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MEASUREMENTS OF ICELAND SCALLOP (CHLAMYS ISLANDICA MÜLLER) IN THE SPITZBERGEN AND BEAR ISLAND REGIONS.

by

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ABSTRACT

A stratified bottom trawl fish survey was carried out in the Spitzbergen and Bear Island regions from 9 September to 5 October 1985. On 30 out of 108 trawl stations, Chlamys islandica were caught as a by-catch, and samples from 8 stations have been measured for height, length, width, total wet weight, and wet weight of the total content, muscle and gonads. The sex has been determined and the number of zones in the ligament counted.

C.islandica were caught on stations with depths from 48m to 525m. The scallops from the deepest stations seemed to be somewhat younger and smaller. The adductor muscle made up 19-24% of the total weight of cleaned shells. The northernmost sampled station (N $79^0$29') had the oldest scallops, but the zones in the ligaments from this station were difficult to read because of the often bad consistency of the ligament.

INTRODUCTION

The Iceland scallop, Chlamys islandica, is mainly found at 10-100 metres depth along the coast of the North Atlantic and Arctic oceans (Zenkewitch 1963, Bourne 1964, Wiborg 1970). Along the Norwegian coast the main distribution of the species is north of the Lofoten Islands, and the densest populations are found in fjords with a sill, in places with comparatively strong current (Wiborg 1963). In the Norwegian part of the North-East Atlantic C.islandica is also found in the Spitzbergen and Bear Island regions and on the shelf around Jan Mayen. During a survey in 1973 Wiborg, Hansen and Olsen (1974) found the greatest quantities of Iceland scallops south-east of Bear Island and north of West-Spitzbergen. The surveyed areas outside the western coast of West-Spitzbergen seemed both quantitatively and qualitatively to be of less commercial importance (Wiborg et al. 1974) C.islandica is also fairly common off Newfoundland, and in the Pacific it occurs in the Okhotsk Sea and down the eastern Pacific Coast as far south as Puget Sound (Mottet 1979).

C.islandica is dioecious. It becomes sexually mature at an age of three to six years, and has a longevity of about 20 years (Vahl and Sundet 1985). The main growth of both shell, soma, gonad, and gametes takes places from late March until the end of June (Vahl 1981). In Balsfjord (70^0N), it spawns within a short period in the end of June or beginning of July (Skreslet and Brun 1969), and the planktotrophic, widely dispersed larvae settle in August/September (Wallace 1982).

MATERIALS AND METHODS

A total of 196 Iceland scallops from 8 different locations, A-G (Figure 1), in the Spitzbergen and Bear Island regions have been measured. Station G includes shells from two trawl stations. The

scallops were caught as a by-catch in the annual bottom fish survey in the area. The vessel was equipped with a Campelen 1800 mesh shrimp trawl with rubber bobbins and cod-end mesh size of 35 mm. During a standard haul the trawl was towed for three nautical miles at a speed of three knots.

Iceland scallops were caught on 30 of the 108 trawl stations in the bottom fish survey (Figure 1), at depths ranging from 48 metres to 525 metres. Of the trawl stations with scallop by-catch, 11 were shallower than 100 metres, 13 were between 100 and 200 metres, 3 were between 200 and 300 metres, and 3 were deeper than 300 metres. The initial plans for the survey did not include Iceland scallop, and the gear and the grid of trawl stations were unsuitable for showing a quantitative distribution of the scallop. Nevertheless, the samples taken show interesting biological aspects.

The scallops were frozen whole and measured at the laboratory on land. There is little uniformity in the litterature on the appropriate terminology for the measurements of length, height, and thickness or width. Figure 2 shows the terms which have been used in this work. The measurements include height, length, width, total wet weight, and the wet weight of the total content, muscle and gonad. All these measurements are listed in Table 2. The height, length, and width of the shells were measured with a sliding calliper, and the measurements were grouped in 5 mm groups. The sex decision was based on the colour of the gonads, orange or reddish ones as females, and pale or whitish ones as males. However, the gonads in specimens with height less than 40 mm were generally so small that it was impossible to determine what sex they belonged to.

The gonads of immature or spawned out individuals are usually whitish, regardless of sex, and colour will therefore not always be a useful indicator (Mottet 1979). This was a problem at station A where all the gonads were rather pale and whitish and difficult to separate into male or female.

It seems obvious that a light and a dark zone are formed annually

on both the ligament and the shell, and therefore can be used for age determination (Johannessen 1973, Wiborg et al. 1974). The regression line of shell height and ligament height shows that the two dimensions grow at the same relative rate, at least up to 80 mm shell height, and should therefore be equally suited as a parameter of growth (Johannessen 1973). Johannessen (1973) found that whereas the zones or rings on the shell can be obscured, making age determination impossible, the lines on the ligament can be seen on every individual. The ligament was therefore used for age reading.

The dried shells were first softened in water, and then the dark, elastic part of the ligament was removed, exposing the underlying harder part with the zones clearly visible. This part was kept wet while the zones were counted under a binocular.

RESULTS

Hydrography.

The temperature distribution at the bottom is shown in Figure 3. It is worth noticing that the by-catches northeast of Bear Island partly were taken in areas with bottom temperature below 0^0C.

Size composition.

The height of the shell has been used as the measure of shell size. Figure 4 shows the size distributions from station A-G. The measured shells were taken from different depths, and there is a tendency for the smallest shells to come from the greatest depths. The greatest shells were taken at depths from 130 metres and shallower.

Growth zones - Age.

The dark zones or bands within the ligament at the umbo were counted. This is often a rather subjective and time consuming job. When there were more than 16-18 zones, the substance of the readable part of the ligament itself very often became porous and difficult to slice and read. These problems occurred especially at station A.

Figure 5 shows the number of zones, or age, for each shell size group at each station. Equations for the linear regression curves and the corresponding regression coefficients have been found. The correlation between number of zones (age) and shell height is poor. An explanation for this may be that the regression analysis included too few shells at some stations.

The text table below shows the mean number of zones at each station.

Station	Depth (metres)	Mean number of zones ± 1 st.dev.
A	130	18 ± 5.7
B	525	7 ± 1.1
C	50	12 ± 1.7
D	178	11 ± 1.4
E	155	8 ± 2.5
F	80	11 ± 1.9
G[1)]	48-136	13 ± 4.0

1) 85% of the scallops were caught on the shallowest trawl station, at 48 metres depth.

The oldest shells were caught on the northernmost station and the youngest at the greatest depths. The age composition of scallops from station B-F were rather uniform. On station A and G there was a greater variance in the age composition.

Weight of muscle and gonad.

The adductor muscle is commercially the most valuable part of the Iceland scallop, and is frequently the only part that is utilized. Figure 6 shows the mean weight of the muscles in each 5 mm size-group. For a certain shell size there were only small differences between stations with regard to the weight of the adductor muscle. The variances in the material were, however, at some stations rather high.

The weight of the muscle compared with the total weight (shell + content) is shown in Table 1. This ratio seems to be fairly constant from station to station, around or just above 20%. Table 1 indicates that shells from the shallowest stations have the greatest muscles. The surfaces of the shells were cleaned before weighing. Barnacles were the most common fouling organisms, especially at the deepest part of station G southwest of Hopen Island.

The weight of the gonad contributed very little to the total weight (Table 1). Shells with height less than 40 mm contained very small and commercially unimportant gonads.

Table 1. The ratio muscle weight/total weight, and the muscle and gonad weights (in grams) from stations A - G.

Station	Depth	Muscle weight	Muscle weight		Gonad weight	
	m	Total weight	Range	Mean	Range	Mean
A	130	0.19	1.52-6.46	3.80	0.10-1.56	0.68
B	525	0.24	0.40-1.46	0.93	very small	
C	50	0.22	2.67-6.56	5.07	0.50-1.91	1.22
D	178	0.21	1.83-5.61	3.33	0.53-0.86	0.66
E	155	0.24	0.57-4.44	2.36	0.06-1.08	0.60
F	80	0.22	2.89-9.04	6.14	0.60-1.37	1.02
G	48-136	0.21	3.27-12.14	7.88	0.56-3.54	1.93

DISCUSSION

Changes in total dry weight of the soft body parts of both mature and immature Iceland scallops seem to follow the same pattern throughout the year, maximum weight occurring in the autumn (August/September) and minimum in early spring (Sundet and Vahl 1981). It is therefore reasonable to expect that the scallops caught during this fish survey, from 9 September to 5 October, were caught at their most valuable and commercially interesting time of the year.

Food reserves are stored in the adductor muscle mainly in the form of glycogen. Scallop meat which is full of glycogen is enlarged and has the finest taste. Meat with low glycogen contents is stringy, shrunken, and watery and may be unusable (Mottet 1979). Glycogen is mainly stored in the adductor muscle during summer and the glycogen content reaches a maximum in August (Sundet and Vahl 1981).

In the adult, the adductor muscle typically makes up about a third of the weight of the soft parts, or 10-18% of the total weight (Mottet 1979). The muscles of Iceland scallops caught during the survey at Spitzbergen and Bear Island in August 1973 gave yields from 9.0% to 11.5% of the total weight of a fouled scallop (Wiborg et al. 1974). The muscles in the scallops caught during the survey in 1985 seemed to contribute more to the total weight, about 20%, although the absolute wet weight of the muscles did not seem to be higher than Wiborg et al. (1974) found. Fouling organisms like barnacles were removed before weighing.

Shells from the deepest stations or from the stations farthest from the coast seemed to be smaller than shells caught on the shallowest stations. Wiborg et al. (1974) did not find any clear connection between shell size and depth in the Spitzbergen and Bear Island regions. However, their samples were only taken from

depths less than 100 metres, and in such shallow waters investigations on the eastern coast of U.S.A. and Canada have also failed to show clear differences in size with depth (e.g., Bernier, Poirier and Poirier 1981, Serchuk and Wigley 1984).

One possible explanation for catching younger and smaller scallops at the greatest depths is that these populations in fact are younger. While scallops are swimming off the bottom, they may be carried along by local currents; but active migrations have not been proved for any scallop species (Mottet 1979). In most tagging studies, all recaptured individuals have been caught near the locality where they were released. It seems therefore unlikely that the younger and smaller scallops caught on the deepest stations will migrate into shallower waters as they grow. This leads to the conclusion that Iceland scallops from greater depths are exposed to greater mortalities than scallops from shallower waters.

Another explanation may be that small scallops swim more readily and move faster for their size than larger scallops (Mottet 1979), and may therefore be more easily caught by a shrimp trawl as they rise off the bottom. The reaction of scallops upon the trawl may differ with depth, and consequently be an explanation for the somewhat truncated length distribution at some stations and the catch of younger scallops at greater depths.

REFERENCES

Bernier, L. and Poirier, L. 1981. Les stocks de petoncle d'Islande, Chlamys islandica Müller de la region de Mingan, en 1979. Cahier d'information No 96, Quebec 1981, 31 pp.

Bourne, N. 1964. Scallops and the offshore fishery of the Maritimes. Bull. Fish. Res. Bd Can., No. 145, 60 pp.

Johannessen, O.H. 1973. Age determination in Chlamys islandica (O.F. Müller). Astarte 6, 15-20.

Mottet, M.G. 1979. A rewiev of the fishery biology and culture of scallops. Technical report no. 39. State of Washington. Department of fisheries. May 1979. 66 pp.

Serchuk, F.M. and Wigley, S.E. 1984. Results of the 1984 USA Sea Scallop Research Vessel Survey: Status of Sea Scallop Resources in the Georges Bank, Mid-Atlantic, and Gulf of Maine Regions and Abundance and Distribution of Iceland Scallops off the Southeastern Coast of Cape Cod. Woods Hole Lab. Ref. Doc. No.84-34, 74 pp.

Skreslet, S. and Brun, E. 1969. On the reproduction of Chlamys islandica (O.F.Müller) and its relation to depth and temperature. Astarte, 2, 1-6.

Sundet, J.H. and Vahl, O. 1981. Seasonal changes in dry weight and biochemical composition of the tissues of sexually mature and immature Iceland scallops, Chlamys islandica. J. mar. biol. Ass. U.K. (1981) 61, 1001-1010.

Vahl, O. 1981. Energy transformations by the Iceland scallop (Chlamys islandica (O.F. Müller)), from 70^0N. I. The age-specific energy budget and net growth efficiency. J. exp. mar. Biol. Ecol., 53, 281-296.

Vahl, O. and Sundet, J.H. 1985. Is sperm really so cheap? Page 281-285 in Gray, J.S. and Christiansen, M.E. (eds.) Marine Biology of Polar Regions and Effects of Stress on Marine Organisms. John Wiley & Sons Ltd.

Wallace, J.C. 1982. The culture of the Iceland scallop, Chlamys islandica (O.F.Müller). I. Spat collection and growth during the first year. Aquaculture, 26, 311-320.

Wiborg, K.F. 1963. Some observations on the Iceland scallop Chlamys islandica (Müller) in Norwegian waters. FiskDir. Skr. Ser. Havunders., 13 (6), 38-53.

Wiborg, K.F. 1970. Utbredelse av haneskjell (Chlamys islandica (Müller)) på Bjørnøybankene. Fiskets Gang, 43, 782-788.

Wiborg, K.F., Hansen, K. and Olsen, H.E. 1974. Haneskjell (Chlamys islandica Müller) ved Spitsbergen og Bjørnøya - Undersøkelser i 1973. [Iceland scallop, Chlamys islandica (O.F.Müller), at Spitsbergen and Bear Island - Investigations in 1973]. Fiskets Gang, 60: 209-217.

Zenkevitch, L. 1963. Biology of the seas of U.S.S.R. George Allen and Unwin Ltd., London.

Table 2. Measurements of Iceland scallops from stations A-G.

STATION A:

Size in millimeters			Weight in grams				Sex	Number
Height	Length	Width	TOTAL	Contents	Muscle	Gonad	M/F	of zones
47	41	-	9.20	4.47	2.72	0.27	F	11
49	47	15	10.97	5.00	2.07	0.28	M	18
50	45	15	12.26	5.35	2.54	0.30	M	18
51	46	15	12.84	4.75	2.12	0.45	F	14
51	46	16	12.65	6.30	3.13	0.70	M	11
52	47	15	12.02	4.90	2.12	0.51	M	20
53	49	15	11.16	3.59	1.96	0.10	F	16
54	49	17	13.23	3.42	1.52	0.12	F	-
54	49	14	11.45	5.45	2.48	0.43	F	9
54	49	13	10.82	5.37	3.05	0.21	F	8
54	50	16	12.53	5.36	2.60	0.42	F	-
54	51	17	13.62	4.81	2.33	0.31	M	15
55	51	15	12.77	6.14	2.92	0.44	M	-
55	53	17	15.80	7.00	3.35	0.99	M	18
55	49	18	17.76	5.84	2.93	0.77	M	-
55	52	15	14.52	7.26	3.60	0.70	M	19
56	53	18	16.79	7.49	3.34	1.10	M	10
56	50	16	14.60	6.79	2.67	0.47	F	-
56	53	16	14.73	7.51	3.31	0.48	M	10
57	53	17	17.20	7.24	3.04	0.76	M	22
57	55	15	15.80	7.42	3.20	0.59	M	17
57	55	17	18.02	7.42	3.84	0.84	M	20
57	53	15	16.34	7.64	3.25	0.40	F	9
57	52	18	14.09	6.28	3.13	0.79	M	20
58	52	18	20.32	7.23	3.53	0.57	M	27
58	55	17	16.05	7.64	3.51	0.97	M	17
58	55	17	17.13	7.12	3.53	0.68	F	16
58	53	17	16.84	7.63	3.37	0.77	F	20
58	54	17	19.87	8.15	4.19	0.53	F	16
58	55	17	17.56	7.62	3.76	0.95	M	-
58	53	17	15.99	7.23	3.28	0.64	M	12
58	52	16	15.14	7.13	3.20	0.46	F	-
58	52	18	18.49	6.66	3.02	0.56	F	-
59	55	18	18.41	6.70	3.81	0.78	M	11
59	54	15	15.58	7.32	3.20	0.70	F	-
59	55	18	19.17	7.94	4.01	0.84	M	18
59	54	16	16.18	7.21	3.48	0.33	M	12
59	55	16	16.04	8.13	3.29	0.49	F	8
60	57	19	19.73	8.96	4.34	1.11	M	16
60	56	17	18.84	8.83	4.49	0.54	F	9
60	55	14	16.54	8.20	3.43	0.71	F	11
60	58	19	20.48	9.77	4.66	1.17	M	15
60	58	17	18.29	8.26	4.44	0.78	F	14
60	52	16	17.24	7.25	3.68	0.42	F	-
60	59	19	20.83	8.65	3.80	0.57	F	-
61	57	17	19.90	8.59	3.95	1.11	M	17
61	56	16	12.43	4.77	2.01	0.27	-	-
61	59	20	21.72	8.36	3.72	0.77	M	20
61	53	17	16.18	6.99	3.71	0.74	M	-
61	59	18	19.08	7.36	3.09	0.75	M	24
61	56	19	21.16	6.18	2.99	0.30	F	18
61	56	18	19.74	9.12	4.47	1.30	M	26
62	58	18	19.57	8.24	3.80	1.02	M	-
62	54	19	20.85	6.74	2.84	0.63	M	-
62	58	19	20.93	7.18	3.03	0.42	F	14
62	57	19	22.82	6.72	3.06	0.31	F	-
62	58	20	20.39	8.52	4.03	0.69	F	21
62	57	21	20.89	8.95	4.02	0.97	M	-
62	58	17	18.57	7.53	3.50	0.89	M	17
62	57	20	19.59	9.80	5.29	0.38	F	8
62	60	18	17.51	7.72	3.62	0.94	M	18
62	59	19	25.99	9.17	4.51	0.65	M	23
63	56	17	18.19	7.44	4.43	0.77	M	26

63	59	19	23.01	9.41	4.63	0.63	M	19
63	59	18	21.26	9.38	4.65	0.73	F	13
63	58	20	21.37	10.00	5.35	0.37	F	12
63	60	22	25.90	9.15	4.33	0.80	M	20
64	59	17	20.51	8.72	4.04	1.06	M	20
64	61	20	21.32	7.65	3.06	0.85	M	25
64	61	24	29.37	9.84	4.40	0.88	M	-
64	60	18	21.65	8.23	3.74	0.87	F	18
64	59	18	22.21	7.34	3.99	0.56	F	19
64	61	20	23.38	9.49	4.30	0.87	M	-
65	61	20	24.88	9.24	4.22	0.73	M	21
65	60	21	22.24	5.82	2.43	0.23	F	23
65	61	22	27.41	9.91	4.63	0.86	F	22
65	60	20	30.22	7.79	3.46	0.46	M	21
65	63	20	26.06	9.86	4.89	0.73	F	32
65	64	22	32.28	10.54	5.20	0.85	M	20
65	60	20	23.21	8.97	4.35	0.70	F	29
66	60	20	25.02	9.69	4.22	0.64	F	-
67	63	20	25.94	10.91	5.59	0.67	F	22
67	62	20	26.06	7.58	4.39	0.38	F	25
67	64	22	33.78	8.39	3.88	0.54	F	-
67	64	23	27.36	10.61	5.34	0.93	F	25
67	62	18	24.24	8.00	3.76	0.94	M	21
68	63	22	32.58	10.11	4.30	1.02	M	18
68	64	22	26.94	8.43	3.46	0.59	M	14
69	63	23	29.64	11.73	6.38	0.83	M	27
69	62	19	23.98	10.32	5.20	0.31	F	20
69	67	23	32.32	12.29	5.89	0.77	M	-
70	63	22	31.61	10.78	4.98	1.18	M	26
70	67	21	33.02	10.85	5.09	0.68	F	22
70	67	20	26.87	9.35	4.47	0.79	F	33
71	67	24	33.41	12.17	6.46	0.84	M	-
71	65	23	32.55	12.66	5.93	1.56	F	-
72	65	22	31.63	10.68	5.14	0.73	M	-
72	66	18	25.59	10.58	4.86	0.59	F	18
77	72	20	29.39	10.20	4.18	0.96	M	-

STATION B:

Size in millimeters			Weight in grams				Sex M/F	Number of zones
Height	Length	Width	TOTAL	Contents	Muscle	Gonad		
32	30	8	-	1.21	0.40	-	-	7
38	33	18	2.43	1.21	0.66	-	-	5
40	37	11	5.41	2.35	0.77	-	-	8
42	36	10	4.83	2.61	1.46	-	-	7
43	39	10	5.51	2.83	1.38	-	-	7

STATION C:

Size in millimeters			Weight in grams				Sex M/F	Number of zones
Height	Length	Width	TOTAL	Contents	Muscle	Gonad		
53	48	19	14.46	6.37	2.67	0.50	M	13
58	55	17	18.32	8.61	4.27	0.85	F	13
58	54	16	17.15	-	3.51	0.68	M	10
60	56	20	24.29	12.38	5.17	1.38	F	12
62	58	22	27.14	12.19	5.50	1.18	M	12
63	59	20	22.50	10.10	5.00	1.24	M	14
63	59	19	21.98	11.98	5.12	1.46	M	9
65	62	19	26.76	13.69	6.09	1.91	M	12
65	56	17	22.48	11.40	5.06	1.33	M	8
65	60	18	25.24	11.18	5.19	1.21	F	-
66	61	15	25.10	13.75	6.56	1.71	F	12
67	63	20	26.51	12.87	5.76	1.59	F	13
67	61	20	27.10	12.21	6.01	1.18	M	11
68	61	-	25.00	11.49	5.13	0.89	F	12

STATION D:

Size in millimeters			Weight in grams				Sex	Number of
Height	Length	Width	TOTAL	Contents	Muscle	Gonad	M/F	zones
48	43	14	10.73	5.67	2.49	0.58	M	10
53	50	15	13.56	6.12	2.50	0.67	M	12
54	48	16	14.37	6.53	3.37	0.53	-	8
56	53	15	15.63	8.12	3.64	0.86	M	11
56	55	16	17.48	8.20	3.90	0.58	M	12
56	50	15	13.37	5.61	1.83	0.70	F	10
64	60	18	22.71	10.83	5.61	0.73	F	11

STATION E:

Size in millimeters			Weight in grams				Sex	Number of
Height	Length	Width	TOTAL	Contents	Muscle	Gonad	M/F	zones
32	27	7	2.51	1.24	0.58	-	-	4
33	29	8	2.69	1.50	0.59	-	-	4
33	28	8	2.84	1.44	0.57	-	-	5
34	30	8	3.74	1.75	0.87	-	-	5
35	31	9	3.67	1.87	0.74	-	-	4
36	33	9	4.05	2.07	0.99	-	-	5
38	33	8	4.43	2.32	1.12	-	M	5
38	33	8	3.90	2.26	1.24	-	-	6
40	35	10	5.10	2.63	1.29	0.06	-	7
40	34	10	5.14	2.75	1.23	0.17	-	6
41	36	10	5.70	2.49	1.18	0.08	-	5
42	37	12	7.32	3.74	1.54	0.53	F	11
43	38	10	6.16	2.68	1.40	-	-	9
45	42	12	8.40	4.14	1.87	0.28	-	8
47	42	13	8.47	4.37	2.01	0.38	M	10
47	41	13	8.62	4.51	2.03	0.51	F	8
48	43	12	9.70	4.92	2.68	0.66	M	8
49	45	14	11.27	4.82	2.24	0.44	F	11
50	46	14	10.10	5.18	2.41	0.33	M	9
50	46	15	10.75	6.02	2.61	0.84	M	7
51	48	15	12.49	6.12	3.45	0.68	M	12
51	46	13	10.73	5.64	2.79	0.74	M	9
51	47	15	12.40	6.88	3.70	0.62	F	9
52	48	13	10.51	5.32	2.64	0.56	M	10
52	47	14	12.33	5.97	2.76	0.98	M	9
53	48	14	11.98	5.83	3.10	0.70	M	9
53	48	15	14.46	7.97	3.14	0.59	F	9
53	47	13	13.00	6.28	2.94	0.79	M	11
54	49	15	11.70	6.67	3.27	0.55	F	9
54	49	15	-	6.19	3.38	0.58	F	11
55	51	17	15.92	7.02	3.61	0.92	M	12
56	51	16	16.33	7.61	3.94	0.95	M	10
58	55	15	14.60	7.18	3.44	0.57	M	10
58	54	15	15.33	7.55	3.57	0.99	M	10
58	52	15	14.51	7.68	4.25	0.35	F	9
59	53	15	16.40	8.73	3.64	1.08	M	10
59	54	16	16.41	8.76	4.44	0.88	M	12

STATION F:

Size in millimeters			Weight in grams				Sex M/F	Number of zones
Height	Length	Width	TOTAL	Contents	Muscle	Gonad		
47	42	14	13.34	5.78	2.89	0.67	F	8
58	55	17	20.46	9.98	3.99	0.60	F	10
58	54	18	19.57	9.40	4.46	1.05	M	11
59	54	16	19.80	9.27	4.74	1.03	F	10
70	65	21	34.09	16.02	9.04	1.26	F	12
72	70	21	34.11	16.37	8.34	1.37	F	12
73	64	22	40.87	17.50	7.61	1.14	F	14
78	73	24	48.28	17.27	8.05	1.06	F	-

STATION G:

Size in millimeters			Weight in grams				Sex M/F	Number of zones
Height	Length	Width	TOTAL	Contents	Muscle	Gonad		
54	49	16	16.45	7.80	3.27	0.89	M	9
57	54	17	22.58	9.45	4.54	1.08	M	9
62	58	23	28.00	8.89	4.42	1.03	M	11
63	58	18	26.58	14.27	6.32	2.14	M	10
65	61	19	28.64	14.86	5.86	2.85	M	13
65	60	21	36.27	16.17	8.22	0.81	F	11
65	60	20	32.63	15.28	7.56	1.89	M	14
66	60	21	31.02	14.52	7.02	1.68	M	15
67	61	23	37.70	15.15	7.78	0.56	F	20
68	64	19	33.78	15.87	6.48	2.44	M	9
68	65	21	33.71	16.95	7.42	2.80	M	12
69	60	24	43.33	16.31	7.60	1.21	F	16
70	62	23	46.13	18.47	9.02	3.13	M	17
70	67	21	38.74	20.34	8.63	3.54	M	8
71	66	25	49.21	21.75	11.70	1.65	F	12
71	65	21	36.17	18.66	8.06	3.36	M	10
71	66	20	35.53	17.97	8.81	1.27	F	11
72	65	21	37.32	12.68	6.90	1.22	F	-
72	66	25	44.66	18.09	8.01	2.53	M	-
74	70	24	49.86	22.69	10.11	3.32	M	15
75	71	24		E m t y				15
76	68	26	51.74	17.15	6.74	2.24	M	-
76	68	21	40.63	18.02	8.57	1.32	F	14
78	72	25	51.81	20.08	10.88	1.65	F	17
80	73	25	54.33	22.54	12.14	2.01	F	25
82	74	24	49.07	20.44	10.87	1.62	F	16

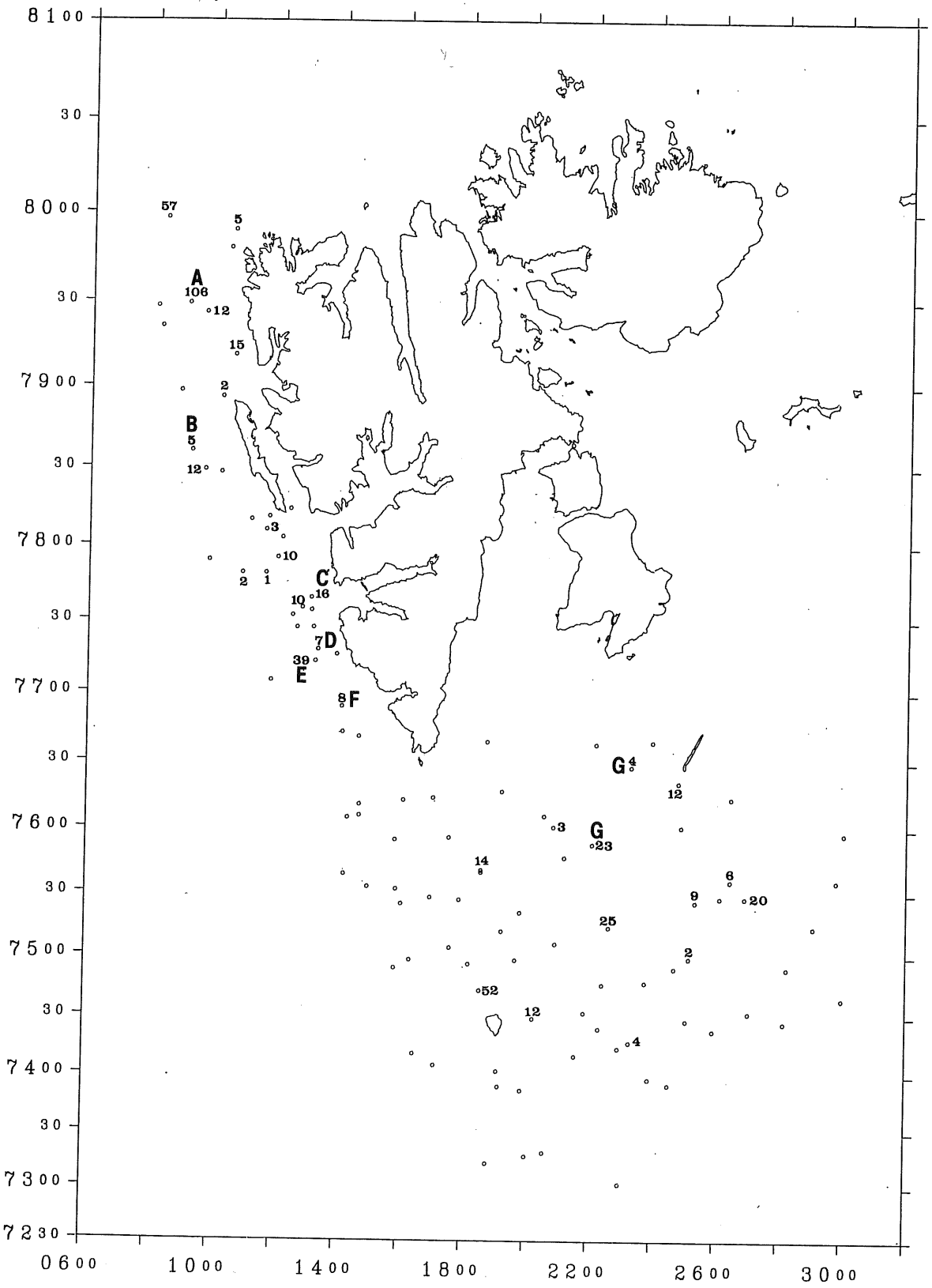


Figure 1. Number of living Iceland scallops caught as bi-catch during hauls of 3 nautical miles in the bottom fish trawl survey. Trawl stations without Iceland scallops have only been marked. Stations from where samples for the measurements were taken have been labeled A-G.

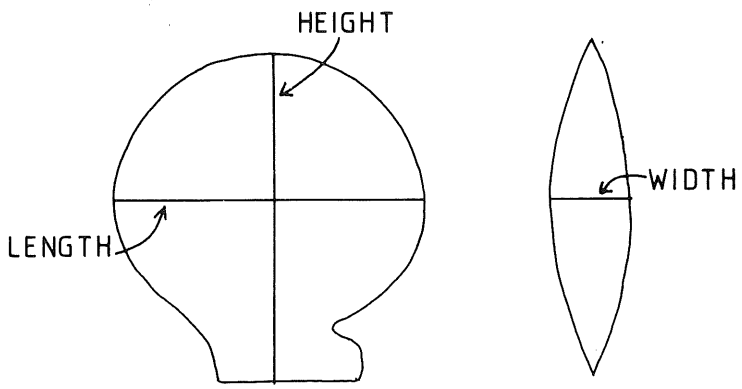


Figure 2. Measurements done on the shells.

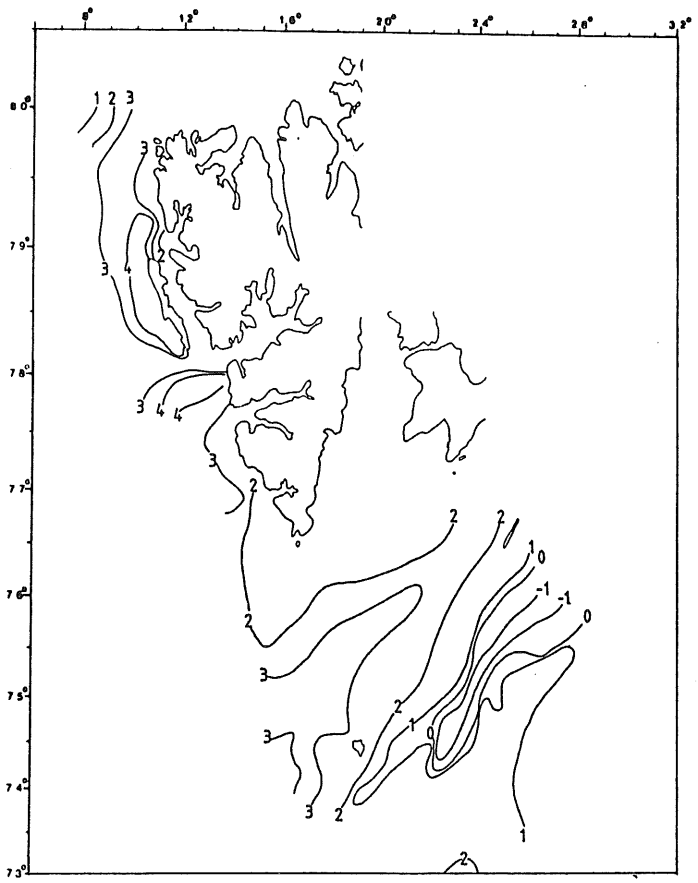


Figure 3. Distribution of the temperature at the bottom.

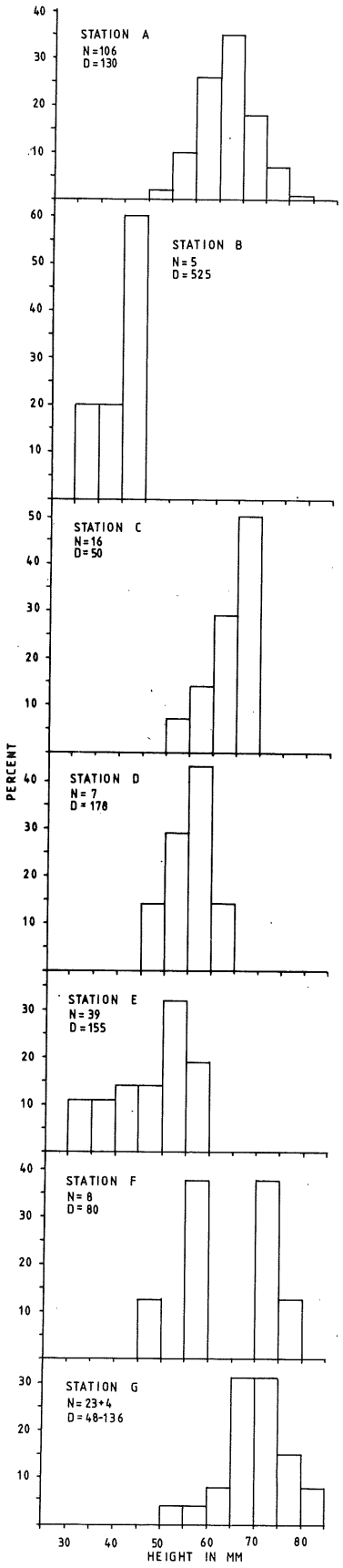


Figure 4. Size distributions of scallops from stations A-G. N: Total number caught as bi-catch on the station. D: Depth.

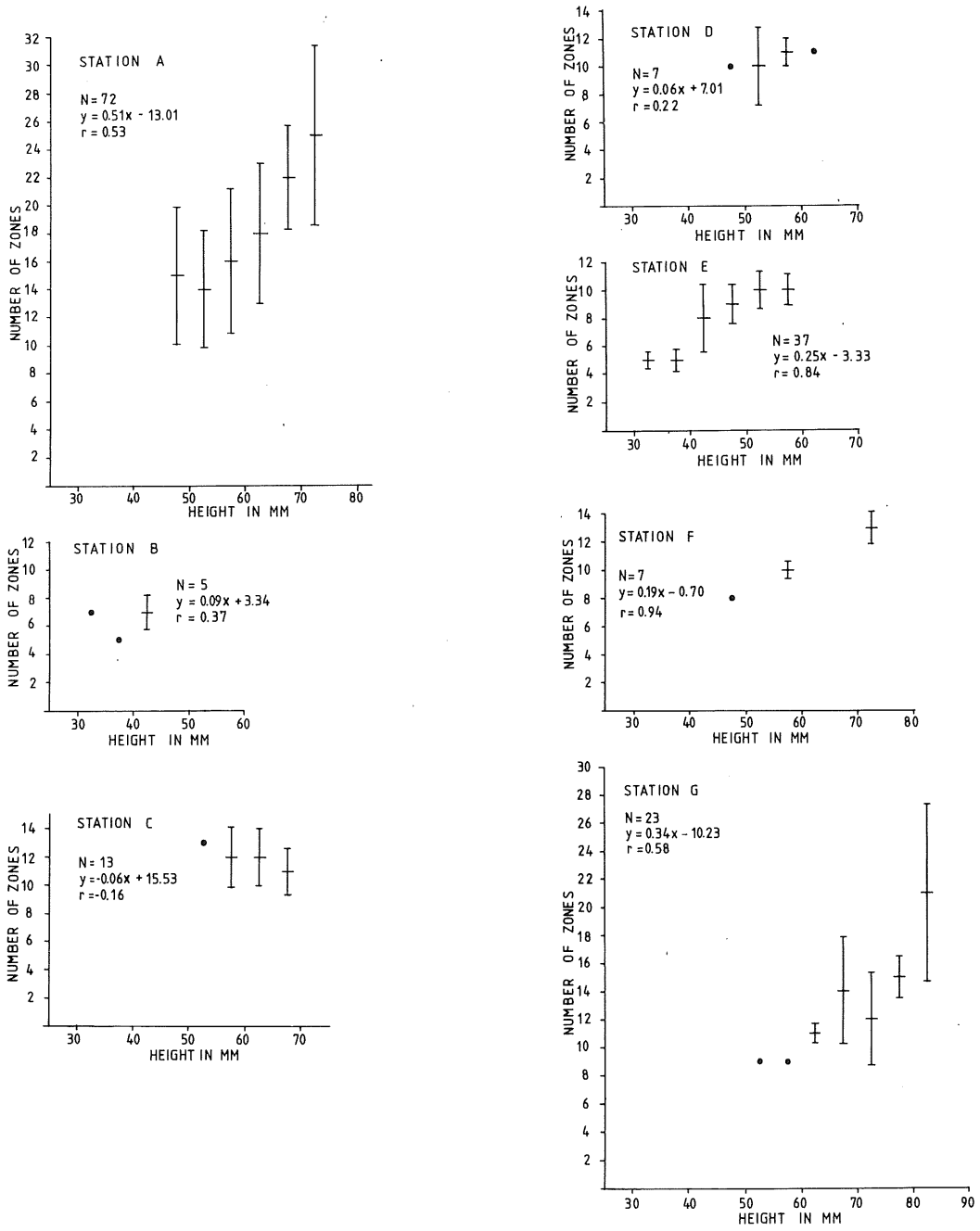
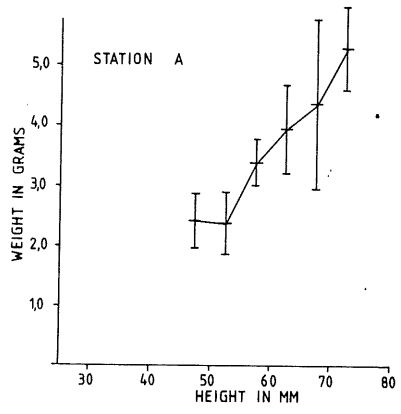
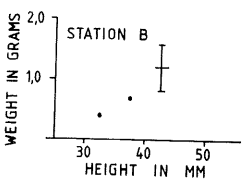
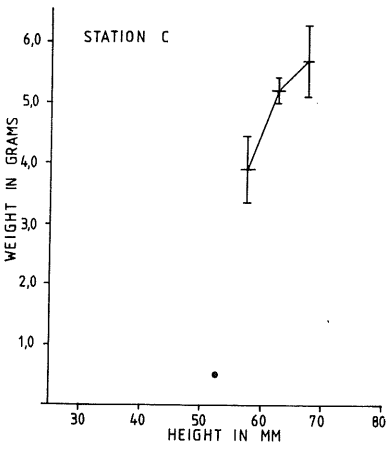
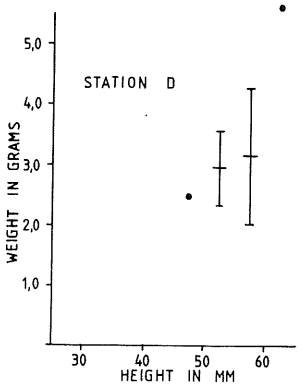


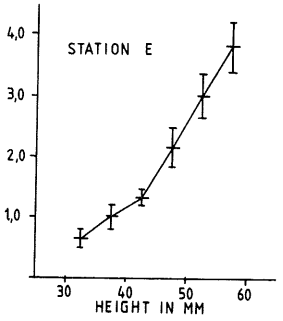
Figure 5. Mean number of zones (age) ± one standard deviation for each 5 mm size-group. The equations for the linear regression lines and the corresponding regression coefficients have been noted. Single observations are marked by dots. N: Number of scallops analysed.

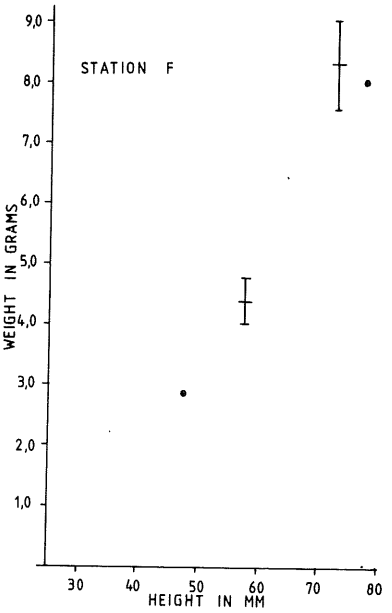












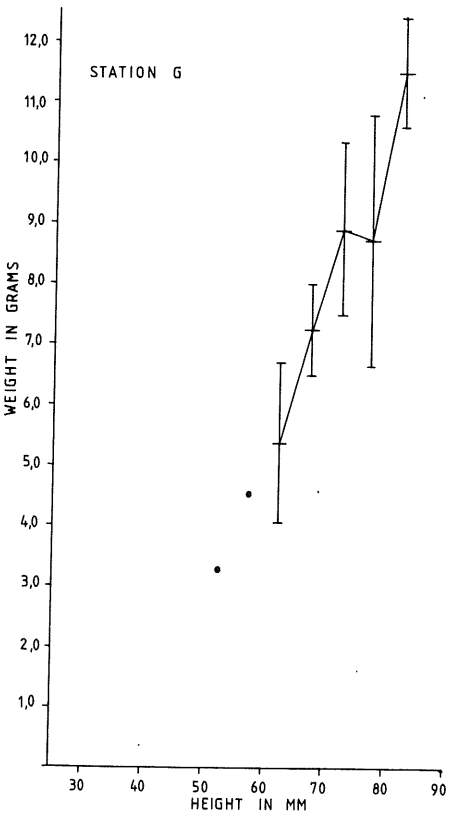


Figure 6. Mean weight of the adductor muscle ± one standard deviation for each 5 mm size-group. A line has for some stations been drawn through the means. Single observations are marked by dots.