FiskDir. Skr. Ser. HavUnders., *16*: 465—487.

VARIATIONS IN ZOOPLANKTON VOLUMES AT THE PERMANENT OCEANOGRAPHIC STATIONS ALONG THE NORWEGIAN COAST AND AT WEATHERSHIP STATION M(IKE) IN THE NORWEGIAN SEA DURING THE YEARS 1949—1972

By

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ABSTRACT

Wiborg, K.F. 1978. Variations in zooplankton volumes at the permanent oceanographic stations along the Norwegian coast and at weathership station M(ike) in the Norwegian Sea during the years 1949—1972. *FiskDir. Skr. Ser. HavUnders.*, *16*:465—487.

During the years 1949—1972 zooplankton was sampled in vertical hauls at permanent oceanographic stations along the coast of Norway and at the weathership station «M» in the Norwegian Sea. During 1949—1962 (station M:—1965) Nansen net «8/72» was used, later the Juday net, J.36. The Juday net was found to catch more plankton in relation to the opening of the net.

During May—August average plankton volumes were larger off northwestern Norway than farther south.

Deviations from the long term averages in plankton volumes were compared with observations from adjacent areas of the North Sea, Norwegian Sea and Barents Sea. Some similarities were found, but local variations seem to be the major cause of observed differences.

No clear relationship was established between zooplankton biomass and sea temperature.

Rich year classes of cod seem to be born more frequently in years when zooplankton biomass is above average, while medium and poor year classes are possibly more frequent in years with lower abundance of plankton, but the data are not sufficient for a conclusion.

No correlation was found between abundance of plankton and of cod larvae.

INTRODUCTION

Since 1949 the composition and quantities of zooplankton along the coast of Norway and in the Norwegian Sea have been described in a number of reports (LIE 1961, 1966, 1968, WIBORG 1954, 1955, 1958, 1960 a and b, 1976). This paper deals with variations in zooplankton volumes at the permanent oceanographic stations and at station M during the years 1949—1972.

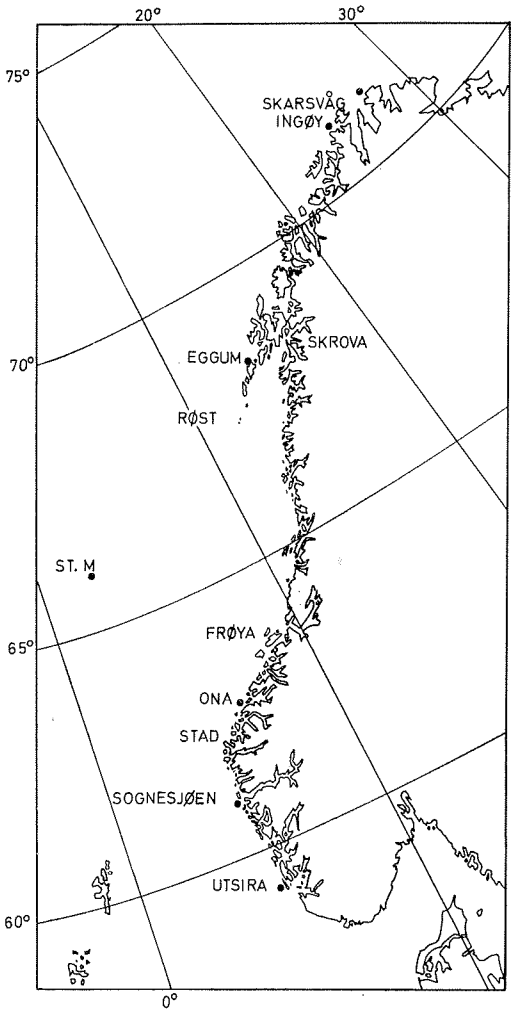

Fig. 1. Permanent zooplankton stations 1949—1972.

MATERIALS AND METHODS

Zooplankton has been sampled in vertical hauls from the bottom to 0 m and from 50 to 0 m at permanent oceanographic stations along the coast of Norway (Fig. 1) at intervals from one week to one month since 1949. At weathership station M in the Norwegian Sea (lat. 66°00′ N, long. 02°00′ E) samples have been taken weekly from 100 to 0 m and during some years also from 25 to 0 m. Here, a 600—100 m haul was also taken once a month and since September 1959, once a week.

During 1949—1965 a Nansen net (opening diameter 70 cm, mesh size

approx. 180 μ, Dufour bolting silk No. 8) was used, to be replaced by the Juday net, (diameter 36 cm, mesh size 180 μ, Nytex nylon gauze). The net was not changed simultaneously at all stations and was shifted last at station M.

Plankton volumes were measured after removal of large organisms such as salps and medusae, until 1970 by draining (WIBORG 1954) and later by displacement (ROBERTSON 1970). A comparison indicated slightly higher figures for draining, and a correction factor of 0.75 was calculated and used for the earlier figures from draining.

According to BOGOROV (1959) the Juday net catches up to twice as many organisms per 1 m^3 as the Nansen net. In the present investigation the displacement volumes in relation to the net opening were also larger in the Juday net hauls. TRANTER and SMITH (1968) assumed that the tropical Juday net, which is a scaled up version of the ordinary Juday net, might have an initial efficiency of more than 100% because of its non-porous reduction cone, and that the probability of clogging could be high in tows longer than 50 m in water rich in plankton. In order to test the effect of the reduction cone a Juday net similar to those used in the present investigation was equipped with a Tsurumi-Seiki flowmeter placed halfway between the sentre and the rim (ANON. 1968 p. 156) and suspended from a bar, one end of which extended well outside the rim of the net. Another flowmeter was fastened at this end. The unit was twice towed round a circular tank for a distance of approximately 180 m at a speed of 1.0 m/sec. and 0.8 m/sec. The reading of the flowmeter indicated a filtration of 83.2% of the water offered. Vertical hauls were taken in September 1977 in the sea near Bergen at a speed of 0.5 m/sec. In five 20-0 m hauls the percentages of filtration were, 73.8, 88.3, 88.3, 88.3, and 90.2; average 85.8%. In four 200-0 hauls, 62.8, 67.0, 68.7, 71.0, average 67.4%. In two 300-0 hauls, 65.1, 67.7, average 66.4%. Thus it is evident that the initial filtration of the Juday net is below 100% and that the percentage of filtration may decrease further with increasing length of the haul if plankton is abundant. No flowmeter tests are available for the Nansen net.

In the present investigation no correction factor has been used for filtration. Accordingly, volumes of plankton per unit of sea surface are minimum figures.

RESULTS

AVERAGE MONTHLY ZOOPLANKTON VOLUMES DURING 1949—1972

The monthly average plankton volumes during 1949—1972 are shown in Fig. 2 and Table I, p. 484. The Juday net figures are generally higher, and are considered to give a more reliable picture of the plankton quantities.

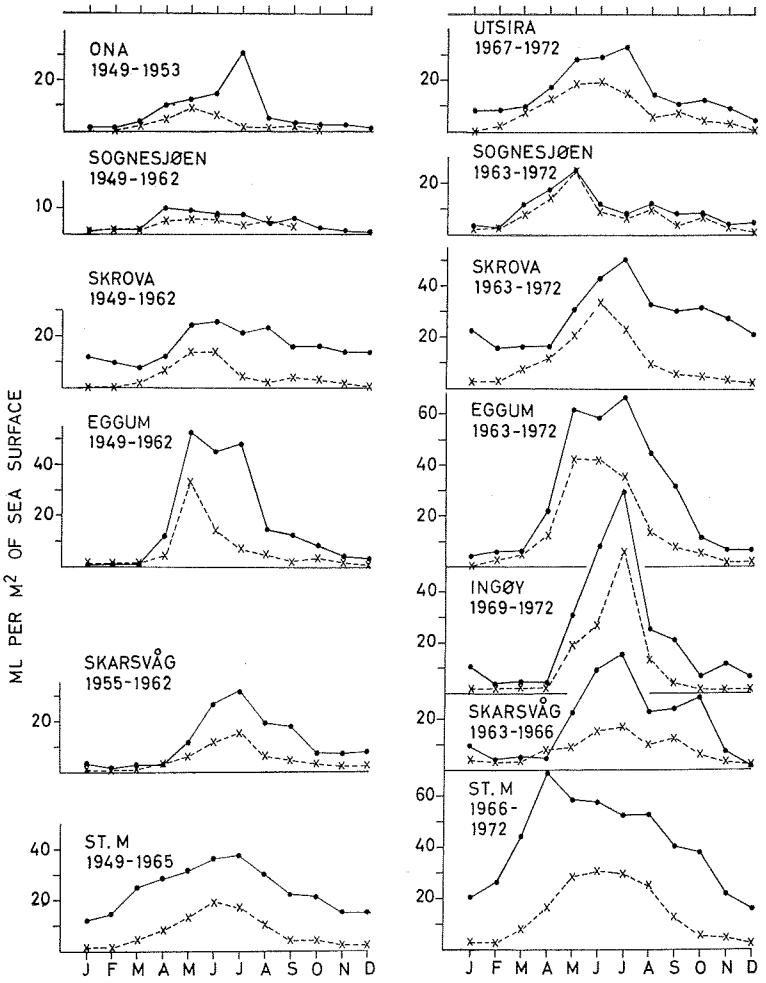

Fig. 2. Average annual variations in displacement volumes of zooplankton at permanent stations along the coast of Norway and at station M 1949—1972. Left) Nansen net hauls, right) Juday net hauls. Monthly mean figures per m² of sea surface. Dashed) 50-0 m, solid) bottom to 0 m (station M 100-0 m and 600-0 m).

Utsira

Sampling started in 1965 though samples were not regular until 1967. The spring increase starts at the end of March with maximum volumes occurring in June—July. These were of about 30 ml/m² in the total hauls and 20 ml/m² in the upper 50 m. Small increases have been observed in September—October.

Sognesjøen

Plankton volumes were small when compared to those of the other stations. The bottom is at 300 m, but hauls were only taken from 200 m, and some plankton may not have been sampled due to it staying below this depth, especially from autumn to spring. The spring increase starts in March—April though during 1949—1962 the average volume did not change very much from April to July. There was a second increase in August—September.

During 1963—1972 the peak in May was more pronounced with a maximum of 25 ml/m².

Ona

Complete data are only available from 1949 to 1953. The spring increase started in March—April, the main maximum in the upper 50 m occurring in May and in the total water column, in July.

Skrova

The spring increase started in April—May. During 1949—1962 the plankton of the upper 50 m was most abundant from May to June and in the total hauls from May to August. A second peak was indicated in September—October. During 1963—1972 the total volume had a main peak of 50 ml/m² in July while the 50-0 volume was at a maximum of 34

Table 1. Average biomass of zooplankton from 0 to 50 m in the eastern Norwegian sea (Norwegian Current) in June 1958 (mg/m³). From GRUZOV and PAVSHTIKS (1961), TIMOKHINA (1963, 1972).

Section	1958	1959	1960	1961	1962	1965	1966	1967	1968	1969	1970
71°10′ N	1183	831	1464	1240	1154	960	1480	—	1220	1870	1223
69°20′ »	1736	1100	1160	1230	1528	1180	1684	1820	1480	1444	830
67°30′ »	—	—	1256	735	818	2040	3000	2080	2500	1370	1014
65°45′ »	—	—	—	—	1346	2320	1840	1040	1620	574	1600
63°00′ »	—	1070	920	552	1204	1200	1340	840	846	1407	1134
60°04′ »	—	1406	940	—	636	1240	—	—	1432	1056	822

ml/m² in June. During winter the plankton was relatively abundant, 15—22 ml/m², probably an accumulation effect due to the topography of the Vest fjord.

Eggum

The variations have been characterized by small volumes during late autumn and winter and distinct peaks in May—July. Volumes have been larger than at Skrova, maxima in 1963 were 60—67 ml/m² for the total hauls and 42 ml/m² in the upper 50 m.

Skarsvåg—Ingøy

The spring increase starts in April—May, the main maximum occurring in July and a second peak in September. In 1963—1966 the average maximum volumes were 37—45 ml/m². After three years without plankton sampling at the Skarsvåg station, it was replaced by Ingøy in 1969 with complete sampling from July 1969 to August 1972. The high peak in July (Fig. 2) was caused by one sample of 165 ml/m² in July 1970.

Station M

The spring increase starts in February—March. For the 1949—1965 period the peak for the 100-0 m hauls reached in May, for 600-0 m in July, and during 1966—1972 the maxima for both intervals were reached in April. Plankton was relatively abundant in the upper 100 m until July and in the upper 600 m until October.

AVERAGE ZOOPLANKTON VOLUMES DURING MAY—AUGUST

Averages have been worked out per month for the period May—August when the plankton generally is most abundant (Fig. 3).

The larger figures calculated for the Juday net hauls are immediately apparent, but the ranging in biomass at the stations is more or less the same, viz. Eggum, station M, Skrova, Skarsvåg and Sognesjøen. During the period 1949—1962 Ona ranged before Sognesjøen as did Utsira during 1963—1972.

The 50-0 m volumes were about half the total volume or below, except at Sognesjøen where the deeper layers may have been sampled insufficiently. At station M the 100-0 m volumes where of nearly the same size as the 50-0 m volume at Eggum.

It is assumed that the 1963—1972 figures give a relatively correct picture of the average quantities of plankton during May—August at Eggum and station M, *i.e.* 50—60 ml/m², at Skrova and Skarsvåg 30—40 ml/m², at Sognesjøen and at Utsira 15—25 ml/m².

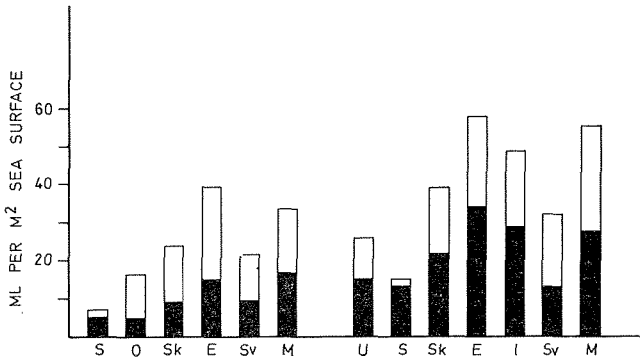

Fig. 3. Average monthly zooplankton volumes during May—August. Left) Sognesjøen (S), Skrova (Sk) and Eggum (E) 1949—1962, Ona (O) 1949—1954 Skarsvåg (Sv) 1955—1962, station M 1949—1965. Right) Utsira (U) 1967—1972, Sognesjøen, Skrova and Eggum 1963—1972, Ingøy (I) 1969—1972, Skarsvåg 1963—1966, station M 1966—1972. Total column) bottom to surface, black column) 50-0 (station M 600-0 m and 100-0 m).

DEVIATIONS FROM THE MEAN MONTHLY AVERAGES DURING THE YEARS 1949—1972

Fig. 4—10 show deviations from the mean plankton volumes for each month and for the period April—August during the years 1949—1972 (Table I). In some years data are incomplete, lacking for one to several months or even years. For this reason the period April—June has been used for station M instead of April—August. The figures have therefore to be considered with reservation.

The deviations in a particular year are seldom similar at two or more stations. During 1950 positive deviations occurred in June at Eggum and station M, and in August at Ona, Skrova, Eggum and station M. In

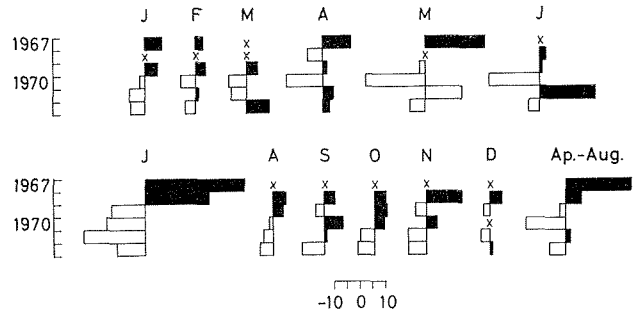

Fig. 4. Utsira. Deviations from the mean zooplankton volumes for each month of the year and of the period April—August 1967—1972. x) No observations.

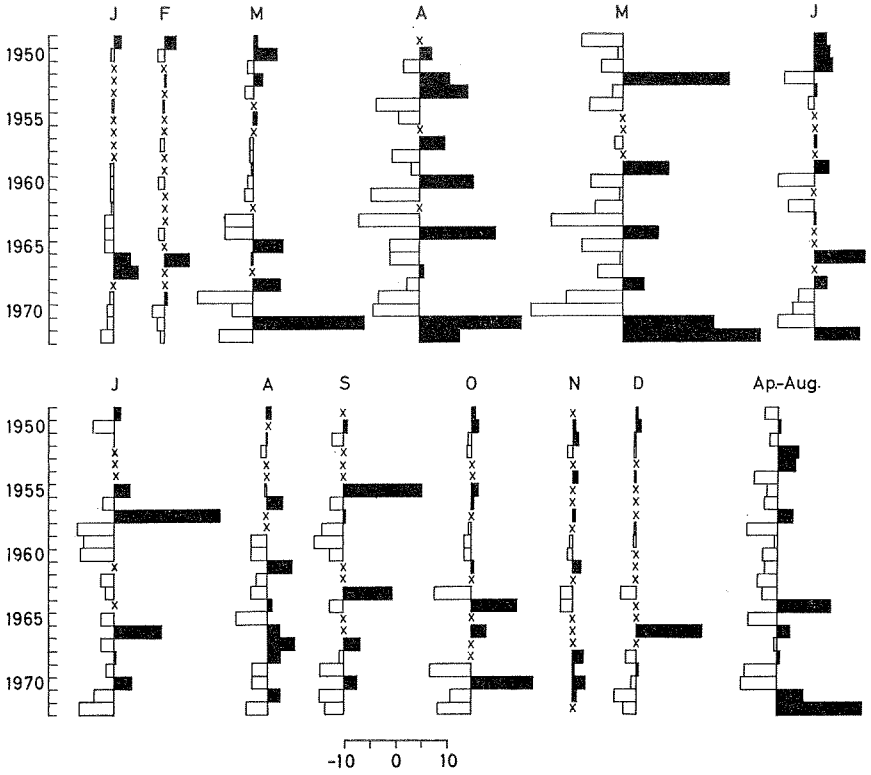

Fig. 5. Sognesjøen. Deviations from the mean zooplankton volumes for each month of the year and of the period April-August during 1949—1972. x) No observations.

1965 there were positive deviations in June, July and August at Skarsvåg and station M. In 1966 deviations were common in June at Sognesjøen, Skrova and Eggum, and in July at Sognesjøen and Skrova.

DISCUSSION

COMPARISON OF ZOOPLANKTON IN ADJACENT AREAS

During April 1962 and April—May 1963 zooplankton was very abundant on the coastal banks off Stad—Frøya on the west coast of Norway (Wiborg 1976), but scarce at the permanent station at Sognesjøen. At Eggum the biomass was below average during April—May 1962, but above average in May 1963. During April—May 1964 zooplankton was abundant over all coastal banks between Stad and Røst (Wiborg 1976) and at Sognesjøen and Eggum.

Longhurst *et al.* (1972) reported on annual fluctuations in abundance of various plankton organisms west of the British Isles and in the North

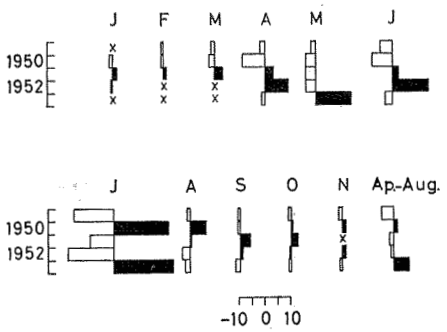

Fig. 6. Ona. Deviations from the mean zooplankton volumes for each month of the year and of the period April—August 1949—1953. x) No observations.

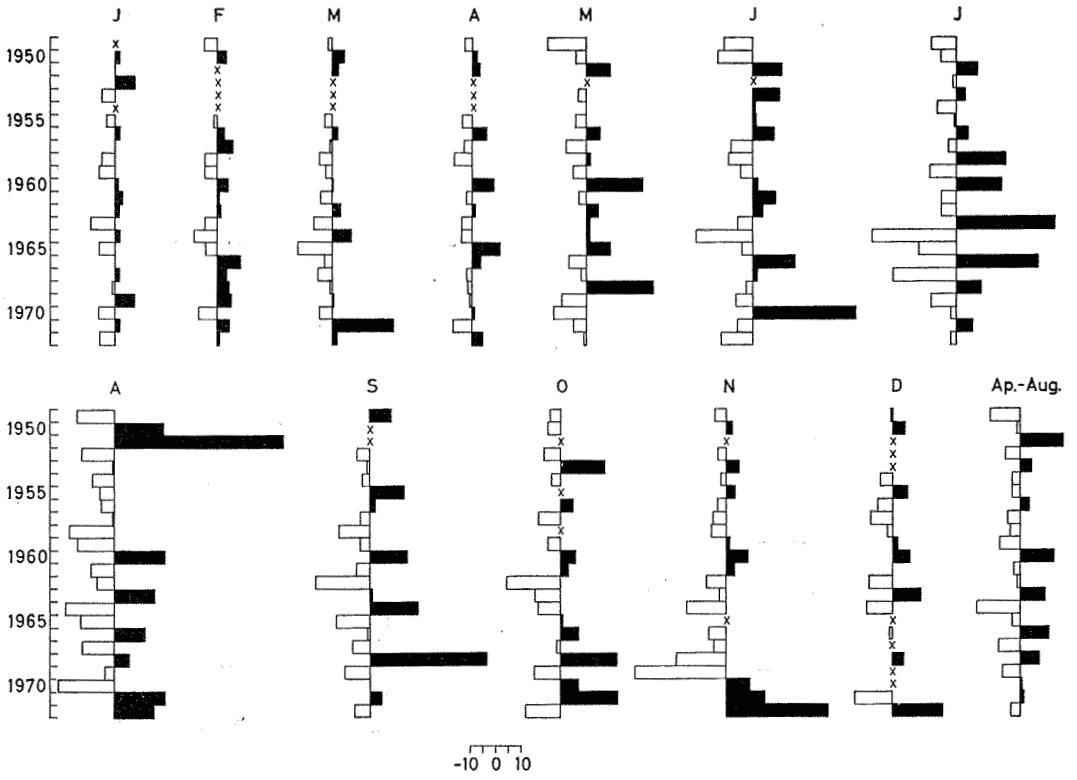

Fig. 7. Skrova. Deviations from the mean zooplankton volumes for each month of the year and of the period April—August 1949—1972. x) No observations.

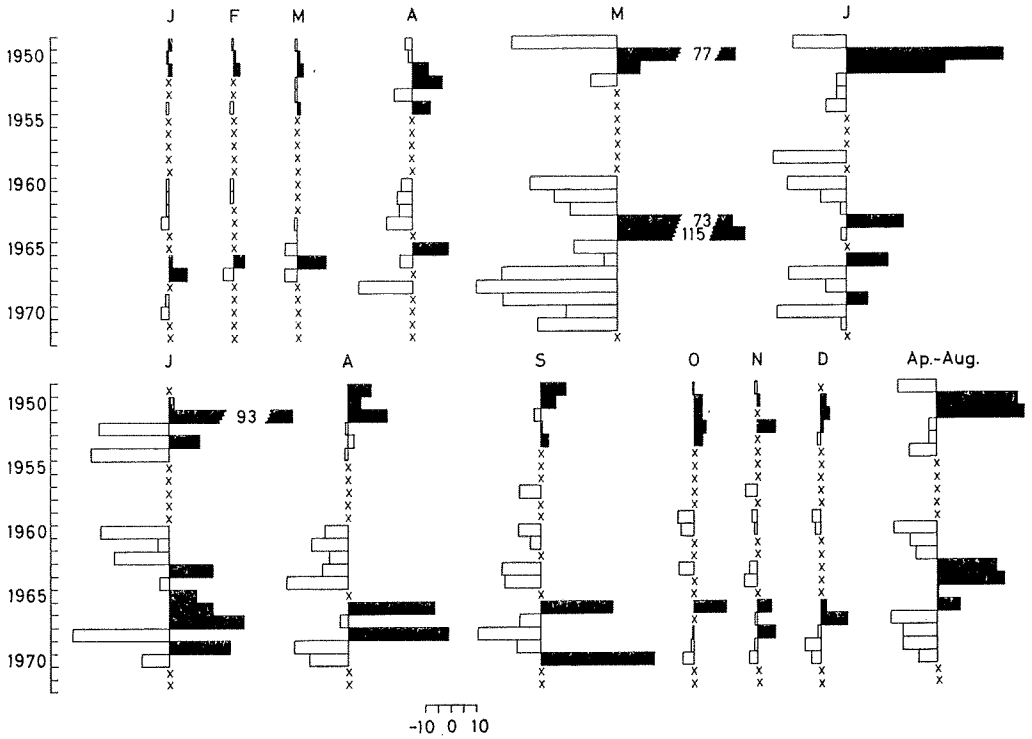

Fig. 8. Eggum. Deviations from the mean zooplankton volumes for each month of the year and of the period April—August 1949—1972. x) No observations.

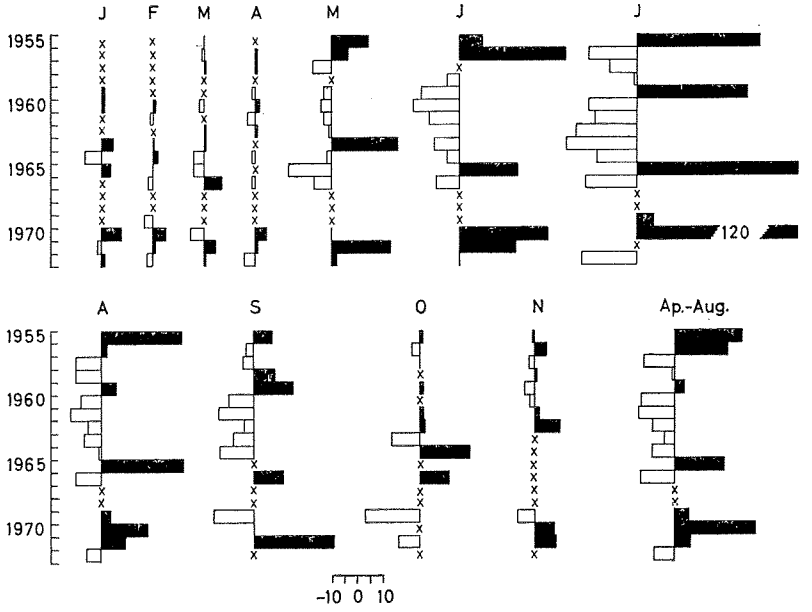

Fig. 9. Skarsvåg and Ingøy. Deviations from the mean zooplankton volumes for each month of the year and of the period April—August 1949—1972. x) No observations.

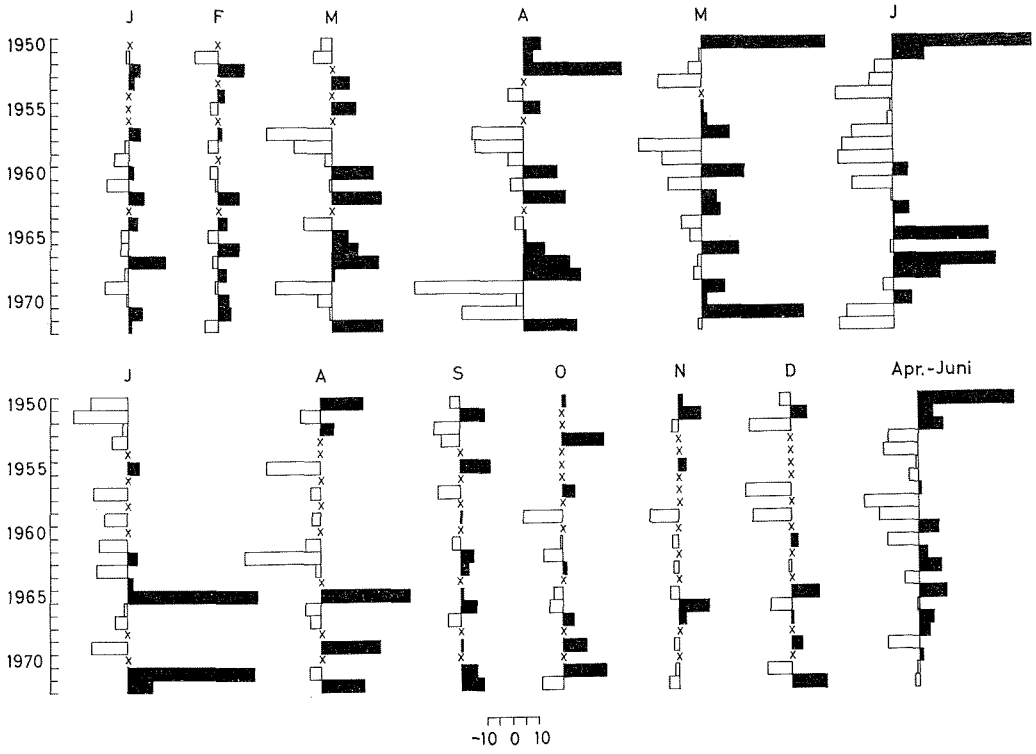

Fig. 10. Station M. Deviations from the mean zooplankton volumes for each month of the year and of the period April—June 1949—1972. x) No observations.

Sea during the years 1949—1970. In the North Sea the number of *Calanus* sp. fluctuated in very much the same way as in the figures for April—August at Sognesjøen, with peaks in 1952 and 1964 and large reductions in 1958, 1962 and 1965 (Fig. 11).

The biomass and composition of the zooplankton in the Norwegian Sea have been studied for a number of years by Soviet scientists. Most of the samples were collected in June in the eastern part of the area in sections along the parallels between 60°N and 74°N. Biomass was calculated as mg/m³ of zooplankton in 50-0 m. Data from GRUZOV and PAVSHTIKS (1961), and TIMOKHINA (1963, 1972) are compiled in Table 1. The two northern sections may be compared with Skarsvåg and Ingøy, the median ones with Skrova and Eggum and the two southern sections with Sognesjøen. There does not seem to be any common trend in the variations of abundance among the sections, neither do they correspond with any of the coastal stations in their variations.

TIMOKHINA (1968) calculated the average annual biomass of *Calanus*

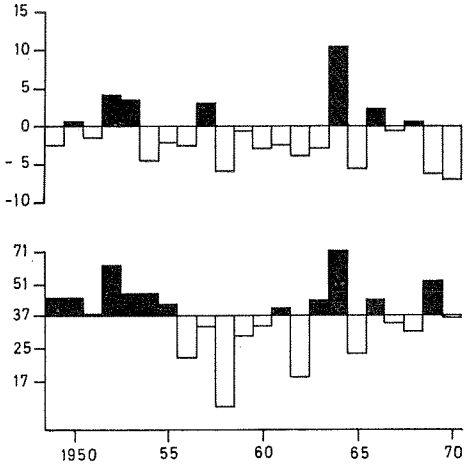

Fig. 11. Deviations from the mean monthly zooplankton volumes for the period April —August at Sognesjøen 1949—1970 compared with variations in relative abundance of *Calanus* sp. in the same years, redrawn from LONGHURST *et al.* (1972).

finmarchicus in coastal waters off western and northern Norway during 1959—1963. The figures were as follows (tons per km^2): 1959, 19.5; 1960, 14.4; 1961, 2.8; 1962, 12.4; 1963, 22.0.

A zooplankton biomass above average was recorded at station M and Skrova during April—August 1960 and at station M, Skrova and Eggum during the same period in 1963. At Skarsvåg the biomass was above average in 1959, but below during 1960—1963.

CORLETT (1965) studied zooplankton in the western Barents Sea during the summers of 1949—1959. The biomass was relatively high in 1949, 1950, 1954 and 1957—1959, but low in other years (see Table 4, p. 00). Similarities to the Eggum and Skarsvåg results thus occurred in 1950, 1952, 1953, 1958 and 1959.

During the years 1951—1958 ZELIKMAN and KAMSHILOV (1960) observed a small biomass in the southern Barents Sea in 1952, maxima in 1951 and 1954, and also high figures in 1955—1957. At Eggum and Skarsvåg the April—August figures were similar in 1951, 1952, 1955 and 1956.

ANTIPOVA, DEGTYAREVA and TIMOKHINA (1974) observed peaks in abundance of zooplankton biomass in the southern Barents Sea in May 1950, 1959, 1960, 1961 and 1967, and in July 1950, 1953, 1962 and 1964.

Zooplankton thus seems to have been commonly very abundant both off the northwestern coast of Norway and in the western, or southern, or in both areas of the Barents Sea during the spring and summer months of 1950, 1951, 1955, 1956 and also in July 1953. A biomass below average was common in 1952.

ZOOPLANKTON AND SEA TEMPERATURE

ZELIKMAN and KAMSHILOV (1960) did not find any clear relationship between the abundance of zooplankton and sea temperature.

ANTIPOVA, DEGTYAREVA and TIMOKHINA (1974) observed a positive correlation between the temperature of the sea in April and May and the biomass of zooplankton along the Kola section in the southern Barents Sea. They concluded that the warming of the upper water layers stimulated the growth of phytoplankton which in turn influenced the development of the zooplankton. Furthermore, the heat content of the upper water layers might also stimulate the development of the gonads of *Calanus finmarchicus*. For June, July and September there was no positive correlation, probably because *Calanus* then descended to deeper layers to hibernate.

MIDTTUN (1969, 1975) studied the annual variations in the sea temperature at the permanent oceanographic stations along the Norwegian coast during 1945—1965 and also surface temperatures at other coastal stations during 1936—1970. At Eggum maxima in temperatures were observed in 1950, 1961, and 1964 while surface maxima occurred in 1967 and 1970. Plankton biomass above average was observed in 1950 and 1964, but also in 1963 and 1966 when the temperature was low. Near Skarsvåg there were temperature maxima in 1959—1961 and minor peaks in 1964, 1967 and 1969—1970. Zooplankton biomass was slightly above average in 1959 and 1970 whereas the other peaks coincided with low sea temperatures.

The simultaneous occurrence of high sea temperatures and above average plankton biomass seems therefore to be rather accidental. It should, however, be noted that in 1950 there was a more general abundance of plankton at several localities, both at station M, Eggum, and partly at Ona and Skrova.

ZOOPLANKTON BIOMASS, ABUNDANCE OF COD LARVAE OFF THE NORTHWESTERN COAST OF NORWAY, AND THE SIZE OF THE YEAR CLASSES OF ARCTO-NORWEGIAN COD

Deviations from the mean of the zooplankton biomass at Skrova, Eggum and Skarsvåg during April—August are compared in Table 2 with the relative abundance of cod larvae during May—July 1949—1972 and with the strength of the same year classes of cod at an age of 2 + years. Data on cod larvae have been taken from BARANENKOVA (1974), DRAGESUND and HOGNESTAD (1967), HOGNESTAD (1969 a, b, and c, 1971, 1972, 1973), SMESTAD and ØYESTAD (1974) WIBORG (1957, 1960) and on year classes of cod from PONOMARENKO (1976) and ANON. (1976).

Table 2. Occurrence of cod larvae off northern Norway, number of cod of 2+years/hour of trawling in the Barents Sea, and abundance of zooplankton at Skrova (S), Eggum (E) and Skarsvåg-Ingøy (Sk) during April—August 1949—1972. +) at or above average, ÷) below average, ×) no observation. R-rich, M-medium, P-poor. See text, p. 477-478

Year	Cod larvae		Cod, 2 + years No./hr of trawling	Zooplankton abundance		
	Apr.—June	June—July		S	E	Sk
1949	+	×	24 M	÷	÷	×
1950	÷	×	75 R	+	+	×
1951	÷	×	6 P	+	+	×
1952	+	×	3 P	÷	÷	×
1953	÷	×	9 P	+	÷	×
1954	+	×	6 M	÷	÷	×
1955	+	×	9 P	÷	×	+
1956	+	×	14 M	+	×	+
1957	÷	×	13 M	÷	×	÷
1958	+	×	19 M	÷	×	+
1959	+	÷	10 M	÷	×	+
1960	÷	÷	13 M	+	÷	÷
1961	÷	+	2 P	÷	÷	÷
1962	+	+	6 M	+	÷	÷
1963	÷	+	76 R	+	+	÷
1964	÷	÷	46 R	÷	+	÷
1965	÷	÷	1 P	÷	÷	+
1966	÷	÷	1 P	+	+	÷
1967	÷	÷	1 P	÷	÷	×
1968	÷	÷	5 P	+	÷	×
1969	÷	÷	9 P	÷	÷	+
1970	+	+	79 R	+	÷	+
1971	+	×	32 R	+	÷	+
1972	+	×	35 R	÷	×	+

The abundance of cod larvae has been classified very roughly as high (+) or low (—). Year classes of cod with 30—79 specimens per hour of trawling are characterized as rich, those with 10—29 per hour as medium and those below 10 per hour as poor. The year classes of 1954 and 1962 have been adjusted to medium according to ANON. (1976).

The figures do not lend themselves to detailed statistical analysis, but in order to get a rough idea of the relationships, the data have been arranged as shown in Tables 3—6.

Rich year classes of cod seem to be born more frequently in years when zooplankton biomass is above average while medium and poor year classes are possibly more frequent in years with low abundance of plankton, but as data are lacking for a number of years, the conclusion is uncertain.

Table 3. Number of instances where zooplankton biomass was at or above average (+) or below average (÷) at Skrova, Eggum and Skarsvåg-Ingøy during April-August and year classes of cod aged 2 + years in the Barents Sea for the years 1949—1972. ×) no observation. Data from Table 2.

Cod Year-class	Zooplankton										
	Skrova		Eggum			Skarsvåg-Ingøy			Total		
	+	÷	+	÷	×	+	÷	×	+	÷	×
Rich	4	2	3	2	1	3	2	1	10	6	2
Medium	3	6	0	5	4	4	3	2	7	14	6
Poor	4	5	2	6	1	2	2	5	8	13	6

CORLETT (1965) found a high positive correlation between the summer biomass of zooplankton in the western Barents Sea and the relative strength of the corresponding year classes of cod. His data have been used in Table 4 together with the figures from Eggum and Skarsvåg for the same period. Only 6 of the 11 observations of zooplankton above or below average correspond with the figures of relative strength of the cod year classes. This may indicate that the size of the year classes is partly determined after the cod fry have left the coastal areas of northern Norway.

SYSOEVA (1973) studied the feeding and survival of the Barents Sea cod larvae. She concluded that the number of cod larvae in June—July did not depend on the number of eggs and larvae in April—May, but was determined by the survival from April—May to June—July. This sur-

Table 4. Year-classes of cod and zooplankton biomass in the western Barents Sea during summer (CORLETT 1965), and at Eggum-Skarsvåg in 1949—1959. Data and symbols as in Table 2.

Year	Year-class cod	Zooplankton mg/m³	Zooplankton Eggum-Skarsvåg
1949	M	47	÷
1950	R	54	+
1951	P	15	+
1952	P	22	÷
1953	P	26	÷
1954	M	46	÷
1955	P	24	+
1956	M	29	+
1957	M	34	÷
1958	M	45	+
1959	M	35	+

Table 5. Number of cases where abundance of zooplankton was above (+) or below (÷) average, and abundance of cod larvae above (+) og below (÷) average in April—June and June—July at Skrova, Eggum and Skarsvåg. ×) no observation. Data from Table 2.

Cod larvae April—June	Skrova		Eggum			Skarsvåg			Total		
	+	÷	+	÷	×	+	÷	×	+	÷	×
+	4	7	0	6	5	7	1	3	11	14	8
÷	7	6	5	7	1	2	6	5	14	19	6
June—July											
+	3	1	1	3	0	1	3	0	5	7	0
÷	3	5	2	5	1	3	3	2	8	13	3

vival was determined by the feeding conditions and by the condition of the larvae. The feeding conditions were influenced by the number of nauplii of *Calanus finmarchicus* in May, but this dependency was not expressed very clearly. In June—July she found a negative correlation between the biomass of plankton and survival and number of cod larvae, therefore she concluded that the plankton had been consumed by the cod larvae.

The relationship between cod larvae and plankton biomass at Skrova, Eggum and Skarsvåg—Ingøy in 1949—1972 is shown in Table 5. As observations on zooplankton are missing for a number of years no conclusions may be drawn with certainty. As mentioned by Sysoeva (1973) eggs and larvae of copepods (*Calanus finmarchicus*) which are important as food for cod larvae, may be abundant in April—May, even if the biomass of zooplankton is small. It may therefore be concluded that it is the *quality* and *particle size* rather than the quantity of zooplankton which is the critical factor for the survival of the cod larvae.

The relationship between the size of the year classes and the abundance of cod larvae is shown in Table 6. For the poor year classes a positive correlation seems to exist with a low abundance of cod larvae both in

Table 6. Number of cases with high (+) or low (—) abundance of cod larvae along the coast of northern Norway in April—June and June—July and the same year-classes 2 + years old. Data from Table 2.

Year-class	Abundance of cod larvae			
	April—June		June—July	
	+	—	+	—
Rich	3	3	2	1
Medium	6	2	1	2
Poor	2	8	1	5

April—June and June—July, for the rich and medium year classes combined, a positive correlation in April—June. The observations are, however, too few to be reliable. WIBORG (1957) found no correlation between abundance of cod eggs and larvae in the Lofoten area and the size of the corresponding year classes.

CONCLUSION

It may be concluded that plankton observations from single stations close to the Norwegian coast mainly reflect the local conditions. When plankton hauls are taken at long time intervals, occasional patchiness may obscure the variations. This is especially felt for the quantitative observations.

Continuous observations during a series of years may nevertheless yield valuable information on the general trends in the development and quantity of the plankton, especially when combined with information from other sources on physical, chemical and biological parameters.

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Table I. Plankton displacement volumes per m² of sea surface at the permanent oceanographical stations along the coast of Norway and at St. M in the Norwegian Sea during the years 1949—1972. Mean of the monthly averages and mean of the months April—August of the different years. x̄)mean, s) standard deviation, n) number of years. As the period April—August during some years is incomplete, the corresponding *n* may be larger than n̄ of the individual months, see text, p 468.

	J	F	M	A	M	J	J	A	S	O	N	D	April—August
Utsira 200-0 m (1976—1972)													
x̄	8.1	7.8	10.0	17.6	28.1	29.4	33.2	14.8	11.3	12.4	8.7	4.0	26.3
s	5.90	3.98	7.70	8.56	18.45	15.59	25.47	4.52	6.01	7.26	8.79	3.17	13.77
n	5	5	4	6	5	5	6	5	5	5	5	5	6
Utsira 50-0 m (1967—1972)													
x̄	3.2	2.9	8.3	12.9	18.5	20.3	15.0	5.8	7.6	5.4	3.4	1.5	17.0,
s	2.14	1.25	6.43	7.16	16.65	12.70	12.21	1.80	8.40	4.50	4.27	0.97	7.39
n	5	5	4	6	6	5	6	5	5	5	5	5	5
Sognesjøen 200-0 m (1949—1962)													
x̄	1.2	2.2	2.2	10.3	8.5	7.9	7.4	3.9	6.1	2.4	1.7	1.1	7.7
s	0.67	1.51	1.78	6.96	8.35	3.89	8.12	2.83	6.64	1.12	0.95	0.51	2.93
n	6	6	11	11	10	10	10	9	8	10	8	7	13
Sognesjøen 200-0 m (1963—1972)													
x̄	3.5	3.0	12.0	17.8	26.1	12.3	8.8	12.0	8.5	8.7	4.1	5.1	17.4
s	2.71	2.75	10.22	10.78	14.20	6.46	5.24	3.85	4.94	8.25	2.00	5.90	7.64
n	9	6	9	10	10	7	9	10	8	7	6	7	10
Sognesjøen 50-0 m 1949—1962)													
x̄	0.4	0.4	2.3	6.2	5.4	7.3	3.6	3.5	4.1	1.6	0.8	0.4	5.1
s	0.34	0.37	1.3	3.58	5.48	3.90	1.58	3.55	7.67	1.33	0.95	0.31	1.45
n	9	6	9	10	10	10	8	7	8	9	8	8	11

Sognesjøen 50-0 m (1963—1972)

$\bar{x}$	2.8	3.3	8.2	14.4	26.6	9.0	7.4	10.5	4.5	7.5	4.2	2.0	14.5
s	0.65	2.40	3.61	15.30	15.79	8.24	4.42	6.86	2.21	12.98	2.50	1.14	5.91
n	9	6	8	10	10	6	9	10	7	7	8	9	10

Ona 200-0 m (1949—1953)

$\bar{x}$	1.5	1.5	3.8	12.3	12.2	15.7	31.3	5.2	2.7	2.8	2.6	1.7	15.3
s	1.07	0.35	2.53	6.37	7.37	8.54	20.17	3.42	1.76	1.04	1.39	1.63	4.10
n	3	3	3	5	5	3	5	5	5	5	4	2	5

Ona 50-0 m (1949—1953)

$\bar{x}$	—	1.0	2.3	5.3	8.6	7.0	1.9	0.8	2.1	1.1	3.0	1.1	4.7
s		0	0	3.51	8.80	4.60	2.02	0.29	1.93	0.64	0	0	3.36
n		1	1	4	4	3	3	3	3	2	1	1	4

Skrova 300-0 m (1949—1962)

$\bar{x}$	12.0	9.7	7.9	12.3	24.5	25.7	22.1	23.7	16.0	16.2	13.6	13.9	21.8
s	4.23	3.82	3.25	4.35	8.87	8.35	9.52	19.75	7.71	7.48	4.53	4.54	7.65
n	12	11	11	11	13	13	14	14	14	12	11	13	14

Skrova 300-0 m (1963—1972)

$\bar{x}$	22.9	15.8	17.4	17.2	30.8	43.1	50.4	33.0	32.4	36.4	28.6	23.3	34.9
s	6.71	6.04	9.75	4.78	11.00	17.38	22.83	15.61	17.26	15.21	18.01	13.07	18.35
n	10	10	10	10	10	10	10	10	10	10	9	6	10

Eggum 200-0 m (1949—1962)

$\bar{x}$	1.7	1.4	1.52	8.9	52.5	41.7	47.9	15.3	9.8	8.9	4.9	3.8	32.0
s	1.17	1.17	1.06	6.74	40.37	28.12	40.62	9.04	6.66	4.07	3.86	2.33	19.24
n	8	6	6	9	7	10	8	9	8	7	6	6	9

Eggum 200-0 m (1963—1972)

$\bar{x}$	5.3	6.6	6.9	22.0	61.8	58.8	67.0	44.9	32.1	7.0	6.8	7.4	54.1
s	4.10	5.09	7.66	12.49	56.44	25.02	22.17	25.67	25.37	9.97	4.41	5.98	16.74
n	5	2	4	3	9	8	8	7	7	6	7	5	8

	J	F	M	A	M	J	J	A	S	O	N	D	April – August
						Eggum 50-0 m (1949–1962)							
$\bar{x}$	0.6	0.6	0.9	3.1	33.5	14.0	6.8	4.9	2.3	3.1	1.6	0.8	11.9
s	0.6	0.76	0.94	2.63	41.30	11.43	8.68	4.76	1.55	2.40	1.91	0.76	9.38
n	7	6	5	7	7	10	9	7	9	7	5	6	9
						Eggum 50-0 m (1963–1970)							
$\bar{x}$	2.3	3.0	5.6	12.5	42.6	42.7	35.8	13.9	16.0	11.9	2.3	3.2	30.8
s	1.27	0	2.40	6.45	39.79	26.32	18.29	7.39	21.50	16.10	1.94	2.14	13.61
n	3	2	3	4	8	7	8	8	8	8	7	4	8
						Skarsvåg 260-0 m (1955–1962)							
$\bar{x}$	2.9	2.1	2.7	3.1	11.5	26.6	31.3	19.0	18.1	7.5	6.7	8.0	19.5
s	0	1.00	1.37	1.46	6.99	20.61	28.79	13.95	9.65	1.98	4.18	4.19	13.14
n	2	3	4	6	7	7	8	8	8	6	8	4	8
						Skarsvåg 260-0 m (1963–1966)							
$\bar{x}$	8.6	4.0	5.4	4.5	22.5	39.5	45.5	22.5	24.0	28.0	7.5	1.8	30.7
s	5.89	2.11	4.82	2.12	19.08	15.86	42.00	19.36	13.08	15.10	2.12	0	16.10
n	3	3	4	2	4	4	4	4	3	3	2	1	5
						Skarsvåg 50-0 m (1955–1962)							
$\bar{x}$	0.5	10.0	10.0	2.4	5.7	11.1	14.9	6.2	3.9	2.7	2.0	2.2	9.6
s	0	0	0	0.78	3.79	7.11	12.83	3.76	2.45	2.15	1.41	1.42	6.0
n	2	1	1	2	5	6	8	8	5	5	2	4	8
						Skarsvåg 50-0 m (1963–1966)							
$\bar{x}$	4.0	3.0	3.0	7.5	9.0	14.7	16.5	9.8	11.7	5.6	3.0	3.0	12.1
s	1.73	0	0	6.36	4.24	5.29	7.14	2.87	10.92	2.42	0	0	2.66
n	3	4	4	2	4	4	4	4	4	3	1	1	4

Ingøy 50-0 m (1969—1972)

$\bar{x}$	1.9	1.8	1.6	2.4	18.7	26.7	56.3	13.6	5.4	2.4	2.0	2.4	23.1
s	1.85	1.11	1.13	1.60	10.13	10.50	37.88	7.27	3.29	2.26	2.26	1.13	9.67
n	3	3	2	3	3	4	3	4	4	2	2	2	4

Ingøy 300-0 m (1969—1972)

$\bar{x}$	10.4	4.0	4.8	5.3	30.9	50.7	80.2	26.2	22.2	7.6	12.5	8.0	39.2
s	4.45	3.70	5.66	3.33	12.76	17.39	75.18	10.58	21.00	9.62	8.17	3.39	16.80
n	3	4	2	3	3	3	3	4	4	2	3	2	4

St. M 100-0 m (1950—1965)

$\bar{x}$	0.6	0.7	4.0	8.2	12.6	19.0	16.6	10.2	4.3	3.7	2.1	1.2	13.3
s	0.46	0.40	2.10	5.33	4.71	13.46	6.91	6.25	2.44	2.22	1.35	1.15	6.31
n	13	14	13	14	15	15	12	10	11	9	9	9	16

St. M 100-0 m (1966—1972)

$\bar{x}$	2.5	2.0	7.5	15.8	28.0	30.2	29.1	23.8	12.2	5.0	3.6	18.0	27.1
s	3.06	0.98	8.18	8.49	20.44	19.53	19.78	15.65	11.10	3.50	3.94	0.93	5.99
n	7	7	9	9	9	9	5	5	5	5	5	5	7

St. M 600-0 m (1950—1965)

$\bar{x}$	11.9	13.9	24.8	28.1	30.9	35.9	37.0	30.3	21.8	21.2	14.6	14.9	31.5
s	4.60	5.65	11.75	13.23	17.83	20.62	25.76	13.07	7.20	9.45	4.15	10.81	13.79
n	11	11	12	14	15	16	12	10	11	8	8	8	16

St. M 600-0 m (1966—1972)

$\bar{x}$	20.0	26.1	43.6	69.2	58.4	57.7	52.4	52.9	40.3	38.1	22.2	15.3	61.8
s	7.87	7.47	16.57	24.76	24.51	23.15	30.94	15.67	13.37	15.42	6.81	9.41	6.77
n	7	7	7	7	7	7	7	5	5	5	5	5	7