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QUANTITATIVE DISTRIBUTION OF ZOOPLANKTON IN THE COAST AND BANK AREAS OF WESTERN AND NORTHWESTERN NORWAY DURING MARCH—JUNE 1959—1966

By
K. F. WIBORG
Institute of Marine Research, Bergen

ABSTRACT

WIBORG, K. F. 1976. Quantitative distribution of zooplankton in the coast and bank areas of western and northwestern Norway during March—June 1959—1966. *FiskDir. Skr. Ser. HavUnders.*, *16*: 259—277.

During March—June 1959—1966 the coastal banks off western and northwestern Norway were surveyed for fish eggs and larvae. Zooplankton was sampled with Juday nets, Nansen nets and Clarke-Bumpus plankton samplers. The sample volumes were measured by displacement. From the end of March to the middle of April volumes were below 10 ml/m^2 of sea surface except for local patches of prespawning *Calanus finmarchicus* where there were up to 90—110 ml/m^2 with maximum concentrations of 3 ml/m^3. After the middle of April volumes increased to average 25—50 ml/m^2 with maxima of 100—200 ml/m^2 and concentrations of up to 4—7 ml/m^3.

Similar conditions persisted throughout May. On the northern banks the increase in sample volumes was most marked in June. *C.finmarchicus* was generally the dominant species. On the southern banks stage V copepodites and females of the wintering generation were in majority at the end of March — beginning of April, while stages III—IV of the spring generation were predominant in the middle of April, progressing to stages IV—V at the end of the month. On the northern banks the development was slower, stages II—III still dominating at the end of April. The total standing stock of zooplankton in the coast and bank areas between Stad and Andenes in April—June is estimated to be of a size order of 7×10^6 t weight and for the entire coastal area of Norway 13×10^6 t. The total annual production of zooplankton along the coast of Norway based on the figures of TIMOKHINA (1964) is estimated to be 26×10^6 t and when based on a primary production estimate of 100 g C/m^2/year (RYTHER 1969), $25—50 \times 10^6$ t.

INTRODUCTION

During the years 1959—1966 the coast and bank areas of western and northwestern Norway were surveyed during the spring months for fish eggs and larvae. Reports have been published (DRAGESUND 1965, DRAGESUND and HOGNESTAD 1966 and 1967, DRAGESUND and WIBORG

1963, WIBORG 1960 b, 1961, 1962 a). In addition to the eggs and larvae of fish, zooplankton samples were also analyzed, and these results are presented in this paper.

MATERIAL AND METHODS

Samples were taken in oblique hauls with a Clarke-Bumpus plankton sampler (CB) in the upper 50 m and in vertical hauls from bottom to surface or 200 (100)—0 m with various nets, Nansen 70 cm (N 70), Juday 80 cm (J 80), Juday 36 cm (J 36) and a one meter egg net (0/100). The mesh sizes used were: in J 36 — 180 µ, N 70 — 180 µ and 500 µ J 80, 0/100 and CB — all 500 µ.

The samples were preserved in 4% formaldehyde. After removal of fish eggs and larvae the zooplankton volumes were measured by displacement (ROBERTSON 1970) and volumes calculated per m^2 of sea surface of per m^3 of sea water.

Biomass determination by volume incorporates measurements of the highly variable water and ash contents of the plankton organisms and therefore does not give an accurate picture of their nutritional state or potential values as food (STEEDMAN 1974). The plankton samples were also taken with different types of gear and in various kinds of hauls and therefore are not strictly comparable. However, as the zooplankton was fairly uniform, being mainly composed of copepods and other crustaceans, the figures will indicate the relative biomass of plankton on the Norwegian coastal banks during the spring and early summer.

The main data are presented in Fig. 1—7 and Table I.

RESULTS

1959

(0/100, 100—0 m. Fig. 1 A.)

During the first half of April the plankton was generally scarce, less than 20 ml/m^2, except near the slope off Røst—Vesterålen with figures of about 50 ml/m^2. Further south, at Stad—Ona, volumes exceeded 20 ml/m^2 at a few stations, and *Calanus finmarchicus* adults and stage V copepodites predominated.

During the second half of April volumes increased to 40—45 ml/m^2 of Stad and Ona and near the slope farther north up to 60 ml/m^2, but were much lower elsewhere.

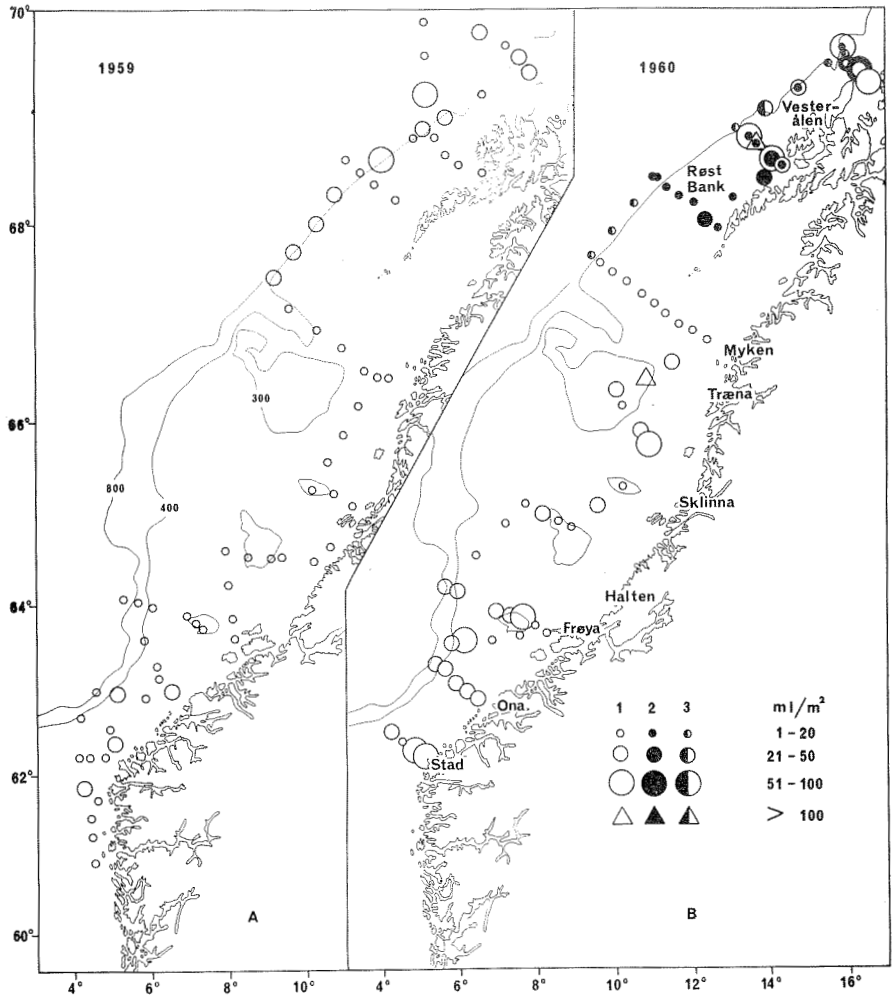

Fig 1. Zooplankton volumes, ml/m² of sea surface.
A) 1959, 0/100, 100—0 m. 18—29 April. B) 1960, CB, 50—0 m. 1) 25 May—2 June. 2) 7—10 June. 3) Equal volumes in both periods.

1960

(CB upper 50 m. Fig. 1 B.)

At the end of March less than 10 ml/m² were taken in the upper 50 m. At the end of May — beginning of June maxima of 180 and 120 ml/m² were recorded at Stad—Ona and Vesterålen banks respectively. Maximum concentrations in the upper 25 m were 5 ml/m³ off Vesterålen, 6.6 ml/m³ off Træna and 2.9 ml/m³ off Ona.

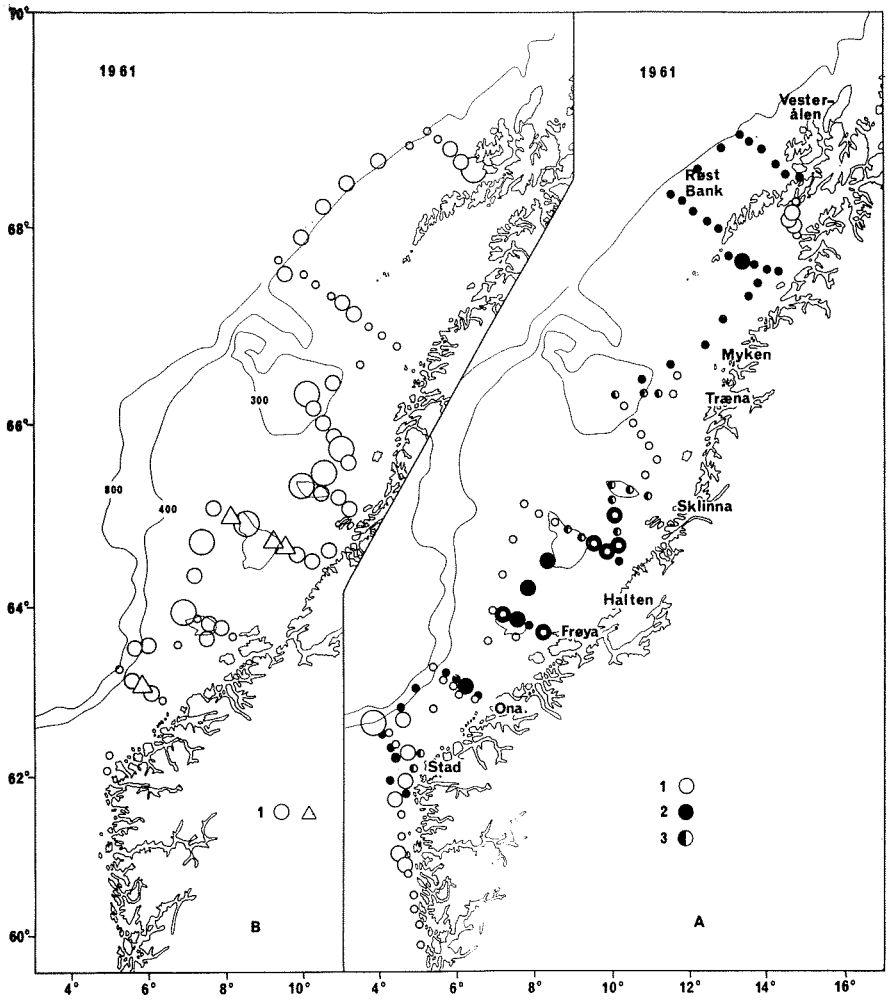

Fig. 2. Zooplankton volumes, ml/m² of sea surface.
A) 1961, J 36, bottom to 0 m. 1) 6—19 April. 2) 20—29 April. 3) Equal volumes in both periods. B) 1961, CB, 50—0m, 25 May—3 June. Symbol size as in Fig. 1.

1961

(J 36 and N 70, bottom to 0 m, and CB in the upper 50 m. Fig. 2.)

During April, plankton was generally scarce. At the end of May-beginning of June *C.finmarchicus* predominated, with maxima of 100—150 ml/m² between Stad and Halten. Farther north, figures were mostly below 50 ml/m² with the exception of a few rich hauls with 60—100 ml/m² off Sklinna and Træna. Maximum concentrations were 3.7 ml/m³ in the Ona—Frøya area, 5.2 ml/m³ on the Sklinna and Halten banks and 2.0 ml/m³ on the Røst bank.

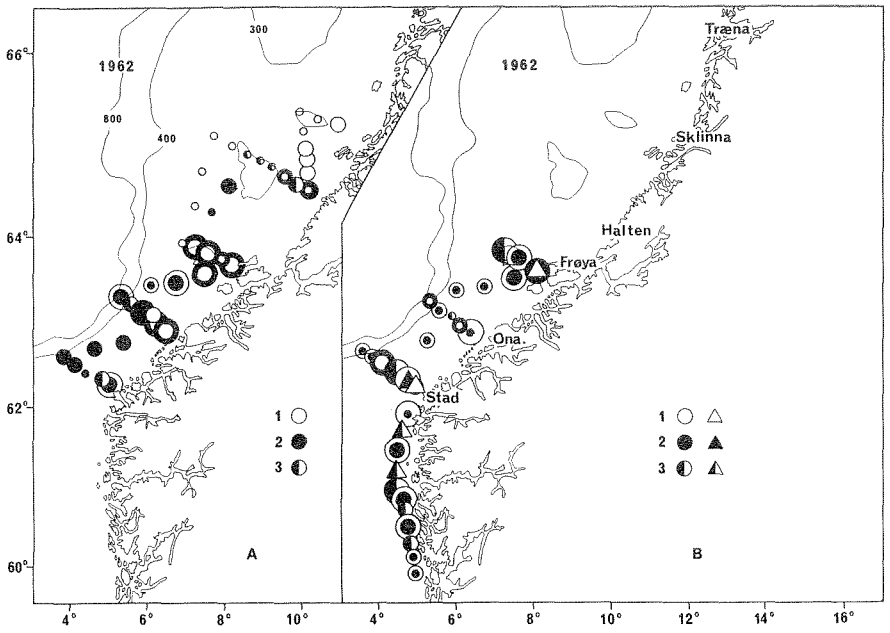

Fig. 3. Zooplankton volumes, ml/m² of sea surface.
A) 1962, J 36, bottom to 0 m. 1) 2—7 April. 2) 9—12 April. 3) Equal volumes in both periods. B) 1962, 24—27 April. 1) CB, 50—0 m. 2) J 36, bottom to 0 m. 3) Equal volumes in both gears. Symbol size as in Fig. 1.

1962

(J 36, bottom to 0 m, and CB in the upper 50 m. Fig. 3.)

At the beginning of April evidently most of the plankton was concentrated below 50 m as the J 36 nets yieled up to 60—90 ml/m², CB hauls less than 20 ml/m², but the J 36 net may also have caught more plankton because of the smaller mesh. At the end of April both types of gear caught approximately equal volumes/m² sea surface, and the plankton was also more abundant; 50—160 ml/m² between the Sognefjord and Stad, 60—120 ml/m²off Frøya. Maximum concentrations in two areas were 7.0 and 4.0 ml/m³ respectively.

1963

(N 70, J 80 and J 36, 100—0 m, CB in the upper 50 m. Fig. 4 A.)

At the beginning of April a patch of prespawning *C.finmarchicus* off Stad yielded 109 ml/m² and 3.4. ml/m³. In other areas the plankton was scarce, with maxima of 20—25 ml/m². During the second half of April plankton was scarce except off Frøya where 50— 80ml/m² and 2.5 ml/m³ were recorded in the upper 25 m.

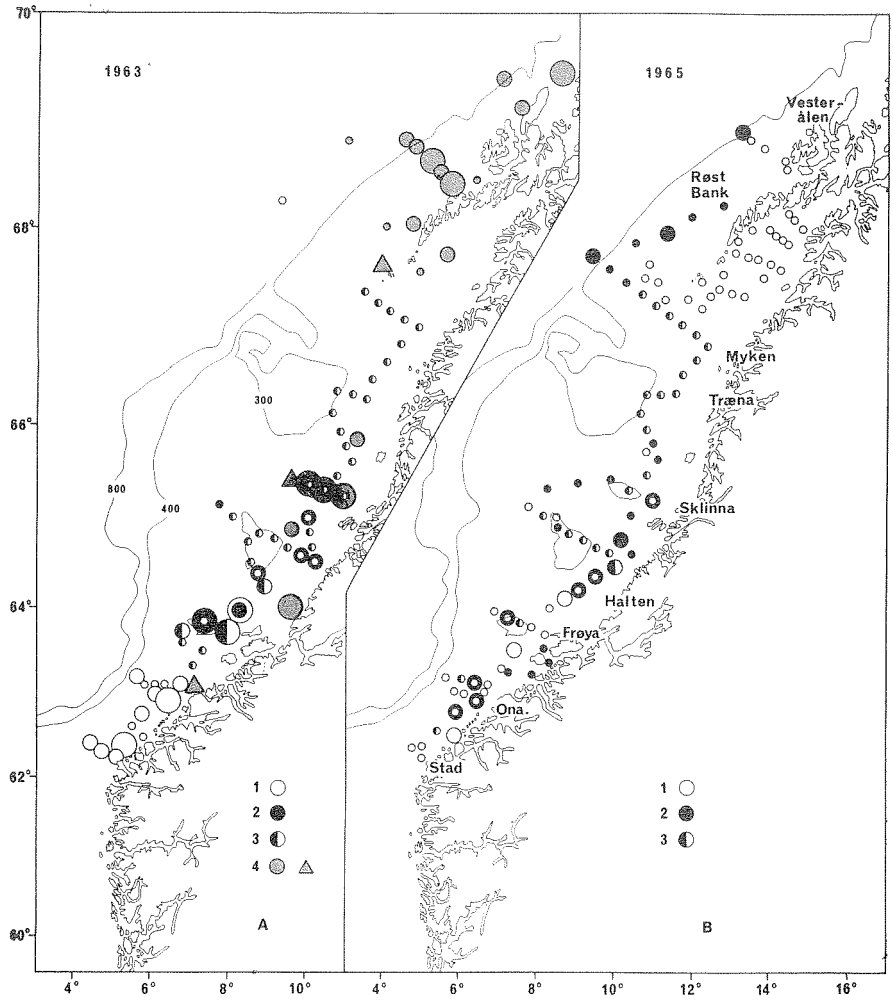

Fig. 4. Zooplankton volumes, ml/m² of sea surface.
A) 1963, 16—22 April. 1) CB, 50—0 m. 2) N 70, bottom—0 m. 3) Equal volumes in both gears. 4) J 36, 30 April—13 May. B) 1965. 1) J 80, bottom—0 m, 29 March—5 April. 2) J 36, bottom—0 m, 6—12 April. 3) Equal volumes in both periods. Symbol size as in Fig. 1.

Diurnal variations in the volumes of plankton in the upper 50 m were studied on the Frøya bank on 20—21 April, CB hauls being taken around drifting subsurface dragues (DRAGESUND and WIBORG 1963). The extremes were 27 ml/m² at 1400 hr and 82 ml/m² at 0800 hr (Tabel 1). The variations were probably caused both by vertical migration of the plankton and by shifting of water masses with varying contents of plankton. Similar

variations were observed in the numbers of herring larvae (DRAGESUND and WIBORG 1963).

During the first half of May maximum figures in vertical hauls were 200, 76 and 160 ml/m² off Ona, Frøya and Sklinna respectively.

Table 1. Volumes of plankton per m² of sea surface in the upper 50 m at a drift station on the Frøya bank 20—21 April 1963. CB hauls.

Hr	0800	1000	1200	1400	1600	1800	2000	2200	2400	0200	0400	0600	0800
ml/m²	82	68	66	27	33	65	38	44	31	31	48	30	53

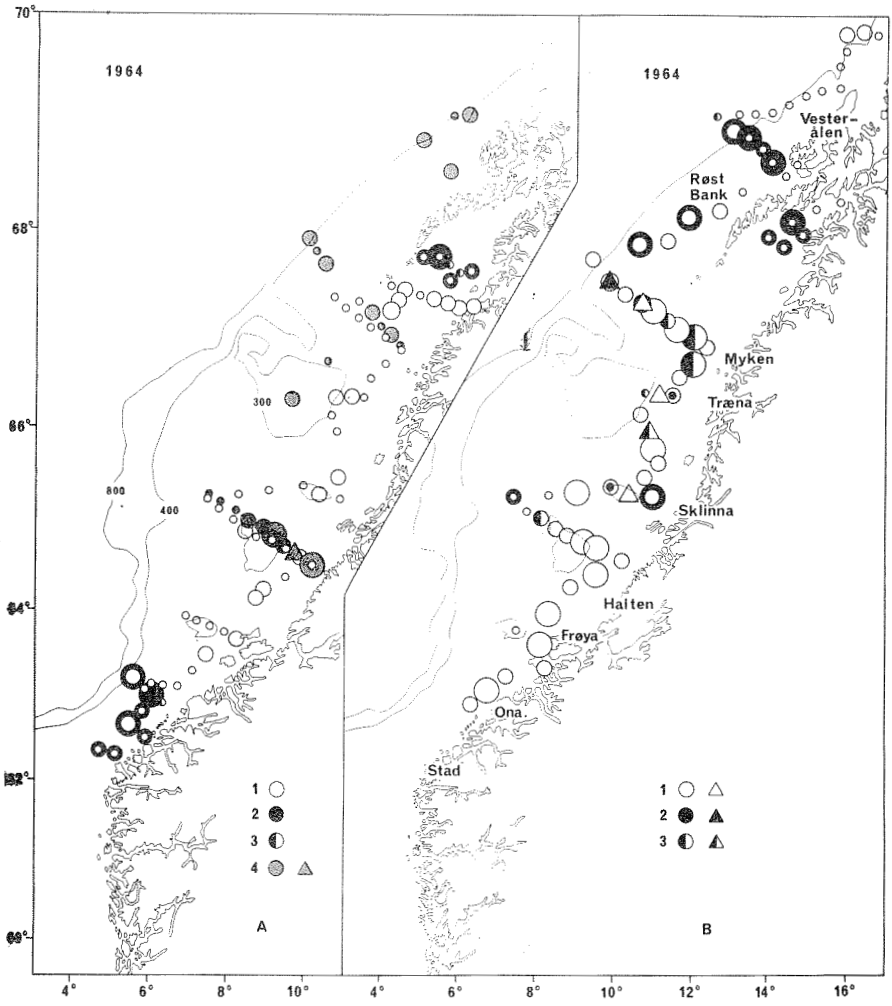

Fig. 5. Zooplankton volumes ml/m² of sea surface.
A) 1964. 1) CB, 50—0 m, 14—23 April. 2) J 36, bottom—0 m, 14—23 April. 3) Equal volumes in both gears. 4) CB, 50—0 m, 20—23 April. B) 1964, 23 April—5 May. 1) CB, 50—0 m. 2) J 80, bottom—0 m. 3) Equal volumes in both gears. Symbol size as in Fig. 1.

1964

(J 36 and J 80, bottom to 0 m, CB in the upper 50 m. Fig. 5.)

During the second half of April plankton was mostly scarce, as a rule less than 35 ml/m². *C.finmarchicus* stage IV copepodites predominated. A diurnal drift station on the Sklinna bank on 18 and 19 April (Table 2) yielded 19—32 ml/m² during the first 12 hours (1400 hr — 2400 hr) and 5—18 ml/m² from 0400 hr to 1400 hr. It is probable that different water masses were fished.

Table 2. Volumes of zooplankton per m² of sea surface in the upper 50 m at a drift station on the Sklinna bank 18—19 April 1964. CB hauls.

Hr	1400	1600	1800	2000	2200	2400	0200	0400	0600	0800	0900	1000	1200	1400
ml/m²	21	22	30	21	32	25	19	13	9	9	14	18	5	5

The Halten bank was visited twice at 6 days intervals, on 17 April and 23 April respectively. On the first date plankton was scarce, 5—25 ml/m², but the next time figures increased to 45—115 ml/m², and maximum concentrations went up to 4.0 ml/m³.

From 23 April to 2 May plankton was much more abundant than 10 days earlier, in some places more than 100 ml/m², and off Frøya 60—90 ml/m² and 1.5—3.0 ml/m³. The development of *C.finmarchicus* had progressed to equal proportions of copepodite stages IV and V.

At a drift station on the Røst bank 28—29 April plankton volumes varied between 11 and 68 ml/m², with a maximum at midnight (Table 3).

Table 3. Volumes of zooplankton per m² of sea surface in the upper 50 m at a drift station on the Røst bank 28—29 April 1964. CB hauls.

Hr	1000	1200	1300	1500	1700	1900	2100	2300	0100	0300	0500	0700	0900
ml/m²	12	11	23	21	33	51	63	68	33	24	19	24	22

At a drift station on the Træna bank on 30 April—1 May the volume variations were small and irregular, 33—65 ml/m² (Table 4).

Table 4. Volumes of zooplankton per m² of sea surface in the upper 50 m at a drift station on the Træna bank 30 April—1 May 1964. CB hauls.

Hr	2200	2400	0100	0300	0600	0800	1000	1300
ml/m²	65	44	33	39	35	63	41	43

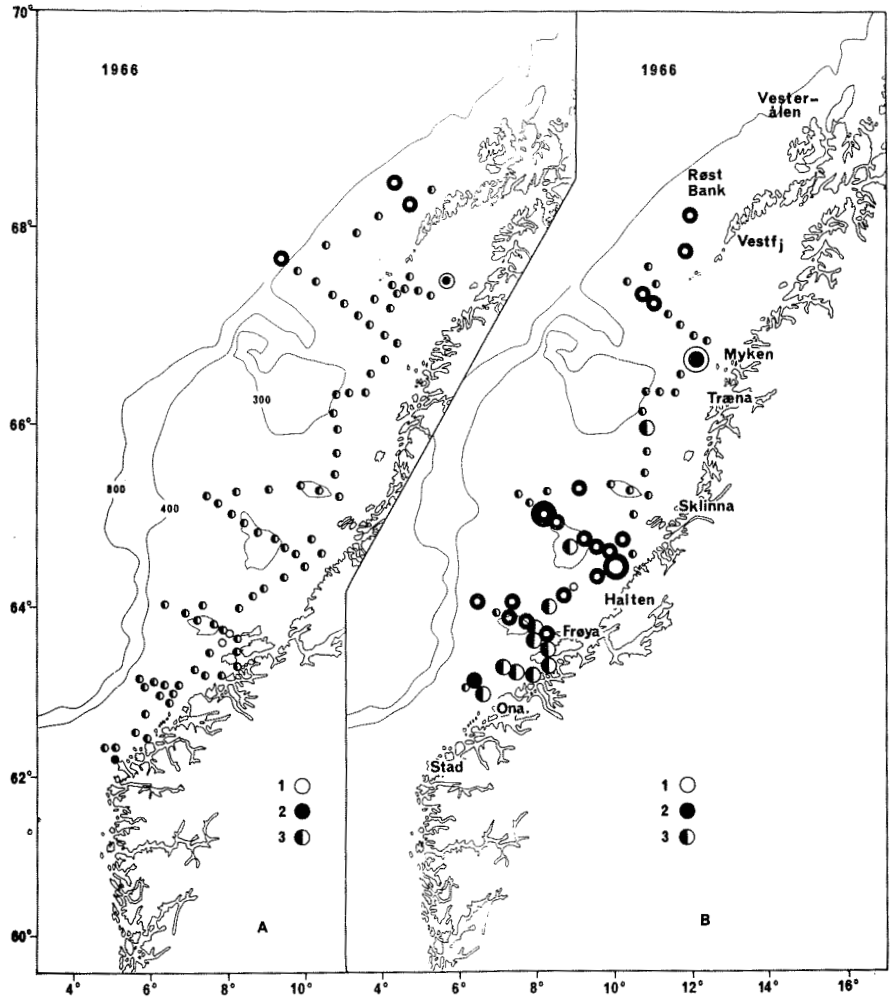

Fig. 6. Zooplankton volumes, ml/m³ of sea surface.
A) 1966, 15—23 April. 1) CB, 50—0 m. 2) J 36, bottom—0 m. 3) Equal volumes in both gears. B) 1966, 23 April— 5 May. 1) CB, 50—0 m. 2) J 80, bottom— 0 m. 3) Equal volumes in both gears. Symbol size as in Fig. 1.

1965

(J 36, J 80, bottom to 0 m. Fig. 4 B.)

During the period 28 March—12 April the coast and bank areas were surveyed twice. Plankton was scarce, less than 10 ml/m² in the CB hauls, and maximum 40 ml/m² in the vertical hauls. Stage IV—V copepodites and females of *C.finmarchicus* predominated, indicating an early spring situation.

1966

(J 36, J 80, bottom to 0 m, CB in the upper 50 m. Fig. 6.)

Plankton hauls were taken from 15 April to May. At the beginning of the period plankton volumes were mostly below 10 ml/m² with maxima of 20 ml/m² in the vertical hauls. *C.finmarchicus* stage II—III copepodites predominated. At the end of the period volumes had increased in the Ona—Halten area to 46—60 ml/m² in vertical hauls in which copepodites of stage IV predominated. Farther north plankton was scarce and *C.finmarchicus* was still in stages II—III.

DISCUSSION

In the coastal area off western and nortwestern Norway the maximum in zooplankton biomass is usually reached during May though sometimes in the northernmost area not until June (WIBORG 1954). In the eastern Norwegian Sea maximum usually occurs in June, later than on the coastal banks (PAVSHTIKS 1956, WIBORG 1954, 1955). However, conditions may vary from one year to another. In the area of the Norwegian current the dominant species, *C.finmarchicus,* started spawning in March in 1954, one month earlier than in 1951 (PAVSHTIKS 1956). The conditions in the open sea however, do not always correspond with those on the banks.

In the present investigation the material was collected mainly during April, and the biomass may not have reached the maximum. Some conclusions may nevertheless be drawn on the development of zooplankton during April—June. Average figures for the different areas are shown in Fig. 7 and Table I.

FIRST HALF OF APRIL

Plankton is generally scarce on the coastal banks, on an average 10 ml/m² or less, maximum 25—45 ml/m². Prespawning concentrations of *C.finmarchicus* may occasionally yield up to 90—110 ml/m² and 3.4 ml/m³ in the Stad—Frøya area.

SECOND HALF OF APRIL—BEGINNING OF MAY

Plankton is more abundant but figures vary considerably, averaging mostly 25—50 ml/m², maximum volumes in all areas 100—200 ml/m² and maximum concentrations 4—7 ml/m³. The large variations in abundance

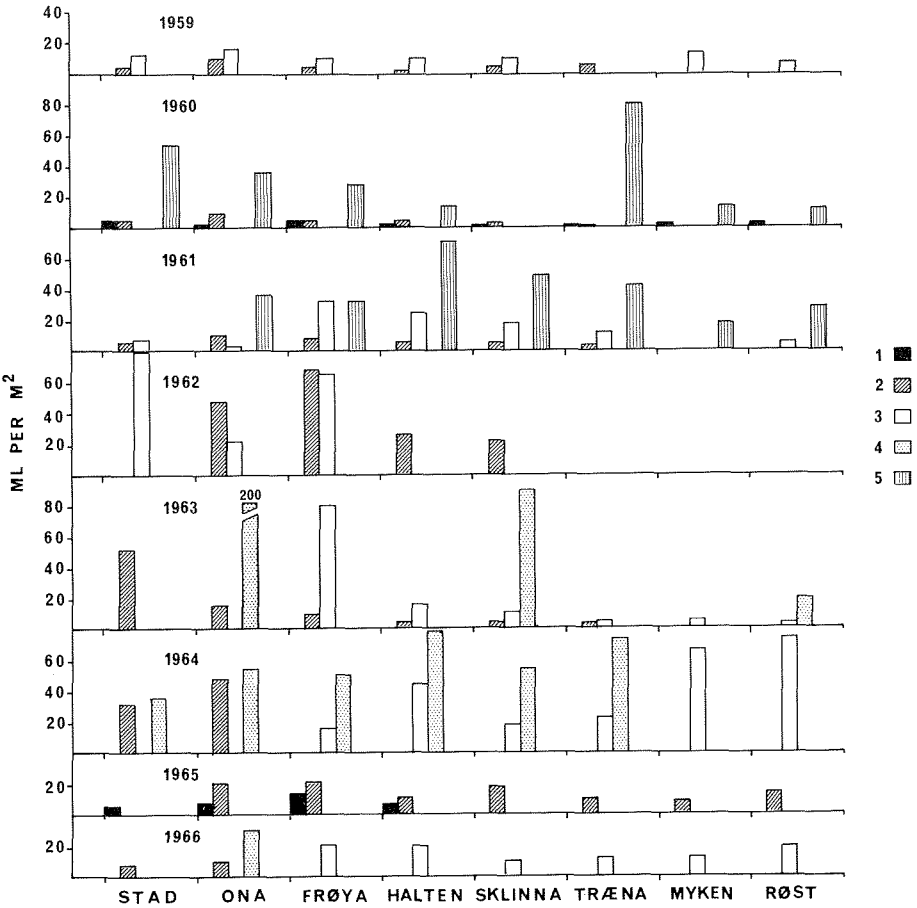

Fig. 7. Zooplankton volumes, ml/m² of sea surface. Average figures.
1) end of March, 2) first half of April, 3) second half of April, 4) first half of May, 5) second half of May — beginning of June.

may partly be caused by the varied vertical distribution of the plankton. According to TIMOKHINA (1964) zooplankton on the coastal banks in May is more evenly distributed in the upper 100 m and in June mainly in the upper 50 m.

MIDDLE OF MAY

Observations from one year only; with volumes of 75—200 ml/m² in the Ona—Sklinna area.

END OF MAY – BEGINNING OF JUNE

Average volumes are slightly higher than in April, 30—60 ml/m², and maximum volumes and concentrations are of about the same magnitude as in late April.

Observations from earlier years may be used for comparison. During May—June 1949—1951 the quantitative distribution of zooplankton was studied off northern Norway in the Lofoten—Vesterålen area (WIBORG 1954). At the beginning of May 1951 volumes of 50—100 ml/m² were recorded over relatively wide areas. At the beginning of June the figures increased even more, some areas with more than 100 ml/m², maximum 190 ml/m² and concentrations of 6.0 ml/m³.

In the middle of June 1974 the average volume on the Røst bank was 44 ml/m², in the Vestfjord 36 ml/m², maximum 106 ml/m²; in the middle of June 1975 the corresponding figures were 39, 39 and 255 ml/m² respectively; in the Ona—Stad area the average volume in the middle of June 1975 was 42—51 ml/m², maximum 110 ml/m² (WIBORG, unpublished).

(The samples taken in June 1974 and 1975 were measured fresh, and in order to compare the volumes with those of preserved samples, the figures have been reduced to 85% as indicated for copepod plankton by AHLSTROM and THRAILKILL (1963).)

In a section along 67°30' N. TIMOKHINA (1965) estimated the average quantity of zooplankton in Norwegian coastal waters (Røst Bank) in May to be 61.3 g/m² (= ml/m²). Large quantities have been recorded in June, sometimes more than 100 g/m² (TIMOKHINA 1972) and even 220 g/m² (4476 mg/m³ in the upper 50 m, (NESTEROVA 1974), mainly consisting of *C.finmarchicus* stage IV—V.

The areas of maximum abundance seem to vary from one year to another and also from season to season. The patchy occurrence of the plankton is indicated by great differences in volumes at stations situated close to each other, or in hauls taken at short intervals at the drift stations. Rich plankton patches are very often found on or close to the edge of the continental shelf, and on and around the banks.

Some calculations have been made of the total biomass of zooplankton on the coastal banks between Stad and Vesterålen (see Fig. 6), a distance of about 900 km. Assuming an average continental shelf width of 150 km, the area will be approximately 135 000 km². With an average volume of plankton at the beginning of June of 50 g/m² or 50 t/km², the total biomass will be about 6.8×10^6 t. If similar conditions prevailed along the remainder of the Norwegian coast, about 1 200 km in length, in a zone averaging 100 km in width, or 120 000 km², the biomass of zooplankton in this area would be $120\,000 \times 50 = 6 \times 10^6$ t.

TIMOKHINA (1964) found that in May—June 1959 *C.finmarchicus* constituted 80—90% of the total plankton biomass in Norwegian coastal waters. She calculated the annual production of *C.finmarchicus* in this area to be about 103 t/km^3. Applying this figure to the Stad—Vesterålen area we obtain: $103 \times 135\,000 = 13.9 \times 10^6$ t, and for the remaining coastal areas: $103 \times 120\,000 = 12.4 \times 10^6$ t, in total: 26.3×10^6 t/year.

The average primary production in coastal areas is assumed to be in the order of 100 t C/km^2/year (RYTHER 1969). If this figure is applied to the Norwegian coastal areas the annual primary production should be $(135\,000 + 120\,000) \times 100 = 25.5 \times 10^6$ t C. Assuming further an ecological efficiency factor of 10—20% and 10% of C in the wet weight of zooplankton (RYTHER 1969), the annual secondary production of zooplankton along the coast of Norway would be of an order of $26—52 \times 10^6$ t. This is quite close to be above figure of 26.3×10^6 t/year based on calculations by TIMOKHINA (1964)

If calculations are continued to the next link in the food chain, the annual production in the Norwegian coastal areas of fish, mammals and other organisms feeding on zooplankton will be of an order of 2.5—10 x 10^6t.

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Table I. Quantitative distribution of zooplankton off western and northwestern Norway in March—June 1959—1966. For gear symbols — see text.

Area	Year	Date	Gear	No. of st.	ml/m² sea surf.			ml/m³	C.finm. dom. stage
					aver-age	min.	max.	max.	
Stad	1959	5. IV	N 70	7	4.0	1.3	7.5		
		27. IV	0/100	5	13.8	5.0	37.5		
Ona		7–8. IV	0/100	14	9.7	1.8	41.5		
		26. IV	0/100	7	17.7	3.8	42.5		
Frøya		8–9. IV	0/100	7	3.8	0.6	12.5		
		25. IV	0/100	8	10.1	1.2	15.6		
Halten		10–11. IV	0/100	8	2.8	0.6	8.8		
		24–25. IV	0/100	5	9.2	6.3	10.6		
Sklinna		13. IV	0/100	5	3.9	0.6	6.3		
		24. IV	0/100	3	9.6	5.0	12.5		
Træna		13–14. IV	0/100	11	5.6	0.6	29.5		
Myken		22–23. IV	0/100	7	15.0	6.3	50.0		
Røst		19–20. IV	0/100	7	6.3	2.5	14.4		
Stad	1960	22. III	N 70	6	4.3	1.5	5.0		
		7. IV	N 70	3	4.3	4.0	5.0		
		24. V	CB	4	52.9	9.8	83.5	2.1	
Ona		23. III	N 70	7	2.8	1.5	4.0		
		5. IV	N 70	5	10.0	5.0	18.0		
		27. V	CB	7	36.1	21.5	85.5	2.9	
Frøya		23. III	N 70	8	5.4	1.5	10.0		
		4. IV	N 70	5	4.7	1.5	8.0		
		27–28. V	CB	7	27.1	15.5	51.8	1.7	
Halten		24–25. III	N 70	9	2.7	1.5	8.0		
		4. IV	N 70	8	4.6	3.0	10.0		
		28–29. V	CB	5	14.3	6.8	25.3	0.7	
Sklinna		25. III	N 70	4	1.9	1.5	3.0		
		3. IV	N 70	4	2.8	1.5	3.0		
Træna		26. III	N 70	8	2.1	1.5	4.0		
		2. IV	N 70	7	2.3	1.5	5.0		
		29–30. V	CB	4	79.4	42.0	177.3	6.6	
Myken		28. III	N 70	8	1.5	1.5	1.5		
		30. V	CB	10	14.0	6.8	19.8	0.6	
Røst	1960	29–30. III	N 70	11	2.7	1.5	8.0		
		8–9. VI	CB	15	12.5	1.0	39.3	1.4	
Stad	1961	10. IV	J 36	6	4.3	1.5	5.0		
			CB	6	3.0	0.5	4.3		
		29. IV	N 70	6	6.2	3.8	20.0		
Ona		11. IV	J 36	5	9.6	4.0	12.0		
			CB	8	5.3	1.6	10.5		
		28. IV	J 36	4	2.3	11.4	15.4		
		29. V	CB	7	37.1	11.3	100.8	3.7	

Table I. (cont.)

Area	Year	Date	Gear	No. of st.	ml/m² sea surf.			ml/m³	C.finm. dom. stage
					aver-age	min.	max.	max.	
Frøya		12. IV	J 36	5	7.2	4.0	8.0		
			CB	7	4.0	2.9	5.7		
		27. IV	J 36	5	32.0	16.0	40.0		
			CB	4	10.1	3.9	25.4		
		29–30. V	CB	5	33.4	18.5	65.5	2.6	
Halten		12. IV	J 36	7	5.1	4.0	8.0		
			CB	9	2.2	0.8	4.6		
		26. IV	J 36	8	24.8	12.0	48.0		
			CB	8	2.8	0.8	4.4		
		30–31. V	CB	7	71.7	20.3	146.8	5.2	
Sklinna		13. IV	J 36	5	3.5	0.5	8.0		
			CB	5	2.4	0.9	4.0		
		25. IV	J 36	5	18.0	10.5	28.0		
			CB	5	5.9	2.6	10.3		
		31. V	CB	4	49.8	31.5	76.3	2.5	
Træna		14. IV	J 36	8	4.3	0.5	20.0		
			CB	5	3.4	2.5	4.7		
		24. IV	J 36	5	12.8	4.0	16.0		
			CB	3	2.2	0.7	3.8		
		30. V	CB	6	42.9	16.3	95.5	2.7	
Myken		1. VI	CB	10	18.2	10.8	22.5	0.7	
Røst		20–21. IV	CB	13	3.0	0.6	4.2		
		2–3. VI	CB	11	28.1	5.3	60.8	2.0	
Stad	1962	25. IV	J 36	5	70.5	16.0	112.0		
			CB	5	80.3	20.3	179.5	7.1	
Ona	1962	4. IV	J 36	6	43.3	16.0	88.0		
			CB	6	24.9	14.5	42.0	1.4	
		11–12. IV	J 36	6	47.3	20.0	92.0		
			CB	6	8.9	4.3	15.8	0.6	
		26. IV	CB	6	22.3	5.8	59.3	2.3	
Frøya		5. IV	J 36	5	28.0	20.0	40.0		
			CB	5	10.8	1.5	22.0	0.4	
		10. IV	J 36	5	68.0	48.0	02.0		
			CB	5	14.6	7.3	23.0	0.7	
		26–27. IV	J 36	5	65.6	24.0	96.0		
			CB	5	74.0	56.3	117.5	4.0	
Halten		5–6. IV	J 36	8	10.5	4.0	24.0		
		10. IV	J 36	7	26.8	4.0	44.0		
			CB	7	2.4	1.5	4.0		
Sklinna		5–6. IV	J 36	4	22.0	16.0	32.0		
Stad	1963	2–3. IV	N 70	5	5.0	1.3	12.5		
		8. IV	CB	3	52.5	18.8	109.3	3.4	

Table I. (cont.)

Area	Year	Date	Gear	No. of st.	ml/m² sea surf.			ml/m³	C.finm. dom. stage
					aver-age	min.	max.	max.	
Ona		8. IV	J 80	1	16.0	—	—		
			CB	2	16.5	2.0	31.0		
		13. V	J 36	1	200.0	—	—		
Frøya		3. IV	N 70	6	2.5	0.5	6.3		
		6–7. IV	N 70	5	10.0	5.0	17.5		
		21. IV	N 70	4	79.3	62.5	102.3		
			CB	4	38.6	12.0	82.3	2.5	
Halten		3. IV	N 70	10	0.8	0.5	2.5		
		7. IV	N 70	6	2.9	1.3	6.3		
		19. IV	N 70	10	16.3	1.3	5.0		
			CB	10	6.6	15.0	19.5		
Sklinna		6–8. IV	N 70	5	2.3	1.3	5.0		
		17–18. IV	N 70	5	11.3	7.5	16.3		
			CB	5	4.6	2.3	7.0		
		10. V	J 36	4	90.0	58.0	160.0		
Træna		8. IV	N 70	5	2.0	0.5	2.5		
		17. IV	N 70	4	1.3	0.5	7.5		
Træna	1963	17. IV	CB	5	2.7	1.7	6.3		
Myken		16–17. IV	N 70	7	5.4	2.5	15.0		
			CB	7	3.3	2.0	4.5		
Røst		15–16. IV	N 70	12	2.5	1.3	15.0		
		8. V	J 36	6	21.3	4.0	32.0		III–IV
Stad	1964	14. IV	J 80	3	33.7	31.0	36.0		IV
			CB	3	9.3	5.3	15.3	0.4	
		5. V	CB	1	36.5	—	—	1.1	IV–V
Ona		15. IV	J 80	4	48.3	5.0	84.0		IV
			CB	7	13.0	4.5	24.5	0.7	
		4. V	CB	1	55.0	—	—	1.9	IV–V
Frøya		16. IV	CB	5	15.5	6.5	33.0	1.1	III–IV
		3. V.	CB	3	50.4	9.5	71.3	3.2	IV–V
Halten		17. IV	CB	10	16.4	5.8	24.3	0.8	IV
		23. IV	CB	8	45.7	11.0	112.5	4.2	
		2–3. V	J 80	4	79.0	30.0	188.0		IV–V
			CB	9	33.8	10.0	67.5	2.5	
Sklinna		17. IV	CB	4	17.7	6.3	33.0	0.9	IV
		2. V	J 80	2	55.5	11.0	100.0		IV–V
			CB	5	51.4	27.0	123.3	4.8	
Træna		19–20. IV	CB	5	21.7	17.0	28.0	0.7	IV
		1. V	J 80	3	73.0	10.0	198.0		IV
			CB	5	58.2	24.5	121.5	4.9	
Myken		20. IV	CB	6	13.7	9.5	21.0	0.5	IV
		21–22. IV	CB	7	21.0	8.5	31.5	1.0	IV
		30. IV	J 80	4	67.0	34.0	128.0		
			CB	9	54.2	13.8	113.3	4.0	IV–V

Table I. (cont.)

Area	Year	Date	Gear	No. of st.	ml/m² sea surf.			ml/m³	C.finm. dom. stage
					aver-age	min.	max.	max.	
Røst		27–28. IV	CB	12	12.5	7.3	24.0		IV–V
		29. IV	J 80	3	74.0	36.0	98.0		
			CB	4	37.6	25.0	61.0	1.7	
Stad	1965	29–30. III	J 80	3	7.0	6.0	8.0		
Ona		30. III	J 80	7	8.6	6.0	18.0		♀
		11–12. IV	J 36	3	21.3	4.0	32.0		♀
Frøya	1965	31. III	J 80	5	14.8	3.0	20.0		♀
		10–11. IV	J 36	2	22.0	20.0	24.0		♀
Halten		31. III–1. IV	J 80	9	6.8	1.0	24.0		IV– ♀
		8. IV	J 36	11	11.3	4.0	28.0		IV– ♀
Sklinna		2. IV	J 80	3	3.8	2.8	4.8		V– ♀
		8. IV	J 36	2	16.0	12.0	20.0		V– ♀
Træna		2. IV	J 80	5	2.0	1.0	3.0		V– ♀
		7. IV	J 36	5	10.4	4.0	16.0		♀
Myken		2–3.IV	J 80	10	5.0	2.0	9.0		♀
		6–7. IV	J 36	9	9.8	8.0	24.0		♀
Røst		5–6. IV	J 80	9	14.8	4.0	40.0		♀
Stad	1966	15. IV	J 80	3	8.3	4.0	12.0		III
			CB	2	5.0	3.6	6.6		
Ona		15. IV	J 80	7	8.7	5.0	12.0		III
			CB	7	8.8	5.5	12.5		
		I. V	J 80	3	29.3	12.0	48.0		
		I. V	CB	2	17.5	7.0	28.0	0.8	IV
Frøya		16–17. IV	J 80	6	6.3	2.0	14.0		♀–III
			CB	8	4.6	3.5	7.5		
		27–28. IV	J 36	8	35.0	16.0	48.0		IV
			CB	7	16.9	12.0	24.8		
Halten		17–18. IV	J 80	13	9.9	3.0	20.0		♀–III
			CB	13	7.3	3.0	14.5	0.4	
		25–26. IV	J 36	13	29.2	8.0	60.0		
			CB	13	13.7	4.0	32.5	1.2	IV–V
Sklinna		19. IV	J 80	2	11.0	9.0	13.0		♀ II–III
			CB	2	3.8	2.8	4.8		
		24–25. IV	J 80	3	11.2	8.0	16.0		
			CB	3	11.1	10.3	12.0	0.3	II–III
Træna		19. IV	J 80	5	8.0	6.0	14.0		
			CB	5	4.3	1.3	7.3		
		24. IV	J 80	5	18.4	12.0	28.0		
			CB	5	12.9	6.3	24.8	0.6	II–III

Table I. (cont.)

Area	Year	Date	Gear	No. of st.	ml/m² sea surf.			ml/m³	C.finm. dom. stage
					aver-age	min.	max.	max.	
Myken	1966	20–22. IV	J 80	8	9.6	6.0	16.0		
				(9)	(17.7)		(83.0)		
			CB	9	8.5	4.0	11.5	0.3	II–III ♀
		23–24. IV	J 80	7	15.4	4.0	36.0		
			CB	7	13.5	5.8	17.0	0.4	(♀) II–III
Røst		22. IV	J 80	5	15.4	4.0	28.0		
			CB	5	8.7	4.3	10.8	0.3	
		23. IV	J 80	5	23.2	12.0	32.0		
			CB	5	8.7	3.8	12.5	0.2	