

Northwest Atlantic



Fisheries Organization

Serial No. N886

NAFO SCR Doc. 84/VI/93

SCIENTIFIC COUNCIL MEETING - JUNE 1984

Subarea 1 Cod: Results of Research Vessel Surveys

Conducted off West Greenland in 1982 and 1983

by

J. Messtorff and H. P. Cornus

Institut für Seefischerei, Bremerhaven and Hamburg, Federal Republic of Germany

Introduction

Stratified-random bottom trawl surveys off West Greenland have been introduced on a routine basis in November/December 1982 by *RV Walther Herwig*. The survey area includes the West Greenland shelf outside the 3-mile limit and the continental slope down to 600 m depth, extending from the southern part of Division 1B (south of 67° north latitude) southward as illustrated in Fig. 1. The area consists of 7 main strata equal to Division 1B-F or parts thereof. The main strata are subdivided each by 100 m depth zones between 0-600 m into 6 substrata, except in Division 1F (stratum 7), where due to the lack of suitable bathymetric charts a substratification was only possible by 200 m depth zones. Stratum 4 west of 55° west longitude mainly containing depths exceeding 600 m has not yet been covered by the surveys. Strata areas (nm²) are given in Table 1. The stratification is generally based on the scheme developed and described in the NAFO Survey Manual (Doubleday, 1981).

Biomass and abundance estimates were obtained by applying the "swept area" method with the following trawl parameters:

Towing time	30 min.
Towing speed	4.5 knots (average)
Horizontal net opening	22 m (standard survey trawl)

Lacking a reliable estimate of the catchability coefficient, it was taken as 1.0 to avoid over-estimation of stock biomass and abundance.

Survey Results

During the surveys in 1982 and 1983 the number of randomly distributed fishing stations occupied by *RV Walther Herwig* amounted to 111 and 153 respectively. The results were based on 98 and 142 valid sets distributed as follows:

Depth zone	1-1B		2-1C		3-1C		5-1D		6-1E		7-1F		Total	
	82	83	82	83	82	83	82	83	82	83	82	83	82	83
0-200	7	6	6	8	10	20	16	25	10	18	15	18	64	95
201-400	4	1	2	2	5	10	6	12	6	7	5	10	28	42
401-600	1	-	0	1	3	4	2	-	-	-	0	-	6	5
Total	12	7	8	11	18	34	24	37	16	25	20	28	98	142

Cod biomass and abundance estimates for 1982 and 1983 for the total survey area (19,864 nm²) off West Greenland amounted to:

179,934 tonnes ± 37% and 109,039 x 10³ nos. ± 36.1%
and 98,843 tonnes ± 28.5% and 59,375 x 10³ nos. ± 26.5% respectively.

The confidence intervals are given at the 95% significance level.

The drastic decline in survey biomass and abundance against the previous year was observed in all Divisions as shown in detail by abundance estimates by age and Division in Table 2. The already low abundance of cod in Divisions 1B and C decreased by 1983 to only 16% and in Division 1B even to zero. Indications of low stock abundance in 1983 were also confirmed by continuous echosounder recordings covering all course tracks between stations without locating concentrations of cod which might have yielded higher catch rates as observed at random stations.

The age compositions (Table 2, Figures 11 and 10) for both surveys show the year-classes 1977 and 1979 clearly dominating in both years. The decrease in abundance in 1983, however, is much more pronounced and abrupt for the 1977 year-class in all Divisions. A similar sharp decrease also occurs for most year-classes prior to 1977. The same conclusion can be drawn by comparing the length frequencies for 1982 (Figures 2-4) to those of 1983 (Figures 5-9). From the abundance estimates (Table 2) also a southward migration and possible emigration to East Greenland of adult cod of ages 6+ can be concluded from their increasing proportions in Divisions 1D to 1F in 1983, accounting for 15, 30 and 46 percent of the total abundance estimates for Divisions 1D, 1E and 1F respectively.

Mean lengths-at-age obtained from survey results are given for Divisions 1C-F separately in Table 3.

The possibility that changes in stock abundance may be influenced by environmental conditions cannot be excluded. Stein and Buch (MS 1984) stated a period of strong negative anomalies of temperature and salinity from the long term average (20 years) which yielded a maximum during 1983, indicating for the first time during this period sub-zero temperatures of the surface water off West Greenland in autumn of one year. At the same time the upper boundary of the warm component of the West Greenland Current ($T > 5^{\circ}\text{C}$) was found below 300 m depth at the shelf slope. The cooling of the surface water was confirmed by negative temperatures prevailing at most fishing stations distributed over the whole survey area in 1983. Mean bottom temperatures, however, were found to be positive in all depth zones fished:

	1B-C	1D	1E	1F
<100 m	0.99°C	0.54°C	1.31°C	-
101-200 m	2.18°C	2.01°C	2.35°C	2.14°C
201-300 m	3.69°C	3.71°C	3.71°C	4.81°C
301-400 m	4.25°C	4.14°C	4.78°C	4.89°C
>400 m	4.40°C	4.40°C		

Except for depth <100 m bottom temperatures were in fact not unfavourable for cod. Nevertheless, the majority of cod, although of very low abundance in Division 1C, were found in the slope area in depths exceeding 200 m at temperatures around 4°C.

References

- Doubleday, W.G. 1981. Manual on groundfish surveys in the Northwest Atlantic. Sci. Coun. Studies, No. 2, 55 pages.
- Stein, M., and E. Buch. MS 1984. 1983: an unusual year off West Greenland? NAFO SCR Doc., No. 59, Serial No. N847, 18 pages.

Table 1. Strata areas in square nautical miles of West Greenland (territorial waters excluded).

Depth zone (m)	Stratum No.-Division						SA 1
	1 - 1B	2 - 1C	3 - 1C	5 - 1D	6 - 1E	7 - 1F	Total
0-100	865	593	598	1,475	276	-	-
101-200	1,256	1,574	1,902	875	1,662	-	-
0-200	2,121	2,167	2,500	2,350	1,938	2,568	13,644
201-300	297	259	708	628	464	-	-
301-400	209	54	280	390	278	-	-
201-400	506	313	988	1,018	742	971	4,538
401-500	149	122	156	176	33	-	-
501-600	215	293	78	83	24	-	-
401-600	364	415	234	259	57	353	1,682
Total	2,991	2,895	3,722	3,627	2,737	3,892	19,864

Strata boundaries:	Latitudes	Longitudes
1 = Div. 1B	66°15'-67°00'N	57°00'W
2 = Div. 1C	65°30'-66°15'N	57°00'W
3 = Div. 1C	64°15'-65°30'N	55°00'W
(4 = Div. 1C+D	63°45'-65°30'N	55°00'-57°00'W, not included in survey area)
5 = Div. 1D	62°40'-64°15'N	55°00'W
6 = Div. 1E	60°45'-62°30'N	53°00'W
7 = Div. 1F	59°00'-60°45'N	44°00'-50°00'W

Table 2. Cod in Subarea 1: Survey abundance estimates (Nos. $\times 10^{-3}$) by age and Division in 1982 and 1983.

Age	1B+C		1D		1E		1F		Total 1B-F		Total SAL*	
	1982	1983	1982	1983	1982	1983	1982	1983	1982	1983	1982	1983
1	60	-	16	395	65	-	19	516	160	722	154	-
2	610	166	90	2,915	15	658	7	72	722	1,735	713	1,595
3	3,686	228	18,862	8,951	111	111	5,191	72	36,691	3,326	36,181	3,498
4	292	352	4,151	15,059	2,854	9,302	3,523	6,733	10,821	31,446	12,771	33,245
5	96	4	21,238	683	6,214	2,463	11,241	2,709	38,789	5,859	42,629	4,895
6	11	13	3,903	2,779	2,613	3,718	7,091	6,448	13,618	12,958	14,488	12,412
7	2	-	1,082	203	627	752	3,046	1,268	4,754	2,223	5,002	1,996
8	-	-	270	271	115	393	661	508	1,047	1,172	1,245	1,121
9	-	-	335	60	227	157	1,443	158	2,006	375	2,071	359
10	-	-	30	52	22	84	74	62	126	198	181	226
11	-	-	75	-	5	-	5	-	85	-	159	-
12	-	-	70	-	-	-	-	-	70	-	57	-
13	-	-	-	15	-	-	-	-	-	15	-	16
14	-	-	-	-	-	-	13	-	13	-	14	-
NK	-	-	38	27	67	8	32	20	137	55	20	12
Total	4,757	763	50,161	22,459	21,775	17,646	32,346	18,494	109,039	59,362	115,685	59,375
								max.	148,402	75,087	157,447	79,103
								min.	69,676	43,637	73,923	43,647

* Based on combined age/length key.

Table 3. Subarea 1 cod, mean lengths-at-age by Division and Subarea 1 combined according to 1983 survey results.

Year Class	Age	1C	1D	1E	1F	1C-F
1981	2	26.08	27.63	26.71	26.59	26.80
80	3	34.38	36.97	36.80	37.17	36.55
79	4	42.81	45.62	46.10	46.48	45.94
78	5	(52.50)	56.16	54.49	55.93	55.77
77	6	57.35	61.71	64.01	64.95	63.71
76	7	-	68.80	65.57	66.82	66.98
75	8	-	73.42	79.03	76.31	76.71
74	9	-	85.15	83.67	76.63	82.06
73	10	-	92.77	87.18	84.29	89.63
72	11	-	-	-	-	-
71	12	-	-	-	-	-
70	13	-	-	-	-	(82.50)

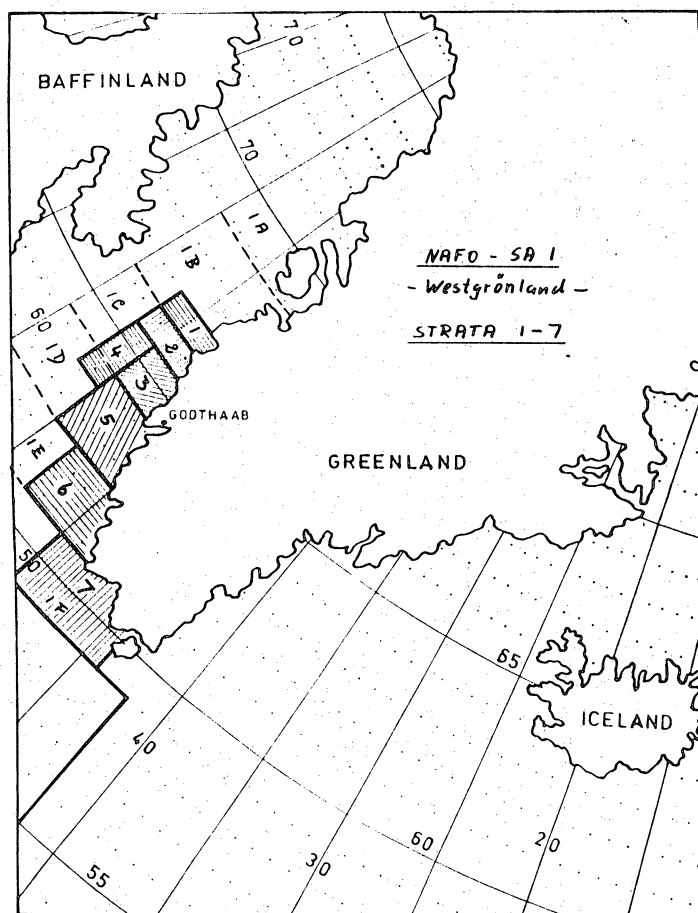


Fig. 1. Survey area in Subarea 1.

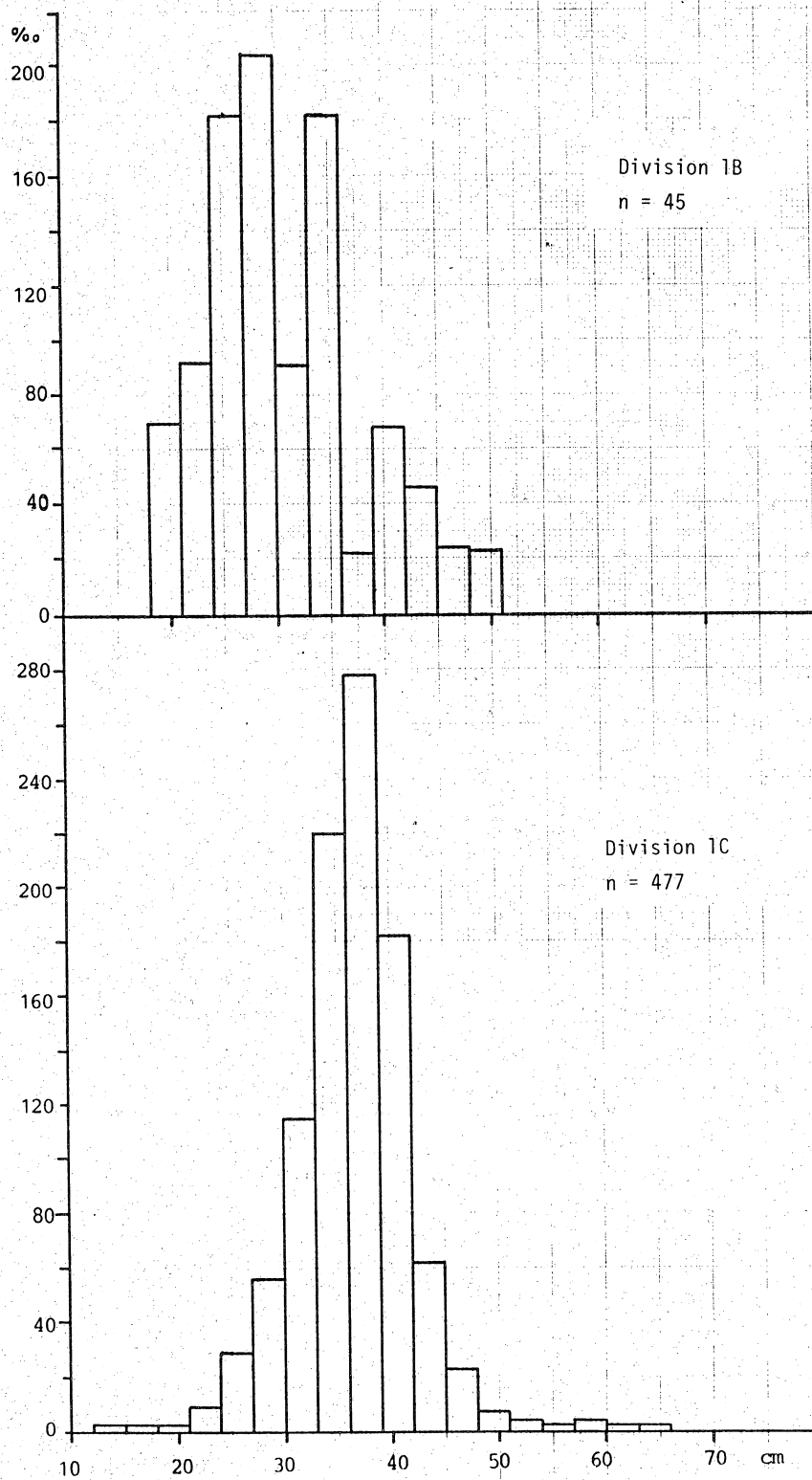


Fig. 2. Subarea 1 Cod (Div. 1B and 1C): Length frequencies (%) by 3 cm groups from survey catches in November/December 1982 (n = measured fish).

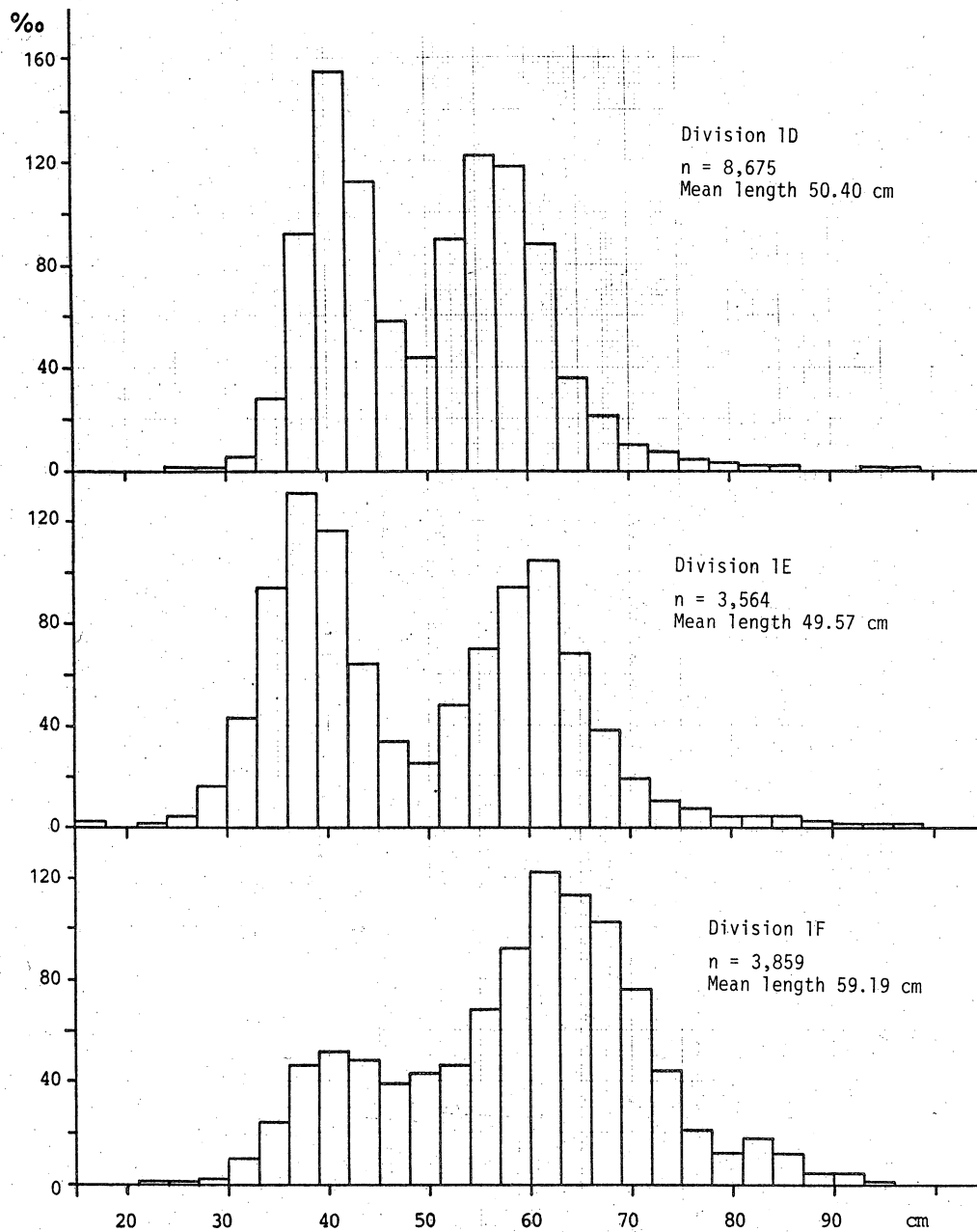


Figure 3. Subarea 1 Cod (Div. 1D, 1E and 1F): Length frequencies (%) by 3 cm groups from survey catches in November/December 1982 (n = measured fish).

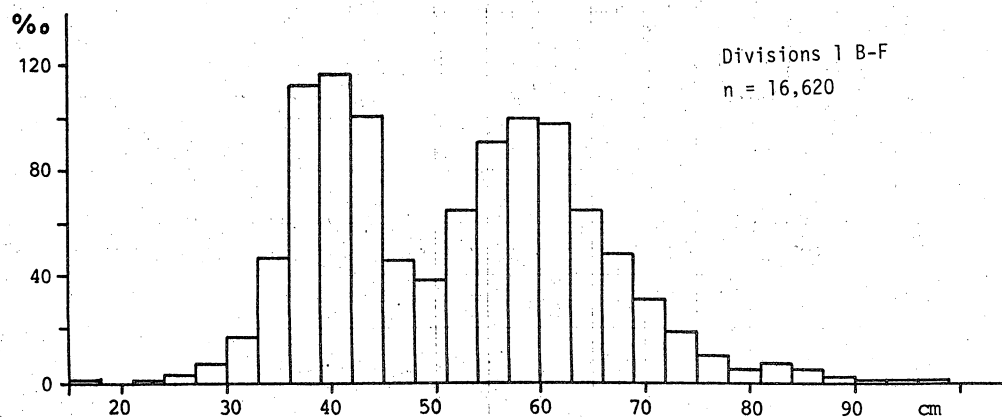


Figure 4. Subarea 1 Cod (Divisions 1B-F): Length frequencies (%) by 3 cm groups from survey catches in November/December 1982 (n = measured fish).

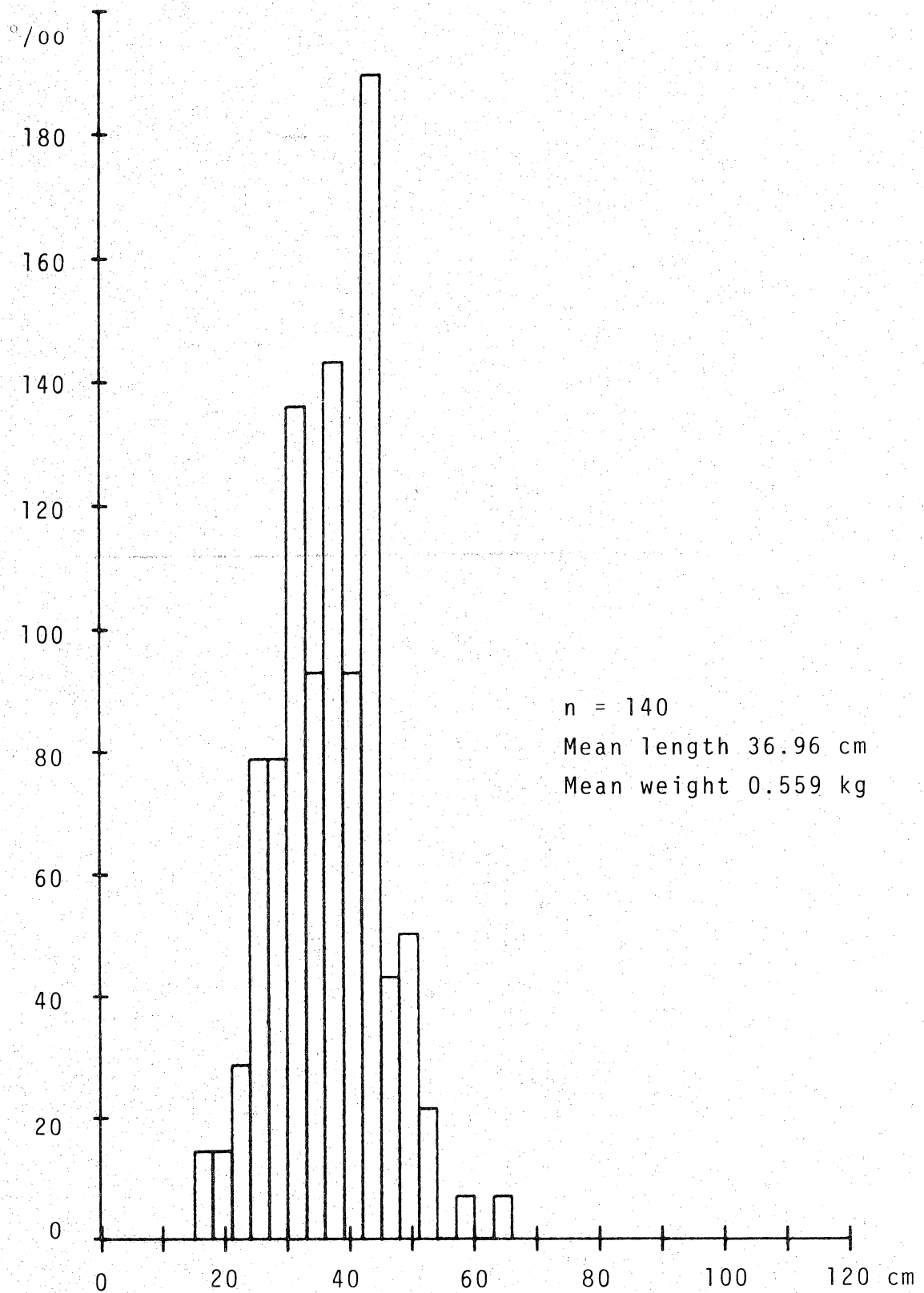


Figure 5. Subarea 1 Cod (Div. 1C): Length frequencies (‰) by 3 cm groups from survey catches in November/December 1983 (n = measured fish).

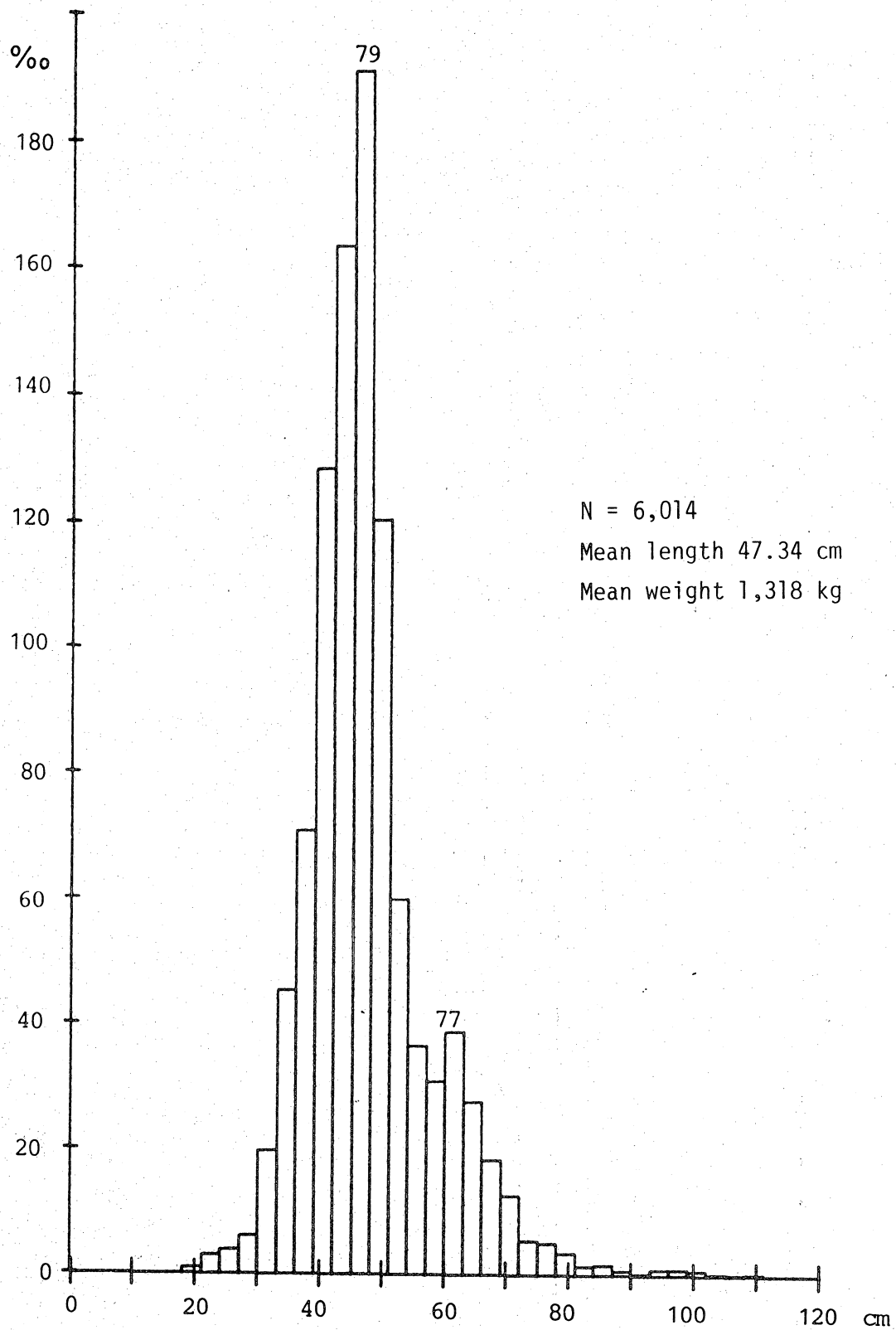


Figure 6. Subarea 1 Cod (Division 1D): Length frequencies (%/%) by 3 cm groups from survey catches in November/December 1983 (n = measured fish).

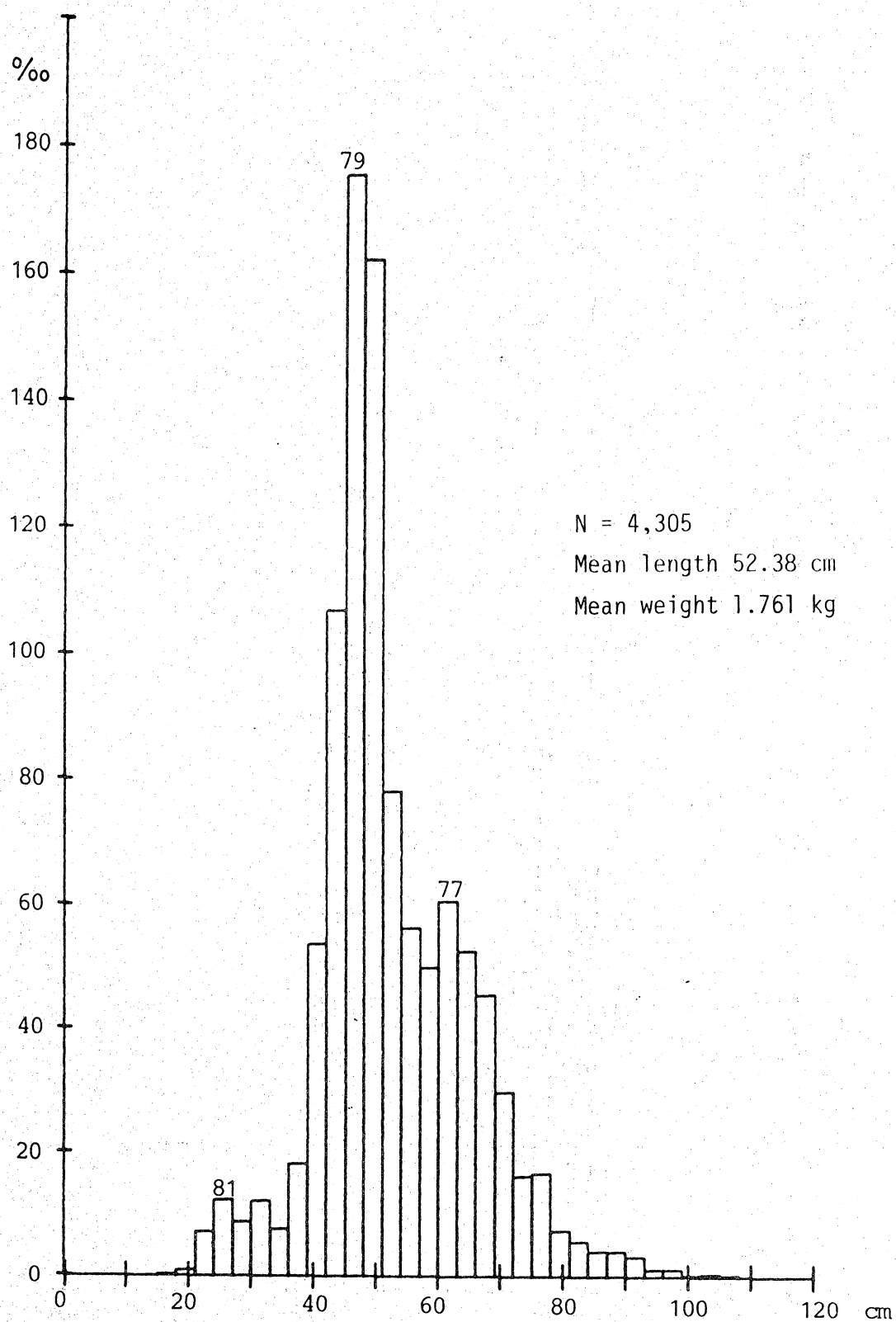


Figure 7. Subarea 1 Cod (Div. 1E): Length frequencies (%/oo) by 3 cm groups from survey catches in November/December 1983 (n = measured fish).

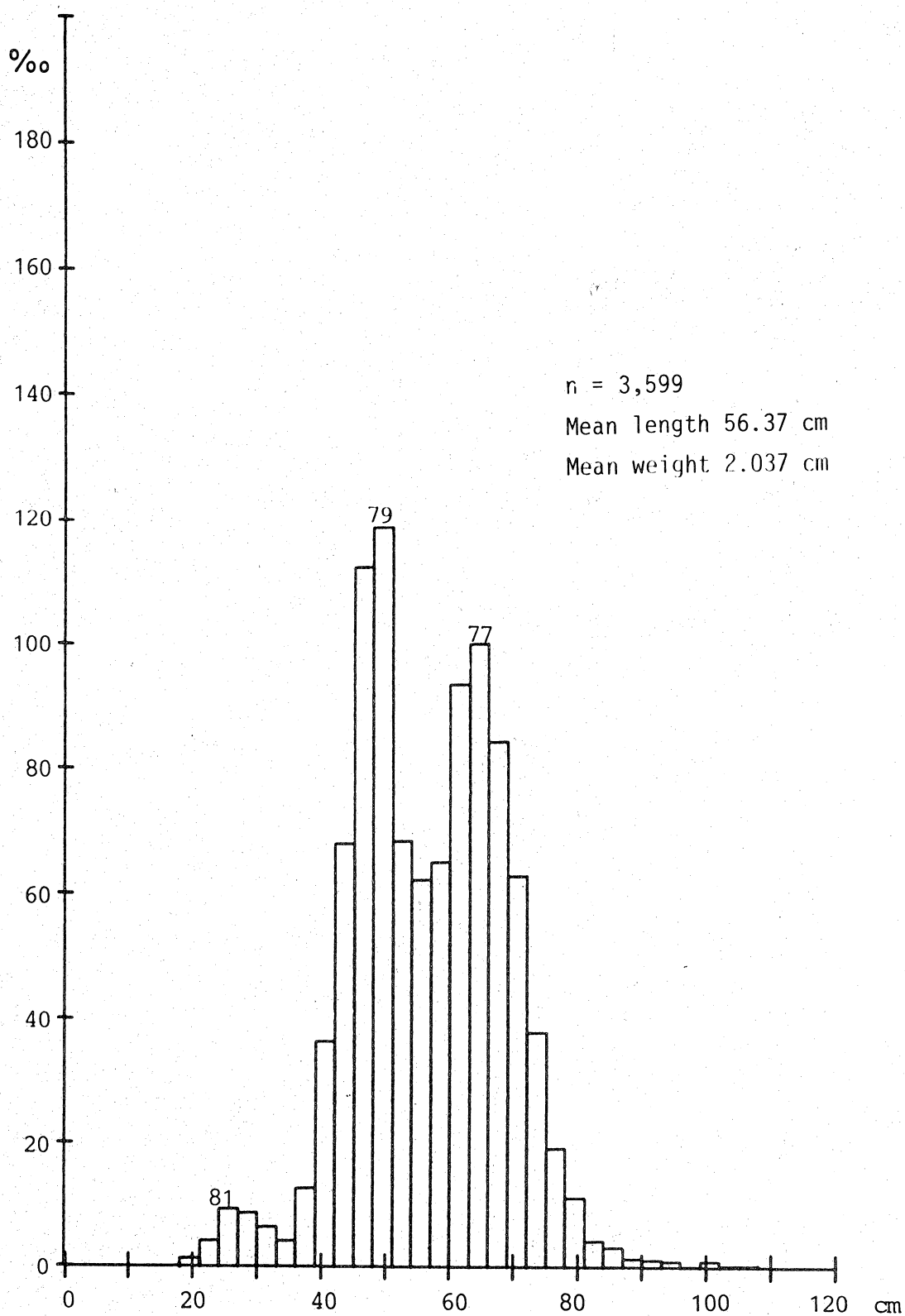


Figure 8. Subarea 1 Cod (Div. 1F): Length frequencies (%/oo) by 3 cm groups from survey catches in November/December 1983. (n = measured fish).

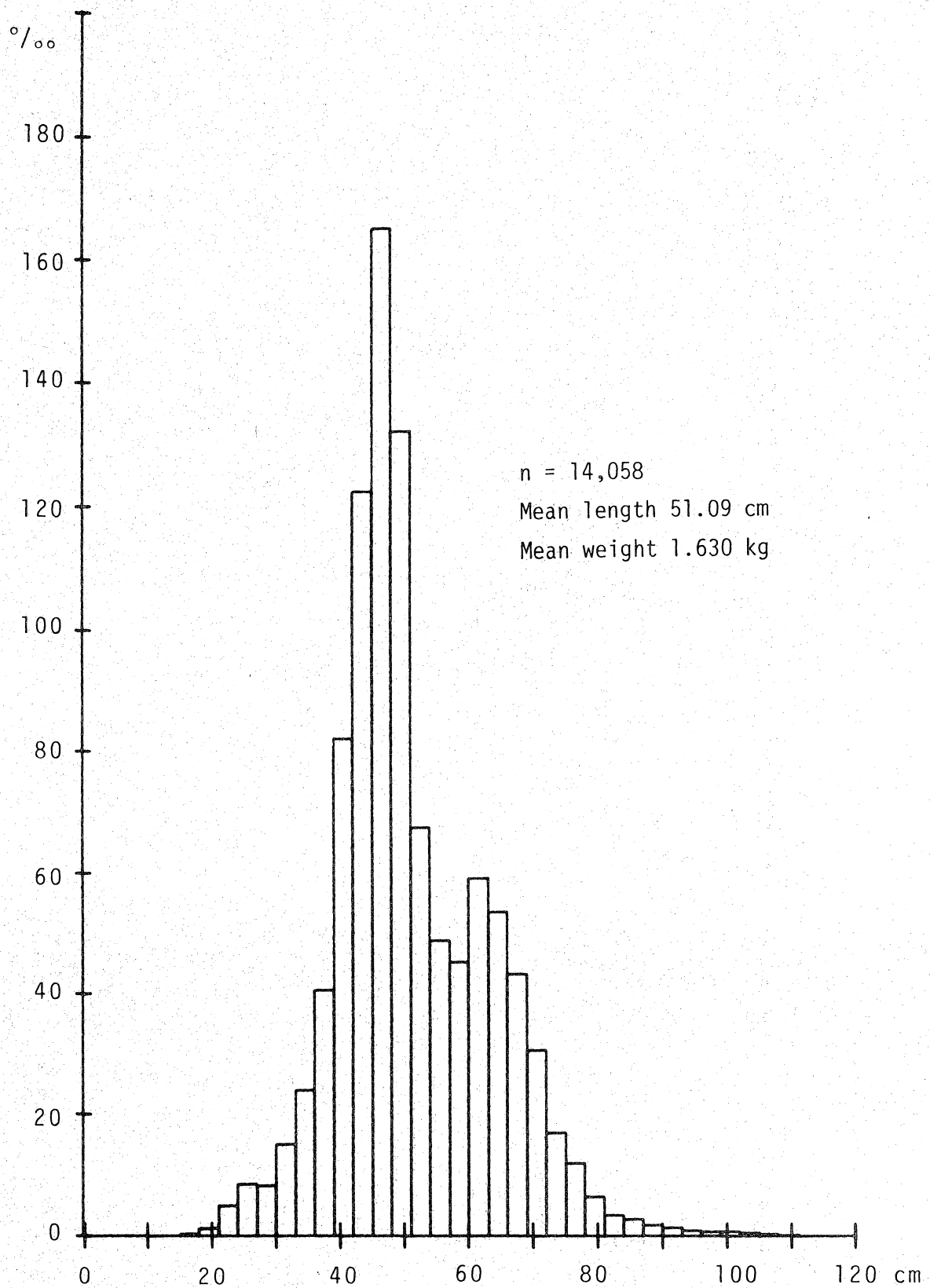


Figure 9. Subarea 1 Cod (Div. 1C-F combined): Length frequencies (‰) by 3 cm groups from survey catches in November/December 1983 (n = measured fish).

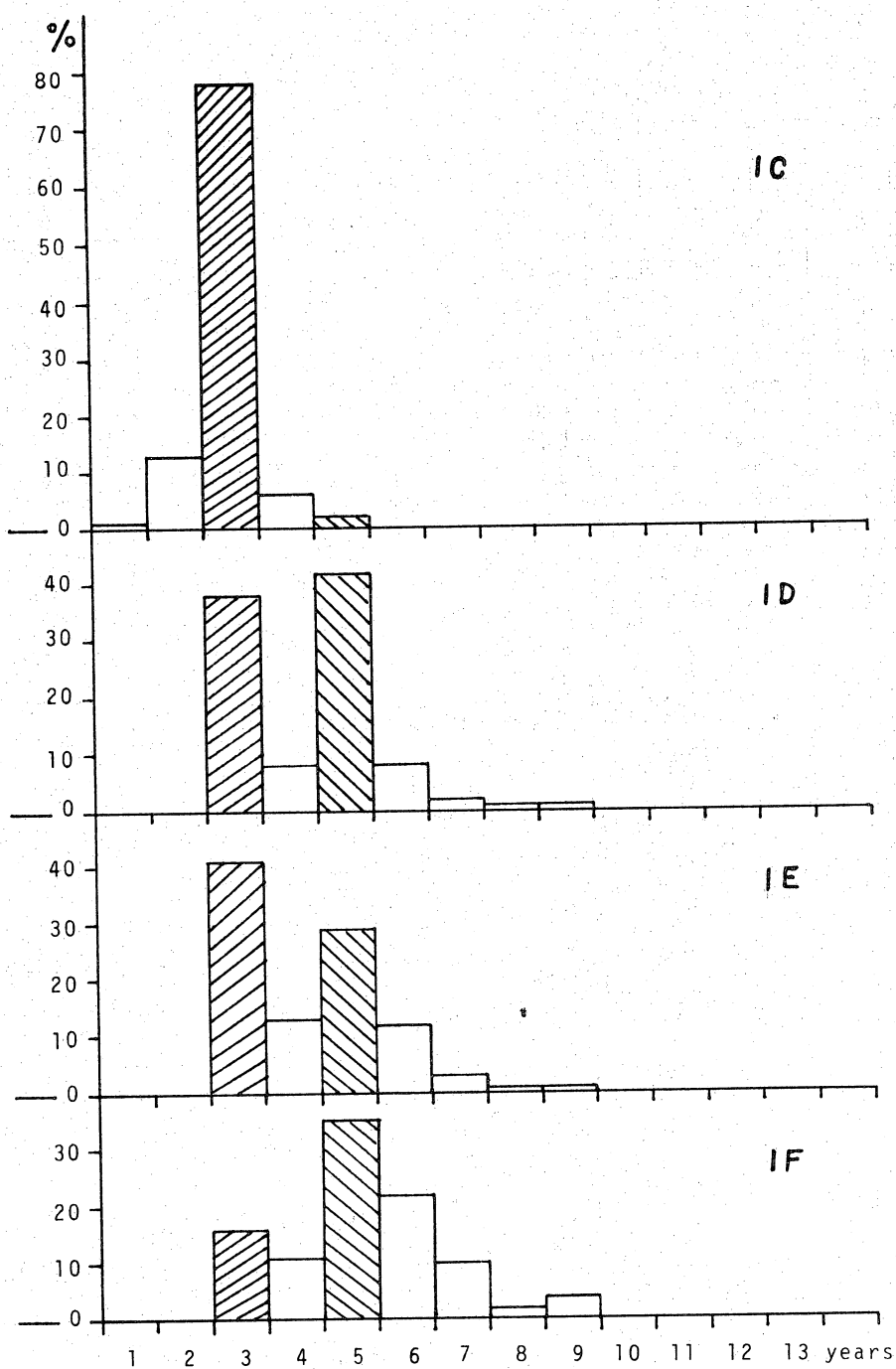


Figure 10. Subarea 1 Cod, age compositions (%) by Divisions according to 1982 survey results.

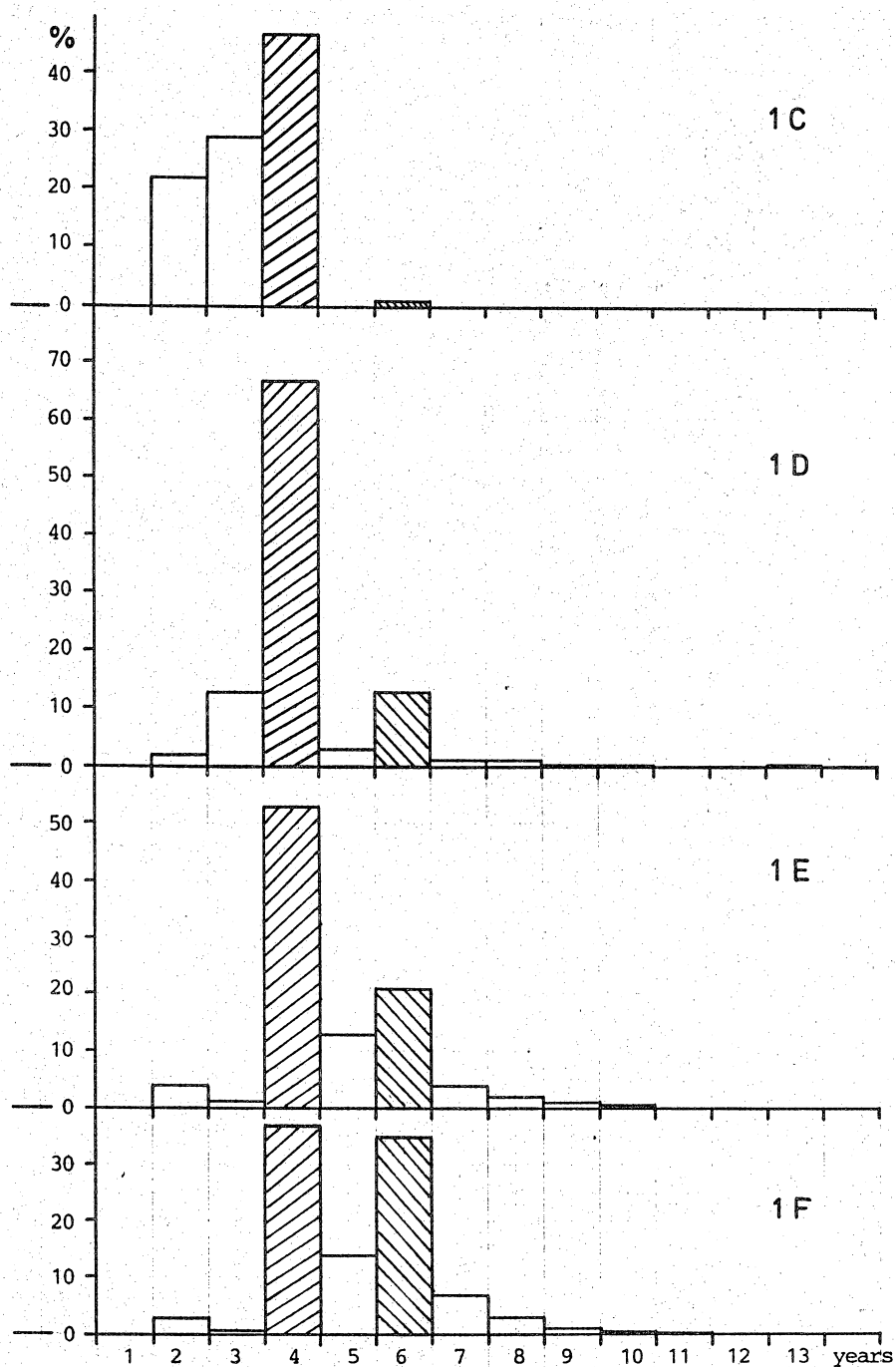


Fig. 11. Subarea 1 Cod, age compositions (%) by Divisions according to 1983 survey results.