# A survey of the benthic coastal fauna of Surtsey in 1992 and a comparison with earlier data

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#### ABSTRACT

This paper consists of a discussion of the results so far obtained from the samples of benthic animals collected from the subtidal zone at Surtsey in June, 1992, and an attempt to compare these results with earlier data from the same area.

# INTRODUCTION

Already during the initial phases of the underwater eruption of 1963, which in the years that followed was to build up the new island of Surtsey, and which first became visible to observers on November 14 of that year, marine biologists had begun speculating on the extent of the influence that such an event might exert on marine life in the area. As a result, during this early period scientists from the Marine Research Institute in Reykjavík embarked upon research surveys of subsequent biological development in the region (Sigurðsson 1965, Skúladóttir 1966).

The first attempt to follow the colonization of benthic fauna at Surtsey was made during the years 1966-1968 by Willy Nicolaisen, who used grabs and dredges (Nicolaisen 1967a, 1967b, 1968, 1970). However, as the underwater slopes off the east, south and west coasts of Surtsey were largely found to be covered by rocks, it was not considered satisfactory to continue the use of such equipment to sample benthos in these areas. Therefore sampling by the method of SCUBA-diving was commenced in 1967 (Jónsson 1968, Sigurðsson 1968), excepting however the sandy subtidal bottom off the north coast, as no scientists were then available for work on the fauna of this type of bottom. As sampling by means of SCUBA- diving of fauna found on the subtidal slopes proved to be the best method available, it has been used exclusively after 1968 (Sigurðsson 1968, 1970, 1972, 1974, Hauksson 1982, 1992).

In the beginning, the sampling was carried out annually; soon, however, the development of the fauna and flora proved to be so slow that it was considered satisfactory to collect samples every third year. It was also necessary to take account of problems imposed by limited economic resources. The interval between the last two samplings was five years. The identification of the animals has as yet not been completed. Thus in Tables 1-3, \* after the larger groups means that there are still some species that have not been identified. The bryozoans were identified by Dr. Karen Bille Hansen, while the author is responsible for the identification of the other groups found in the samples from 1992.

# THE SAMPLING

The benthic animals from the subtidal zone off Surtsey down to 30 m were collected by the technique of SCUBA-diving during June 21-25, 1992. Samples were taken on the three main transects off the east, south and west coasts (Sigurðsson 1968, 1970, 1972, 1974, Hauksson 1982, 1992).

Weather conditions being bad, only one tran-

sect, that off the east coast, could be worked as planned. The collections of samples taken off the south and west coasts therefore gave limited results, a fact that has to be borne in mind when the present attempt to compare them with earlier faunal records is considered. Particularly at the 5m stations the surf was too heavy for adequate sampling, but the whole of the research work was difficult and some of the stations had to be omitted (see Tables 2 and 3). Adverse weather conditions did not allow access to the littoral zone.

# RESULTS

Tables 1-3 show the distribution by depth of the benthic animals on the three transects at Surtsey which were sampled in 1992. It has, however, to be borne in mind that weather conditions at the time were bad and the sampling, therefore, was ineffective, especially off the south and west coasts. Although the number of species may be different at the various coasts, it is not likely that the difference is as big as might seem to appear from Tables 1-3, where the fauna

Table 1. Benthic animals from the subtidal zone off the east coast of Surtsey in June 1992

Depth (m)	5	10	15	20	25	30	Depth (m)	5	10	15	20	25	30
PORIFERA*)	x	x	x	x	x	x	Idotea neglecta G. O. Sars	21		x			
HYDROZOA*)	x	x	x	х	x	x	Janiropsis breviremis G. O. Sars			**	x		
ANTOZOA							Janira maculosa Leach		x	x			
Alcyonium digitatum L.		x	X	x	x	x	Munna kröyeri Goodsir	x	x		x		142
NEMATODA*)		x	x	х		** :	AMPHIPODA*)	x	x	x	х	х	х
POLYCHAETA*)		х	x	х	х	x	DECAPODA						
BRYOZOA							Hyas coarctatus Leach		х	**	х	х	
Tubulipora liliacea (Pallas)		х		х	х	х	Galathea nexa Embl.	.,					х
Tubulipora sp.		x			х	x	Eupagurus bernhardus L.	22					x
Diplosolen obelia (Johnston)				**		х	POLYPLACOPHORA*)	**	х				
Lichenopora verrucaria (Fabr.)	••		х			**	PROSOBRANCHIA						
Disporella hispida (Fleming)	**					x	Helcion pellucidum (L.)	х	х		•		••
Scruparia ambigua (d'Orbigny)						х	Acmea testudinalis (Müller)		х				
Scruparia chelata (L.)		x		x	366	x	Margarites groenlandicus (Chemn.)	44		**		x	544-5
Membranipora membranacea (L.)		х	х	х	х		Margarites helicinus (Fabr.)	х	х	( <b>39</b> 8)	••		
Electra pilosa (L.)	••	x	х	х	122		Lacuna divaricata (Fabr.)	x	х	х	х	22	22
Callopora lineata (L.)	**	x					Skenopsis planorbis (Fabr.)		x		**		
Callopora craticula (Alder)	••			••		х	Omalogyra atomus (Phil.)				х		
Tegella unicornis (Fleming)	24	x	144	x	x	x	Neptunea despecta (L.)	22	224	144	320	12	х
Tegella arctica (d'Orbigny)		2002		X	х	x	Buccinum undatum (L.)		х	2.00			
Amphiblestrum flemingii (Busk)	••	••		х		X	Buccinum undatum var.						
Membraniporella nitida (Johnston)				**	х	87	coeruleum (G.O.Sars)	••			х	a	
Scrupocellaria scruposa (L.)	••		••	х	••		Nassa incrassata (Ström.)		х	х	х	х	х
Scrupocellaria elongata (Smitt)				34	x	x	NUDIBRANCHIA*)	x	x	- 332	x	х	х
Tricellaria ternata (Ellis & Solander)	2.00	X	3.00	X	1999	X	LAMELLIBRANCHIA						
Cribrilina punctata (Hassall)	••	х	••	••	**	1	Mytilus edulis (L.)	х	х	х	х	х	х
Cribrilina cryptooecium Norman		x		х	х	X	Modiolaria discors (L.)				х		
Cribrilina annulata (Fabr.)		х		х	х	х	Modiola phaseolina (Phil.)				х		х
Umbonula littoralis Hastings	( <b></b> )	x		X		х	Chlamys islandicus (Müller)	~	1947	242			X
Porella alba Nordgaard	:22	х		х	х	х	Heteranomia squamula L.		х	х	х	х	х
Escharella immersa (Fleming)	**	х	••	х	**	••	Kellia suborbicularis (Mont.)			х	••		х
Parasmittina trispinosa (Johnston)		332		x	X	**	Cardium fasciatum (Mont.)	**			X		х
Microporella ciliata (Pallas)		171				X	Syndosmya prismatica (Mont.)		х				•••
Cylindroporella tubulosa (Norman)		x	146	11	- 62		Hiatella arctica (L.)	X	X	X	х	X	х
Celleporella hyalina (L.)		х	х	х	х	х	ASTEROIDEA						
Celleporina hassallii (Johnston)		х	**		••	х	Asterias rubens L.		х		х	х	х
Alcyonidium mamillatum Alder		100			х		OPHIUROIDEA						
Alcyonidium mytili Dalyell	••	х			••	x	Ophiopholis aculeata (O.Fr.Müller)		х	х	••	х	х
Alcyonidium parasiticum (Fleming)	100	5 <b>6</b> .2	346	х	58.	32	ECHINOIDEA						
Arachnidium fibrosum Hincks	. 11			**	335	х	Echinus esculentus (L.)			х		X	х
CIRRIPEDIA							ASCIDIACEA*)	х		х	х		
Verruca stroemia (Müller)	38	х	х	х	х	x	Styela rustica (L.)	••	••	х	х	**	••
Balanus balanus (L.)	х	х	х	х	х	X	Halocynthia pyriformis (Rathke)		х	х			
ISOPODA							Boltenia echinata (L.)			**	x	**	302
Idotea granulosa Rathke	х		х		••								

<sup>(0)</sup> Species among these were not identified

Table 2. Benthic animals from the subtidal zone off the south coast of Surtsey in June 1992.

Depth (m)	5	10	15	25	30
PORIFERA*)		x	x	x	x
HYDROZOA*)		x	x	x	x
ANTOZOA*)		x			
Alcyonium digitatum L.				x	x
NEMATODA*)		x		x	x
POLYCHAETA*)		x	x	x	x
BRYOZOA					
Tubulipora liliacea (Pallas)					х
Tubulipora sp.	2000			110	x
Diplosolen obelia (Johnston)					x
Scruparia chelata (L.)	1220	323			x
Electra pilosa (L.)					x
Callobora lineata (L.)			1.2		x
Callobora craticula (Alder)	1220	0240 17242		22.1	x
Tegella unicornis (Fleming)					x
Ambhiblestrum fleminoii (Busk)		1.20	100		x
Membraniborella nitida (Johnston)					x
Scrubocellavia elongata (Smitt)					x
Tricellaria ternata (Ellis & Solander)			×		x
Cribriling bunctata (Hassall)					x
Cribriling crybtooecium Norman					a X
Cribriling annulate (Fabr.)					~
Umbouula littoralis Hastings					x
Celleboring hassallii (Johnston)				· ·	~
Alexanidium transiticum (Flaming)	304.3		~		~
CIRRIPEDIA	•••)	340			~
Verruca stroemia (Müller)	••			x	х
Balanus balanus (L.)	••		••	х	х
Balanus hammeri (Ascanius)		**	**	x	
ISOPODA					
Munna kröyeri Goodsir	14	x		х	х
Janiropsis breviremis G. O. Sars	••	x	x	х	
Janira maculosa Leach		x		х	
AMPHIPODA*)		x	x	x	x
DECAPODA					
Hyas coarctatus Leach		**		X	x
PROSOBRANCHIA					
Lacuna divaricata (Fabr.)		х	х	x	х
Nassa incrassata (Ström.)			x	x	x
NUDIBRANCHIA*)	х	x		x	х
LAMELLIBRANCHIA					
Mytilus edulis (L.)		x	x	x	x
Modiola phaseolina (Phil.)			х	x	x
Heteranomia sauamula L.		1000		x	x
Hiatella arctica (1.,)		x	x	X	x
Kellia suborbicularis (Mont.)					x
ASTEROIDEA				0	2
Asterias rubens L.			х	х	х
OPHIUROIDEA					
Ophiopholis aculeata					
(O. Fr. Müller)		••		х	х
ASCIDIACEA*)	**		**	x	
Styela rustica (L.)		x			

\*) Species among these were not identified.

at the east coast is represented by twice as many species as at each of the other two transects.

The efficiency of the sampling may have been further affected by other factors than adverse weather conditions. Thus, for instance, some of the animals present may easily have been so small as to have escaped the attention of the divers. An example is the prosobranch *Omalogyra atomus* (Phil.) which is only about 1mm in diameter, being the smallest invertebrate dealt with in the present paper. Such small animals may even have been overlooked during the identification of the samples.

It is noteworthy how few species were found for the first time at Surtsey in 1992 (see Tables 4-9). It is only the bryozoans that include a number of new species, though it should be mentioned that samples from this group for the years between 1971 and 1992 have not been identified, so nothing is said here about new species in the latter year. It is therefore obvious that the development of the benthic fauna at Surtsey has been very slow, and is likely to remain so for a long time to come, especially if compared with the relatively much richer and more advanced benthic fauna at the other islands of the Vestmannaeyjar archipelago.

There would seem to be two main reasons for this slow development. In the first place, the underwater slopes of Surtsey are very unstable and therefore hostile to some of the colonizing species. Every year heavy waves forced by winter storms break off a large quantity of the southern lava field and transport lava blocks, gravel and sand northwards along the west and east coasts, thereby disturbing the settlement of fauna and flora on the subtidal slopes and in the tidal zone. Secondly, difficulties in the way of transport of animals to Surtsey from the adjacent islands can limit the development of the faunal communities, especially in the case of animals with no or short larval stages.

It will clearly take a long time for the benthic communities at Surtsey to develop and stabilize to an extent comparable with what is to be found at the other islands. This holds good both for the underwater slopes and the littoral zone, though development in the latter is a long way behind that found in the former, as a 1997 survey would seem to indicate (Sigurðsson 1999).

# COMPARISON WITH OLDER DATA

Tables 4-9 demonstrate the arrival of benthic animals in the upper part of the underwater slopes and the tidal zone of Surtsey, as far as the present stage of the work of identification allows this to be determined. This topic was treated by Hauksson (1992), but as the data from 1970,

Table 3. Benthic animals from the subtidal zone off the west coast of Surtsey in June 1992

Depth (m)	5	10	15	25
PORIFERA*)	x	x	x	x
HYDROZOA*)	x	x	x	x
ANTHOZOA	07	2000	0.00	355
Alcxonium digitatum L.			x	x
NEMATODA*)	x	x	x	100
NEMERTINI*)			x	
POLYCHAETA*)	x	x	x	2004) 2023
BRYOZOA				
Tubulipora liliacea (Pallas)			x	
Tubulibora sp			x	
Plagioecia batina (Lamarck)	8.2 15		x	*** 
Lichenobora verrucaria (Fabr.)			Ŷ	
Scrubaria ambigua (d'Orbigny)	55		~	
Scruparia chelata (L.)			~	
Montranitora montranacea (L.)			~	
Flasha bilosa (L.)		х	- X	••
Securita phosa (L.)	<i></i>	**	X	**
Tricellaria temata (Ellia % Salandar)		••	x	••
Umbanda littardia Hastiara	••	**	x	**
Collectorelle busking (L.)		(**) (	x	3000
Celleporella nyalina (L.)		x	x	**
Celleporina hassallii (Johnston)	**	300	x	112
CIRRIPEDIA				
Verruca stroemia (Muller)			x	225
Balanus balanus (L.)		54C	X	
ISOPODA				
Idotea granulosa Rathke			x	563
Janiropsis breviremis G. O. Sars	х	х	x	х
Janira maculosa Leach	- 14	••		х
Munna kröyeri Goodsir			х	
AMPHIPODA*)	X	x	x	х
DECAPODA				
Hyas coarctatus Leach	**	••	x	330
PROSOBRANCHIA				
Margarites groenlandicus (Chemn.)			x	
Margarites helicinus (Fabr.)	22	x		1.1
Lacuna divaricata (Fabr.)		x	x	
Buccinum undatum (L.)			x	422
NUDIBRANCHIA*)	x	2000	x	x
LAMELLIBRANCHIA				
Mytilus edulis (L.)	x	x	х	х
Modiola phaseolina (Phil.)		x	x	
Heteranomia squamula L.			x	
Cardium fasciatum (Mont.)			x	440
Hiatella arctica (L.)	x	x	x	x
ASTEROIDEA	100	\$75U	0579	05
Asterias rubens L.	x	x	x	x
OPHIUROIDEA	1.52	5.52	0.0	222
Obhiobholis aculeata (O. Fr. Müller)	15	325	x	x
ASCIDIACEA*)	×	100	v	~

\*) Species among these were not identified.

1971 and 1977 were not available to him, the subject will be resumed here.

No other identifications of nudibranchs than those referred to by Hauksson (1992) are available, so this group will not be treated further here. Hydrozoans, polychaets and amphipods have partly been identified but the results were not available to the present author. These three groups have all been represented in every sampling year since 1967.

Although the samples are not quantitative, I have tried to give a rough idea of the density of the faunal elements at Surtsey by using frequency of individual species in the samples in combination with the divers' reports and underwater photographs.

# Scyphozoa (Table 4)

*Halyclystus octoradiatus* (Lamarck) is the only species of this group found at Surtsey. It seems to be very thinly scattered as only a few individuals have been found in the samples, and these not every year.

## Anthozoa (Table 4)

Alcyonium digitatum L. This species, which was first found in 1969, and again every sampling year from then on, is very common (Fig. 1).

*Tealia felina* (L.) has only been determined in the samples from 1987.

# Bryozoa (Table 5)

The bryozoans from Surtsey have only been identified from 4 sampling years, so their immigration to Surtsey cannot be followed in the same measure as for some of the other groups of benthic animals that are treated here. However, as can be seen from the table, the number of species has increased fairly rapidly, 38 of these having been identified, the bryozoans thus being among the most diverse benthic groups at the island. One of

#### Table 4. Arrival and occurrence of Scyphozoa and Anthozoa at Surtsey.

Year	69	70	71	74	77	80	83	84	87	92
SCYPHOZOA										
Haliclystus octoradiatus (Lamarck)	x	x					x	x	1.44	544
ANTHOZOA										
Alcyonium digitatum L.	x	x	x	x	x	x	x	x	x	x
Tealia felina (L.)			1.25			22.1			x	

Table 5. Bryozoa found at Surtsey in 1967, 1968, 1971 and 1992.

Year		67	68	71	92
	Membranipora membranacea (L.)	x	x	x	x
	Celleporella hyalina (L.)	x		x	х
	Scruparia ambigua (d'Orbigny)		x	x	х
	Scruparia chelata (L.)		x	x	x
	Electra pilosa (L.)		x	х	х
	Amphiblestrum flemingii (Busk)		x	x	х
	Tricellaria ternata (Ellis & Solander)		x	x	х
	Cribrilina punctata (Hassall)		х	x	х
	Alcyonidium parasiticum (Flem.)		x	x	x
	Alcyonidium polyoum (Hassall)		x	х	
	Umbonula littoralis Hastings		x	220	х
	Flustra foliacea (L.)	~	x		
	Callopora craticula (Alder)			х	х
	Tegella unicornis (Flem.)		22	x	x
	Membraniporella nitida (Johnston)	~		x	х
	Scrupocellaria elongata (Smitt)			х	x
	Escharella immersa (Flem.)			х	х
	Parasmittina trispinosa (Johnston)			х	х
	Alcyonidium mamillatum Alder		••	x	x
	Disporella hispida (Flem.)	24	**	х	х
	Porella alba Nordgaard			х	х
	Callopora dumerilii (Audouin)			х	
	Porella minuta (Norman)			x	
	Porella smitti Kluge		545	x	
	Tubulipora liliacea (Pallas)				х
	Plagioecia patina (Lamarck)	**	3425	2000	X
	Diplosolen obelia (Johnston)				х
	Lichenopora verrucaria (Fabr.)				х
	Callopora lineata (L.)				x
	Tegella arctica (d'Orbigny)				х
	Scrupocellaria scruposa (L.)			**	x
	Cribrilina cryptooecium Norman				х
	Cribrilina annulata (Fabr.)				х
	Microporella ciliata (Pallas)		**	1944	x
	Cylindroporella tubulosa (Norman)				х
	Celleporina hassallii (Johnston)			12	х
	Alcyonidium mytili Dalyell				х
	Arachnidium fibrosum Hincks				x

the species, *Membranipora membranacea* (L.), is very conspicuous, being at once very common and covering extensive parts of algae. It has been found in every sampling year since 1967.

## Cirripedia (Table 6)

*Verruca stroemia* (O. Fr. Müller) is commonly found living on stones and on shells of other animals at Surtsey and has occurred in every sampling year since 1967, except in 1984.

Balanus balanoides (L.) was already found in the tidal zone in 1967, and in every summer and autumn sampling in the same area since, though only in its first year of life. This barnacle is very common in the neighbourhood of Surtsey, where its larvae arrive every spring and settle down in the tidal zone. However, this habitat is



Figure 1. Aleyonium digitatum at Surtsey in 1974. (Photo. Halldór Dagsson).

so unstable that normal littoral animal communities have still not developed there. During the winter the young barnacles have been destroyed by surf caused by frequent winter storms. This species has occasionally been found down to a depth of 15 m at Surtsey.

*Balanus balanus* (L.) was first found in 1968 and every sampling year since and seems to be fairly common.

*Balanus hammeri* (Ascanius) has only occasionally been found at Surtsey and is presumably rare at the island.

## Isopoda (Table 6)

Janiropsis breviremis G. O. Sars was first found at Surtsey in 1971 and has occurred in subsequent sampling years except in 1983. In that year the sampling was ineffective on account of bad weather conditions. This species is by no means rare at Surtsey.

Munna kröyeri Goodsir was first found in 1971 and again in subsequent collections, except in 1984 and 1987. Because of its small size it may well be more common than its occurrence in the samples might seem to indicate.

Janira maculosa Leach has only been found in samples from 1977 and 1992, which indicates that it might be rare.

*Idotea granulosa* Rathke has only occurred in samples from 1987 and 1992, and then only some few individuals found at depths from 5 to 20 metres.

*Idotea neglecta* G. O. Sars. Only one specimen was found at a depth of 15 m off the east coast in 1992.

Table 6. Arrival and occurrence of Cirripedia, Isopoda and Decapoda at Surtsey.

Year	67	68	69	70	71	74	77	80	83	84	87	92
CIRRIPEDIA												
Verruca stroemia (O. Fr. Müller)	x	x	x	x	x	x	x	x	x		x	x
Balanus balanoides (L.)	x	x	x	х		х	x	••	x	x	x	
Balanus balanus (L.)	24	x	x	x	x	x	x	x	x	x	x	X
Balanus hammeri (Ascanius)		x	x	x	**		x	x				х
ISOPODA												
Janiropsis breviremis G. O. Sars	11				x	x	x	x		x	x	x
Munna kröyeri Goodsir					x	x	x	x	x			x
Janira maculosa Leach	44						x	11 C			222	x
Idotea granulosa Rathke											x	х
Idotea neglecta G. O. Sars		1220										х
DECAPODA												
Hyas coarctatus Leach	х	x	х	х	x	х	x	х	х	х	х	х
Portunus holsatus Fabr.	x	x	х		x		11					
Eualus pusiola (Kröyer)	x		x	x	x	x	x	x	••			
Galathea nexa Embl.			х	х	х	x	x	х		х	х	х
Pandalus montagui Leach	22					x	x	44.0			••	
Eupagurus bernhardus L.		1000						x	200	x		x

Table 7. Arrival and occurrence of Prosobranchia at Surtsey.

Year	68	69	70	71	74	77	80	83	84	87	92
PROSOBRANCHIA											
Lacuna divaricata (Fabr.)	x	x	x	x	x	x	x	x	x	x	x
Aporrhais pes-pelicani (L.)	x										
Odostomia unidentata (Mont.)		x	х	x	х	x	X				
Skenopsis planorbis (Fabr.)				x			x				х
Velutina velutina (Müller)					x	x	x				
Buccinum undatum (L.)				5	x	x		Sec. 1			x
Margarites groenlandicus (Chemn.)			~			х	x	х	x	x	х
Nassa incrassata (Ström.)				11		х	x	х		x	х
Acmaea testudinalis (Müller)			<u>.</u>			x			x		х
Onoba striata (Mont.)						x	x				
Lacuna pallidula (da Costa)						x				x	(24)
Helcion pellucidum (L.)		•				x					х
Acmaea virginea (Müller)						x					
Natica clausa (Brod. & Sow.)	<u></u>					x					
Gibbula tumida (Mont.)							х				
Margarites olivaceus (Brown)					342				x	x	342
Omalogyra atomus (Phil.)										x	х
Margarites helicinus (Fabr.)		**	.,							x	х
Neptunea despecta (L.)											x

#### Decapoda (Table 6)

*Hyas coarctatus* Leach, having occurred in the samples since 1967, appears to be quite common at Surtsey

*Portunus holsatus* Fabr. was sparsely represented in the samples from Surtsey in 1967-69 and again in 1971, but has not been found later.

*Eualus pusiolus* (Kröyer) occurred in samples from 1967-80, except for 1968. This is a swimming decapod which is probably still in the area.

Galathea nexa Embl. has been found at Surtsey

since 1969 and is probably not rare there.

*Pandalus montagui* Leach has only occurred twice in the samples from Surtsey; nevertheless, it is not uncommon in the surrounding region.

*Eupagurus bernhardus* (L.) was found at Surtsey in 1980, 1984 and 1992 only, which might point to its rarity at the island.

# Prosobranchia (Table 7)

Lacuna divaricata (Fabr.) was first found at Surtsey in 1968. Its frequent occurrence in later sampling years shows it to be common at the island.

Aporrhais pes pelicani (L.). Only one juvenile individual was found at Surtsey in 1968, but none later. This must be considered natural as a convenient habitat for this species is absent from the sampling area. However, the species has been found in the surroundings of Surtsey, and its shells were brought to the surface during the eruption and were found in the tephra part of the island.

Odostomia unidentata (Mont.) occurred first at Surtsey in 1969 and was found in the next 5 collections, but not later, being represented by a small number of individuals only. However, as it is a very small prosobranch, it may have been more frequent than the records indicate, and might still be living at the island.

Skenopsis planorbis (Fabr.). This prosobranch was first found at Surtsey in 1971, and again in 1980 and 1992. It seems to be rare, but might have escaped the divers' attention on account of its small size.

*Velutina velutina* (Müller) occurred in the samples in 1974, 1977 and 1980. It is rare at Surtsey, and likewise not frequent at the south coast of Iceland.

Buccinum undatum (L.) has been found in the samples from 1974, 1977 and 1992. It is still infrequent at Surtsey.

Margarites groenlandicus (Chemn.) occurred first in 1977 and has been found in every sampling year since then. However, up to now it does not seem to be common at Surtsey.

Nassa incrassata (Ström.) has been found at

Surtsey since 1977, except in 1984, and appears to be fairly common.

Acmaea testudinalis (Müller) was only found to occur in the samples from 1977, 1984 and 1992.

Onoba striata (Mont.) is one of the small prosobranchs which were only brought up in samples with other animals or algae and are only found in the samples from 1977 and 1980.

*Lacuna pallidula* (da Costa) only occurred in the samples from 1977 and 1987.

*Helcion pellucidum* (L.) was only found in the samples from 1977 and 1992.

Acmaea virginea (Müller) was only found once, i.e. in 1977.

*Natica clausa* (Brod. & Sow.) like the last-mentioned species, only occurred in the samples from 1977, so nothing further can be said about its presence at Surtsey.

*Gibbula tumida* (Mont.) has only been found in samples from 1980, and must thus be considered to be very rare at Surtsey.

*Margarites olivaceus* (Brown), found in 1984 and 1987, did not occur in the 1992 samples, and can thus be presumed to be still uncommon.

*Omalogyra atomus* (Phil.) was rare in the 1987 and 1992 samples. As this prosobranch is extremely small, it can easily have been missed by the divers, and even by sorters of the samples.

*Margarites helicinus* (Fabr.) was first found in 1987; again in 1992 several individuals were discovered at 3 stations at the east and west coasts, so it can now be assumed to be a resident in the fauna at Surtsey.

Neptunea despecta (L.). Only one individual has

Table 8. Arrival an	d occurrence of	Lamellibranchia	at Surtsey.
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Year	67	68	69	70	71	74	77	80	83	84	87	92
LAMELLIBRANCHIA												
Mytilus edulis (L.)	x	x	x	x	X	x	x	x	x	x	x	х
Heteranomia squamula L.	x	x	x	x	x	x	x	х	x	x	х	x
Hiatella arctica (L.)	x	X	х	x	х	х	х	х	х	х	х	X
Chlamys pusio (L.)		x	x			x	х	х	x			••
Cardium fasciatum (Mont.)		x	x		x		х				x	х
Syndosmya nitida (Müller)		x					22					
Modiola phaseolina Phil.				x				x			х	х
Spisula solida (L.)	**)			x	••		x	••				252
Mya truncata (L.)	(24)				x		x					
Chlamys tigrina (Müller)	200		1.22		х	533						••
Lyonsia norvegica (Chemn.)			1.22	22	x	1946	33		1942			
Kellia suborbicularis (Mont.)				~			х	**				х
Modiolaria discors (L.)											х	X
Chlamys islandicus (Müller)											x	х
Syndosmya prismatica (Mont.)				**			210			••		х



Figure 2. Colony of *Mytilus edulis* with Asterias rubens feeding on it at 20 m depth at Surtsey in 1970. (Photo. Halldór Dagsson).

been found, in 1992. This large prosobranch is not likely to settle down on the hard bottom sampled at Surtsey although it is common in the surrounding area.

# Lamellibranchia (Table 8)

Mytilus edulis (L.). The common mussel had already settled down at Surtsey in 1967, having in the years that followed formed quite extensive colonies on the underwater slopes (Fig. 2), and being now the most common bivalve at the island.

*Heteranomia squamula* L. has been found at Surtsey in every sampling year since 1967, being common at the island.

*Hiatella arctica* (L.) is very common at Surtsey, being first recorded there in 1967.

Chlamys pusio (L.) occurred first in the sam-

ples of 1968, and then on five subsequent occasions, though not after 1983, which points to its being relatively rare.

*Cardium fasciatum* (Mont.) was first found at Surtsey in 1968, but is not common there.

Syndosmya nitida (Müller) has only been collected once at Surtsey, i.e. in 1968, so it is hardly an inhabitant of the underwater slopes of the island.

Modiola phaseolina Phil. was first recorded at Surtsey in 1970, and three times subsequently. This small bivalve might easily have been missed in some of the samplings, but as it was fairly frequent in the samples of 1992, it seems to be getting common in the area.

*Spisula solid*a (L.) was only found at Surtsey in 1970 and 1977, thus being very rare.

*Mya truncata* (L.) only occurred in the samples of 1971 and 1977. It is an unlikely inhabitant on the hard bottom from which samplings are made at Surtsey.

Chlamys tigrina (Müller) was only found in 1971 and is thus hardly an inhabitant at Surtsey.

Lyonsia norvegica (Chemn.). As was the case with the previous species, this was only collected in 1971, and the same observation applies to its inhabitation at Surtsey.

*Kellia suborbicularis* (Mont.) was found in the samples from 1977 and again in those of 1992. The latter year so many individuals were found that it is obviously one of the inhabitants at Surtsey.

Modiolaria discors (L.) occurred at Surtsey in 1987 and again in 1992. In the latter year some few animals were collected from a depth of 20 m

Table 9. Arrival and occurrence of Asteroidea, Ophiuroidea, Echinoidea and Ascidiacea at Surtsey.

Year	68	69	70	71	74	77	80	83	84	87	92
ASTEROIDEA											
Asterias rubens L.	х	х	х	x	х	x	X	x	X	x	x
Hippasteria phrygiana (Parelius)			**			x			**		
OPHIUROIDEA											
Ophiopholis aculeata (O. Fr. Müller)			21		x	••	x	x	x	x	X
ECHINOIDEA											
Echinus esculentus (L.)						х	X			x	X
Strongylocentrotus droebachiensis											
(O. Fr. Müller)	e.	••			**	x	x	••		x	
ASCIDIACEA											
Ascidia callosa Stimpson	x			33	x	x	••	**		••	••
Styela rustica (L.)	55	х	÷	х	х	X	X	x	-	х	X
Boltenia echinata (L.)		36 S		X	**	x		**	22		x
Halocynthia pyriformis (Rathke)	**			et.		x	x	х	x	x	х
Ascidia obliqua Alder		111	11			x		**	**		

at the east coast, so this appears to be a beginning to permanent settlement.

*Chlamys islandicus* (Müller) was only found in 1987 and 1992. In the latter year only a solitary young individual was collected, so little can be said about its settlement except that it is rare at Surtsey.

Syndosmya prismatica (Mont.). Only one young animal was brought up in the samples of 1992.

# Asteroidea (Table 9)

Asterias rubens L. is very common at Surtsey, having been found there since 1968, grazing on the colonies of the common mussel.

*Hippasteria phrygiana* (Parelius) has only been recorded at Surtsey on one occasion, i.e. in 1977, thus hardly being a permanent member of the fauna at the island.

#### Ophiuroidea (Table 9)

*Ophiopholis aculeata* (O. Fr. Müller) was first found at Surtsey in 1974, being now common locally.

# Echinoidea (Table 9)

*Echinus esculentus* (L.) occurred first in samples from 1977. Although by no means rare by now, it was not found in 1983 and 1984.

Strongylocentrotus droebachiensis (O. Fr. Müller) was first found at Surtsey in 1977, and again in 1980 and 1987. It seems to be rather uncommon.

# Ascidiacea (Table 9)

Ascidia callosa Stimpson only occurred in the 1968 and 1974 samples.

*Styela rustica* (L.) was first found at Surtsey in 1969. Although it has not occurred in every subsequent collection, it is probably not uncommon.

*Boltenia echinata* (L.) was only found in the 1971 and 1992 samples.

Halocynthia pyriformis (Rathke) has been found in all sampling years since 1980, and is thus now one of the inhabitants on the underwater slopes at Surtsey.

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