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Preliminary Results from Tagging of Lump sucker
(*Cyclopterus lumpus*) in Icelandic Waters 1971-3.

by

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Investigations of the general biology and population dynamics of the lump sucker in Icelandic Waters were started in 1971. This work included tagging experiments described in this paper. The main purpose of these experiments was to obtain information on migration and growth. During the years 1971-1973 a total of 6665 lump sucker were tagged at various localities around the island. On August 1st 1974 680 lump sucker have been recaptured or 10.2%.

Methods

The tagging experiments can be divided into two main types: Tagging on board research vessels all around the island throughout the year and tagging on board small lump sucker fishing boats during the spawning season in shallow waters at two localities: off Reykjavík at the SW-coast and off Húsavík at the N-coast.

No special lump sucker surveys have been made from Icelandic research vessels. Therefore those specimens tagged on board the R/v Bjarni Sæmundsson and R/v Hafþór were all caught with bottom trawl as bycatch. The lump sucker tagged off Reykjavík and Húsavík were caught with gill nets with different mesh size depending upon fishing of male and female lump sucker specially used in the lump sucker fisheries.

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Two types of tags were used: Hydrostatic tags (Lea tags) for the first 44, and for all the other red or yellow plastic plates fastened with spun nylon thread through the first dorsal fin. The technique used proved to be satisfactory in nearly all cases, the tagged fish were in perfect condition, so that tagging mortality is thought to be very low, or possibly negligible.

Liberation

Table 1 shows the number of lumpsucker tagged each month during the period 1971-1973. The majority of fish were liberated during April - July when the lumpsucker is spawning along the coast in shallow waters. In 1971 252 lumpsucker were tagged off Húsavík in June and 500 off Reykjavík in July. Both of these experiments took place after the end of the fishing season for lumpsucker in that year (Table 6). In 1972 two tagging experiments were carried out off Húsavík - the first one in April during the fishing season and the second one in June after the season. A total of 1596 fish were liberated (Table 7). In the same year 1363 fish were marked off Reykjavík during 3 tagging experiments. Two of the experiments took place during the fishing season (April and May) but the third one in July after the season (Table 8). In 1973 one experiment was carried out off Húsavík where 182 fish were liberated in May at the end of the fishing season and two experiments were made off Reykjavík where 335 fish were marked in May and 948 in June (Table 9).

During autumn and winter when the lumpsucker is found farther away from the coast taggings have been made on board research vessels. The relatively few taggings made in the period August - October are to some extent due to fewer surveys suitable for this purpose but mainly to lesser availability of lumpsucker during this time of the year. Fig. 1 shows the distribution of tagged fish liberated from research vessels. This illustration also reflects to some extent the real distribution and abundance of male and female lumpsucker. Remarkable is the fact that the few lumpsucker tagged during autumn (September - October) off the west coast were all females (Fig. 1 a). In the period November - February the proportion of males in the catches is still low

(< 10%) especially in farther regions off the coast (Fig. 1 b and c). This suggests that outside the spawning period males and females are living more or less separated. In March and April (Fig. 1 d) the abundance of lumpsucker in deeper waters decreased markedly due to migration to the spawning grounds in inshore waters.

The low abundance of lumpsucker in the bottom trawl catches during autumn indicates a pelagic environment with gradual change during winter back to the demersal stage before spawning in spring. Based on the results of the research surveys, the overwintering and feeding area of lumpsucker seems to be restricted more or less to the waters off the W- and N- coasts of Iceland (Fig. 1).

Length composition and mean length of tagged fish are given in Tables 2-4. The difference in mean length between fish liberated off Húsavík and Reykjavík were significant in 1971 and 1972, but not significant in 1973.

Recaptures

Recaptures from the tagging experiments carried out on board the research vessels are given in Table 5. A total of 1418 lumpsucker were liberated. Recaptures from the 1971 and 1973 tagging experiments were quite similar 3.0% in 1971 and 3.1% in 1973 but from the taggings in 1972 only 0.9% have been recaptured. Striking are the similarities in the returns of males and females each year.

Recaptures from the tagging experiments carried out off Húsavík and off Reykjavík are given in Tables 6-9. Returns from both places show a rather similar picture. The experiments in 1971 (Table 6) which were at both places undertaken after the end of the fishing season yielded very few returns. Shortly after tagging 2 returns (0.8%) were reported from the Húsavík area and 17 (3.4%) from Reykjavík where still few boats were fishing for lumpsucker. From the 1971 tagging experiment off Reykjavík no further fish have been recaptured, but from that made off Húsavík in 1971, 5 returns (2.0%) were reported in 1972 and 1973 1 return (0.4%). The taggings which took place at the end of

the fishing season in 1972 or thereafter and again in 1973 have also yielded very few returns in the years of tagging (Tables 7-9).

As expected much more fish have been recaptured from the tagging experiments which were carried out during the fishing season than from those carried out after the season. The 1972 experiment off Húsavík in April gave 30.9% returns within the season (Table 7). The lower returns off Reykjavík in the same year (9.0%) (Table 8) can not be fully explained by lower fishing intensity, incomplete reporting of tags by fishermen may also play some role. The increase in returns at Reykjavík in 1973 (Table 9) is thought to be both due to better reporting as well as an increase in fishing.

Lower returns of males is due to the fact that females are more demanded and therefore subject to more intense fishing.

It should be noted that most of the fish which were marked off Húsavík and Reykjavík have been recaptured during the first days after the tagging. Only very few fish have been recaptured more than 3 weeks after liberations. This indicates that spawning of each fish takes 2-4 weeks (Schopka 1970) after which time the lump sucker leave the spawning grounds and are replaced by new immigrating spawners.

Finally of considerable interest are lump sucker tagged off Húsavík and Reykjavík which were a year at liberty. These fish were all recaptured at the locality of liberation. Homing seems therefore to be of great importance in the migrational behaviour of the lump sucker. A total of 3 males and 30 females were recaptured after one year of liberty (i.e. 0.2% ♂ and 0.9% ♀). These fish were all mature so that at least a small part of the stock spawns twice. This is in good agreement with the results of Bagge (1967). In one case a female was two years at liberty. It is possible that this single female had spawned the third time.

Migration

In Figs. 2-3 localities of tagging and corresponding recapture localities are shown. From the tagging experiments which took

place during November - January just 5 returns have been reported (Fig. 2 a). The fish which were marked in deep waters off the NW-coast were all mature when recaptured during spring, 4 at the N-coast but 1 at the SW-coast (Faxaflói).

Recapture localities from liberations carried out in March off the N- and W-coast are shown in Fig. 2 b. The returns are all taken during the spawning period i.e. March - June. The migrational pattern seems to be rather confused because the fish do not migrate to the nearest spawning ground although spawning occurs all along the W- and N-coast. Bearing in mind what was mentioned earlier, that homing is of great importance in the biology of this species, the quite different migrational routes illustrated in Figs. 2 b and 3 can be interpreted to mean that from the feeding area which seems to be very widespread the fish migrate to its "home" spawning area.

Very little is known about the emigration from the spawning grounds. Most of the recaptures from the experiments off Húsavík and Reykjavík have been made close to the tagging locality. From the liberation off Húsavík some fish have been recaptured in neighbouring fjords on both sides of the tagging place. At Reykjavík the picture is similar: recaptures have been made all around the tagging place in Faxaflói proper (Fig. 3). Only one fish marked during the spawning period was recaptured outside the spawning area. This fish was tagged off Reykjavík in May and recaptured by an Icelandic trawler in the end of August at $65^{\circ}11'N-26^{\circ}10'W$.

Growth

Information on length at recapture was available for 22 of the 33 returns made one year after tagging. In some cases age determination was also possible (Table 10). The growth increment varies from 1-10 cm for females. The mean growth in the fourth year was 4.0 cm. Data on growth in other age groups are too limited to make any conclusions. The single male had grown 3 cm.

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Legend

- Fig. 1. Distribution of lumpsucker tagged on board research vessels. Abundance per square. $1 \text{ mm}^2 = 1$ individual tagged. Liberation during: 1 a) September and October. Trawling off the W- and NW- coasts, 1 b) November and December. Trawling all around the island, 1 c) January and February. Trawling off the SW-, W- and NW-coasts. 1 d) March and April. Trawling off the S, W and N-coasts.
- Fig. 2. Tagging and corresponding recapture localities of lumpsucker liberated on board research vessels. Liberation during: 2 a) November - January, 2 b) March.
- Fig. 3. Tagging and corresponding recapture localities of lumpsucker liberated during April and May.

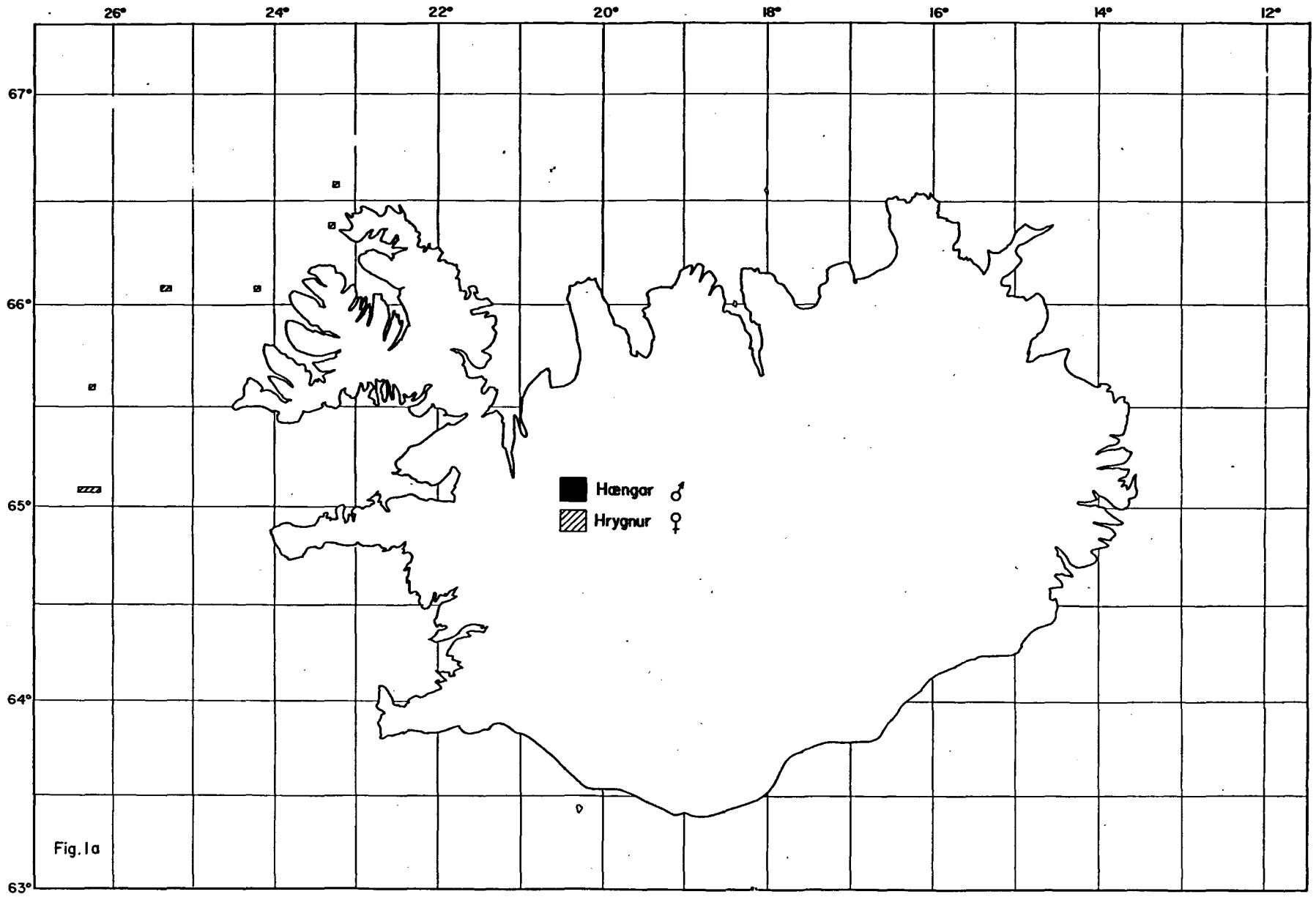
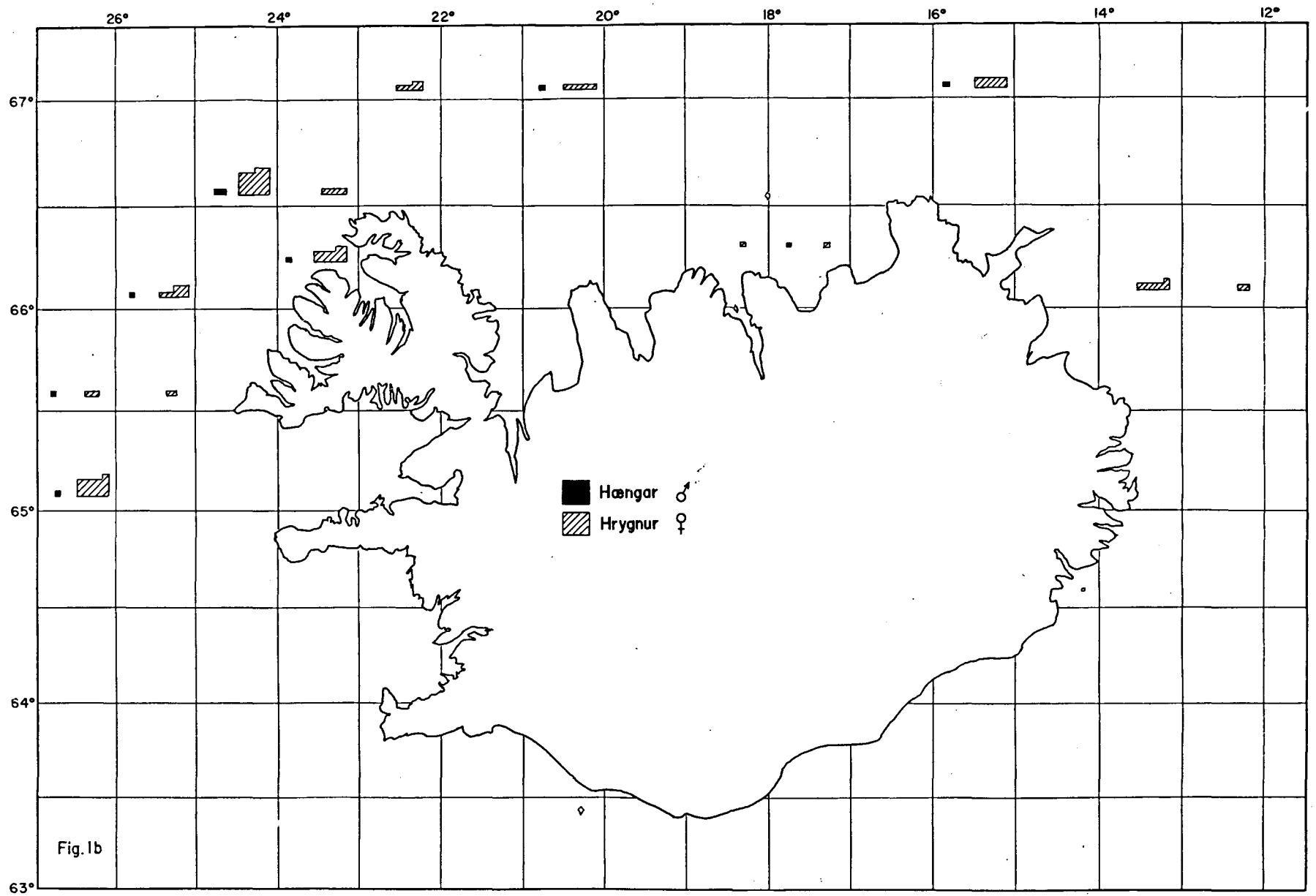
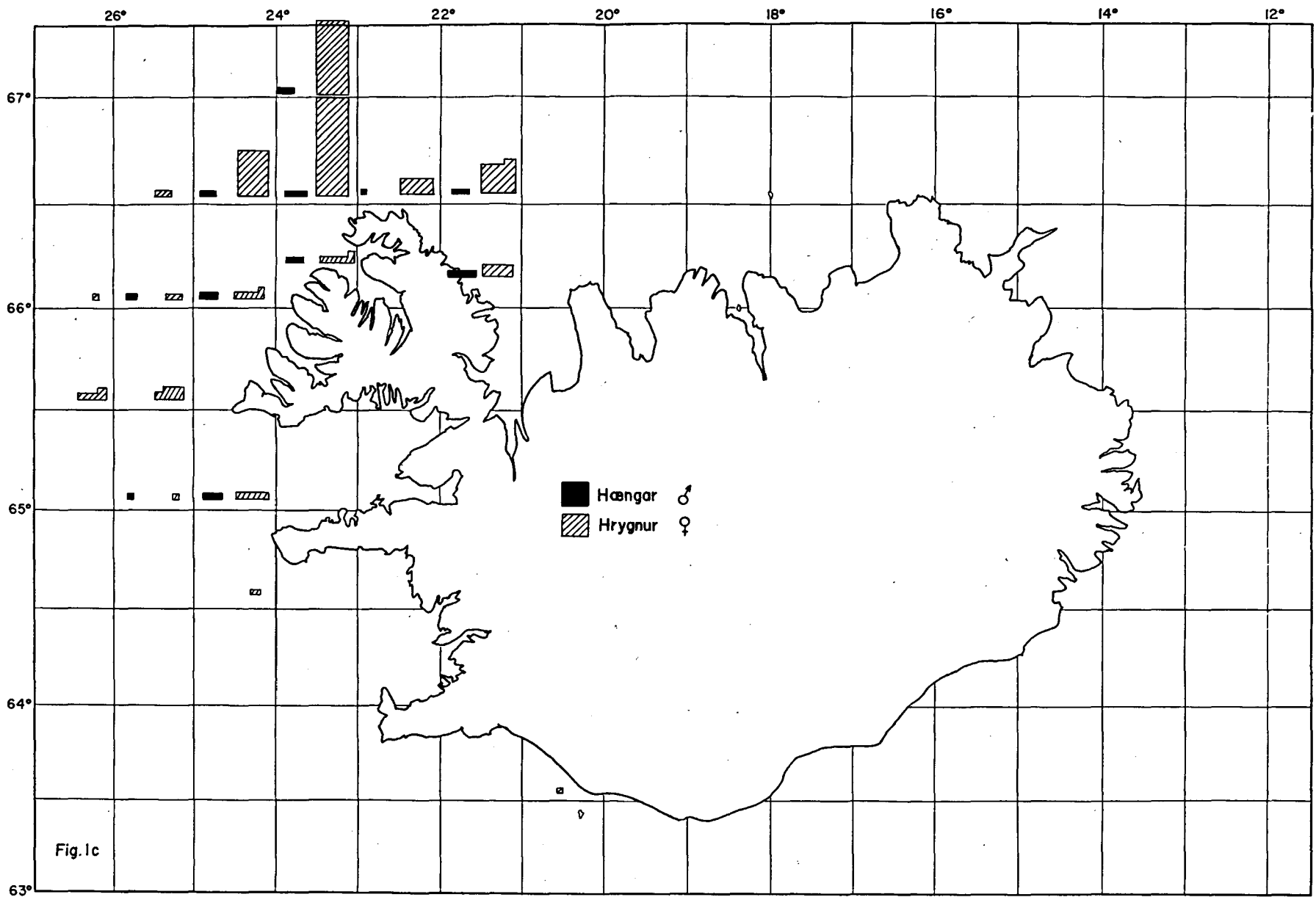
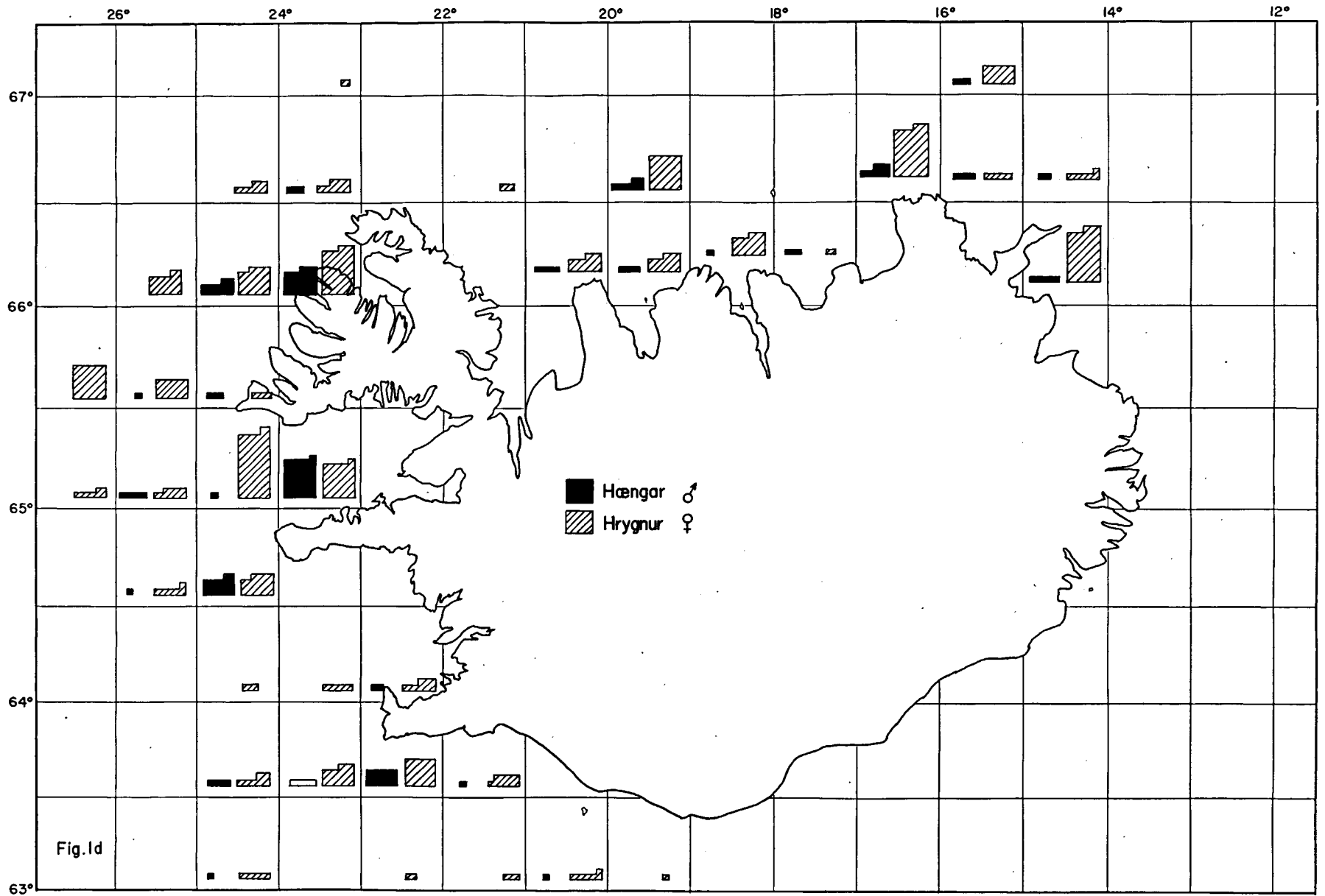


Fig. 1a







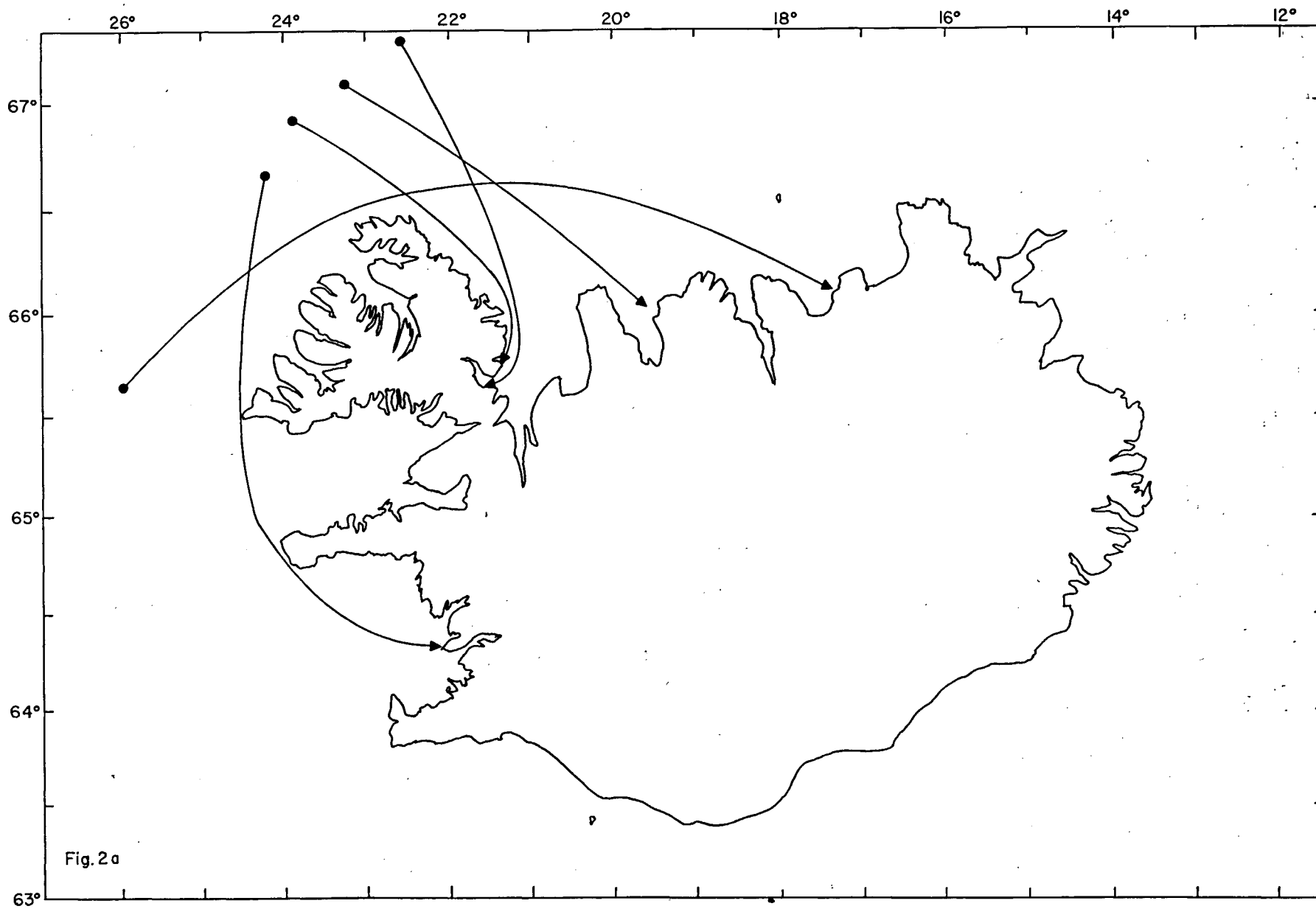
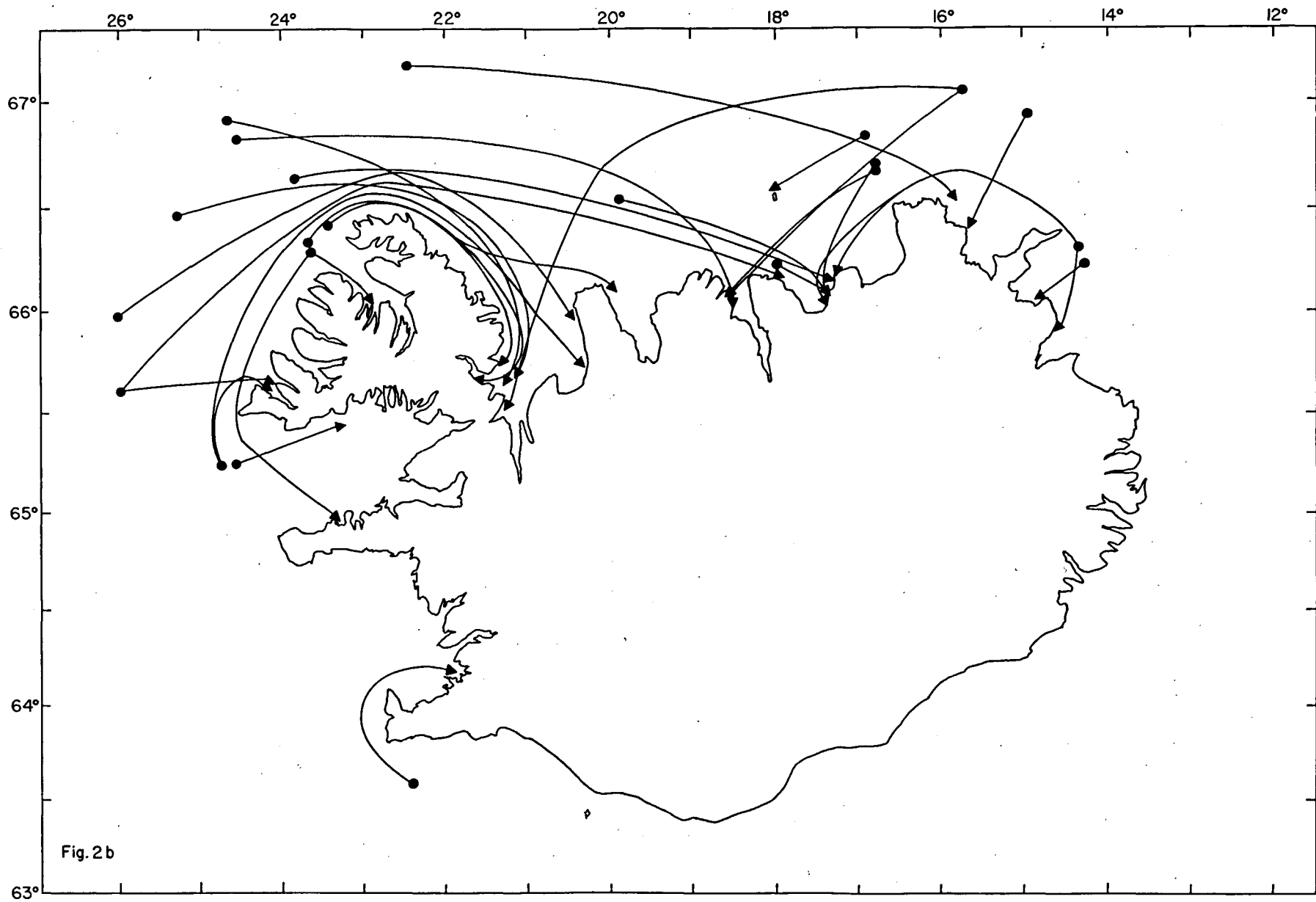


Fig. 2a



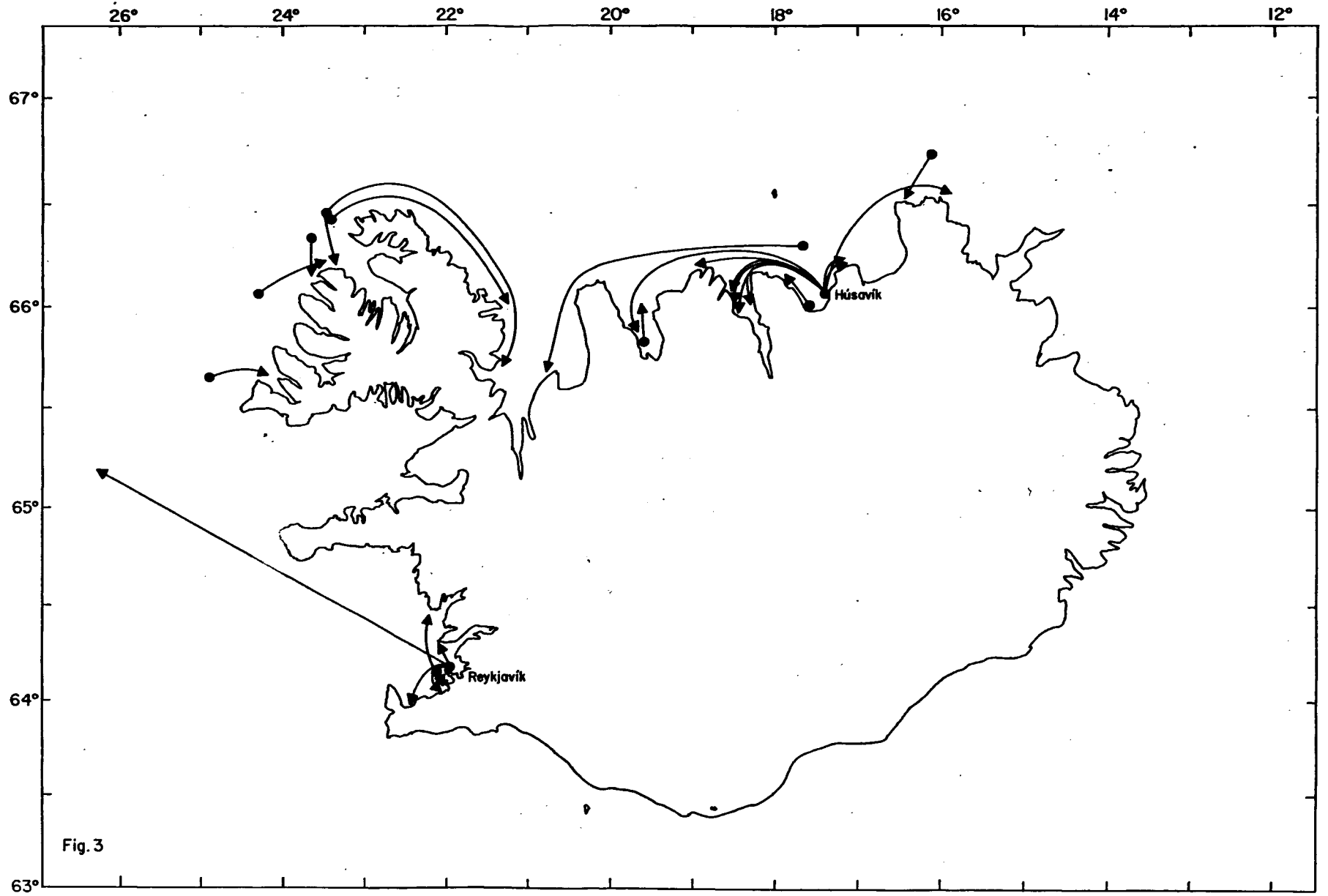


Table 1.

Numbers tagged by months, years and sex.

<u>Year</u> Month	<u>1971</u>				<u>1972</u>				<u>1973</u>				<u>1971 + 1973</u>			
	♂	♀	?	Total	♂	♀	?	Total	♂	♀	?	Total	♂	♀	?	Total
January	5	41		46	16	202		218	12	119	1	132	33	362	1	396
February									1	2		3	1	2		3
March	80	250		330	8	16		24	99	341	2	442	187	607	2	796
April	8	20		28	349	673		1022	4	35	3	42	361	728	3	1092
May	17	155		172	407	845		1252	26	487	4	517	450	1487	4	1941
June	10	140		150	53	399		452	46	898	4	948	109	1437	4	1550
July	274	223	3	500	104	136	1	241					378	359	4	741
August			1	1											1	1
September		11		11										11		11
October		3		3										3		3
November		11		11	4	47		51		17	2	19	4	75	2	81
December	2	10		12	3	32	3	38					5	42	3	50
Total	396	864	4	1264	944	2350	4	3298	188	1899	16	2103	1528	5113	24	6665

Table 2.

Length composition of Lump sucker tagged in 1971.

Length group (cm)	♂			♀		
	Off Reykjavík	Off Húsavík	From research vessels	Off Reykjavík	Off Húsavík	From research vessels
21-23						
24-26	5	3	1			1
27-29	114	4	16	1		2
30-32	121	2	31		1	2
33-35	27	4	24	2	8	8
36-38	6	5	15	18	40	33
39-41	1		9	68	87	64
42-44			2	67	66	129
45-47			1	56	29	104
48-50				10	3	24
51-53				1		7
Total	274	18	99	223	234	374
Mean length	30.1	31.6	33.4	42.5	40.9	43.0

Table 3.

Length composition of Lump sucker tagged in 1972.

Length group (cm)	Off Reykjavík	Off Húsavík	From research vessels	Off Reykjavík	Off Húsavík	From research vessels
		♂			♀	
21-23	1					
24-26	38	18				
27-29	305	57	1	1		
30-32	233	110	8	4		1
33-35	49	55	12	29	33	6
36-38	18	18	6	99	232	32
39-41	4	4	4	229	460	92
42-44		1		256	471	112
45-47				86	125	47
48-50				8	11	15
51-53						
54-56					1	
Total	648	263	31	712	1333	305
Mean length	29.7	31.2	34.4	41.2	41.0	42.0

Table 4.

Length composition of Lumpsucker tagged in 1973.

Length group (cm)	♂			♀		
	Off Reykjavík	Off Húsavík	From research vessels	Off Reykjavík	Off Húsavík	From research vessels
21-23						
24-26	1			1		
27-29	16	1	6	2		2
30-32	16	7	21			12
33-35	13	4	26	23	4	21
36-38	10	1	12	249	24	45
39-41	3		10	549	48	143
42-44	1		2	287	61	186
45-47				72	25	93
48-50				8	4	28
51-53						3
Total	60	13	77	1191	166	533
Mean length	32.4	32.1	34.1	40.4	41.6	41.9

Table 5.

Tagging experiments carried out on board research vessels.

	1971			1972			1973			1971-1973		
	♂	♀	Total	♂	♀	Total	♂	♀	Total	♂	♀	Total
Number tagged	99	374	473	25	310	335	77	533	610	201	1217	1418
Number recaptured	3	11	14		3	3	2	17	19	5	31	36
% recaptured	3.0	2.9	3.0	0.0	1.0	0.9	2.6	3.2	3.1	2.5	2.5	2.5

Table 6.

Recaptures from tagging experiments in 1971.

	Off Húsavík in June			Off Reykjavík in July			
	♂	♀	Total	♂	♀	?	Total
Number liberated	18	234	252	274	223	3	500
Number recaptured in 1971 (Weeks at liberty)							
1				5	4		9
2		1	1		2		2
3		1	1		1		1
4							
?				1	4		5
Total recaptured in 1971	0	2	2	6	11		17
(%)	0.0	0.9	0.8	2.2	4.9		3.4
Recaptures in 1972	0	5	5				
(%)	0.0	2.1	2.0				
Recaptures in 1973	0	1	1				
(%)	0.0	0.4	0.4				
Total recaptured	0	8	8	6	11		17
(%)	0.0	3.4	3.2	2.2	4.9		3.4

Table 7.

Recaptures from tagging experiments off Húsavík in 1972.

	April			June		
	♂	♀	Total	♂	♀	Total
Number liberated	179	647	826	84	686	770
Number recaptured in 1972 (Weeks at liberty)						
1	12	134	146		2	2
2	4	50	54		2	2
3	1	16	17			
4		1	1			
5		1	1			
6				1		1
?	1	35	36		1	1
Total recaptured in 1972	18	237	255	1	5	6
(%)	10.1	36.6	30.9	1.2	0.7	0.8
Recaptures in 1973		9	9	1	12	13
(%)		1.4	1.1	1.2	1.7	1.7
Total recaptured	18	246	264	2	17	19
(%)	10.1	38.0	32.0	2.4	2.5	2.5

Table 8.

Recaptures from tagging experiments off Reykjavik in 1972.

	April			May			June			Total
	♂	♀	Total	♂	♀	Total	♂	♀	?	
Number liberated	170	18	188	376	558	934	104	136	1	241
Number recaptured in 1972 (Weeks at liberty)										
1	3		3	10	21	31		1		1
2				9	10	19				
3	2		2							
4										
5	1		1							
?	1		1	7	23	30	2	6		8
July					1	1				
August				2	1	3				
Total recaptured in 1972	7	0	7	28	56	84	2	7		9
(%)	4.1	0.0	3.7	7.4	10.0	9.0	1.9	5.1		3.7
Recaptures in 1973				2		2				
(%)				0.5		0.2				
Total recaptured	7	0	7	30	56	86	2	7		9
(%)	4.1	0.0	3.7	8.0	10.0	9.2	1.9	5.1		3.7

Table 9.

Recaptures from tagging experiments in 1973.

	Off Húsavík in May				Off Reykjavík in May				Off Reykjavík in June			
	♂	♀	?	Total	♂	♀	?	Total	♂	♀	?	Total
Number liberated	13	168	1	182	13	319	3	335	46	898	4	948
Number recaptured in 1973 (Weeks at liberty)												
1					1	35		36		143		143
2		4		4		14		14		4		4
3		1		1						1		1
4		2		2		1		1	1			1
?		1		1		14 _{1^x}		14 ₁		3		3
Total recaptured in 1973	0	8		8	1	65		66	1	151		152
(%)	0.0	4.8		4.4	7.7	20.4		19.7	2.2	16.8		16.0
Recaptures in 1974		1		1		1		1		1		1
(%)		0.6		0.5		0.3		0.3		0.1		0.1
Total recaptured	0	9		9	1	66		67	1	152		153
(%)	0.0	5.4		4.9	7.7	20.7		20.0	2.2	16.9		16.1

x) Recaptured at 65°11'N-26°10'W 96 days after liberation

Table 10

Growth of tagged lumpsucker recaptured after one year at liberty.

Age at recapture	Initial length (cm)	Length at recapture (cm)	Growth increment (cm)	Months at liberty
4 ♀	43	44	1	13
" "	38	48	10	13
" "	43	47	4	12
" "	38	39	1	12
" "	41	42	1	12
" "	44	47	3	11
" "	41	46	5	11
" "	41	43	2	11
" "	39	44	5	11
" "	41	46	5	11
" "	43	49	6	12
Mean	41.1	45.0	3.9	11.7
<hr/>				
5 ♀	42	46	4	12
" "	40	45	5	11
<hr/>				
Unknown				
♀	37	39	2	12
"	37	44	7	13
"	46	49.5	3.5	12
"	43	48	5	12
"	42	44	2	12
"	43	46	3	12
"	42	45	3	11
"	40	43	3	11
"	41	47	5	6 ^x
"	41	46	6	5 ^{xx}
♂	25	28	3	9

x) Tagged in January 1972 and recaptured in June 1972

xx) Tagged in November 1971 and recaptured in May 1972