NOTICE

PORTIONS OF THIS REPORT ARE ILLEGIBLE. It has been reproduced from the best available copy to permit the broadest possible availability.

**TECHNICAL PROGRESS REPORT
OF
BIOLOGICAL RESEARCH ON
THE VOLCANIC ISLAND SURTSEY AND ENVIRONMENT
FOR THE YEAR 1975**

MASTER

Submitted to
Division of Biomedical and Environmental Research
U.S. Energy Research and Development Administration
Washington 25, D.C.

CONTRACT NO: E(11-1)-3531

The study involves the terrestrial biological research on the volcanic island, Surtsey, off the coast of Iceland and the neighbouring islands and environs of the Westman Islands, which are situated on the Mid-Atlantic Ridge.

Principal Investigator: Dr. Sturla Fridriksson
Reykjavik,
Iceland.

NOTICE
This report was prepared as an account of work sponsored by the United States Government. Neither the United States nor the United States Energy Research and Development Administration nor any of their employees nor any of their contractors, subcontractors or their employees makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness or usefulness of any information, apparatus, product or process disclosed, or represents that its use would not infringe privately owned rights.

DISTRIBUTION OF THIS DOCUMENT IS UNLIMITED

DISCLAIMER

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency Thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

DISCLAIMER

Portions of this document may be illegible in electronic image products. Images are produced from the best available original document.

COO 3531 11

UNCLAS

TECHNICAL PROGRESS REPORT OF BIOLOGICAL RESEARCH ON THE
VOLCANIC ISLAND, SURTSEY, AND ENVIRONMENT FOR THE YEAR 1975
Eiriksson, S. (Surtsey Research Society, Reykjavik, Iceland) 1975. 25p
48-4 UNCLD DIST

In 1975 research work was carried out on the islands of Surtsey and Heimaey during the summer-months June through August. Two students, Borgthor Magnusson and Jon Gudmundsson, stayed on the islands and several scientific excursions were taken.

TOPOGRAPHY.

Changes in the topography of Surtsey were, as in the previous summer, quite noticeable. By comparing aerial photographs taken in 1975 with earlier maps it is clear how the island is gradually being eroded on the south-western side, and how the rim of the Western-Bunki is being corroded down.

MICROBIOLOGY.

During excursions in July, Dr. G. H. Schwabe, Max-Planck Institut für Limnologie, Plön, Germany, investigated the terrestrial algae on Heimaey as well as the colonization on its new lava (Appendix I). Lichen were studied by Hördur Kristinsson, Akureyri, Iceland. The lichens were noticed later than the moss but they are now occupying higher levels of the lava. (Appendix II).

MOSS.

The moss flora was investigated by Skúli Magnússon, who examined distribution and cover of the various species.

VASCULAR PLANTS.

The number of higher plants found on Surtsey in 1975 is shown in the accompanying table. Their location was mapped according to the same methods used in earlier

years (Appendix III).

The vascular flora on Heimaey was also investigated following the eruption that took place on the island in 1973. Some bare spots destroyed by ash cover were mapped and an investigation performed on the gradual come-back of plants into the area

ENTOMOLOGY.

Recording of insects was continued by the group of Swedish entomologists led by Dr. Högni Bödvarsson of Stockholm University. (Appendix IV).

VERTEBRATES.

The ornithological studies were carried out by Erling Olafsson and the students. Of major interest in 1975 was the addition of the kittiwake to the breeding birds on Surtsey. (Appendix V).

SOIL.

Investigation of further changes in the substrate soil were continued by Sveinn Jakobsson, who has studied palagonization of the tephra.

OTHER ACTIVITIES.

A book on the terrestrial investigation had been written by the principal investigator Sturla Fridriksson and was published in 1975 by Butterworths, England. The book has received positive critics in various journals. (Appendix VI).

The book's text was used as a basis for a 50 min. color television program, which was taken during the summer 1975 by B.B.C. and shown on February 1st, 1976 in the series "Life about Us" in B.B.C.

A symposium was held in Plön, W.-Germany, where the Surtsey terrestrial research was reviewed (Appendix VII).

Vascular Plants on Surtsey 1975.

Of 1319 plants recorded on Surtsey in 1974, only 446 were found in 1975. 1003 new plants were now recorded, so that as a whole the number of plants has increased by about 130, principally due to a large number of new seedlings of Cochlearia officinalis.

Five new species of plants were found on Surtsey in 1975, giving a present total of 15, in addition to two unidentified plants. Each species will be dealt with separately below. See also the table and Fig. 1.

Older species on Surtsey:

Honckenya peploides: The number of plants of Honckenya peploides decreased drastically after 1974, or by about 50%, principally because such a small part of the 1974 crop survived to the following year. The number of plants was much reduced in quadrats D-12, E-12 and F-13 and similarly in the main plant area on the east of the island. Relatively few new plants were found, or about 167, which is much fewer than in the previous two years.

The chief changes in distribution are that new plants are to be found in quadrats M-15, M-16, N-11 O-11 and P-9, where Honckenya peploides plants have not previously been found, so that it appears to be extending its distribution towards the south of the island.

The majority of the plants are very small, with few stems and leaves and without flowers. The largest, which is at the same time the largest plant on the

island, No. 71-63 in J-13, now covers more than 1 square meter, measuring 120 x 110 cm Aug. 17, 1975. About 20 plants bore fruit in the summer.

Cochlearia officinalis: The number of plants increased enormously since 1974, or by about 486 plants, as a result of the large number of seedlings this year. About 6 plants flowered in the summer and dropped seeds which sprout as soon as they reach the earth, with the result that a large number of very small seedlings immediately form around the mother plant. Plant No. 75-1 in S-14 was the main contributor: about 550 seedlings were counted around this plant alone. Cochlearia officinalis plants were now found in two new places, in J-8 and K-8.

Carex maritima: One plant of this species has been growing on the island since 1970, No. 70-72 in M-11; it has flourished well and had reached a total of 86 shoots, Aug. 17, 1975. The plant first flowered in 1974 and on that occasion bore seed on three shoots, but this year it had increased to eight fertile shoots.

Two new very small Carex maritima individual plants were found this year, No. 75-10 in M-9 (4 shoots) and No. 75-71 in P-9 (3 shoots), and it is safe to regard them as offspring of the plant No. 70-72. It is therefore likely that Carex maritima will multiply considerably on the island in the next few years.

Tripleurospermum maritimum: One plant has been growing in S-14 since 1972, No. 72-40. It remains unchanged, not getting any larger and not flowering, which is probably the result of the infertility of the soil.

A new plant No. 75-90, was found in C-14, but it is also a wretched specimen and will hardly survive the winter in this quadrat, because of the encroachment of the sea.

Puccinellia maritima: Eight descendants of the Puccinellia maritima plant of 1972 are now growing on Surtsey, all on the same patch in R-14, one of them dating from this summer. Four of these plants flowered this summer and bore seed. The unidentified plant No. 74-89 from 1974 proved to be Puccinellia maritima.

Cystopteris fragilis: Only one of the Cystopteris fragilis plants from 1974 survived the winter, No. 72-113 in I-8. A new plant No. 75-62, was found in the same hole. They are both very small, the older having only 2 leaves, the larger of which is 7 cm in length. Neither of the plants bore seed.

Elymus arenarius: Eleven out of 26 plants survived from 1974, but only one new plant was found during the year. The number of Elymus arenarius plants has therefore decreased considerably. None of the plants has managed to flower as yet, but several of the 1974 plants have achieved a respectable level of maturity and it is not improbable that one of them may flower next summer.

Mertensia maritima: The number of Mertensia maritima plants has decreased considerably since 1974, since only five out of 41 survived the winter and only six new plants were found in the summer. All the plants were very small, only a few leaves, and the plants have

not yet managed to flower. They are a mere shadow compared with the plants which grow along the shore on Heimaey, where the soil is presumably much richer.

Festuca rubra: The Festuca rubra plant of 1973 No. 73-730 in L-12) has grown considerably and spread. 90 shoots were counted Aug. 16, 1975 (55 on June 20, 1975). It has not yet flowered.

A second Festuca rubra plant was found in the summer, No. 75-5 in J-18, but here only one shoot is involved. This plant was growing in under a Cochlearia officinalis plant , No. 74-49, and it is safe to conclude that a bird must have brought the seeds to this spot at the same time, but that the Cochlearia officinalis seed sprouted first.

Cakile edentula: Five plants of Cakile edentula, which is an annual, were found and three of these managed to flower and bear seed. Plant No. 75-89 in C-14 was particularly vigorous and formed 100 seeds.

New Plant Species on Surtsey:

Cerastium fontanum: A whole colony of Cerastium fontanum plants, No. 75-9, was found in M-16. On June 24, 1975 it consisted of seven plants of which four were in flower. By August 17, 1975, the plants had increased to eight, had all flowered and dropped seed. About 96 minute seedlings had also formed around them by this time. It is probable that this plant was brought to the island before this summer and was able to form seed last year.

Cerastium fontanum is a common dryland plant throughout Iceland, including Heimaey. It is not easy to say how it was carried to Surtsey, though it is not likely that the seed was brought by sea, since the plant grows quite a distance inland on the island. It is most likely that it was brought by a bird, though it is not possible to exclude human agency, since the plant is common around dwellings.

Conditions on the island seem to suit the plant very well; it grows in sand which has blown onto the lava and settled in depressions. It may be expected to establish itself on the island and spread.

Equisetum arvensis: Two Equisetum arvensis plants No. 75-74 and No. 75-75, were found in J-9, by the crater Surtur II. They were growing on the same patch on the bare lava beside a heat vent. The plants were both very small with traces of three stems on each, all less than 2 cm long, but they were growing up out of the prothallium or gametophyte. About 12 additional prothallia were found in the neighbourhood which had not formed stems.

Equisetum arvensis is the most common of the equisetaceae in Iceland and grows amongst other things on sand and pumice. It has been very prominent on Heimaey since the eruption there in 1973 and the accompanying fall of ash.

The plant was no doubt brought to Surtsey through windborne spores, but it is not easy to say when, since it is not known for certain how long the gametophyte, which is hermaphrodite, takes to mature

after the spore sprouts, though it is conceivable that it takes several years. Conditions ought to be very favourable for the plant on Surtsey and it will probably hold its own there.

Sagina sp.: A very small plant, No.75-78, of the family Sagina was found in quadrat No. I-10, probably a member of S. saginoides or S.procumbens, but because of the small size and absence of flowers it was not possible to reach a conclusion. Both these species are very common all over Iceland and grow in similar conditions.

It is most likely that the seed was brought to the island by a bird, though it is not out of the question that it may have been carried by the wind, since the seed is small and light. It can hardly have come by sea, since the plant is growing far away from the shore at an altitude of about 90 meters above sea level.

Silene vulgaris: A small Silene vulgaris plant, No.75-94, was found in C-14; it was without flower and not very mature. This plant is very common in sandy soil throughout the country and thrives well by the sea. It is very common on Heimaey.

The seed was without doubt carried to Surtsey by sea. It is very unlikely that the plant will survive at this spot, since it is covered by the sea in winter.

Juncus sp.: A small plant, No. 75-64, was found in K-6. It consisted of 11 needle-shaped leaves, without flower. It can safely be taken to be a case of

Juncus sp. and probably of Juncus trifidus, which is a very common moorland plant throughout Iceland, and also thrives well in sandy soil.

Judging from the location there can be little doubt that the seed was carried to Surtsey by a bird. Transport by the sea is out of the question, and the seed is too large to be carried by the wind.

The plant is vigorous and its future on the island looks promising.

Unidentified plants: Two unidentified plants were found in J-8 and they have both been marked 75-79. In both cases minute seedlings were involved, but they are thought on good authority to be of the family Caryophyllaceae.

Following is a list of vascular plants found on Surtsey in 1975 with individual numbers and location in quadrats. The location of plants is also shown on the accompanying map of Surtsey. On this map is also shown the general distribution of moss in 1975.

List of vascular plants discovered in Surtsey in 1975.

I. Overwintering plants, from 1968 - 1974:

No.	Quadrat	Species	No.	Quadrat	Species
60-8	J-18	Honckenya peploides	73-45	I-17	Honckenya peploides
60-21	J-18	"	73-48	I-17	"
60-22	J-17	"	73-51	I-18	"
60-51	J-17	"	73-65	I-17	"
60-56	J-18	"	73-108	I-17	Elymus arenarius
60-64	J-18	"	73-165	G-13	Honckenya peploides
60-70	J-18	"	73-265	K-17	"
60-83	I-17	"	73-272	K-17	"
60-87	J-18	"	73-275	K-17	"
			73-276	K-17	"
69-02	F-13	"	73-278	L-17	"
			73-282	L-17	"
70-4	J-18	"	73-285	J-17	"
70-20	J-18	"	73-287	K-17	"
70-11	J-17	"	73-305	J-17	"
70-71	J-18	"	73-317	J-17	"
70-77	J-17	"	73-318	J-17	"
70-35	I-13	"	73-320	J-17	"
70-42	L-13	"	73-321	J-17	"
70-60	L-13	"	73-322	J-17	"
70-64	L-17	"	73-324	J-17	"
70-72	L-11	Barbarea maritima	73-334	K-17	"
70-74	L-17	Cochlearia officinalis	73-337	K-17	"
			73-344	K-17	"
71-30	I-4	Honckenya peploides	73-347	K-17	"
71-42	L-13	"	73-349	K-17	"
71-47	L-13	"	73-351	I-17	"
71-51	L-12	Cochlearia officinalis	73-352	K-17	"
71-57	L-17	"	73-355	I-17	"
71-62	J-17	Honckenya peploides	73-356	L-17	"
71-63	L-4	"	73-356	L-17	"
71-66	L-10	"	73-361	K-17	"
71-71	L-10	Cochlearia officinalis	73-363	K-17	"
71-75	L-11	"	73-364	K-17	"
			73-365	K-17	"
71-30	J-4	Honckenya peploides	73-370	L-12	Festuca rubra
71-34	J-14	Cochlearia officinalis	73-372	L-11	Honckenya peploides
71-37	J-14	"	73-385	K-17	"
71-40	J-14	Trifolium perenne marit.	73-388	L-17	"
72-41	J-14	Cochlearia officinalis	73-395	L-17	"
72-42	J-14	"	73-409	L-16	"
72-44	J-14	"	73-423	L-16	"
72-53	S-14	"	73-429	K-17	Elymus arenarius
72-56	K-5	Honckenya peploides	73-431	L-17	Honckenya peploides
72-90	J-14	Puccinellia maritima	73-437	L-17	"
72-108	L-10	Honckenya peploides	73-440	K-17	"
72-109	J-18	"	73-441	K-17	Elymus arenarius
72-113	I-8	Cystopteris fragilis	73-444	K-18	Honckenya peploides
72-114	I-4	Honckenya peploides	73-448	J-18	"

No.	Quadrat	Species	No.	Quadrat	Species
73-249	J-18	Honckenia peploides	75-1	S-14	Cochlearia officinalis
73-509	J-18	"	75-2	R-14	Puccinellia maritima
73-538	K-18	"	75-3	D-12	Cakile edentula
73-545	K-17	"	75-4	F-13	"
73-567	K-17	Elymus arenarius	75-5	J-18	Festuca rubra
73-580	L-16	Honckenia peploides	75-6	M-15	Mertensia maritima
73-587	K-17	"	75-8	M-15	Honckenia peploides
73-588	L-17	"	75-9	N-16	Cerastium fontanum
73-594	L-16	Elymus arenarius	75-10	M-9	Carex maritima
73-596	R-11	Cochlearia officinalis	75-11	D-12	Cakile edentula
73-597	R-10	"	75-14	M-12	Honckenia peploides
73-600	M-18	"	75-19	M-9	"
74-2	L-10	Honckenia peploides	75-21	M-11	"
74-4	J-9	"	75-22	M-9	"
74-5	M-9	"	75-23	M-12	"
74-6	L-9	"	75-24	M-9	"
74-7	M-10	"	75-25	M-9	"
74-9	N-10	"	75-26	M-9	"
74-11	L-10	"	75-27	N-9	"
74-13	L-10	"	75-28	M-9	"
74-15	J-10	"	75-33	M-8	"
74-18	J-10	"	75-34	M-8	"
74-22	K-10	"	75-35	M-8	"
74-23	K-10	"	75-36	M-8	"
74-24	K-10	"	75-37	M-8	"
74-27	L-10	"	75-38	N-9	"
74-29	M-8	"	75-40	H-9	"
74-30	M-9	"	75-42	M-9	"
74-31	L-7	"	75-43	O-9	"
74-32	L-8	"	75-44	M-8	"
74-40	J-18	Cochlearia officinalis	75-45	M-8	"
74-51	E-18	Elymus arenarius	75-46	O-9	"
74-53	K-18	Mertensia maritima	75-49	M-9	"
74-55	L-17	Elymus arenarius	75-50	O-9	"
74-62	L-17	Mertensia maritima	75-51	K-9	Carex maritima
74-68	L-17	"	75-52	L-17	Honckenia peploides
74-73	K-17	"	75-54	N-10	"
74-75	K-17	"	75-55	M-15	"
74-77	L-17	Elymus arenarius	75-56	N-9	"
74-78	L-16	"	75-57	N-9	"
74-79	L-16	"	75-58	N-19	"
74-89	R-14	Puccinellia maritima	75-59	L-17	"
74-90	R-14	Elymus arenarius	75-60	D-12	Mertensia maritima
75-12	N-12	Honckenia peploides	75-61	G-13	Honckenia peploides
75-13	L-11	"	75-62	I-8	Cystopteris fragilis
75-15	L-12	"	75-63	J-18	Honckenia peploides
75-16	L-11	"	75-64	K-6	Juncus sp.
75-17	L-11	"	75-65	L-16	Honckenia peploides
75-18	N-11	"	75-66	J-8	Cochlearia officinalis
75-20	L-11	"	75-67	K-10	Honckenia peploides
75-29	L-9	"	75-68	E-13	Elymus arenarius
75-30	L-9	"	75-69	L-17	Honckenia peploides
75-31	M-9	"	75-70	K-8	Cochlearia officinalis
75-32	M-9	"	75-71	K-8	"
75-33	M-9	"	75-72	K-8	Honckenia peploides
75-39	M-9	"	75-73	H-17	Mertensia maritima
75-41	L-5	"	75-74	J-9	Equisetum arvense
75-47	L-7	"	75-75	J-9	"
75-48	M-9	"	75-76	K-8	Cochlearia officinalis
75-53	M-15	"			

No.	Quadrat	Species
75-77	I-10	Laguna sp.
75-78	O-11	Honckenya peploides
75-79	J-8	Unidentified sp.
75-80	C-12	Honckenya peploides
75-81	C-12	" "
75-82	C-12	" "
75-83	C-12	" "
75-84	C-12	" "
75-85	C-12	Mertensia maritima
75-86	O-14	Honckenya peploides
75-87	O-14	Mertensia maritima
75-88	C-14	" "
75-89	C-14	Cakile edentula
75-90	C-14	Tripleurosp. maritimum
75-91	C-14	Honckenya peploides
75-92	C-14	" "
75-93	C-14	Cakile edentula
75-94	O-14	Silene vulgaris
75-95	C-14	Honckenya peploides
75-96	C-14	" "
75-97	C-14	" "
75-98	D-14	" "
75-99	C-14	" "
75-100	D-15	" "
75-101	D-14	" "
75-102	D-14	" "
75-103	D-14	" "
75-104	C-15	" "
75-105	P-9	" "
75-106	M-11	" "
75-107	M-11	" "
75-108	K-18	" "
75-109	K-18	" "
75-110	D-14	" "
75-111	D-14	" "
75-112	D-12	" "
75-113	D-14	" "
75-114	D-12	" "
75-115	D-14	" "
75-116	D-14	" "
75-117	D-14	" "
75-118	D-14	" "
75-119	I-12	" "

The Colonization of Surtsey by soil arthropods (especially collembola)

The first collembolan species found on Surtsey was *Archisotoma besselsi*. The species was caught in 2 specimens 1967 on the coast under stones and pieces of wood. This is a very typical halobiontic species, found almost always on ocean coasts. The species is known from all coasts of the Atlantic Ocean, from Greenland, Jan Mayen, Spitzbergen, from the Icelandic Mainland, from the coasts of the North Sea and the Baltic and from the French and Italian Mediterranean coasts. Thus, *Archisotoma besselsi* is a species with great geographical distribution and great power of dispersal. Since 1969, the species has been regularly found every year of collection, i.e. 69, 70, 71, 72 and 1974. This species has also been found in the greatest number of specimens of all collembola, namely 1545. The species has been found mostly on the coast itself, but also over the whole flat, sandy area in the northern part of the island and as high up as the ocean water goes inxx during winter storms. This could be judged after the strings of fucus beneath the house. Above these the species was not found by me in 1974 and no other collembola either.

In the collection year 1968, two new species of collembola were found, namely *Isotoma maritima* and *Onychiurus duplopunctatus*. Since then, *Isotoma maritima* has been found regularly every year up to 1974, but in smaller numbers than *Archisotoma besselsi*, namely in 72 specimens. *Isotoma maritima* shows the same type of occurrence and dispersal as *Archisotoma besselsi*. *Onychiurus duplopunctatus* was found again first in 1972 and then in 1974. This species has been found in totally 14 specimens. Very little is known about the geographical distribution of this species. It was described as late as 1954. It is known from Jan Mayen, Greenland, the Icelandic Mainland and from Geirfuglask and seems to be halobiontic.

In the next collecting year, 1970, two more species of collembola were found, namely *Hypogastrura assimilis* and *Vertagopus arborea*. Since then, *Hypogastrura assimilis* has been found regularly up to 1974, in totally 52 specimens. The species has been collected on the coast and midway between the coast and the house. The species is not halobiontic. On the continent of Europe it has often been found in rotting, well-aired organic matter.

Vertagopus arborea was found in 1970 and 1972 in 43 specimens. The occurrence of this species on Surtsey is very remarkable. The species is not known from the Icelandic mainland, but from the island Bjarnarey. The species is not at all halobiontic. On the European continent it occurs predominantly on tree trunks and in the higher vegetation. In Surtsey it was found on the coast and in the house.

In 1972 the following three species of collembola were found: *Proisotoma minuta*, *Folsomia fimetaria* and *Anurida granaria*. *Proisotoma minuta* was found again in 1974 and exists in 18 specimens from the island. This species has often been found near ocean coasts. In Surtsey it was found under pieces of wood near the house and half way between the coast and the house. *Folsomia fimetaria* was found again in 1974 but has been found in totally 2 specimens only. The species was found under driftwood on the coast and in a piece of grass with soil which had been washed up on the coast. It ~~is~~ has often been found on ocean coasts but is not a typical halobiontic species.

Judging from the above, 8 species of collembola had been found on Surtsey up to the year 1972. Of these, all but *Anurida granaria* have been found at least two times (with one year between). In the collecting year 1974 4 species new to the island were found. All were found in a piece of grass with soil which was found on the coast by Erling Ólafsson. This piece was treated in a Berlese funnel and contained the following species: *Onychiurus asperatus* (216 ex.), *Friesia mirabilis* (8 ex.), *Hypogastrura denticulata* (2 ex.), and *Folsomia quadrioculata* (1 ex.). None of these species is typically halobiontic and all are common soil animals on the mainland of Iceland.

Now some words about the mites. According to our Surtsey-book, 15 species of mites (Acari) have been found on Surtsey. Many of these are phoretic animals (i.e. they are transported as nymphs with flies), synanthropic or parasites. All have been found on the coasts, between the coast and the house or on birds. In 1972 I collected some samples of the beginning moss-vegetation on the central parts of the island and around the craters. From a moss-sample from the western crater I obtained a mite. It showed to be the Oribatid *Oppiella nova*, a species new to the island. In 1974 the moss-vegetation in the central parts of the island and on the southern lava plains had grown so much, that it was now possible to collect samples of moss that could be treated in Berlese funnels. The result of this was, in my opinion, rather remarkable. In the square E5 above the eastern crater 12 mites (Gamasidae) were found in a sample of small moss-plants on warm, somewhat moist earth near a steam-hole. In the square E6 1 Gamasid was found in moss vegetation on sandy ground in the lava. In the same square at the eastern crater 3 Gamasids were found in very small moss plants in damp earth at a steam hole. In square E7 the following specimens were found among small, dry plants of moss in the lava: 1 Suctobelba (an Oribatid), 2 Trombidids and 3 Gamasids. In square E8 in dry moss in the lava several Trombidids and Gamasids were found. In vigorous, green moss vegetation in a hole in the lava where it was somewhat moist

several Gamasids and Trombidids were found. And in square F8, at least, 2 Gamasids were found in dry moss vegetation in the lava. This means, that the mites have started to colonize the central parts of the island. A real arthropod soil fauna has thus developed in the mossy vegetation in the central parts of the lava plain. This has happened very rapidly but is in full accordance with the prophecies in our book. The mites will soon be ^{identified} ~~examined~~ to species by specialists.

In our Surtsey-book the authors have at length discussed the various possibilities and ways of dispersal of the fauna. For the soil fauna I want here to add the following. ~~In 1974 a piece of grass with soil was found that had been washed ashore. The piece was treated in a Berlese funnel and delivered 248 specimens of collembola belonging to 5 species. Of these, 4 were new to Surtsey, namely Onychiurus armatus (216 ex.), Friesea mirabilis (8 ex.), Hypogastrura denticulata (2 ex.) and Folsomia quadrioculata (1 ex.). Besides these, 21 exp specimens of Archisotoma besselsi were found. This example demonstrates two interesting facts. First, hydrochorous transport/~~ ^{by such things} ~~is really~~ effective when it happens. How often it happens is, however, difficult to say. Second, the collecting of the sample itself is a dramatic interference with the process of immigration to the island. To-day 248 exp specimens of collembola belonging to 5 species, whereof 4 are new to the island, lie in alcohol in Stockholm instead of living freely in Surtsey! What effect has this had on the immigration and colonization of Surtsey?

At last I should like to say something about the colonization. According to the definition used in the Surtsey-book, colonization means "a more or less permanent establishment of a population of an animal or plant species in a new area. "Permanence" requires at least that reproduction occurs but the danger of extinction due to environmental change is always imminent in the initial stages, in which case "temporary colonization" seems an adequate expression." ~~Wm~~ The authors mean in their analysis of the immigration and colonization, that in most cases it has been a question of temporary colonization. As to the collembola, we mean (that is in the year 1973), that only the species Archisotoma besselsi and Isotoma maritima have managed a "real" ^{permanent} colonization. Both these species were of course found in great numbers in 1974, especially Archisotoma besselsi. This species has thus existed continuously in Surtsey during 8 years; Isotoma maritima during 7 years; Hypogastrura assimilis during 5 years; Onychiurus duplopunctatus was found already in 1968 but not in 1970. Then the species was found both in 1972 and in 1974. I think that it is very probable that also these two last-named species, namely Hypogastrura assimilis and Onychiurus duplopunctatus, have managed a ^{permanent} ~~real~~ colonization. Folsomia fimetaria

and *Proisotoma minuta* were found both in 72 and 74. *Proisotoma* was found in 18 specimens. This could possibly mean permanent colonization. On the other hand the species *Anurida granaria* and *Vertagopus arborea* have not been found again since 1972. According to these facts I find it very probable that the half of the 12 species of collembola found in Surtsey have managed a permanent colonization.

As to the mites it seems very probable that the species in the mossy vegetation in the central parts of the island very soon would or perhaps already have managed a permanent colonization. They have already now ~~existed~~ comparatively stable surroundings in the growing soil and this will stabilize itself quickly as time goes. The final conclusion of the above facts will be that Surtsey is ^{quickly} ~~now~~ being colonized by a series of soil arthropods.

Högni Bödvarsson
Skogshögskolan
Fack
104 05 Stockholm 50
Sverige

Observations of Birds on Surtsey,
Summer 1975.

Nesting birds.

Four species of birds laid eggs on Surtsey in the summer of 1975, that is to say; the Fulmar Fulmarus glacialis, and Guillemot Ceppus grylle, which have both laid eggs regularly on the island each year since 1970, the Black-backed Gull Larus marinus, which laid eggs for the first time in the summer of 1974, and the Kittiwake Rissa tridactyla, which laid eggs for the first time this summer. Each of the species will be dealt with here briefly.

Fulmar Fulmarus glacialis:

Fulmar nests were searched for and counted in the later part of June. They proved to be 17 in all. Most of the nests were in the cliff on the west and south-west part of the island, on 13 in all. Two were in the cliff at the extreme south of the island and two in the eastern part of the island.

When the nests were examined in the later part of August it became clear that a disastrous loss had taken place, since living young were found in only four of the nests and it can therefore be considered certain that about 13 nests had perished, since the young fulmar is not able to fly until some time in September. The reasons for this loss can no doubt be traced to the unfavourable weather conditions in the summer, which was cold and wet, with frequent storms, especially from the south-east, it being noteworthy that the four nests where the young survived were all on the western part of the island.

Kittiwake/Rissa tridactyla:

The most important ornithological event of the summer was that this year the kittiwake began to nest on Surtsey. The kittiwake, which is a very gregarious bird and lives in large groups, has always been the most common bird on the island, and it also nests on Heimaey, laying its eggs in close-packed nesting-grounds on the outside of sea-cliffs. The kittiwake was seen sitting on Surtsey as early as 1964 when the eruption was in full swing and was perhaps the first bird to settle on the island. There have been hundreds of kittiwakes on the island in recent summers, and they obtain their food from the sea around the island.

The kittiwake nesting-place was found in the cliff on the south-western part of the island in quadrat N-4. The nests were relatively close together on narrow ledges in the upper part of the cliff. To make the nests the birds had for the most part carried up seaweed, most prominent being Ascophyllum nodosum, which could be seen here and there hanging down out of the nests. In one of the nests a nylon thread from a net had been used as building material. At this time it was still possible to see birds carrying nesting material to the cliff so that it is probable that the birds had not altogether finished their laying.

As far as can be determined there were originally eight nests there in the cliff, which shows that the original nucleus of a nesting-ground does not need to be large. In established nesting-grounds, such as on Heimaey, tens or hundreds of nests are involved.

Guillemot/Ceppus grylle:

There is some difficulty involved in finding the nests of the guillemot, since it lays its eggs in holes in the cliff and the only way to find the nests is therefore to keep track of the birds as they fly into the holes with food which they obtain from the sea. In this way two nests were found in the west of the island. There were at least two other nests, one in the south and the other in the east of the island, where pairs of guillemot were seen by the cliff. The guillemot lays 2-3 eggs in the nests. It is not known for sure how many young grew up.

Black-backed Gull/Larus marinus:

One pair of black-backed gulls nested on the island in the summer as last summer. The nest was not particularly carefully made, and was on smooth lava mixed with ash. The bird had brought scraps of Honckenya peploides for the nest and it also contained a considerable amount of fishbones.

When the young were checked at the beginning of July only one of them was found alive. A second lay beside the nest dead, and the fate of the third is unknown. Only one of them then grew up, and it was tagged. This young bird thrived excellently, and was able to fly about the middle of August. It is not improbable that the unfavourable weather played its part in the death of the two young.

About 15 black-backed gulls are based on Surtsey over the summer, getting their food from driftage and from the surrounding sea. The point must come eventually when more birds will start nesting, because conditions for nesting on the island seem to be good.

This nesting did not go off without set-backs any more than any others on the island. There were two rock-falls from the cliff at the place where the nests were. On the first occasion one nest was lost and three on the second. Four young therefore grew up from as many nests and they were beginning to fly August 21st when a final count was made in the nests.

It will be interesting to see whether there is a follow-up to the nesting of the kittiwake next summer and whether it takes to nesting regularly on the island. The fragile lava of the cliffs, which is always changing its form, must make it difficult for the birds to nest and prevent it from keeping to its regular nesting-places as it does elsewhere.

Other birds:

The Tern Sterna paradisaea has been a regular summer visitor to Surtsey since 1964 and this year in the early part of the summer there was a considerable number, probably about 300 birds. It keeps itself in flocks on the headland at the northernmost part of the island, obtaining its food from the driftage on the beach and the sea around the island. It has not yet begun to nest on Surtsey. One egg was however, found on the north headland June 15th, but it was cold and had apparently not been incubated. When it was examined a few hours later, it had been broken and emptied, presumably the work of a black-backed gull Larus marinus. It is not possible to say definitely whether an attempt to nest was involved here, but there are no cases of tern eggs being found on the island previously. It may be mentioned that

the tern does not nest on Heimaey, where it is thought that the depredations of gulls (black-backed) prevent it, and the same reason may explain why the tern does not nest on Surtsey.

As the summer wears on the number of tern decreases and by the middle of August they had become very few and were very rarely seen.

Other species of birds that were seen were not as confined to the island as the five mentioned above. On July 10, 1975 Phalaropus lobatus were sighted, and numbers of them could be seen off the island until the later part of August. They obtain their food both from the surface of the sea and on the beach.

In the later part of August an almost daily sight on the beach were Charadrius hiaticula, Croethica alba, and Calidris canutus picking up small organisms that the waves bring to the land, the last two being visitors to Iceland in the spring and autumn, but not nesting there.

At the ^{same} time there was also quite a number of Oenanthe oenanthe on the island, doubtless on their way south; but stopping over on the island, where they catch flies for food. The island was also visited by Motacilla alba and Anthus pratensis, which behave in the same way as Oenanthe oenanthe.

Two ravens Corvus corax were seen on the island in the later part of August, but they were rare visitors to the island.

In addition to the black-backed and kittiwakw gulls, Larus argentatus was also seen occasionally on Surtsey.

Below is a table listing the birds' nests
discovered on Surtsey in the summer 1975.

Species	Sites of nests	Number of nests	Fate	Number of young
Fulmar	L-19	1	1 destroyed	
	M-19	1	1 "	
	T-14	2	2 "	
	S-8	1	1 "	
	Q-6	1	1 "	
	O-5	1	1 "	
	N-5	1	1 "	
	L-4	4	2 "	2
	K-4	2	1 "	1
	I-4	1	1 "	
	H-4	2	1 "	1
Rissa	N-5	8	4 "	4
Guillemot	K-19	1 ?		
	T-14	1 ?		
	N-5	2		
Black-backed gull	R-8	1		(3) 1
Arctic tern	A-14	1 ?		

There were approximately 30 nests on the island in 1975
but only nine young were known to reach maturity.
The location of the nests is shown on the accompanying
map. (Fig. II).