzards. In Table I these snow buntings are listed with information on measurements of birds and content of their alimentary tract. The ten birds carried with them 87 seeds. Most of these had hard seed coats and were berry kernels, but two which were soft had burst open and were partly digested. The majority of the seeds seemed viable and when few were tested three of these germinated, two of which were grown to maturity. The plants grown were that of Polygonium persicaria L. and Carex nigra All. (C. Goodenowii Gay). See Table III.

Grit from the ten snow buntings was examined under the petrographic microscope. Each grit sample weighed 0.2-0.5 grams. Half of each sample was used for the preparation of a thin section and each grain identified as a mineral or rocktype. The number of grains identified in each thin section ranged from 97 to 511. Table II shows that the number of mineral or rocktypes is high (18 types and 2 additional unidentified species), but the grit grains can, however, be divided into three clearly separated groups: basaltic ash from

Surtsey, metamorphic rocktypes and younger sediments.

The ash from Surtsey stands out clearly in the microscope as angular and lightbrown glass with a large number of gas bubbles and sparse crystals of plagioclase and olivine.

In the table the minerals quartz, plagioclase and alkali-feldspar are the most conspicuous constituents, but these are the principal rock forming minerals of granite and gneiss. The alkali-feldspar is mostly a microcline which is characteristic of metamorphic rocks. One of the birds carried garnet, but this mineral is common on the metamorphic rocks of the Scottish Highlands and northwestern Ireland. High grade metamorphic rocks occur in the cores of ancient continents. Large areas composed of metamorphic rocks are to be found in Scotland, Hebrides, North and Northwest Ireland, Shetland Islands, Scandinavia and Greenland. In Iceland metamorphic rocks of this kind have never been found, since Iceland is geologically a very young country.

#### Concluding remarks

The records indicate that of the 14 species of birds caught on the island only the snow buntings were seed carriers. It must be regarded as highly doubtful that the birds could have collected seeds of this size and kind on the island. As the seeds were in the gizzard and none in the stomach, it proves that the birds had not been caught feeding, but apparently consumed the seeds at an earlier time. The accompanying rocks and minerals definitely show that the birds had not been on the mainland of Iceland, i.e. there was no old Icelandic basalt in the gizzards. On the other hand, there were grains of cinder picked up in Surtsey and mostly metamorphic rocktypes and younger sediments, which must have been collected by the birds outside Iceland.

It is interesting to note that the birds were not of Icelandic race. It is, however, unlikely that they were arriving from Greenland at this time of the year, and without stopping on the mainland of Iceland. More logical explanation is that the birds migrate for

the winter to the British Islands or the Continent of Europe. The collection of rocks in the grit indicate that the birds had been feeding lately in the Scottish Highlands.

Most of the seed species identified are rather common both to Iceland and the British Islands, such as the Empetrum, Scirpus, Spergula and Carex nigra and the occurrence of these in the gizzards does not allow for any further speculation about their origin. Polygonum persicaria, however, can be regarded as a European species which only survives in Iceland around cultivated areas and hot springs. It is not a common species and it may be considered rather unlikely that seed of this plant would have been picked up in Iceland with the other seeds or that it had been carried by ocean to Surtsey and picked up there.

One of the two seeds in sample no. 5 was identified by Dr. A. Melderis of the British Museum as Andromeda polifolia L. This plant is definitely not found growing in Iceland, but is native to Greenland as well as the British Islands where it is found in bogs from Somerset to the Hebrides.

Finally the occurrence of Medicago sativa seed in four samples (det. Melderis) eliminates both Greenland and Iceland from being the place of origin of the seeds. Medicago is not found in those countries, it is not used in seed mixtures in Iceland and does not produce seed when sown. On the other hand, it grows in the British Islands, and all the plant species are also to be found in Scandinavia, but the possibility of snow bunting coming from there is more unlikely. To explain the occurrence of these particular seeds in the gizzards of the snow bunting it would be logical to conclude that they were together with the grit picked up by the birds in the British Islands and carried by them over the ocean to Surtsey on their migration to Greenland via Iceland. After this transportation some of the seed at least still retained their germination ability. The incidence is thus a rather definite proof of a long distance dispersal of seed by birds.

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TABLE I

Records of snow buntings caught on Surtsey during March 31 to May 12, 1967

Sampling No.	Bird No.	Date of capture	Wind direction	Birds			Content of gizzard		
				Sex	Age	Weight in grams	Total volume in ml.	Total weight in grams	No. of seeds
1	3	April 4	NE			26.0	0.12		1
2	22	April 24	S-SW	female		25.8	0.25		18
3	25	April 24	S-SW	male	adult	28.6	0.1	0.3	1
4	26	April 24	S-SW	male	adult	36.5	0.2	0.5	2
5	27	April 24	S-SW	female	adult	24.7	0.1	0.3	2
6	34	April 24	S-SW	male	adult	28.8	0.2	0.6	1
7	37	April 24	S-SW	male	adult	27.3	0.1	0.3	19
8	38	April 24	S-SW	female	adult	24.8	0.1	0.35	20
9	39	April 24	S-SW	male	adult	27.95	0.1	0.25	20
10	47	April 24	S-SW	male	adult	30.6	0.1	0.55	2
								TOTAL	87

TABLE II

Sample No.	1	2	3	4	5	6	7	8	9	10
Total weight	0.6	0.3	0.2	0.5	0.2	0.4	0.3	0.2	0.1	0.2
Number of identified grains	511	371	173	440	97	387	97	417	177	383
<u>Minerals and rocktypes, excluding ash from Surtsey, %</u>										
Quartz	37.2	54.5	46.5	68.3	76.7	27.0	33.3	15.6	19.5	6.7
Plagioclase	7.4	9.6	18.2	1.9	3.3	46.8	20.8	9.8	9.7	6.7
Alkalifeldspar	43.9	14.6	11.8	5.6	13.4	2.1	15.3	69.8	26.4	2.2
Magnetite			0.9	1.9				0.4		
Garnet		1.8								
Hornblende						2.8		1.0		2.2
Granite	11.5	5.9	4.5	5.6	3.3	7.1	20.8	1.4	20.9	4.4
Hornfels					3.3				1.4	2.2
Sandstone		2.2	0.9				1.4	2.0	6.9	
Quartzite		7.4	11.8			7.8	4.2		8.3	15.6
Clay			5.4	1.9		1.4				
Arkose		4.0								4.4
Limestone				11.1						
Dolerite				3.7						
Gneiss						5.0	4.2		6.9	48.9
Unidentified minerals										6.7
<u>Rockgroups in %</u>										
Ash from Surtsey	77.1	85.5	36.4	90.1	38.1	63.6	25.8	50.8	59.3	88.3
Metamorphic rocks	22.9	14.2	59.5	7.4	61.9	35.0	73.2	48.2	37.9	11.7
Sediments		0.3	4.1	2.5		1.4	1.0	1.0	2.8	

TABLE III

Number of seeds of various species  
found in samples from snow bunting caught on Surtsey 1967

Species of seed	Sampling No.										Total per species	
	1	2	3	4	5	6	7	8	9	10		
<i>Polygonum persicaria</i>					1							1
<i>Carex nigra</i> All.			1									1
<i>Empetrum</i>		12		2			19	19	18			70
<i>Andromeda polifolia</i> L.					1							1
<i>Spergularia</i>		3										3
<i>Medicago sativa</i>		2				1		1	2			6
<i>Scirpus</i>	1	1										2
Unidentified											3	3
Total seeds per bird	1	18	1	2	2	1	19	20	20	3		87