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BEAUFORT SEA PLANKTON STUDIES

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SECTION 1

Nearshore

Prudhoe Bay and USCGC *Glacier*

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I. Summary of objectives, conclusions, and implications with respect to OCS oil and gas development

The primary objectives of this project were to determine the seasonal density distribution and environmental requirements of principal species of phytoplankton, zooplankton, and ichthyoplankton, and to determine seasonal indices of phytoplankton production. A secondary objective was to summarize existing literature, unpublished data, and archived samples.

Most of our conclusions must be preliminary because so little information is available concerning plankton of the Beaufort Sea. In general, the distribution of individual phytoplankton species appears to be widespread within the Beaufort Sea, while the distribution of some zooplankton species is influenced by local hydrographic regimes. Primary production and standing stocks of phytoplankton are variable and patchy based on data from one summer (August) sampling period. Highest primary productivity occurs below the surface , usually between 5 and 20 m, and where diatoms are the most abundant organisms. Meroplankton comprise a large part of the zooplankton of the western Beaufort Sea. Expatriate species are found with the intrusion of Bering Sea water into the Beaufort Sea.

Most of the basic background information necessary to make adequate assessments of the impact of oil and gas development on the plankton is still not available. Changes in species composition or loss of some planktonic species because of an oil spill would probably affect higher levels of the food chain and be damaging to fish, birds and mammals. Basic life history information is not known for most planktonic species and there are essentially no experimental studies concerning the effects of oil on Arctic plankton. Our studies point out the lack of available knowledge on the plankton.

11. Introduction

A. General nature and scope of study

As primary producers and primary and secondary consumers, phytoplankton and zooplankton play an important role in the Beaufort Sea ecosystem. Our purpose was to provide basic biological information about these organisms in order to understand their relationships within the ecosystem.

B. Specific objectives

The specific objectives of this project were to

1. Determine the seasonal density distribution and environmental requirements of principal species of phytoplankton, zooplankton, and ichthyoplankton;

2. Determine seasonal indices of phytoplankton production;

3. Summarize existing literature, unpublished data, and archived samples.

c. Relevance to problems of petroleum development

The development of gas and oil reserves has had, and will continue to have, an impact on the marine environment of the Beaufort Sea. In order to detect changes and predict or assess adverse effects caused by this development, it is necessary to have basic background information on productivity, species composition, distributions, abundances, life cycles and migration patterns of planktonic organisms.

Potential dangers to the plankton community include reduced primary productivity caused by direct toxicity effects or reduced light penetration into the water column as a result of a surface oil slick, and possible changes in the phytoplankton species composition with possible concurrent changes in the zooplankton because of modified food sources.

Some life cycle stages, especially larvae, are more susceptible to pollutants than other stages. It is important to know what these stages are and when and where they occur in the water column.

Oil trapped under the ice would affect the ice algae community that commonly occurs in spring. While the areal extent of this community is not well known, it is important in the shallow water areas (10 to 15 m) along the Beaufort Sea coast and provides a source of food for a number of important species, including amphipods, that are in turn utilized as food by birds and mammals.

In addition to the chemical effects of possible oil pollution, physical changes in the environment will also be critical. Construction of causeways and other structures or dredging of channels that could change circulation patterns will have an effect on primary productivity through changes in nutrient supply, and on planktonic organisms in general through changes in possible migration patterns and recruitment rates.

D. Acknowledgements

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III. Current state of knowledge

Little is known about the biology of the plankton in the Chukchi and Beaufort seas. Table 1 lists expeditions, collections, and publications on plankton from this area. The earliest collections were made during the Canadian Arctic Expedition, 1913-1918. Major groups of zooplankton reported from this expedition included ctenophores and hydromedusae (Bigelow 1920), amphipods (Shoemaker 1920), copepods (Willey 1920), and schizopod crustaceans (Schmitt 1919). The primary constituents of the zooplankton in these samples were crustaceans, particularly copepods. Diatoms, described by Mann (1925), were primarily benthic forms.

Johnson (1956) reported on zooplankton collected in the Chukchi and Beaufort seas in 1950 and 1951 and demonstrated, for the first time, the presence of Bering Sea water in the Beaufort Sea based on zooplankton distributions. Hand and Kan (1961) described the hydromedusae from these samples, including breeding ranges and the influence of hydrography on species distribution.

Wing (1974) described the kinds and abundance of zooplankton from the eastern Chukchi Sea in September and October 1970. Quast (1974) reported the density distribution of juvenile Arctic cod (*Boreogadus saida* Lepechin) from the same cruise and considered Arctic cod to be a "key species in the ecology of the arctic seas", being important as a major secondary consumer.

Studies concerned with annual cycles, biomass, population dynamics, and production of both phytoplankton and zooplankton have been done primarily at Pt. Barrow (MacGinitie 1955; Johnson 1958, Bursa 1963; Homer 1969, 1972; Redburn 1974). MacGinitie (1955), concerned mainly with benthic invertebrates, included *a* limited discussion of phytoplankton and zooplankton based on relative abundances and reproductive periods. Johnson (1958) described the qualitative and quantitative composition of the inshore zooplankton community for one month in summer.

Redburn (1974) described the zooplankton community in terms of species abundance and composition, life cycles, and relationship to the hydrographic regime. Copepods were the major constituents of the community along with large numbers of meroplanktonic larvae. The occurrence of Bering Sea water was indicated by the presence of several expatriate species of copepods and several populations of copepods and hydromedusae that breed from the Bering Sea *to* Barrow.

Bursa (1963) studied the taxonomy, ecology, and abundance of phytoplankton from several habitats near Barrow. Homer (1969, 1972) reported a bimodal annual phytoplankton cycle with a spring maximum in June and early July before ice breakup and a fall maximum in August-September.

In the nearshore area of the Beaufort Sea, Alexander (1974) has reported primary productivity, chlorophyll *a*, and biomass data for the phytoplankton community in the Colville River system, including Harrison Bay and Simpson Lagoon. Coyle (1974) and Homer *et al.* (1974)

Table 1. Expeditions, publications, and subjects of marine biological studies in coastal waters of the Beaufort Sea

Expedition or location	References	Subject
Canadian Arctic Exped. 1913-18 Chukchi - Beaufort	Bigelow 1920	hydromedusae ctenophores
	Shoemaker 1920	amphipods
	Willey 1920	copepods
	Schmitt 1919	schizopod crustaceans
	Mann 1925	diatoms
Chelan 1934	Johnson 1936	zooplankton
	1953	zooplankton
Burton Island 1950, 1951	Johnson 1956	copepods
LCM *Ripley* 1954	Hand & Kan 1961	hydromedusae
	Mohr *et al.* 1957	fish
Barrow: mainly Chukchi Sea	MacGinitie 1955	some zooplankton and phytoplankton
	Shoemaker 1955	amphipods
	Johnson 1958	inshore zooplankton (summer)
	Bursa 1963	phytoplankton
	Homer 1969	phytoplankton
	1972	phytoplankton
	Homer & Alexander 1972	ice algae
	Matheke 1973 Matheke & Homer 1974	benthic microalgae
	Alexander, Homer & Clasby 1974	ice algae, some phytoplankton
	Redburn 1974	zooplankton

Table 1. (continued)

Expedition or location	References	Subject
Oliktok	Alexander 1974	phytoplankton
Prudhoe Bay	Homer, Coyle, Redburn 1974	phytoplankton, zooplankton
	Coyle 1974	phytoplankton
WEBSEC		
Glacier 1970, 1971, 1972, 1973	Quast 1974	Arctic cod - Chukchi
	Cobb & McConnell no date	zooplankton 1971
	Wing 1974	zooplankton - Chukchi
	Homer unpubl	phytoplankton - chl a, standing stock
Staten Island 1974	Homer unpubl	phytoplankton - chl a, standing stock
OCSEAP		
1975 Prudhoe Bay	English, Homer OCS reps.	phytoplankton
Glacier 1976 Beaufort Sea to P.B. Chukchi Sea Icy Cape - Brw.	English, Homer OCS reps.	phytoplankton - chl a, species, prim. prod. zooplankton - species standing stock ichthyoplankton - species, standing stock
Southern Beaufort Sea	Grainger & Grohe 1975	zooplankton
	Adams 1974	prim. prod., oil under ice
	Hsiao 1976	phytoplankton

studied the Prudhoe Bay plankton in terms of primary productivity, standing stock, species composition, and spatial variability, along with local hydrographic conditions.

Cobb and McConnell (unpubl. ins.) have described the species composition, relative abundances, and distributions of zooplankton collected in summer 1971. Homer (unpubl.) has data on phytoplankton standing stock, distribution, and chlorophylls concentrations from summer 1973 and 1974.

Hsiao (1976) and Grainger and Grohe (1975) have reported on phytoplankton and zooplankton studies in the southern Beaufort Sea (Mackenzie River delta), and Adams (1975) studied light intensity and primary productivity under sea ice containing oil.

With the exception of Adams (1975), these studies have been concerned with species composition, abundance, and distribution. Few attempts have been made to determine energy flow within the Arctic ecosystem and only Adams (1975) and Hsiao (1976) have studied the effects of oil on phytoplankton productivity in the Beaufort Sea.

IV. Study area

Plankton collections were made in Prudhoe Bay in Aug-Sep 1975 (Fig. 1) and in the Chukchi and Beaufort seas in Aug-Sep 1976 (Fig. 2 to 3, Table 2). The Prudhoe Bay samples were collected when and where local weather and ice conditions permitted. Plankton collections were made in the Chukchi Sea early during the *Glacier* cruise because ice conditions prevented the ship from entering the Beaufort Sea. Beaufort Sea stations were generally taken along the transects designated by OCS off Pitt Point and Narwhal Island. Ice prevented our working the transect off Barter Island. Additional stations were taken where investigators requested and ice permitted.

V. Sources, methods, and rationale of data collection

Phytoplankton samples were collected in Prudhoe Bay with a 6-ℓ Scott-Richards water bottle (modified Van Dorn bottle). Following collection, the water samples were drained into 4-ℓ polyethylene bottles, kept in a cool place, and returned to the shore laboratory at the V & E Construction camp, Deadhorse, for further processing.

In the laboratory, portions of each water sample were used for chlorophyll a, primary productivity, standing stock, and salinity. Water for chlorophyll a determination was filtered through 47 mm Millipore HA (0.45 μm) filters. A few drops of a saturated $MgCO_3$ solution were added and the filter tower rinsed with filtered seawater. The filters were folded into quarters, placed in a dessicator, and frozen. At the University of Washington, the chlorophyll concentrations were determined using a Turner fluorometer (Strickland and Parsons 1968).

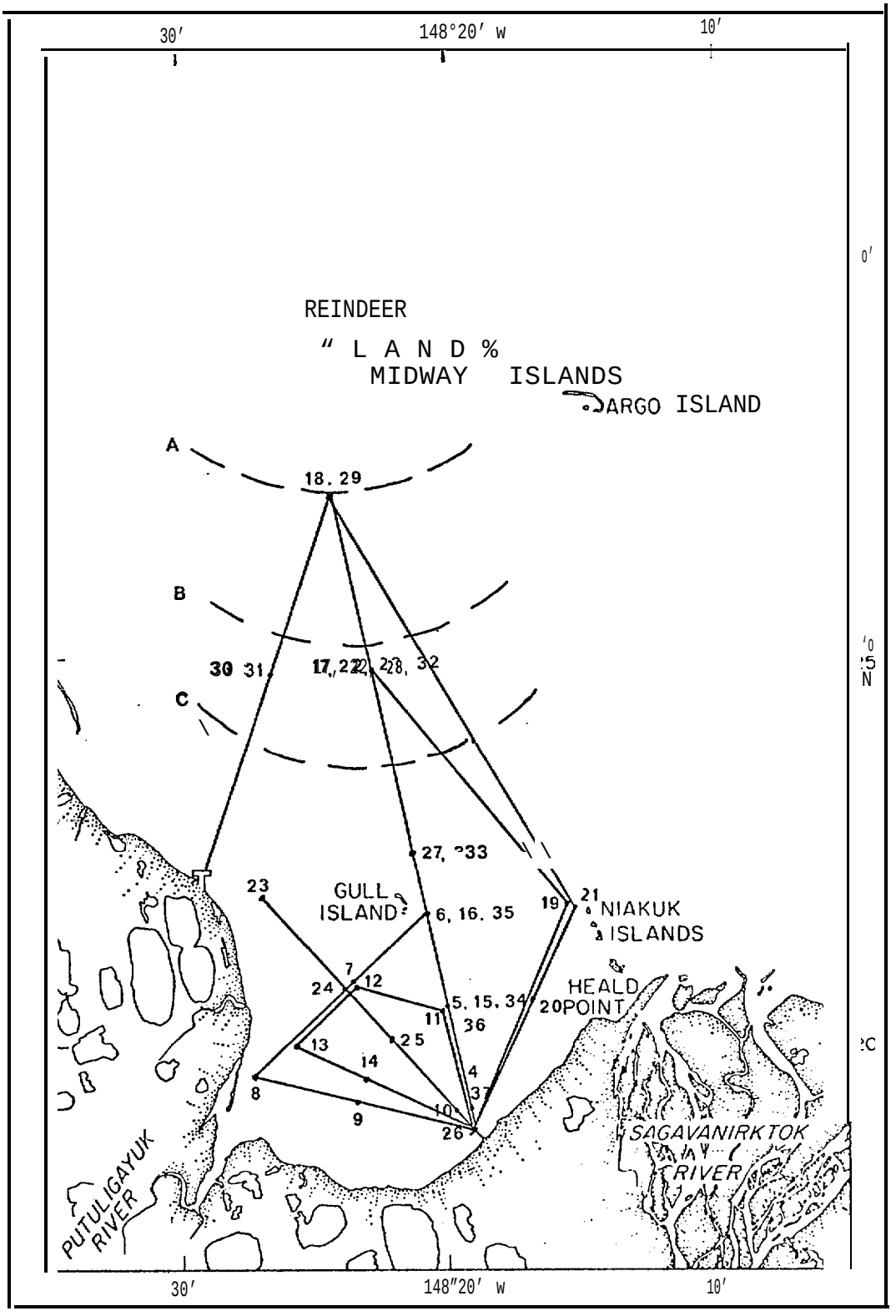


Fig. 1. Station locations, Prudhoe Bay, Sep 1975. A is ice edge 10 Sep; B is ice edge 11 Sep; C is ice edge 14 Sep.

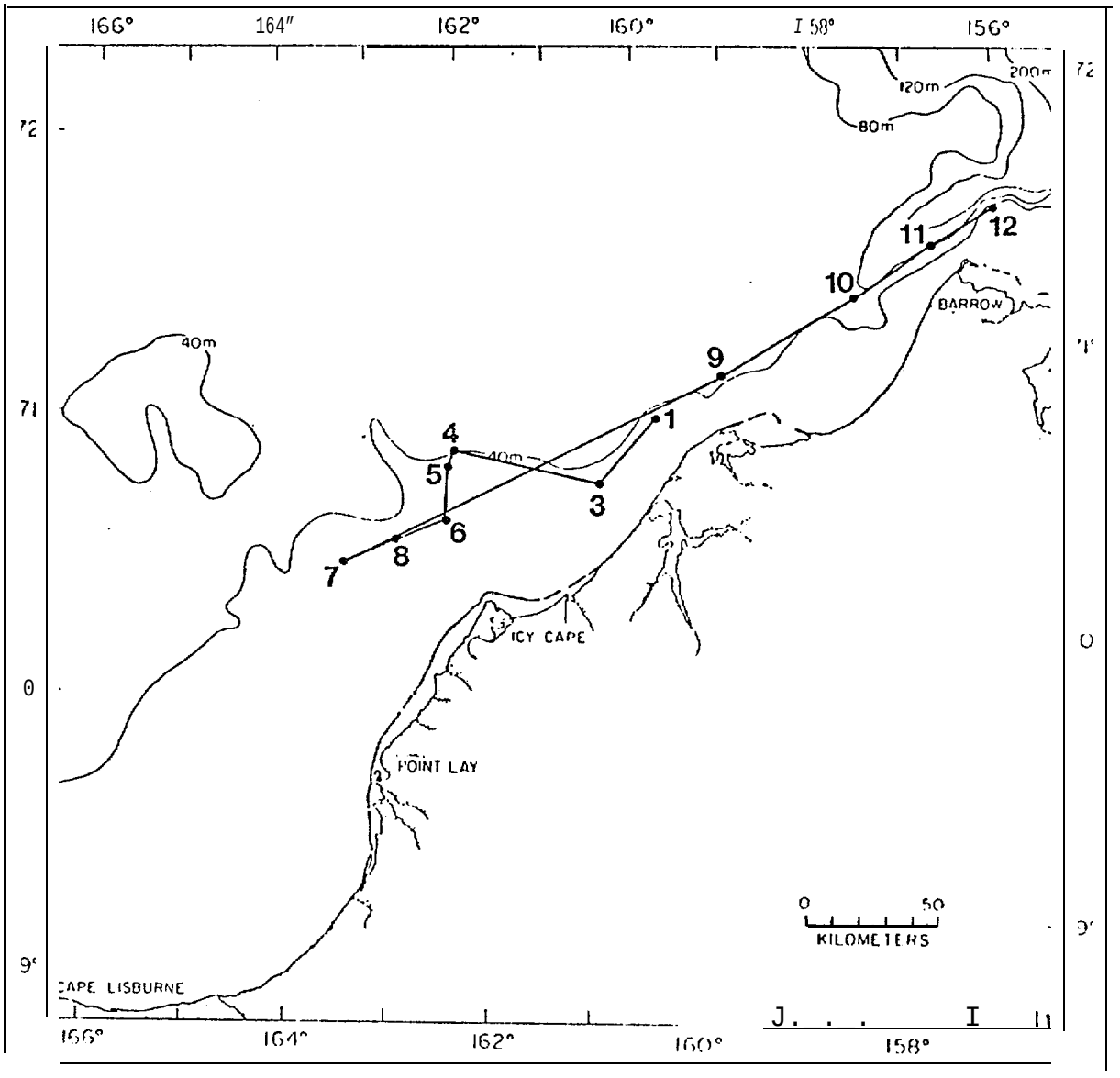


Fig. 2. Chukchi Sea cruise track and station locations, USCGC *Glacier*, 7 Aug to 4 Sep 1976.

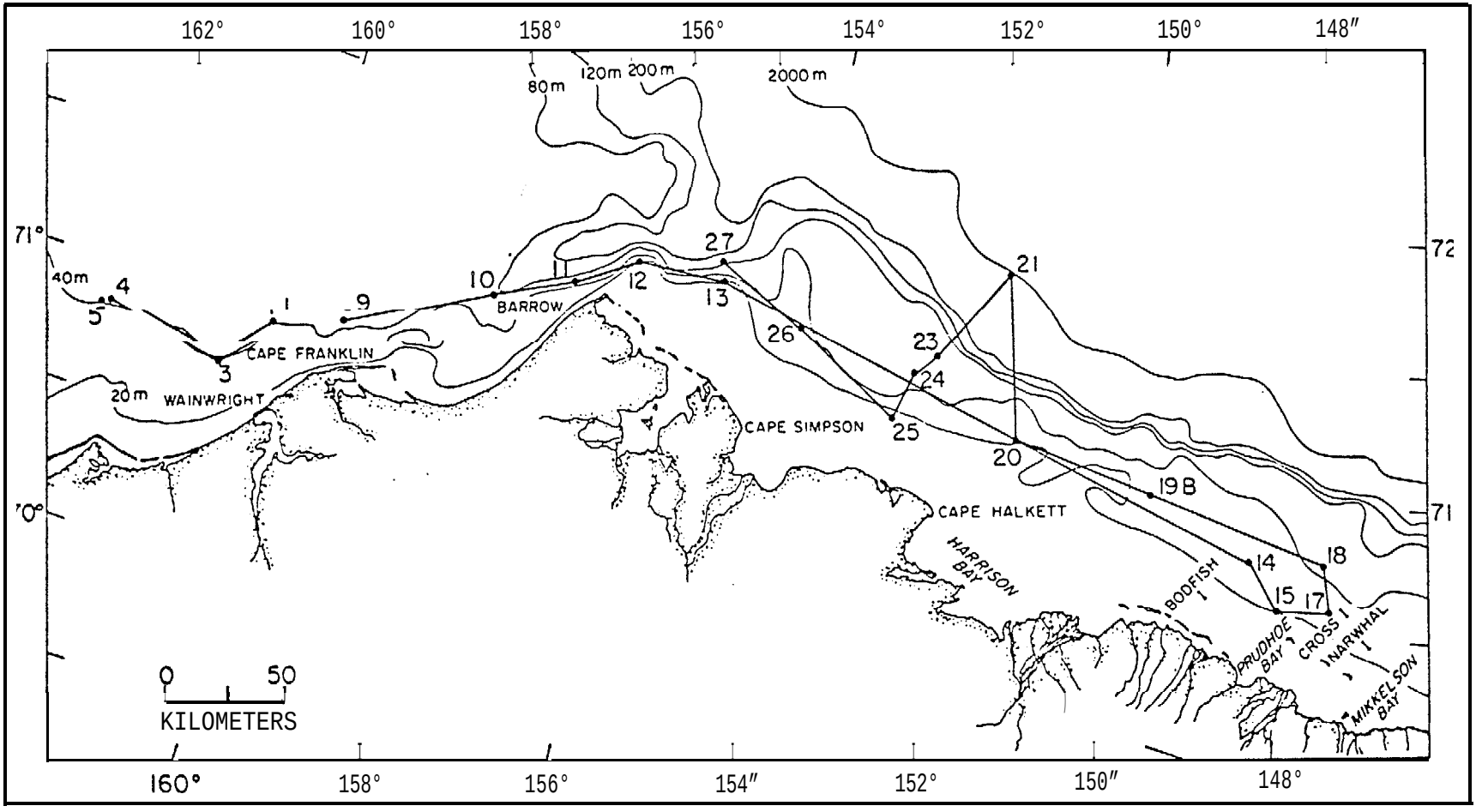


Fig. 3 . Beaufort Sea cruise track and station locations, USCGC *Glacier*, 7 Aug to 4 Sep 1976.

Table 2. Station locations, USCGC *Glacier*, 7 Aug to 4 Sep 1976

Station	Latitude (N)	Longitude (W)	Chart Depth (m)	Location
1	70° 54′	160° Q4'	54	Chukchi Sea
3	70° 43′	160° 40′	20	Chukchi Sea
4	70° 50′	162° 09′	40	Chukchi Sea
5	70° 47′	162° 14′	36	Chukchi Sea
6	70° 39′	162° 16′	36	Chukchi Sea
7	70° 28′	163° 26′	40	Chukchi Sea
8	70° 34′	162° 50′	27	Chukchi Sea
9	71° 03′	159° 17′	61	Chukchi Sea
10	71° 16′	157° 43′	70	Chukchi Sea
11	71° 25.5′	156° 54.8′	106	Chukchi Sea
12	71° 31.5′	156° 09′	139	Chukchi Sea
13	71° 31′	155° 05′	31	Beaufort Sea
14	71° 11′	153° 09′	25	Beaufort Sea
15	70° 36′	148° 12′	16	Beaufort Sea
17	70° 32′	147° 33′	25	Beaufort Sea
18	70° 39′	147° 37′	25	Beaufort Sea
19B	70° 57′	149° 33′	30	Beaufort Sea
20	71° 08′	151° 19′	34	Beaufort Sea
21	71° 43′	151° 47′	1700	Beaufort Sea
23	71° 22′	152° 20′	75	Beaufort Sea
24	71° 19'	152° 32′	52	Beaufort Sea
25	71° 08′	152° 57′	22	Beaufort Sea
26	71° 23′	154° 21′	30	Beaufort Sea
27	71° 36′	155° 32′	171	Beaufort Sea

Primary productivity experiments were run in 60 ml reagent bottles. Two light bottles and one dark bottle were used for each depth. Two ml of $NaH^{14}CO_3$ solution were added to each bottle, aluminum foil was placed around the dark bottle, and the samples were incubated in a plastic bucket filled with water under daylight illumination and ambient air temperature. After a 4 hr incubation period, the samples were filtered onto 25 mm Millipore HA (0.45 µm) filters, rinsed with 5 ml filtered seawater, and the filters were placed in liquid scintillation vials. In Seattle, radioactive uptake was measured using a Packard Tri-Carb Liquid Scintillation Spectrometer with Aquasol (New England Nuclear) as the scintillation cocktail.

Standing stock samples were preserved with 5 to 10 ml of 4% formalin buffered with sodium acetate. Cell counts and species identification were made using a Zeiss phase-contrast inverted microscope following the method of Utermöhl (1931). Species identifications were made using standard phytoplankton reference books with Hustedt (1930, 1959) and Schiller (1933, 1937) as the main authorities. Voucher specimens were not kept.

Nutrient determinations were made on Millipore filtered seawater that was frozen and returned to Seattle. Autoanalyzer methods (Strickland and Parsons 1968) were used to determine nutrient concentrations. Filtered seawater was also used to determine salinity. These samples were analyzed at the Naval Arctic Research Laboratory, Barrow, Alaska, using a Beckman RS 7 B induction salinometer using Copenhagen seawater as the standard.

During the cruise of the USCGC *Glacier* zooplankton and ichthyoplankton were sampled with bongo nets and 0.75-m ring nets. The bongo net consists of a double-mouthed frame, each mouth with an inside diameter of 60 cm and an area of 0.2827 m^2. Nets with a mesh size of 505 µm (8:1 OAR) and 333 µm (8:1 OAR) were attached to the frame. A TSK flow meter was mounted in the mouth of each net to determine the amount of water filtered, and a bathykymograph (BKG) was attached at the center of the frame to determine tow depth. Two or three 25-lb cannon ball weights were attached to the frame. Tows were double oblique with deployment at approximately 50 m/min, with a 30 sec soaking time, and retrieval at 20 m/min. Sampling depth varied because of the shallow water, but the net was placed as close to the bottom as possible without endangering the net. Because of adverse ice conditions, only 10 bongo tows were made.

The ring net has a mesh size of 308 µm (2:1 OAR) and is mounted on a 0.75-m ring. This net was lowered to a predetermined depth, usually 10 or 20 m, allowed to soak for 10 sec, and vertically hauled to the surface. Depending on the water depth, two or more tows were made at a station, with 51 tows being done during the cruise.

The zooplankton samples were concentrated by gently swirling the sample in a net collection bucket to remove excess water. The samples were then placed in 250 or 500 ml jars and preserved with 100% formalin and saturated sodium borate solution. The amount of formalin and buffer depended on the jar size. A label containing collection data was put in the jar, seawater was added, if necessary to fill the jar, and the jar was tightly capped for storage.

The zooplankton samples were first sorted for large or rare organisms, then each sample was split in a Folsom plankton splitter until a subsample containing 100 specimens of the most abundant species was obtained. The organisms were identified and counted using a dissecting microscope. Voucher specimens have been kept for some species. References used to identify zooplankton are given in Table 3.

Acoustic surveys were conducted using a Ross 200A Fine Line Echosounder system operating with a frequency of 105 kHz. A 10° transducer mounted in a 0.6 m V-Fin depressor was lowered to the water surface when the ship was stopped on station. The incoming signal was recorded on a paper chart marked with the station number, date, time (LDT), and other pertinent information. When ice and time allowed, the incoming signal was also recorded on magnetic tape for later analysis. Most of the recording was done in the 0-50 fm range because of the shallowness of the water. Few acoustic measurements were made because of ice conditions.

Phytoplankton samples were collected with 5-ℓ Niskin bottles. Subsamples were taken for salinity, standing stock, primary productivity, and chlorophyll *a* determinations. Salinity was measured on board using a Bisset Berman Hytech salinometer Model 6220 (USCG # 4691 m). Standing stock samples were preserved with approximately 10 ml of 4% formalin. Cell counts and species identifications were made using a Zeiss phase-contrast inverted microscope following the method of Utermöhl (1931). Five and 50-ml settling chambers were set up for each sample. Rare organisms and cells larger than 50 μm were counted at 10 X in the 50-ml chambers and small, abundant organisms were counted at 25 X in the 5-ml chambers. Usually 1/5 of each chamber was counted. Species identifications were made using standard phytoplankton reference books with Hustedt (1930, 1959) and Schiller (1933, 1937) as the main authorities. Voucher specimens were not kept. Standing stock samples collected in the Chukchi Sea have not been analyzed because of time limitations.

Primary productivity measurements were made in 60 ml reagent bottles. Two light bottles and one dark bottle were used for each depth. Two ml of $NaH^{14}CO_3$ solution were added to each bottle, aluminum foil was placed around the dark bottle, and the samples were incubated in a sink in the laboratory. A bank of cool white fluorescent lights was set up over the sink. Light levels were measured at the beginning and end of the incubation period with a Gossen Super Pilot photographic light meter. Low temperature in the sink was maintained by running seawater; temperature was measured at the beginning and end of the incubation period. The incubation period was usually 3-4 hours. The samples were filtered onto 25 mm Millipore HA (0.45 μm) filters, rinsed with approximately 5 ml filtered seawater and 5 ml 0.01 N HCL, and placed in liquid scintillation vials. Radioactive uptake was measured using a Packard Tri-Carb Liquid Scintillation Spectrometer with Aquasol (New England Nuclear) as the scintillation cocktail. Primary productivity was calculated using the equation

$$Ps\ (mg\ C\ m^{-3} \cdot hr^{-1}) = \frac{(L-D) \times w \times 1.05}{R \times T}$$

Table 3. References aiding identification of zooplankton

Copepoda

Brodskii, 1950
Heron and Damkaer, 1976
Jaschnov, 1948
Mori, 1937
Sars, 1900
Sars, 1903
Vidal, 1971

Euphausiacea

Leung, 1970a

Ostracoda

Leung, 1972c
Sars, 1928

Mysidacea

Leung, 1972b

Decapoda

Leung, Havens, and Rork, 1971
Makarov, 1967

Amphipoda

Sars, 1895
Tencati, 1970

Polychaeta

Pettibone, 1954
Yingst, 1972

Appendicularia

Leung, 1972a

Chaetognatha

Dawson, 1971

Hydrozoa

Naumov, 1960
Shirley and Leung, 1970

Ctenophora

Leung, 1970b

Pteropoda

Leung, 1971

Pisces

Blackburn, 1973
Ehrenbaum, 1909
Gorbunova, 1954
Rass, 1949

where (L-D) is light-dark bottle disintegrations per minute; W is carbonate carbon; 1.05 is a ^{14}C isotope factor; R is the activity of the ^{14}C used; and T is the incubation time.

Water for chlorophyll a determinations was filtered through 47 mm Millipore HA (0.45 μm) filters. A few drops of a saturated $MgCO_3$ solution were added and the filter tower was rinsed with filtered seawater. The filters were folded into quarters, placed in labelled coin envelopes, and frozen. The samples were analyzed using a Turner fluorometer (Strickland and Parsons 1968). Calculations were done using the equations

$$\text{chl a} = \frac{\dfrac{F_o/F_{a_{max}}}{Fe/F_{a_{max}-1}} (K_x)(F. - F_a)}{\text{Vol filtered}}$$

$$\text{Phaeo} = \frac{\left(\dfrac{F_o/F_{a_{max}}}{F_o/F_{a_{max}-1}}\right)(K_x)\left(F_o(F_a/F_{o_{max}}) - F_a\right)}{\text{Vol filtered}} -$$

where F_o is fluorometer reading before acidification; F_a is fluorometer reading after acidification; K is fluorometer door calibration factor; and Vol filtered is the volume of sample filtered.

Temperatures, measured using reversing thermometers, were corrected using the calibration factors provided by the Coast Guard and following the procedure outlined in U.S. Naval Oceanographic Office Publ 607 (1968).

VI. Results

A. Prudhoe Bay

Hydrographic data are given in Table 4. Chlorophyll a concentrations were generally < 1 mg m^{-3}, except for near-bottom samples at stations 24, 27, and 30, where concentrations were 2 to 3 mg m^{-3}. Different species accounted for the higher chlorophyll a concentrations in the deeper water with pennate diatoms being most abundant at station 30-15 and *Chaetoceros furcellatus* Bailey being most abundant at station 24-7.

Temperature ranged from -1.0 to +3.0° C with the lowest and highest temperatures at the surface. Salinity ranged from 11.648 to 24.959 °/oo with higher salinities generally being in deeper water.

Phosphate concentrations ranged from 0.03 to 1.31 μg at ℓ^{-1}, "generally being below 0.60 μg at ℓ^{-1}. Silicate concentrations ranged

Table 4. Hydrographic data for OCS stations taken during Sep 1975 in Prudhoe Bay

Sta. No.	Date (1975) (ADT)	Sample Depth	T	S°/₀₀	Nutrients (µg at ℓ) P04	Si	NO_3	NO_2	NH_4	Chl. a (mg m^3)
P-1	9-5	0	-1.0	12.844	0.36	16.60	0.20	0.12	0.86	0.845
P-2	9-5	0	-1.0	20.208	0.52	10.14	0.35	0.24	0.80	1.284
P-3	9-5	0	-1.0	22.126	0.71	8.00	1.19	0.06	1.86	0.777
P-4	9-7	0	0.2	13.168	0.94	20.95	0.27	0.10	0.52	0.879
		7	1.2	12.642	0.95	20.64	1.15	0.10	1.08	0.811
P-5	9-7	0	-0.8	14.054	0.73	19.21	0.16	0.13	0.94	0.714
		8	-0.4	18.948	0.36	12.47	0.85	0.21	1.62	1.048
P-6	9-7	0	-0.8	17.317	0.57	11.21	0.37	0.17	1.29	0.545
		3	-1.5		(No bottom samples taken here)					
P-7	9-7	0	-0.8	16.107	0.52	14.16	0.92	0.21	1.90	0.642
		5	-1.2	19.497	0.58	7.91	0.24	0.39	0.60	0.946
P-8	9-7	0	-1.0	20.579	1.28	10.38	0.08	0.57	0.88	1.169
		2	-1.0		(No bottom samples taken here)					
P-9	9-7	0	-1.0	14.778	0.48	14.65	0.58	0.42	2.01	0.777
		7	-1.0	12.317	0.43	20.92	0.08	0.30	1.09	0.533
P-lo	9-8	0	0.8	17.186	0.22	4.72	0.20	0.05	0.85	0.879
		6	0.8	13.405	0.29	5.65	0.35	0.05	0.84	0.630
P-n	9-8	0	-0.8	12.570	0.47	20.20	1.19	0.11	1.82	0.436
		7	-0.4	19.148	0.36	10.91	0.24	0.06	0.62	0.787

Sta. No.	Date (1975) (ADT)	Sample Depth	T	S°/₀₀	PO_4	Si	Nutrients (µg at ℓ) NO_3	NO_2	NH_4	Chl. a (mg m^3)
P-12	9-8	0	-0.5	12.456	0.45	15.91	1.15	0.11	1.15	0.472
		8	-0.2	19.416	0.63	8.92	0.15	0.05	1.04	1.220
P-13	9-8	0	-0.4	12.522	0.49	20.71	0.86	0.13	1.70	0.521
		6	-0.2	16.811	0.36	14.48	0.40	0*10	1.39	0.606
P-14	9-8	0	-1.0	11.648	0.28	20.22	0.92	0.09	2.03	0.351
		5	-0.5	17.687	0.38	8.33	0.23	0.01	0.74	0.845
P-15	9-1o	0	0.5	16.067	0.17	14.35	0.11	0.00	1.03	0.557
		5	0.2	17.675	0.40	15.45	0.59	0.28	2.17	0.946
P-16	9-1o	0	1.0	17.572	0.27	15.61	0.10	0.07	1.26	0.424
		4	0.8	18.031	0.51	14.15	0.15	0.09	2.65	0.823
P-17	9-1o	0	0.8	22.618	0.53	14.22	0.27	0.12	2.57	0.460
		23	0.5	23.091	0.72	11.80	0.56	0.09	1.23	0.606
P-18	9-1o	0	1.2	23.366	0.50	11.47	0.14	0.07	0.93	0.279
		30	0.5	24.959	0.70	10.17	0.82	0.10	1.47	0.465
P-19	9-1o	0	1.2	21.462	0.45	12.17	0.42	0.14	1.17	0.254
		11	1.0	22.134	0.61	12 .49	0.33	0.08	1.30	0.509
P-20	9-11	0	1.5	15.494	--	--	--	--	--	0.855
		7	1.2	18.356	--	--	--	--	--	1.790
P-21	9-11	0	1.2	16.227	--	--	--	--	--	0.823
		8	1.2	17.708	--	--	--	.-	--	0.799

Table 4. (continued)

Sta. No.	Date (1975) (ADT)	Sample Depth	T	S°/₀₀	PO_4	Si	NO_3	NO_2	NH4	Chl. a (mg m³)
					Nutrients (µg at ℓ)					
P-22	9-11	0	1.2	23.166	--	--	--	--	--	0.606
		19	1.2	23.186,	--	--	--	--	--	0.545
P-23	9-13	0	2.5	19.660	0.47	9.64	0.13	0.26	2.52	0.472
		5	2.3	20.002	0.46	8.97	0.26	0.46	2.40	1.217
P-24	9-13	0	2.2	20.491	0.45	10.77	0.54	0.28	1.03	0.799
		7	2.2	20.832	0.47	10.33	0.15	0.29	0.67	2.907
P-25	9-13	0	1.9	19.571	0.21	11.26	0.80	0.80	1.25	0.799
		8	2.2	20.693	0.29	10.42	0.38	1.10	0.94	0.690
P-26	9-13	0	1.8	17.010	0.19	8.24	0.05	0.07	1.06	0.642
		6	1.8	18.895	0.28	11.03	0.32	1.05	1.01	0.690
P-27	9-14	0	2.2	17.489	0.03	13.01	0.09	0.13	2.18	0.339
		5	1.8	21.055	0.56	11.25	0.03	0.09	0.21	2,260
P-28	9-14	0	1.5	19.314	0.16	12.64	0.03	0.13	0.21	1.048
		20	0.3	23.530	1.09	11.20	0.28	0.27	0.21	0.744
P-29	9-14	0	0.3	21.759	0.45	9.96	0.12	0.15	--	0.246
		19	0.0	23.587	1.31	11.25	0.21	0.36	--	0.777
P-30	9-14	0	1.9	17.261	0.33	13.83	0.04	0.18	--	0.173
		15	0.6	22.801	--	--	--	--	--	2.330
P-31	9-16	0	2.2	17.600	--	--	--	--	--	0.642
		15	1.4	20.872	--	--	--	--	--	0.744

Table 4. (continued)

Sta. No.	Date (1975) (ADT)	Sample Depth	T	S°/₀₀	PO_4	Si	Nutrients (µg at ℓ) NO 3	NO_2	NH4	Chl. a (mg m^3)
P-32	9-16	0	1.2	22.217	--	--	--	--	--	1.180
		20	1.1	22.258	--	--	--	--	--	0.702
P-33	9-16	0	1.9	‘20.767	--	--	--	--	--	0.363
		15	1.5	21.274	--	--	--	--	--	0.744
P-34	9-16	0	2.0	14.567	--	--	--	--	--	0.630
		7	3.0	18.690	--	--	--	--	--	0.879
P-35	9-16	0	2.1	20.067	--	--	--	--	--	0.702
		6	2.0	20.094	--	--	--	--	--	0.879
P-36	9-16	0	2.0	20.071	--	--	--	--	--	0.375
		7	1.7	20.097	--	--	--	--	--	0.545
P-37	9-16	0	2.0	19.916	--	--	--	--	--	0.744
		5	2.0	19.930	--	--	--	--	--	0.507

from 4.72 to 20.95 μg at ℓ^{-1}. The lowest silicate concentration was at station 10 and the highest at station 4, both located inside the bay near the east dock. The samples were collected one day apart and few diatoms were present at either station. Nitrate concentrations ranged from 0.03 to 1.19 μg at ℓ^{-1}; nitrite ranged from 0.00 to 0.57 μg at ℓ^{-1}; ammonia ranged from 0.60 to 2.57 μg at ℓ^{-1}.

Primary productivity was generally low, ranging from 0.01 to 2.97 mg C m^{-3} * hr^{-1}, with the highest occurring at station 24-7 where the chlorophyll a concentration was also high.

Inside Prudhoe Bay, small species of the diatom genus *Chaetoceros*, especially *Ch. furcellatus*, were dominant. Pennate diatoms, mostly unidentified, were also present, but usually not in large numbers. At station 33, slightly north of Gull Island, at 15 m, small flagellates were abundant along with *Chaetoceros* spp. Small flagellates were also abundant at the surface at station 30. Ciliates were abundant at stations 6, 14, 15, 16, 23, 24, and 31, probably grazing on the phytoplankton.

B. USCGC *Glacier*

1. Hydrography

Hydrographic data for stations taken in the Chukchi and Beaufort Seas are given in Table 5. Temperature and salinity depth profiles are plotted in Fig. 4. Bering Sea water, indicated by higher temperatures, can be seen at 10 to 20 m at stations 13,. 21, 23, 24, 26, 27, and possibly 20. The presence of Bering Sea water in the Beaufort Sea is important when discussing distribution patterns of phytoplankton and zooplankton.

2. Primary productivity and chlorophyll a

Primary productivity and chlorophyll a values are listed in Table 5, and depth profiles are shown in Fig. 4. Integrated values for carbon assimilation, chlorophyll *a*, and phaeophytin are given in Figs. 5 to 10. In general, high chlorophyll a concentrations were found at the same depths as high primary productivity. High productivity and high phytoplankton cell counts did not always occur at the same depth. The same species were usually abundant at the depth of greatest primary productivity with the exceptions of stations 23 and 24. At these stations, highest productivity occurred at 15 m in Bering Sea water where *Leptocylindrus minimus* Gran and *Nitzschia closterium* (Ehrb.) W. Smith were the most abundant species.

Relatively high production and chlorophyll a concentrations were found in the Prudhoe Bay area (stations 15, 17, and 18) except at the surface where small flagellates comprised about 75% of the population. Primary productivity was generally < 1 mg C $m^{-3}.hr^{-1}$ at stations and depths where flagellates were the most abundant.

Table 5. Hydrographic data for OCS stations taken during Aug-Sep 1976, USCGC *Glacier*, in the Chukchi and Beaufort Seas

Sta No	Date (1976) (GMT)	Time (GMT)	Latitude (N)	Longitude (W)	Sonic Depth (m)	Sample Depth (m)	S°/₀₀	Temp. (°C)	Chl a (mg m^{-3})	Phaeo (mg m^{-3})	Primary Prod. (mg C m^{-3} · hr^{-1})
01	09 Aug	0635	70°54.0′	160°04.0′	54	000	28.54	0.93	0.17	0.03	0.170
						005	30.09	-0.33	0.14	0.32	1.603
						010	31.82	-1.32	0.95	0.19	--
						015	32.15	-1.72	1.94	0.12	6.793
						020	32.25	-1.85	5.96	0.09	5.135
						025	32.67	-1.72	0.63	0.25	2.835
						030	32.97	-1.25	3.19	0.28	0.610
						045	33.01	-1.27	0.70	0.34	0.426
02	No hydrographic station										
03	09 Aug	2300	70°43.0′	160°40.0′	20	000	29.27	2.06	0.18	0.04	0.068
						005	29.25	1.96	0.12	0.04	0.113
						010	29.20	1.95	0.16	0.04	0.076
						015	31.65	-1.17	0.18	0.09	0.180
						020	32.49	-1.47	0.83	0.38	0.715
						035	32.93	-1.19	0.29	0.22	0.452
04	10 Aug	1800	70° .0′	162°09.0′	40	000	29.88	3.97	0.19	0.04	0.105
						005	29.90	4.04	0.16	0.03	0.096
						010	29.91	3.90	0.16	0.04	0.120
						015	31.57	3.01	0.30	0.05	0.436
						020	31.86	0*66	0.22	0.05	0.580
						025	32.63	-0.57	0.66	0.27	0.698
						035	32.59	MALF	0.48	0.25	0.425

Table 5. (continued)

Sta No	Date (1976) (GMT)	Time (GMT)	Latitude (N)	Longitude (W)	Sonic Depth (m)	Sample Depth (m)	S°/₀₀	Temp. (°C)	Chl a (mg m^{-3})	Phaeo (mg m^{-3})	Primary Prod. (mg C $m^{-3} \cdot hr^{-1}$)
05	11 Aug	1453	70°47.0′	162°14.0′	36	000	29.19	5.02	0.18	0.02	0.131
						005	29.42	4.77	0.23	0.02	0.139
						010	29.98	3.78	0.20	0.06	0.244
						015	30.94	1.94	0.25	0.09	0.251
						020	32.16	-0.20	0.41	0.19	0.266
						025	32.49	-0.85	0.49	0.28	0.471
						030	32.66	-1.07	0.71	0.54	0.488
						035	32.64	-1.04	0.66	0.44	0.589
06	11 Aug	2308	70°39.0′	162°16.0′	36	000	32.48	4.78	0.22	0.03	0.154
						005	32.48	5.45	0.31	0.04	0.189
						010	32.28	5.91	0.24	0.03	0.210
						015	32.23	1.65	0.26	0.05	0.239
						020	32.06	0.12	1.69	0.38	1.721
						025	31.00	-0.84	2.59	0.34	3.012
						030	30.90	-1.03	0.47	0.29	0.615
						035	29.66	-1.00	0.57	0.42	0.647
07	12 Aug	1510	70°28.0′	163°26.0′	40	000	30.30	4.82	0.27	0.03	0.172
						005	30.27	4.82	0.26	0.03	0.226
						010	30.32	4.90	0.17	0.32	0.148
						015	no sample	4.81			
						020	30.62	5.01	0.22	0.02	0.128
						025	32.44	-0.85	0.94	0.12	1.034
						030	32.44	-0.09	1.34	0.11	1.573
						040	32.44	-0.13	1.64	0.02	1.412
08	13 Aug	0745	70°34.0′	162°50.0′	27	000	29.34	3.78	0.23	0.04	0.111
						005	29.57	2.95	0.18	0.03	0.129
						010	no sample				
						015	30.74	-0.09	0.25	0.04	0.205

Table 5. (continued)

Sta No	Date (1976) (GMT)	Time (GMT)	Latitude (N)	Longitude (W)	Sonic Depth (m)	Sample Depth (m)	S°/₀₀	Temp. (°C)	Chl a (mg m^{-3})	Phaeo (mg m^{-3})	Primary Prod. (mg C m^{-3}·hr^{-1})
09	14 Aug	1843	71°03.0′	159°17.0′	61	000	29.81	2.08	0.19	0.03	0.082
						005	29.81	1.94	0.17	0.03	0.038
						010	31.73	-1.08	0.20	0.07	0.090
						015	32.67	-1.33	8.00	0.32	4.528
						020	32.79	-1.29	2.71	0.22	1.990
						" 025	32.81	-1.28	3.00	0.17	1.684
						035	32.71	-1.27	2.55	0.17	1.484
						055	32.77	-1.26	2.49	0.30	1.605
10	15 Aug	1843	71°16.0′	157°43.0′	70	000	29.10	2.42	0.24	0.04	0.144
						005	29.42	2.20	0.28	0.03	0.284
						010	30.68	-1.08	0.81	0.18	" 0.942
						015	32.67	-1.24	2.69	0.21	2.022
						020	32.70	-1.26	2.54	0.44	2.954
						025	32.70	-1.25	3.43	0.24	2.762
						045	no sample	-1.33			
						065	32.94	-1.47	3.30	0.14	2.527
11	16 Aug	1538	71°25.5′	156°54.8′	106	000	28.57	3.26	0.37	0.07	0.375
						005	28.76	2.54	0.33	0.05	0.397
						010	28.90	2.26	0.29	0.06	0.394
						015	32.51	-1.38	14.20	0.28	0.955
						025	32.74	-1.32	1.72	0.18	1.557
						050	32.79	-1.38	1.99	0.24	1.742
						075	32.94	-1.51	2.38	0.25	1.697
						100	33.03	-1.58	2.65	0.38	1.912

Table 5. (continued)

Sta No	Date (1976)	Time (GMT)	Latitude (N)	Longitude (W)	Sonic Depth (m)	Sample Depth (m)	S°/₀₀	Temp. (°C)	Chl *a* (mg m^{-3})	Phaeo (mg m^{-3})	Primary Prod. (mgC·m^{-3}·hr^{-1})
12	17 Aug	1545	71°31.5′	156°09.0′	139	000	29.09	3.23	0.31	0.04	0.145
						005	29.06	3.23	0.27	0.02	0.198
						010	29.25	3.46	0.31	0.04	0.163
						015	29.64	2.54	0.54	0.23	0.447
						025	31.88	-0.72	0.56	0.19	0.448
						050	32.67	-1.33	3.10	0.25	2.812
						075	32.69	-1.29	2.90	0.40	1.753
						100	32.74	-1.34	2.60	0.37	1.812
13	18 Aug	1555	71°31.0′	155°05.0′	31	000	15.35	1.03	0.62	0.09	0.359
						005	28.22	2.54	0.49	0.10	0.516
						010	29.44	2.82	0.59	0.13	0.427
						015	29.63	2.53	0.51	0.08	0.544
						020	29.90	2.09	0.54	0.10	0.538
						025	30.56	0.72	0.47	0.10	0.622
14	21 Aug	0100	71°11.0′	153°09.0′	25	000	07.84	1.78	0.29	0.06	0.164
						005	27.72	-0.80	0.81	0.02	0.550
						010	29.67	-0.67	0.18	0.06	0.070
						015	31.29	-0.67	0.15	0.11	0.094
						020	31.46	-0.87	0.12	0.12	0.066
15	24 Aug	0053	70°36.0′	148°12.0′	16	000	10.04	-0.21	0.32	0.03	0.224
						005	28.48	-0.91	5.07	0.18	4.362
						010	28.23	-1.41	5.20	0.08	3.936
						015	30.32	-1.43	5.38	0.14	4.198
16	No hydrographic data										

Table 5. (continued)

Sta No	Date (1976) (GMT)	Time (GMT)	Latitude (N)	Longitude (W)	Sonic Depth (m)	Sample Depth (m)	S°/oo	Temp. (°C)	Chl a (mg m^{-3})	Phaeo (mg m^{-3})	Primary Prod. (mgC m^{-3}·hr^{-1})
17	26 Aug	0518	70°32.0′	147°33.0′	25	000	06.02	-1.34	0.48	0.06	0.194
						005	28.88	-1.56	3.22	0.51	4.334
						010	30.06	-1.48	3.80	0.25	5.979
						015	30.72	-1.54	2.93	0.36	3.400
						020	31.72	0.67	1.64	0.18	1.672
18	26 Aug	1808	70°39.0′	147°37.0′	25	000	05.05	0.33	0.36	0.05	0.094
						005	25.90	-0.84	2.00	0.08	2.364
						010	29.70	-1.56	3.36	0.34	3.947
						015	30.21	-1.60	3.08	0.21	3.366
19A	Salinity at 0 & 20 m only from this station					000	10.75				
						020	31.90				
19B	27 Aug	0900	70°57.0′	149°33.0′	30	000	07.64	0.43	0.43	0.08	0.335
						005	24.63	-1.15	0.71	0.07	0.447
						010	30.01	-1.12	0.38	0.07	0.144
						015	31.44	-1.16	0.23	0.13	0.183
						020	30.43	-1.01	0.32	0.21	0.037
						025	31.62	-1.05	0.20	0.15	0.123
20	28 Aug	2327	71°08.0′	151°19.0′	34	000	19.05	MALF	0.30	0.03	0.098
						005	22.81	0.78	1.76	0.06	0.861
						010	32.25	-1.36	3.90	0.75	2.449
						015	30.73	-0.57	0.50	0.12	0.465
21	30 Aug	0035	71°43.0′	151°47.0′	1700	000	10.18	0.28	0.18	0.03	0.095
						005	25.63	-0.98	0.48	0.10	0.356
						010	28.06	-1.02	0.65	0.02	0.493
						015	29.54	-0.96	0.53	0.04	0.377
						020	30.04	0.54	0.74	0.10	0.718
						025	30.58	0.53	0.63	0.03	0.375

Table 5. (continued)

Sta No	Date (1976) (GMT)	Time (GMT)	Latitude (N)	Longitude (W)	Sonic Depth (m)	Sample Depth (m)	S°/₀₀	Temp. (°C)	Chl a (mg m^{-3})	Phaeo (mg m^{-3})	Primary Prod. (mg C m^{-3}·hr^{-1})
21 (cont.)	29 Aug	2355	71°43.0′	151°47.0′	1700	030	30.85	MALF	0.22	0.03	0.131
						040	31.33	-0.12	0.25	0.10	0.174
						050	32.04	-0.77	0.24	0.18	0.134
						060	32.44	-1.19	0.39	0.26	
						075	32.62	-1.30	0.39	0.25	0.119
						100	32.74	-1.49	0.62	0.20	0.318
	29 Aug	2300				500	no sample	0.33			
						510	34.79	0.34	0.11	0.14	
						700	34.84	0.05	0.35	0.30	
						800	34.84	-0.04	0.09	0.11	
						900	34.85	-0.09	0.19	0.30	
						1000	34.85	-0.18	0.18	0.28	
22	No hydrographic data										
23	31 Aug	0112	71°22.0′	152°20.0′	75	000	15.71	0.54	0.53	0.04	0.232
						005	25.52	1.45	0.67	0.08	0.318
						010	27.43	1.91	0.83	0.06	0.599
						015	28.84	2.67	1.98	0.83	0.756
						020	30.98	0.92	0.41	0.09	0.315
						025	31.25	0.52	0.38	0.11	0.271
						030	24.05	1.33	0.73	0.14	0.363
						040	28.34	2.34	1.00	0.06	0.972
						050	31.10	-0.12	0.36	0.12	0.250
						060	31.59	-0.66	0.27	0.13	0.166
						075	32.22	-0.94	0.77	0.35	0.546

Table 5. (continued)

Sta No	Date (1976) Time (GMT) (GMT)	Latitude (N)	Longitude (W)	Sonic Depth (m)	Sample Depth (m)	S°/₀₀	Temp. (°C)	Chl a (mg m^{-3})	Phaeo (mg m^{-3})	Primary Prod. (mg C m^{-3} ·hr^{-1})
24	31 Aug 1715	71°19.0′	152°32.0′	52	000	17.36	0.27	0.58	0.07	0.233
					005	25.83	1.68	0.75	0.09	0.422
					010	27.87	3.18	0.89	0.12	0.583
					015	28.55	2.78	1.03	0.09	0.767
					020	29.42	2.32	0.74	0.06	0.527
					025	30.09	1.91	0.49	0.05	0.364
					030	30.60	2.05	0.34	0.07	0.217
					045	31.47	-0.30	0.46	0.16	0.206
25	01 Sep 1625	71°08.0′	152°57.0′	22	000	20.47	1.79	0.19	0.03	0.123
					005	26.24	-0.26	0.47	0.07	0.353
					010	28.99	-0.41	2.20	0.60	2.250
					015	30.09	0.30	1.08	0.14	0.734
26	02 Sep 1420	71°23.0′	154°21.0′	30	000	17.40	1.15	0.22	0.03	0.063
					005	25.27	0.19*	0.44	0.08	0.286
					010	27.55	2.95	0.69	0.10	0.380
					015	28.77	2.73	0.62	0.09	0.479
					020	29.15	2.15	0.66	0.09	0.372
					025	29.38	2.13	0.36	0.06	0.168
27	02 Sep 2158	71°36.0′	155°32.0′	171	000	08.35	0.14	1.00	0.20	0.298
					005	25.79	2.31	0.54	0.05	0.315
					010	27.73	2.12	0.46	0.05	0.344
					015	28.48	-0.67	0.53	0.04	0.299
					020	31.05	-1.34	1.28	0.01	1.240
					025	31.92	0.23	0.69	0.12	0.361
					030	32.00	0.19	0.51	0.15	0.334

* One thermometer malfunctioned; this temperature based on only one thermometer.

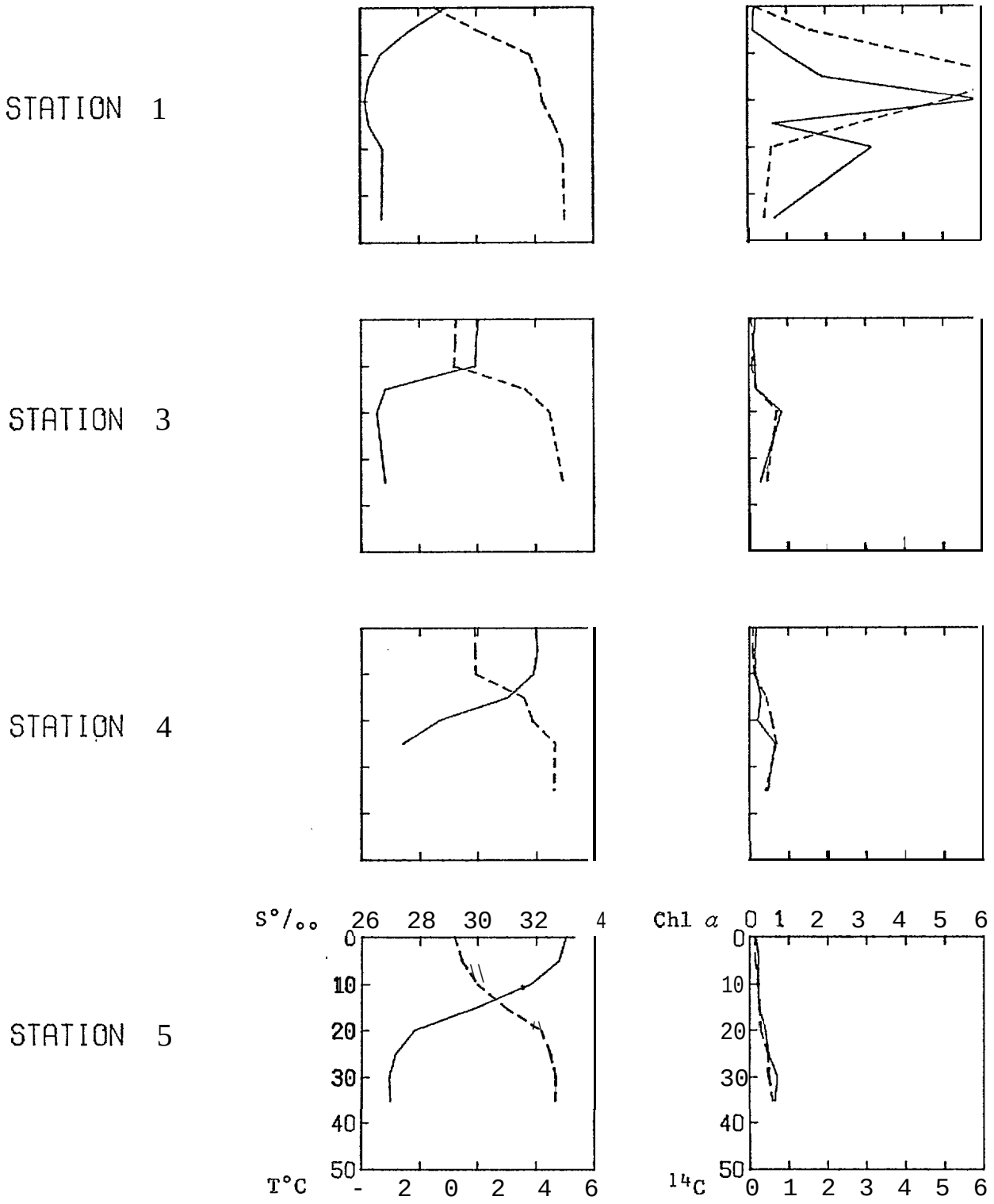


Fig. 4. Depth profiles of temperature-salinity and chlorophyll a-^{14}C assimilation in the Chukchi and Beaufort seas, Aug-Sep 1976. Salinity ---; temperature _; chl a, mg m^{-3} — ; ^{14}C assimilation, mg C m^{-3} . hr^{-1} ----

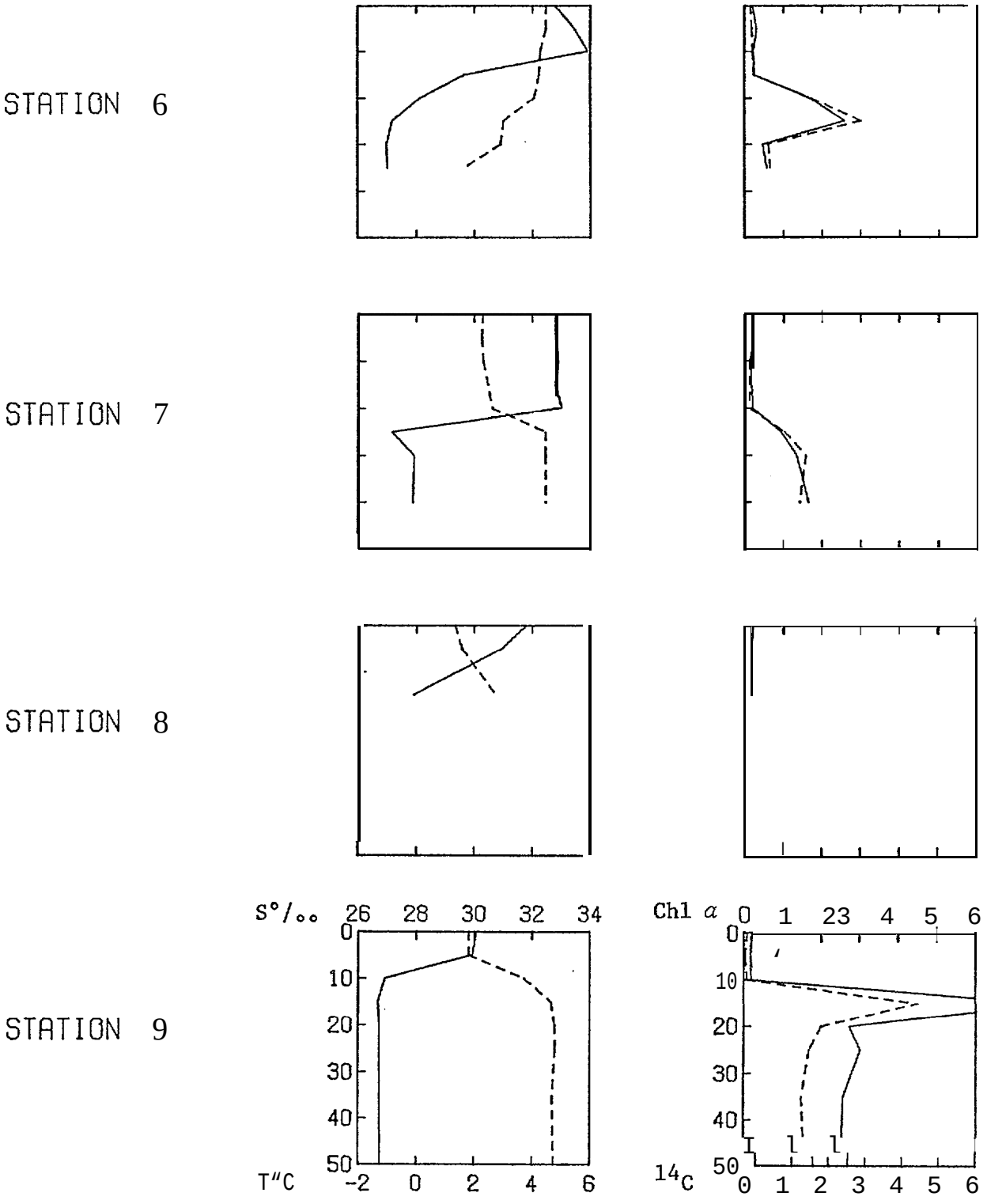
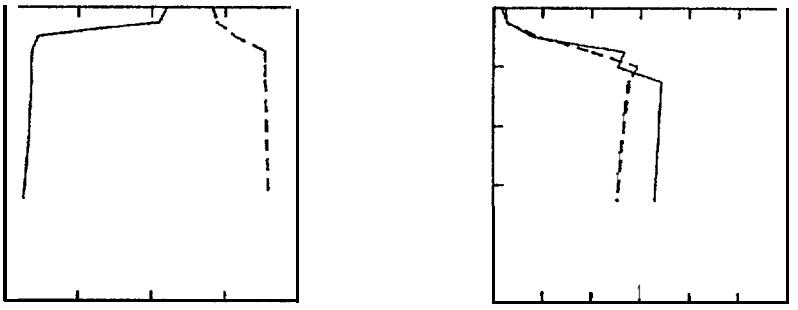


Fig. 4. (continued)

STATION 10



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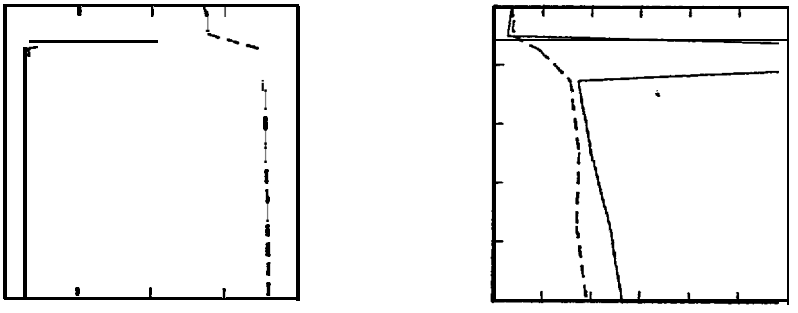

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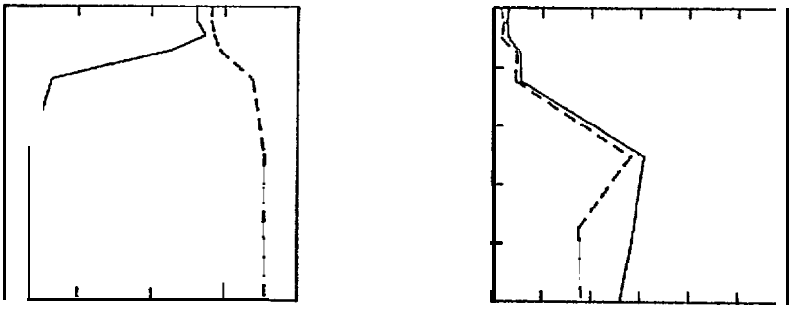

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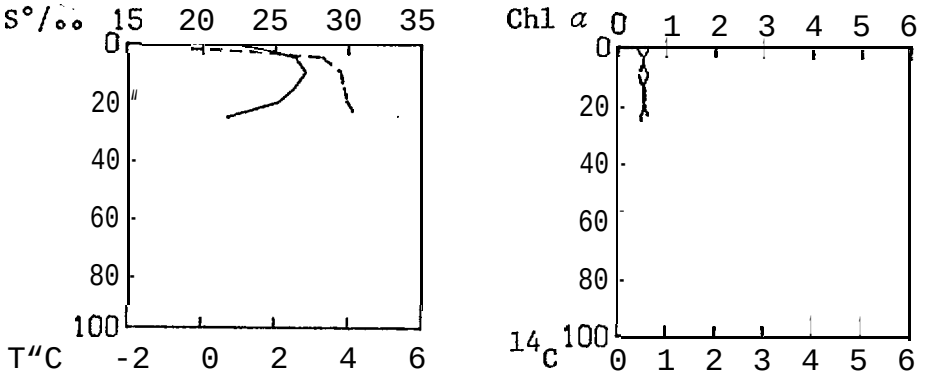


Fig. 4. (continued)

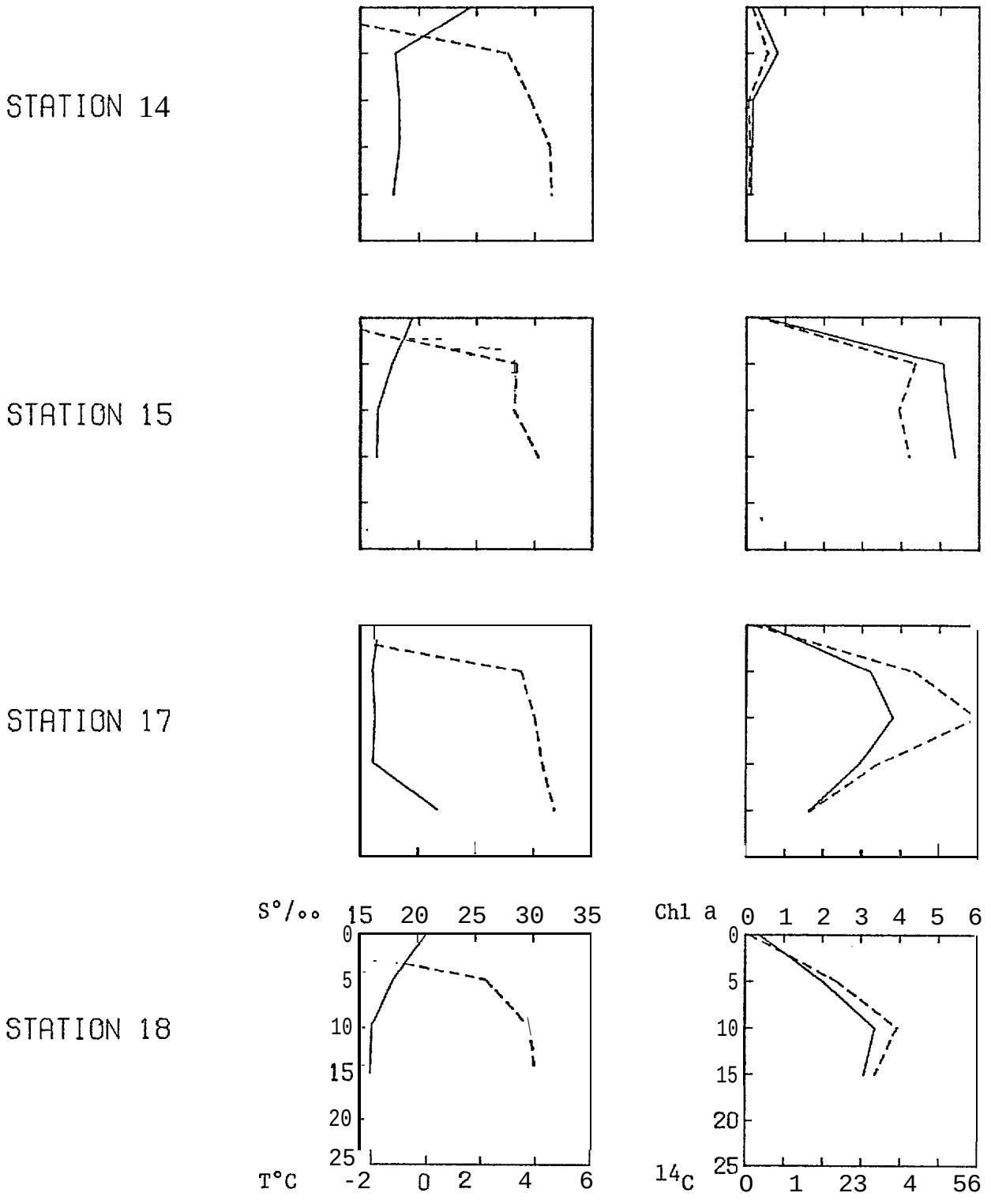
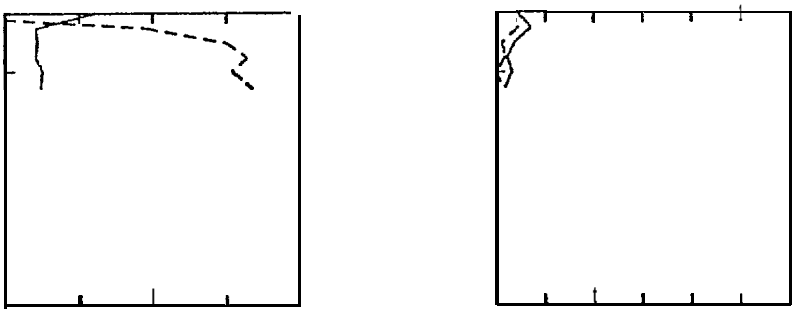
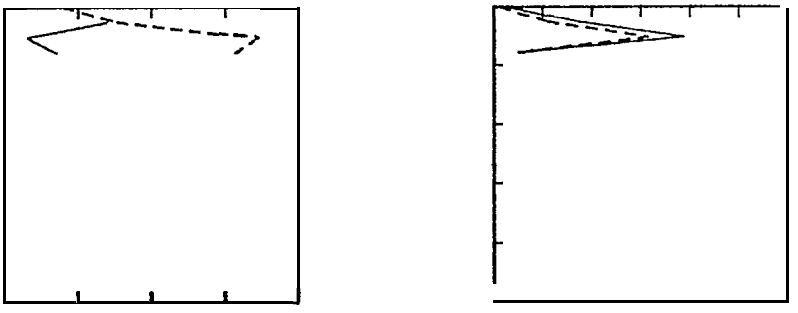


Fig. 4. (continued)

STATION 19



STATION 20



STATION 21

STATION 23

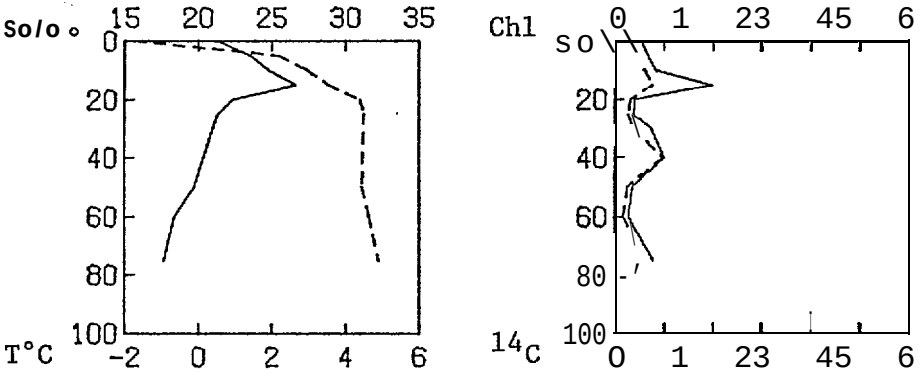


Fig. 4. (continued)

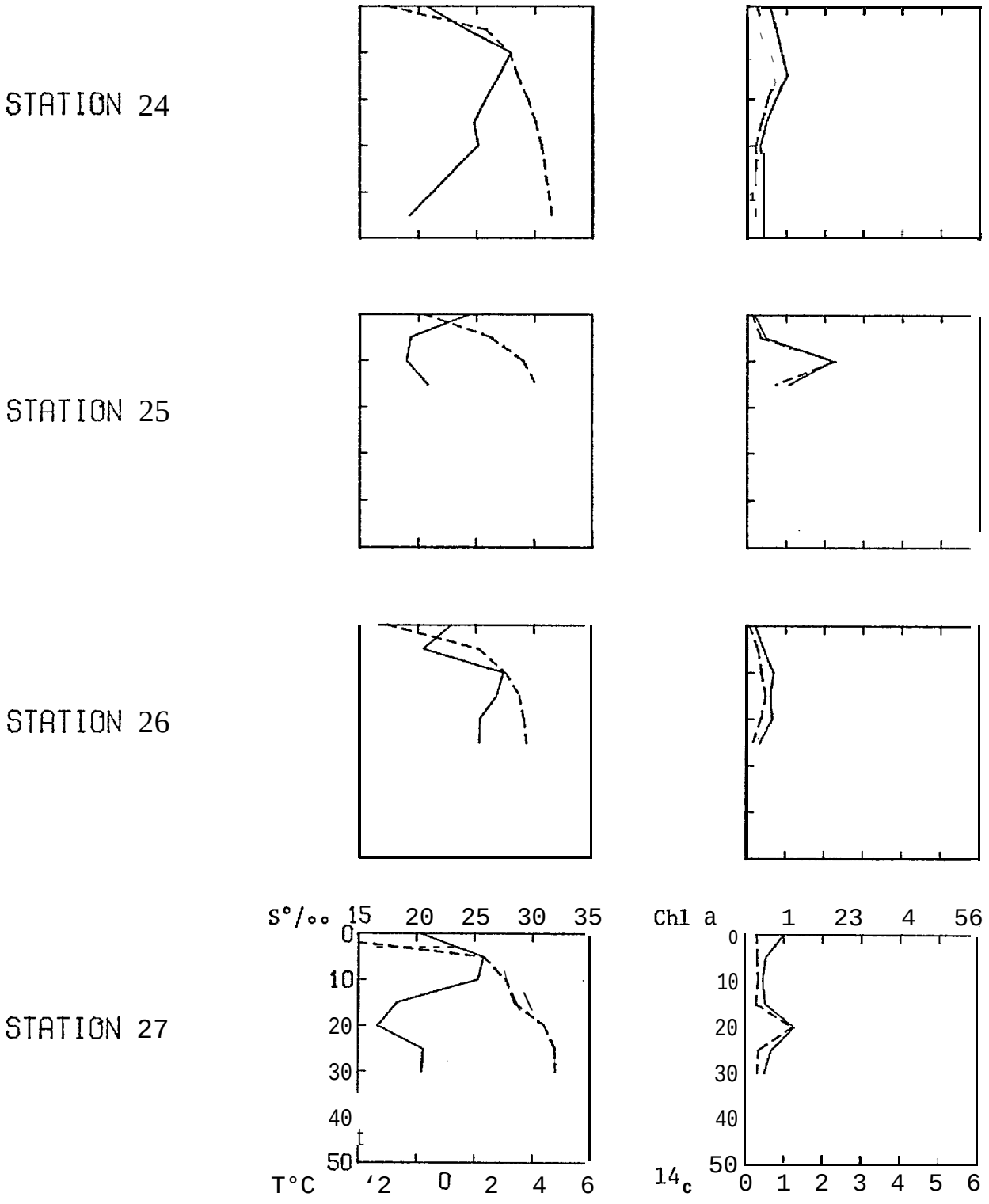


Fig. 4. (continued)

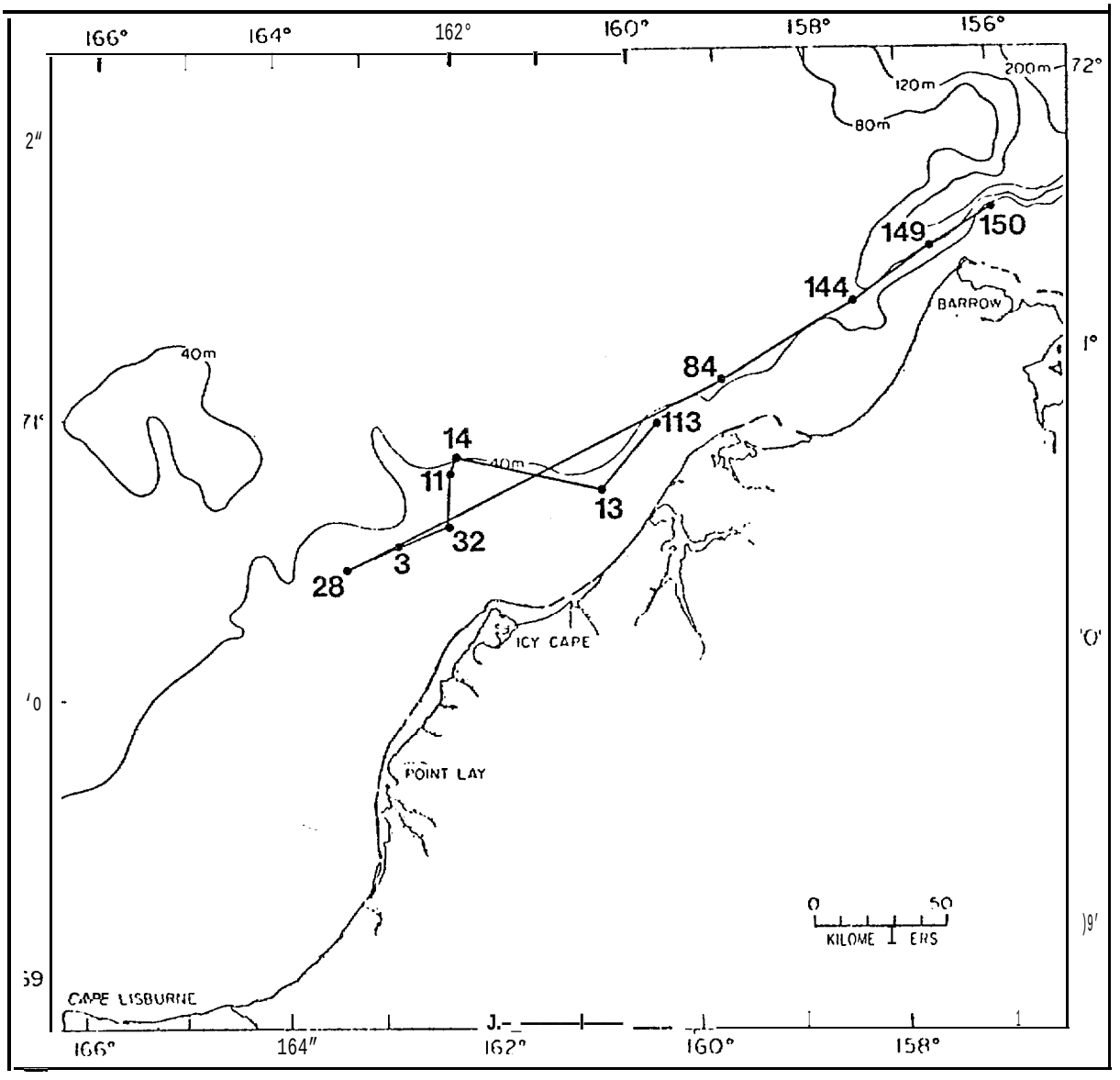


Fig. 5. Integrated ^{14}C uptake (mg C $m^{-2} \cdot hr^{-1}$) , Chukchi Sea stations, Aug 1976.

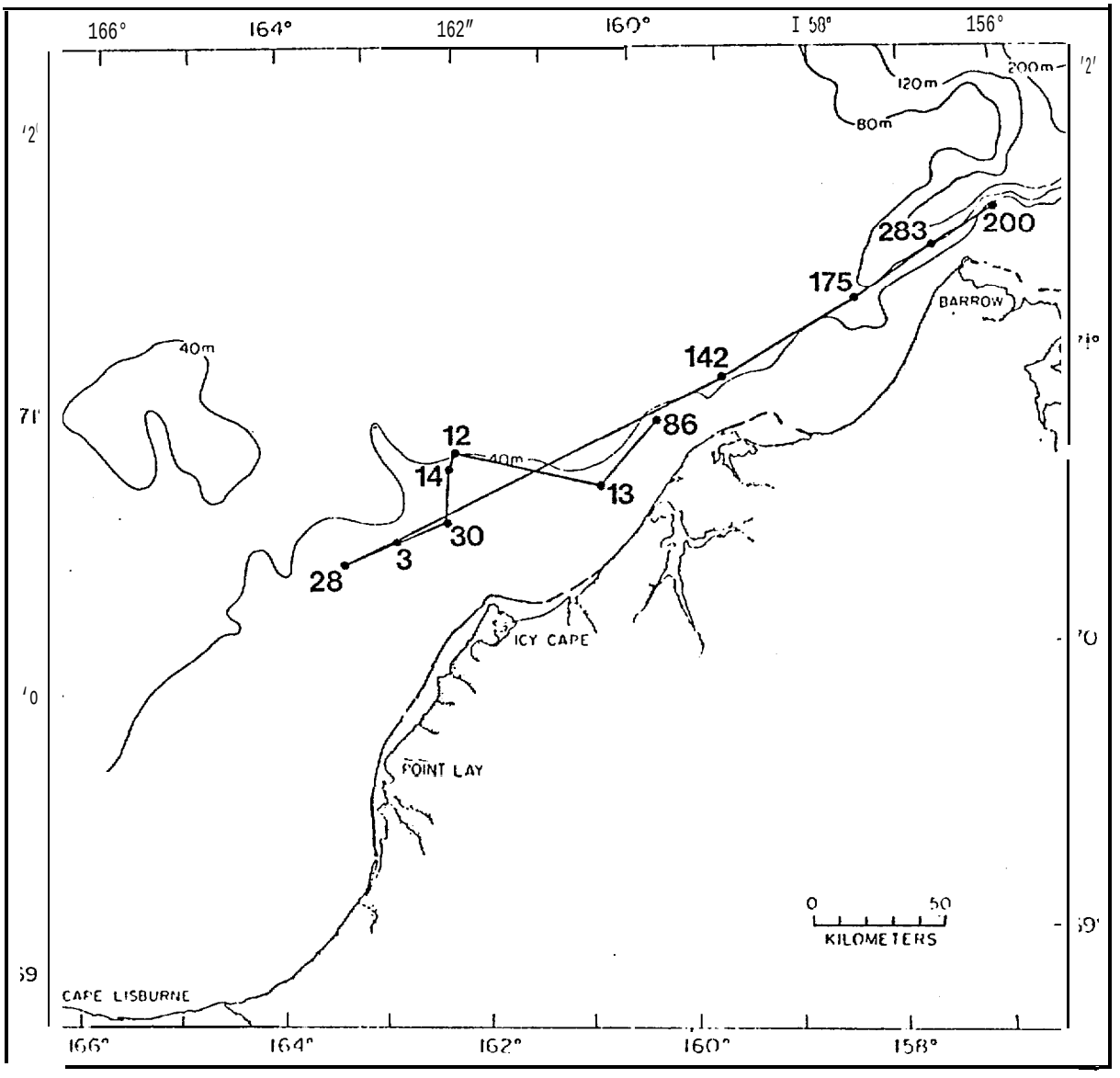


Fig. 6 . Integrated chlorophyll a concentrations (mg m^{-2}) , Chukchi Sea stations, Aug 1976.

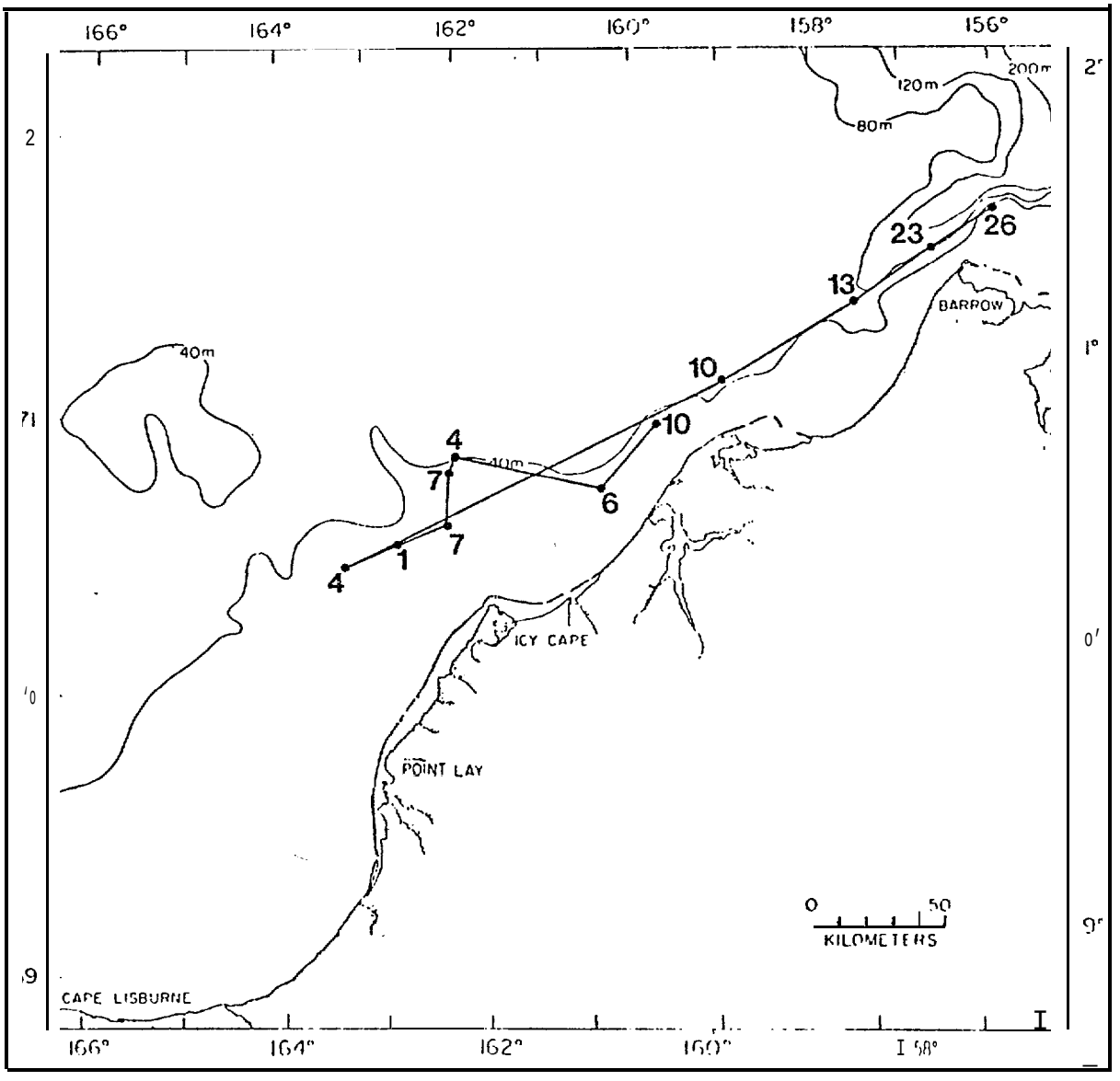


Fig. 7. Integrated phaeophytin concentrations (mg m‘2), Chukchi Sea stations, Aug-Sep 1976.

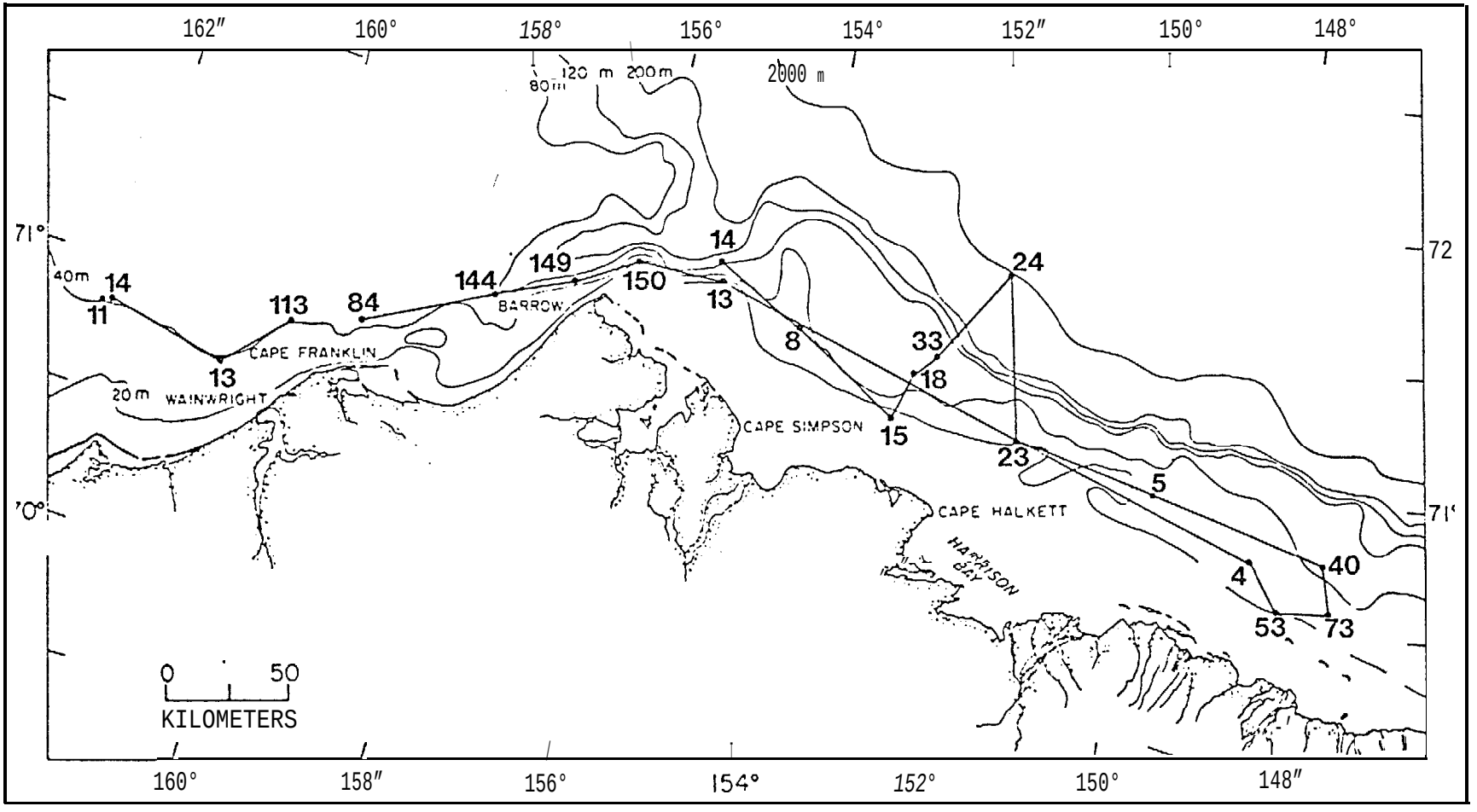


Fig. 8. Integrated ^{14}C uptake (mg C $m^{-2} \cdot hr^{-1}$), Beaufort Sea stations, Aug-Sep 1976.

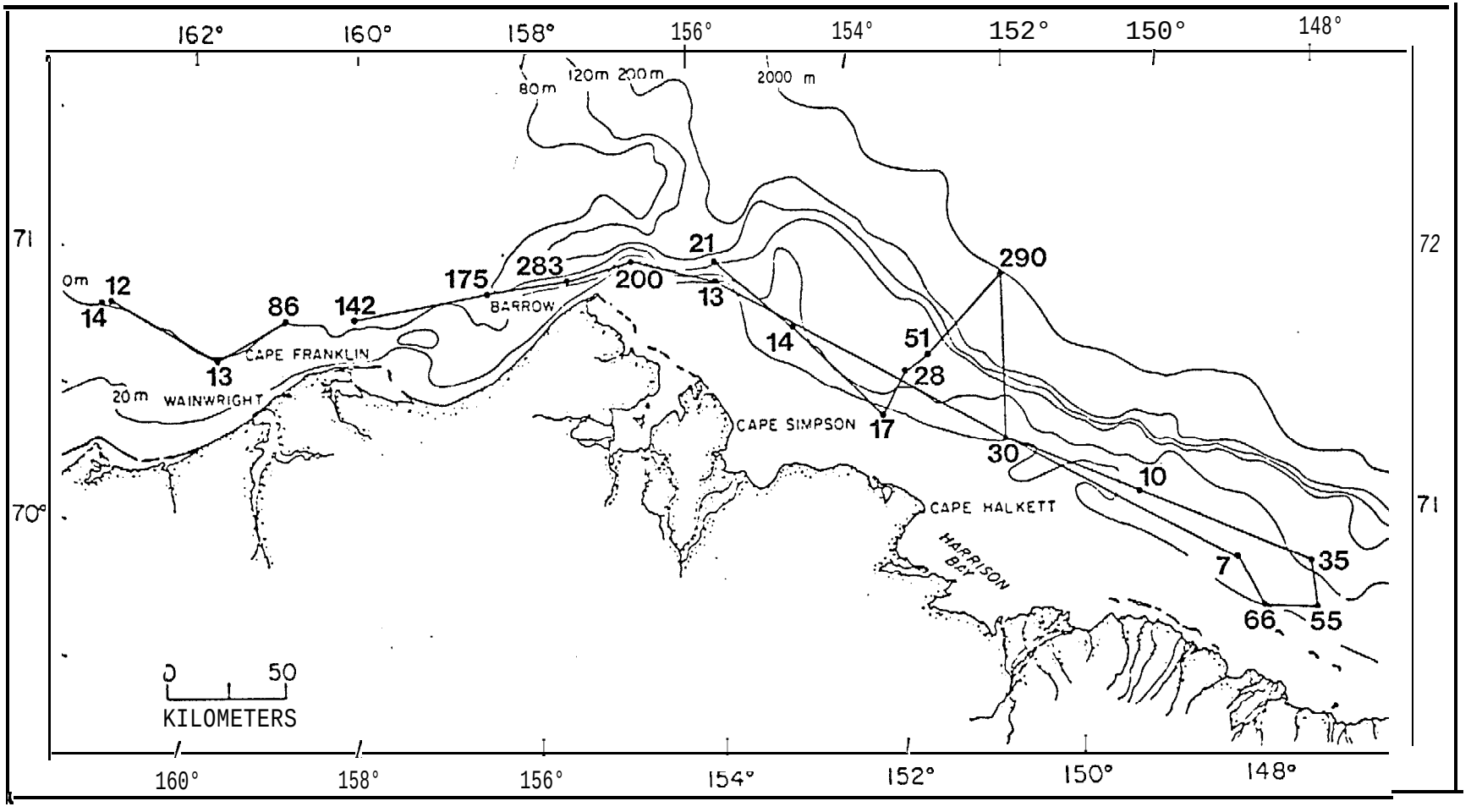


Fig. 9. Integrated chlorophyll a concentrations (mg m^{-2}), Beaufort Sea stations, Aug-Sep 1976.

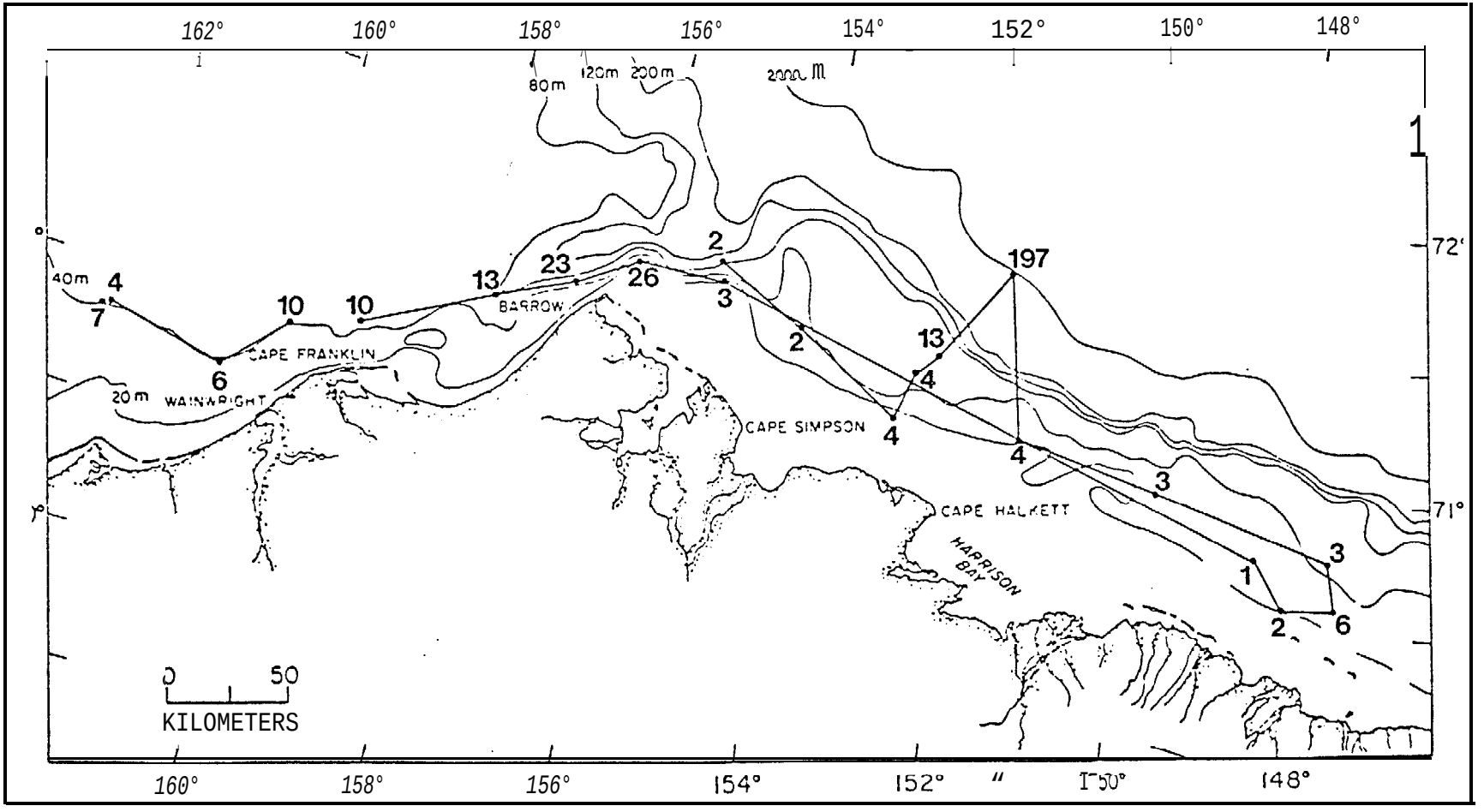


Fig.. 10. Integrated phaeophytin concentrations (mg m^{-2}), Beaufort Sea stations, Aug-Sep 1976.

3. Phytoplankton standing stock

A list of phytoplankton species known to occur in the Beaufort Sea is given in Table 6. Not all of these species were found in the *Glacier*-76 samples, although 75 categories from 6 phyla, including 61 species and 14 other categories including unidentified species and groups of species were present. With the exception of *Leptocylindrus minimus*, all species identified in the *Glacier*-76 samples have previously been reported from the Chukchi and Beaufort seas (Bursa 1963, Homer 1969, Hsiao 1976).

The phytoplankton have been grouped into four major categories based on taxonomic group and abundance in the samples. The percentage of phytoplankton by major category at the depth of greatest carbon uptake at each station is given in Fig. 11 and Table 7. The percentage of phytoplankton by major category by depth for each station is given in Fig. 12 and Table 8. Table 9 lists the number of cells per liter by depth.

Standing stock ranged from *ea. 1.0 x* 10^5 cells $\cdot \ell^{-1}$ at station 14-20 to 5.0 x 10^6 cells $\cdot \ell^{-1}$ at station 15-10. Small flagellates were the most abundant organisms at station 14-20, with ea. 5.0 x 10^4 cells cells $\cdot \ell^{-1}$, while *Chaetoceros* spp., with 4.7 x 10^6 cells $\cdot \ell^{-1}$, was most abundant at station 15-10.

Species of the genus *Chaetoceros* were the most abundant organisms at most stations and were especially numerous below the surface at stations 15, 17, and 18 near Prudhoe Bay. The category *Chaetoceros* spp. includes *Ch. fragilis* Meunier, *Ch. furcellatus*, *Ch. gracilis* Schütt, *Ch. socialis* Lauder, and Cl.. *wighami* Brightwell which were not separated in the cell counts (listed on data cards as *Chaetoceros* spp.), along with *Ch. atlanticus* Cleve, *Ch. compressus* Lauder, *Ch. concavicornis* Mangin, *Ch. debilis* Cleve, *Ch. septentrionalis* Østrup, and several other species present in smaller numbers.

At stations 23 and 24, the diatoms *Nitzschia closterium* and *Leptocylindrus minimus* were most abundant in Bering Sea water.

Small flagellates, mostly < 10 μm in diameter, were generally more abundant at western stations and at the surface at the eastern stations (Fig. 12). Where flagellates were abundant, productivity and chlorophyll a concentrations were low, suggesting that many of the flagellates were probably not photosynthetic.

Dinoflagellates, while never very abundant, ranged from ea. 2.0 x 10^3 to 61.2 x 10^3 cells $\cdot \ell^{-1}$, and were always present. They occurred in larger numbers at stations taken toward the end of August and in early September.

4. Zooplankton standing stock

A list of zooplankton species found in the Beaufort Sea is

Table 6. Preliminary list of phytoplankton species in the Beaufort Sea. This list does not include species that are known primarily from the ice or the benthos.

Bacillariophyta

Amphiprora hyperborea

Bacterosira fragilis

Biddulphia aurita

Chaetoceros atlanticus
borealis
ceratosporum
compresses
concavicornis
danicus
debilis
decipiens
fragilis
furcellatus
gracilis
karianus
radicans
septentrionalis
socialis
subsecundus
teres
wighami

Coscinodiscus centralis
curvatulus
excentricus
oculus-iridis

Coscinosira (Thalassiosira) polychorda

Detonula confervacea

Eucampia zoodiacus

Gomphonema sp.

Leptocylindrus danicus
minimus

Melosira arctica
juergensi
moniliformis

Navicula pelagica
transitans
Spp .

Nitzschia closterium
delicatissima
frigida
grunowii
seriata
spp .

Porosira glacialis

Rhizosolenia alata
hebatata

Skeletonema costatum

Stauroneis granii

Thalassionema nitzschioides

Thalassiosira antarctica
decipiens
gravida
hyalina
nordenskioe ldii
spp .

unidentified diatoms, mostly pennates

Pyrrophyta

Amphidinium cf. *longum*

Ceratium arcticum
longipes

Dinophysis acuta
norvegica
rotundata

Gonyaulax catenata
spinifera
Sp .

Gymnodinium lohmanni
Spp .

Table 6. (continued)

Oxytoxum spp.

Peridinium belgicum
brevipes
conicum
depressum
groenlandicum
minusculum
pallidum
triquetrum
trochoideum
Spp .

Protoceratium reticulatum

unidentified dinoflagellates, mostly athecate

Flagellates

Calycomonas gracilis
ovalis

Craspedomonadaceae

Chroomonas Spp.

Cryptomonas spp.

Dinema litorale

Diaphanoeca grandis

Dinobryon balticum
petiolatum

Ebria tripartite

Eutreptiella braarudii

Monosiga marina

Parvicorbicula socialis

Platymonas spp.

Pterosperma spp.

Unknown organisms

Piropsis polita

Polyasterias problematic

Radiospermum corbiferum

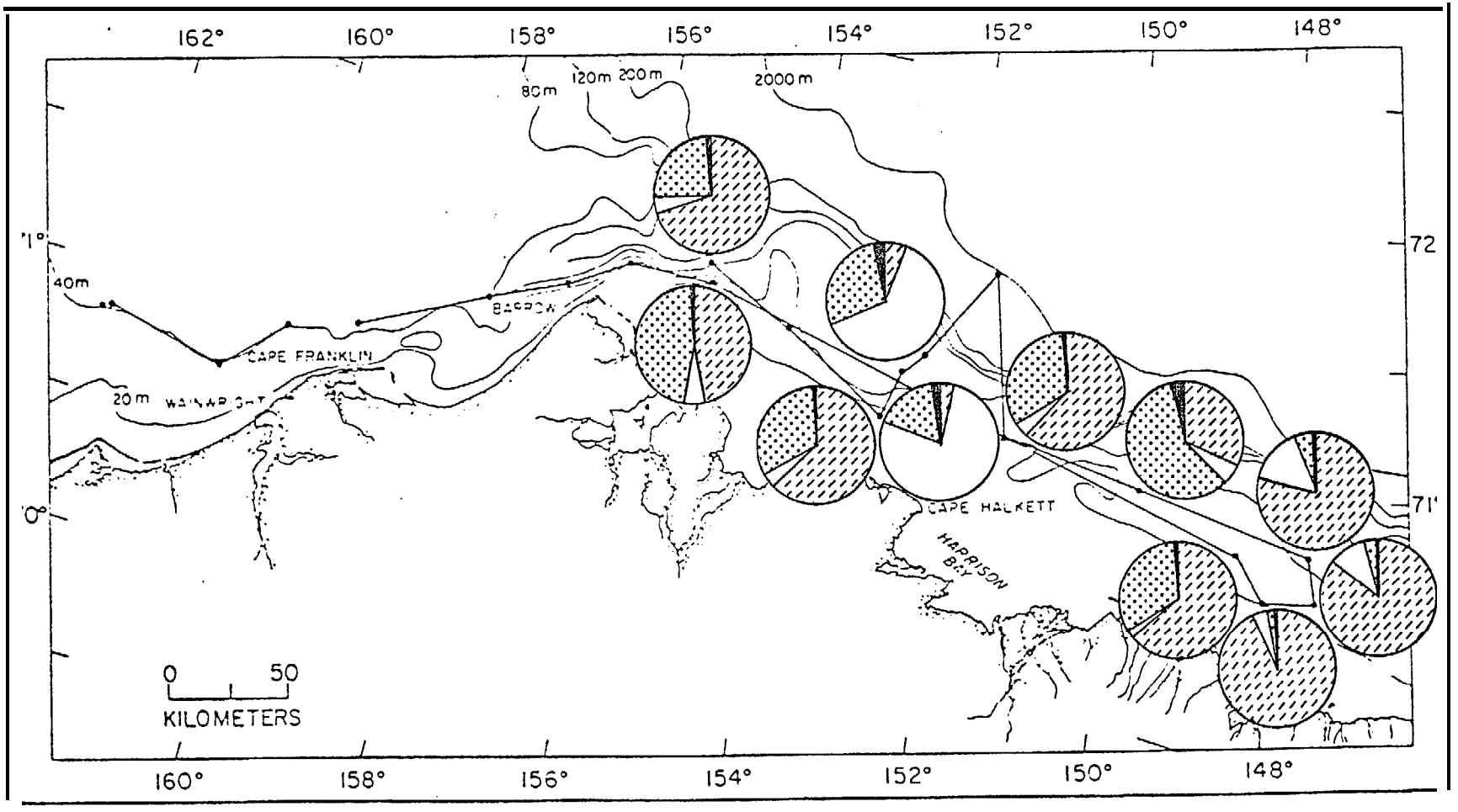


Fig. 11. Per cent *Chaetoceros* species (broken lines), all other diatoms (white), flagellates (stippled), and dinoflagellates (black) at depth of greatest carbon assimilation.

Table 7. Per cent *Chaetoceros* species, all other diatoms, flagellates, and dinoflagellates at depth of greatest carbon uptake

Station Depth \ Category	*Chaetoceros* spp.	All other diatoms	Flagellates	Dinoflagellates
13-20	46	6	46	2
14-05	65	2	33	< 1
15-05	93	4	2	< 1
17-10 "	85	11	4	< 1
18-10	79	15	6	< 1
19-05	32	6	59	4
20-10	62	4	33	< 1
23-15	6	63	28	3
24-15	4	78	16	2
25-10	63	4	32	1
27-10	71	5	24	1

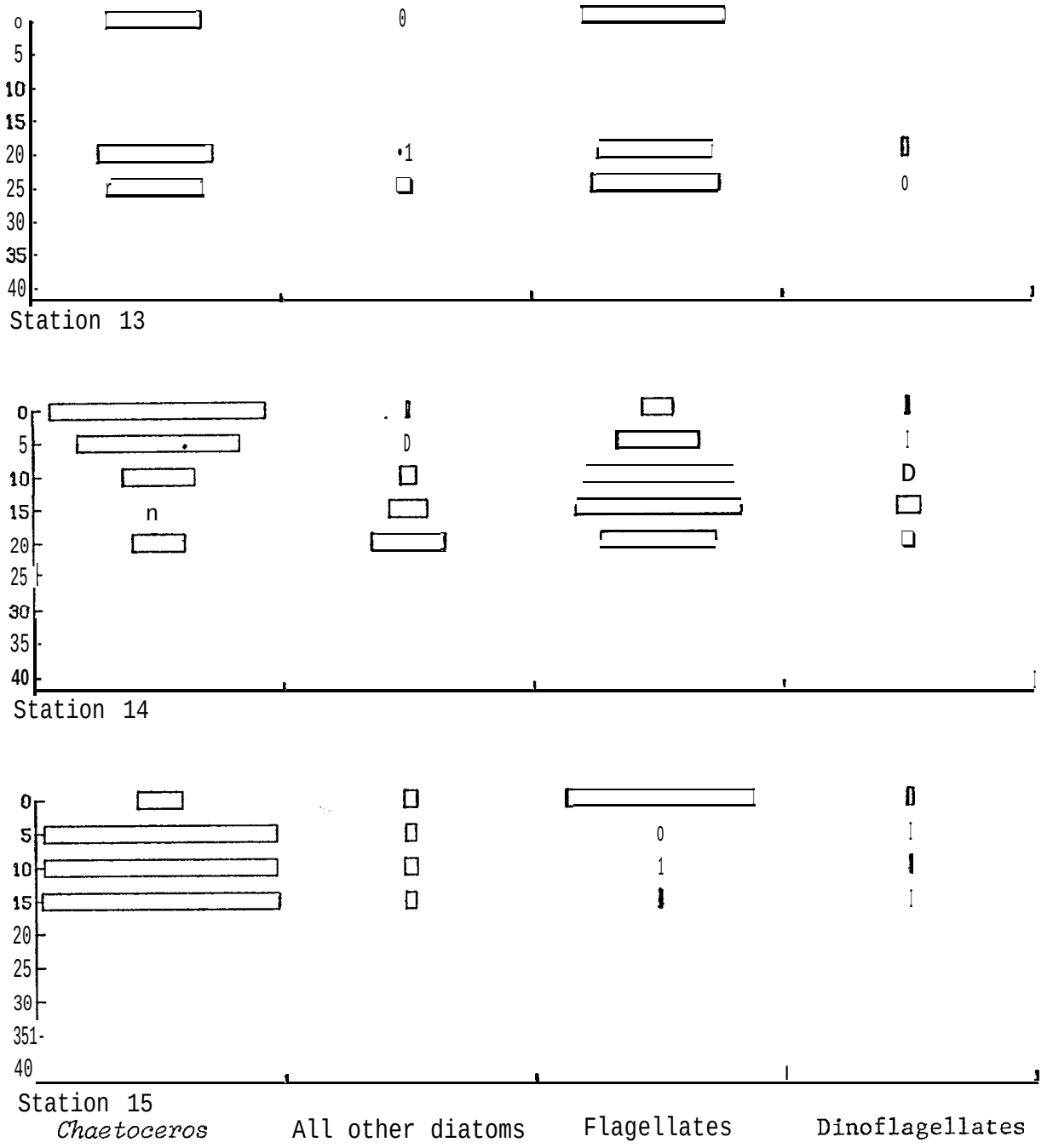


Fig. 12. Percentage of phytoplankton by major category by depth for each station. Blanks indicate depths where samples were not analyzed. Percentages add up to 100% running from left to right across the diagram.

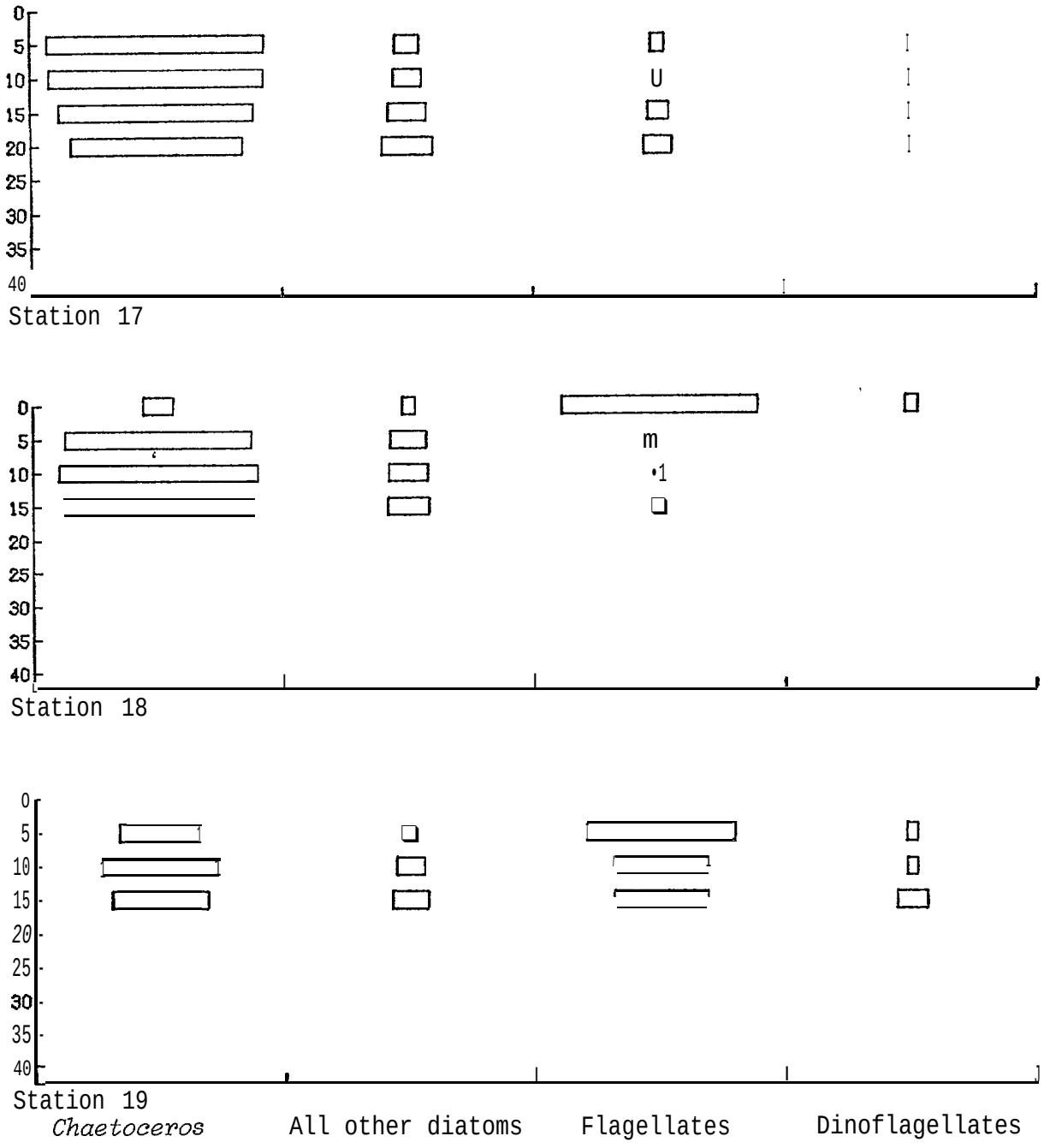


Fig. 12. (continued)

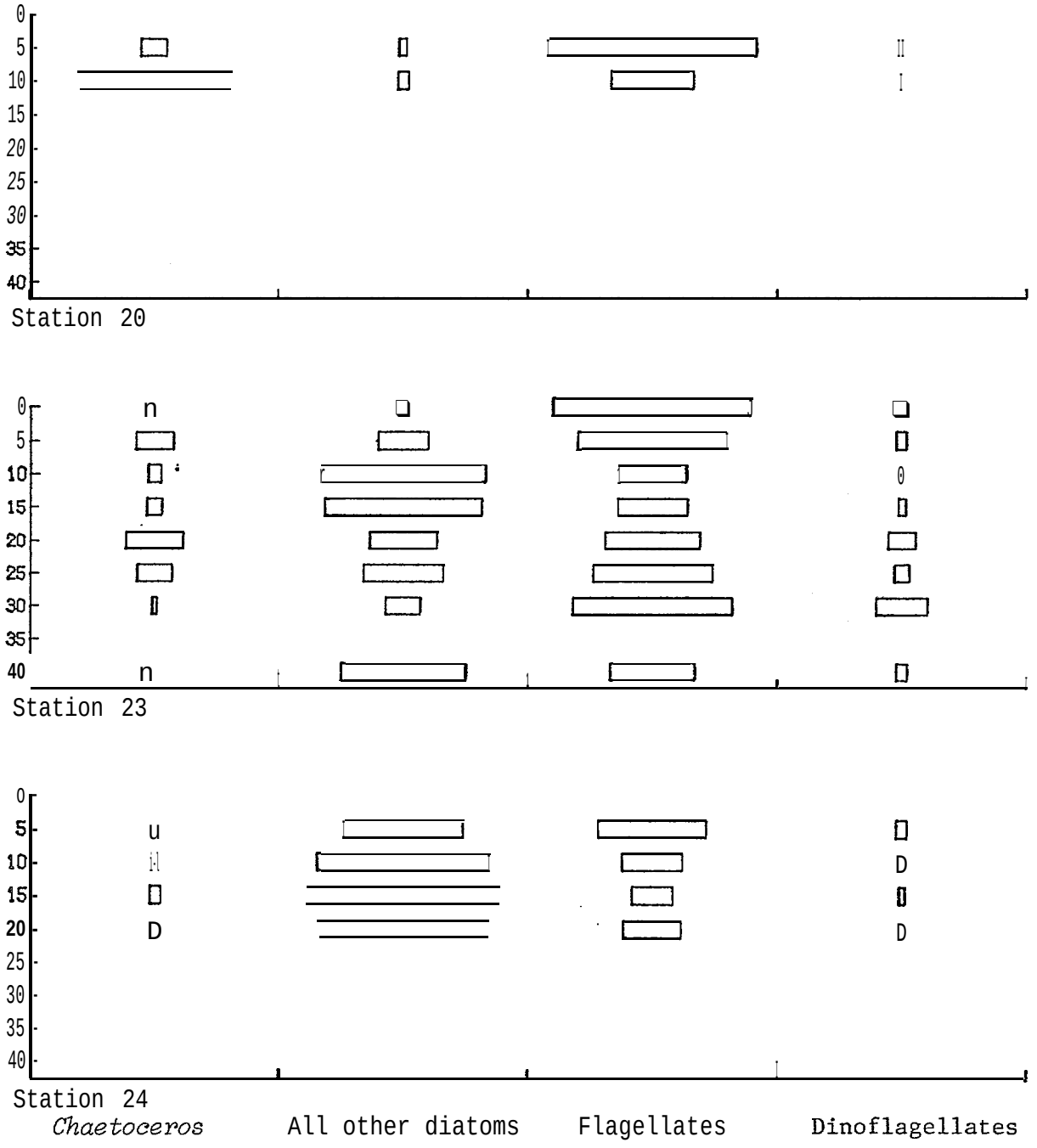


Fig. 12. (continued)

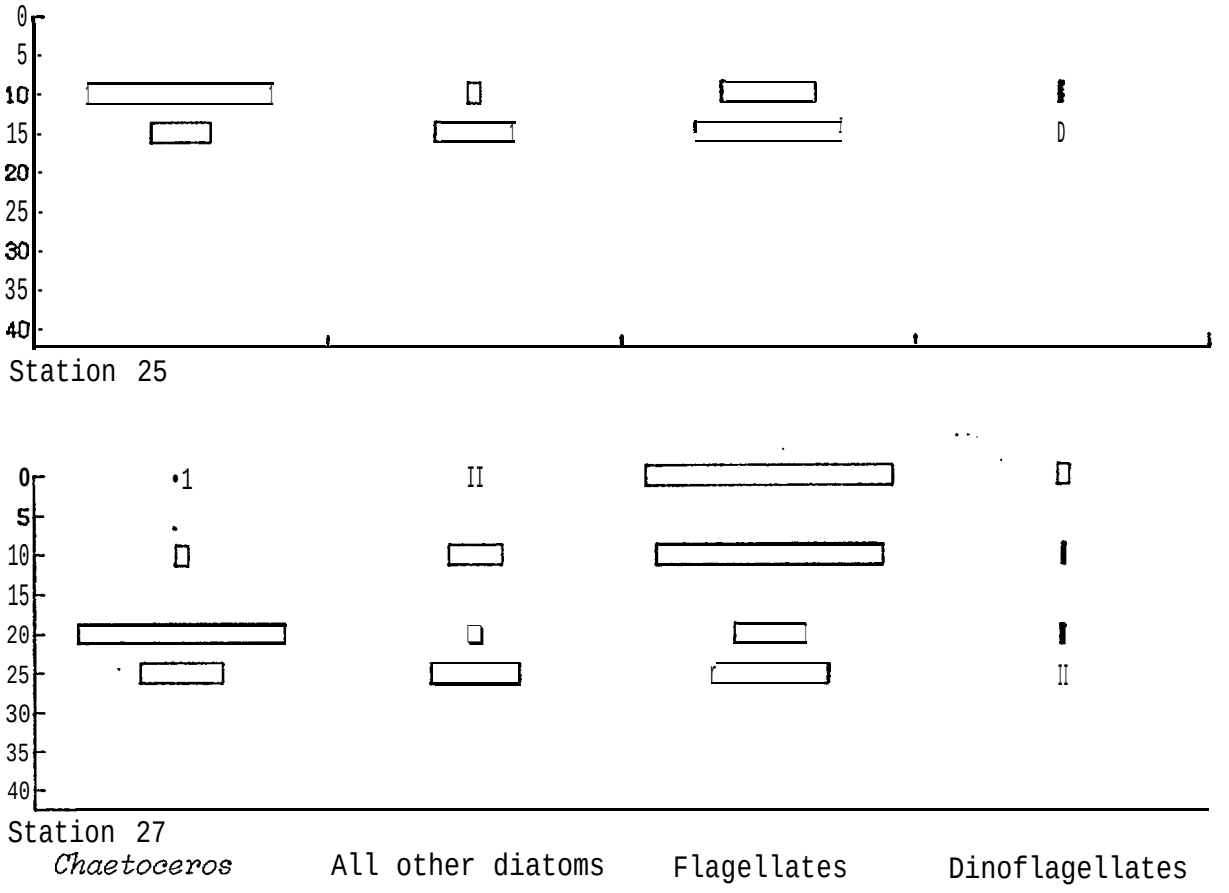


Fig. 12. (continued)

Table 8. Percentage of phytoplankton by major category for the upper 40 m. Where no number is present, the sample was not analyzed.

Station Number	Depth	*Chaetoceros*	All other diatoms	Flagellates	Dino-flagellates
		(Per Cent)			
13	00	38	2	57	2
	05				
	10				
	15				
	20	46	6	46	2
	25	39	7	51	2
14	00	86	1	12	1
	05	65	2	33	< 1
	10	29″	6	60	5
	‘ 15	9	15	66	9
	20	21	29	46	5
15	00	18	5	75	2
	05	93	4	2	< 1
	10	93	5	1	< 1
	15	95	4	1	< 1
17	00				
	05	86	9	5	< 1
	10	85	11	4	< 1
	15	77	15	8	< 1
	20	68	20	11	< 1
18	00	12	5	78	5
	05	74	14	12	< 1
	10	79	15	6	< 1
	15	77	16	6	1
19	00				
	05	32	6	59	4
	10	47	11	38	4
	15	38	14	37	12
	20				
	25				
20	00				
	05	10	3	84	2
	10	62	4	33	< 1
	15				

Table 8. (continued)

Station Number	Depth	*Chaetoceros*	All other diatoms	Flagellates	Dino-flagellates
		(Per Cent)			
23	00	8	8	80	7
	05	15	20	60	4
	10	5	66	27	2
	15	6	63	28	3
	20	23	27	38	11
	25	14	32	48	6
	30	2	14	64	20
	40	12	50	34	4
24	00				
	05	4	48	43	4
	10	3	69	24	4
	15	4	78	16	2
	20	5	69	23	3
	25				
	30				
	45				
25	00				
	05				
	10	63	4	32	
	15	20	27	50	
27	00	7	5	84	
	05				
	10	4	18	77	
	15				
	20	71	5	24	
	25	28	30	40	
	30				

Table 9. Total number of phytoplankton cells by major category for the upper 40 m. Where no number is present, the sample was not analyzed.

Station Number	Depth	*Chaetoceros*	All other diatoms	Flagellates	Dino-flagellates
13	00	467600	23200	698400	26420
	05				
	10				
	15				
	20	105600	13860	105600	3760
	25	57600	10880	75600	3680
14	00	2228600	22200	317400	30920
	05	321000	10160	164000	1960
	10	39000	8000	79000	6560
	15	11200	18400	79200	11200
	20	22400	31200	49600	5680
15	00	153000	40000	618000	16400
	05	4113000	187000	103080	15000
	10	4732000	268240	74160	7160
	15	4680000	193400	45300	6200
17	00				
	05	2824000	284000	169000	2000
	10	3053000	388400	126000	9300
	15	1987000	378900	195000	6000
	20	907000	265400	150000	4000
18	00	101000	37000	636200	43000
	05	2257000	425300	356000	7200
	10	3162000	611200	227000	12400
	15	2917000	616500	234000	19000
19	00				
	05	159000	29000	295000	17900
	10	87000	20300	71000	8300
	15	51000	18400	50000	16000
	20				
	25				
20	00				
	05				
	10	87000	20300	71000	8300
	15	51000	18400	50000	16000

Table 9. (continued)

Station Number	Depth	*Chaetoceros*	All other diatoms	Flagellates	Dino-flagellates
23	00	55000	32000	528000	47600
	05	86000	113200	337000	23700
	10	38000	505700	207000	16500
	15	55000	610900	272000	29400
	20	99000	117200	162000	49000
	25	49000	117000	173000	23500
	30	5000	44000	194000	61200
	40	57000	235000	158000	17300
24	00				
	05	22000	244100	217000	22500
	10	16000	326200	114000	17800
	15	37000	713400	151000	18600
	20	25000	350100	116000	14500
	25				
	30				
	45				
25	00				
	05				
	10	1175000	75400	594000	14400
	15	62000	83700	154000	6300
27	00	125000	80000	1437000	68300
	05				
	10	39000	178400	781000	13700
	15				
	20	1132000	73800	383000	16800
	25	143000	151400	203000	13700
	30				

given in Table 10. Sixty-one categories of zooplankton were identified from 12 stations, representing 8 phyla, 42 species, and 19 other categories including larval stages and categories where identification was made to order, suborder or family (Tables 11 to 16). Abundance of all zooplankton at each station collected in vertical ring net hauls is given in Fig. 13. The percentages of copepods, barnacle larvae, and all other zooplankton collected in vertical ring net hauls are given in Figs. 14 and 15. Presence or abundance by species or taxonomic category found at each station is given in Figs. 16 to 39.

Maximum abundances of total zooplankton occurred at stations 13 and 26, while minimum abundances were found at stations 14 and 15 for 20 - 0 m and 10 - 0 m hauls. Barnacle larvae comprised the largest percentage of zooplankton at stations with maximum abundances and copepods comprised the largest percentage of zooplankton at stations with minimum abundances.

Results for each taxonomic category are given in alphabetical order under major taxonomic categories.

COPEPODA

Twenty-four species of copepods were found, including two unidentified calanoid species, one unidentified cyclopoid species, and two unidentified harpacticoid species. Four species showed a widespread distribution; three of these occurred at all 12 stations. The occurrence of other species was primarily dependent upon hydrographic conditions and depth of sampling. Included among these are four characteristically deep-water species, three neritic species associated with lower salinity, three species characteristically found in larger numbers offshore, five expatriate species from the south, and one species previously undescribed in the area.

Acartia spp.

Two species, *Acartia longiremis* (Lilljeborg) and *Acartia clausi* Giesbrecht have been reported in the plankton off Pt. Barrow (Redburn 1974). However, juveniles of these two species were not easily distinguishable and therefore have been grouped together as *Acartia* spp. Juveniles were present as stage IV and V copepodites of *Acartia* spp. Only adult female *A. longiremis* were found in our samples.

Acartia spp. showed a widespread distribution occurring at 8 stations, but absent from the eastern-most stations (Fig. 16). Maximum abundances occurred at station 21 (326/m^2) and station 13 (290/m^2) for 20 - 0 m and 10 - 0 m vertical net hauls. *Acartia longiremis* is a widespread species characteristic of neritic surface waters; *A. clausi* is characteristic of warmer surface water and probably occurs in the Beaufort Sea as an expatriate from the south. *Acartia* spp. was taken from hauls as deep as 50 m at station 24.

Table 10. Zooplankton found in Beaufort Sea samples collected from 18 Aug to 2 Sep 1976.

COPEPODA

Calanoida

Acartia longiremis
Acartia clausi
Calanus cristatus
Calanus glacialis
Calanus hyperboreus
Calanus plumchrus
Centropages abdominalis
Derjuginia tolli
Eucalanus bungii bungii
Euchaeta glacialis
Eurytemora richingsi
Limnocalanus grimaldii
Metridia longs
Microcalanus pygmaeus
Pseudocalanus minutus
Pseudocalanus major
Pseudocalanus sp.
Scaphocalanus magnus
unidentified Calanoida

Cyclopoida

Oithona similis
Oncaea borealis
unidentified Cyclopoida

Harpacticoida

unidentified Harpacticoida

Copepod nauplii

CIRRIPEDIA

Balanus spp. nauplii
Balanus spp. cypris

EUPHAUSIACEA

Thysanoessa inermis
Thysanoessa longipes
Thysanoessa raschii
Thysanoessa spp. larvae

OSTRACODA

Conchoecia borealis maxima
Philomedes globosus

CLADOCERA

unidentified Cladocera

MYSIDACEA

Mysis litoralis
Mysis oculata
unidentified larvae

DECAPODA

Anomura

unidentified zoea

Brachyura

Chionoecetes opilio zoea
unidentified zoea

Caridea

unidentified larvae

AMPHIPODA

unidentified Gammaridea
unidentified Hyperiidea

POLYCHAETA

pelagic larvae

APPENDICULARIA

Fritellaria borealis
Oikopleura spp.

CHAETOGNATHA

Sagitta elegans

Table 10. (continued)

CNIDARIA

Hydrozoa

Aeginopsis laurentii
Aglantha digitale
Bougainvillia superciliaris
Corymorpha flammea
Perigonimus yoldia-arcticae
Plotocnide borealis
Rathkea octopunctata
unidentified Hydrozoa

Scyphozoa

Cyanea capillata

CTENOPHORA

Beroe cucumis
unidentified Ctenophora

PTEROPODA

Spiratella helicina

ECHINODERMATA

Unidentified larvae

PISCES

Boreogadus saida
Lumpenus sp.
unidentified Cyclopteridae
unidentified Gadidae

Table 11. Abundances of zooplankton collected in 0.75 m ring net hauls from 10-0 m. Quantities are abundance m^2.

Taxon	Station Numbers											
	13	14	15	17	18	19B	20	21	23	24	25	26
Copepoda												
Acartia spp.	290	9	.[1]	.	.	36	18	108	72	145	36	.
Calanus cristatus	.	.	.	.	.	.	.	.	.	.	.	.
Calanus glacialis	P[2]	398	P	154	145	1557	652	905	P	72	597	P
Calanus hyperboreus	.	.	.	45	54	36	18	36	.	.	36	.
Calanus plumchrus	.	.	.		.	.	.	.	.	.	.	.
Centropages abdominalis	.	.	.		.	.	.	.	.	.	.	.
Derjuginia tolli	.	.	109		.	.	.	.	.	.	.	.
Eucalanus bungii bungii	.	.	.	.	.	.	.	.	.	.	.	.
Euchaeta glacialis	.	.	.		.	.	.	.	.	.	.	.
Eurytemora richingsi	.	.	.	.	.	.	.	.	.	.	.	.
Limnocalanus grimaldii	.	9	.	9	1303	18	.	36	.	.	.	.
Metridia longs	.	.	.	18	.	.	.	.	.	.	.	.
Microcalanus pygmaeus	.	.	P	615	18	.	.	.	.	.	.	.
Oithona similis	1086	P	54	552	145	P	18	181	217	217	145	72
Oncaea borealis	.	.	.	.	.	.	.	.	.	.	.	.
Pseudocalanus spp.	72	380	1846	1339	1050	2534	923	1376	145	290	434	72
Scaphocalanus magnus	.	.	.		.	.	.	.	.	.	.	.
unidentified calanoida	.	.	253	.	36	36	.	.	72	.	.	.
unidentified cyclopoida	.	.	18	9	.	.	.	.	.	.	.	.
unidentified Harpacticoida	72	18	18	.	54	36	36	36	72	.	36	.
miscellaneous nauplii	1086	54	.	127	145	1285	398	1050	72	507	289	145
Cirripedia												
Balanus spp. nauplii	13032	588	109	.	P	235	1448	6154	11005	5502	4109	12887
Balanus spp. cyprids	1375	706	36	.	.	163	851	253	2606	2679	832	9412

[1] Not observed in sample
[2] P indicates present in sample but not subsample

Table 11. (continued)

Taxon	Station Numbers											
	13	14	15	17	18	19B	20	21	23	24	25	26
Euphausiacea												
Thysanoessa inermis	•	•	•	•	•	•	•	•	•	•	•	•
Thysanoessa longipes	•	•	•	•	•	•	•	•	•	•	•	•
Thysanoessa raschii	•	•	•	•	•	•	•	•	•	•	•	•
Thysanoessa spp. larvae	•	•	•	•	•	•	•	2	2	•	2	•
Ostracoda												
Conchoecia borealis maxima	•	•	•	•	•	•	•	•	•	•	•	•
Philomedes globosus	•	•	•	•	•	•	•	•	•	•	•	•
Cladocera												
unidentified Polyphemidae	•	•	•	•		•	•	•	•	•	•	•
Mysidacea												
Mysis litoralis	•	•	•	•	•	•	•	•	•	•	•	•
Mysis oculata	•	•	•	•	•	•	•	•	•	•	•	•
unidentified larvae	•	•	•	•	•	•	•	•	•	•	•	•
Decapoda												
Anomuran zoea	9	5	•	•	•	2	2	•	•	•	5	•
Brachyuran zoea	23	5	2	•	•	2	9	2	•	13	9	7
Caridea larvae	9	2	•	2	•	•	11	•	•	•	5	*
Amphipoda												
Gammaridea	•	11	7	2	2	20	27	2	5	2	13	2
Hyperiidea	•	•	•	•	•	•	•	•	•	•	•	•

Table 11. (continued)

Taxon	Station Numbers											
	13	14	15	17	18	19B	20	21	23	24	25	26
Polychaeta												
pelagic larvae	1376	624	36	45	18	1701	1701	1376	1882	2751	1792	9774
Appendicularia												
Fritellaria borealis	1810	36	.	308	796	941	742	2425	579	217	814	724
Oikopleura spp.	290	308	.	9	36	344	778	290	362	217	1068	724
Chaetognatha												
Sagitta elegans	217	145	.	.	.	145	724	1412	1158	579	1285	796
Hydrozoa												
Aeginopsis laurentii	.	.	.	.	2	.	.	.	.	.	.	.
Aglantha digitale	145	45	.	.	.	90	2	P	1231	4489	253	10932
Bougainvillea supercili-aris	.	.	.	.	.	.	.	.	.	.	.	.
Corymorpha flammea	.	.	.	.	.	.	.	.	.	.	.	.
Perigonimus yoldia-arcticae	.	2	.	.	.	5	45	.	.	.	.	.
Plotocnide borealis		.	.	.	.	2	.	.	.	.	.	.
Rathkea octopunctata	.	18	.	.	.	18	18	.	145	72	.	145
unidentified Hydrozoa	145	2	.	.	.	.	9	.	.	.	.	.
Scyphozoa												
Cyanea capillata	2	.	.	.	.	.	.	5	2	7	2	2
Ctenophora												
Beroe cucumis	.	9	.	.	.	5	P	.	.	.	.	.
unidentified Ctenophora	.	.	.	.	.	.	.	.	.	.	.	.

Table 11. (continued)

Taxon	Station Number											
	13	14	15	17	18	19B	20	21	23	24	25	26
Mollusca												
Spiratella helicina	2	9	.	136	.	.	18	72	2	P	18	P
Lamellibranch larvae	.	.	.	.	.	.	.	36	.	72	.	.
Gastropod veligers	.	.	.	.	.	.	.	.	.	.	54	145
Echinodermata												
unidentified larvae	.	18	.	9	163	36	145	72	.	.	90	
Pisces												
Boreogadus saida	.	.	.	.	.	.	.	.	2	.	.	2
Lumpenus sp.	.	.	.	.	.	.	.	.	.	.	.	.
unidentified Cyclopteridae	.	.	.	.	.	.	.	.	.	.	.	.
unidentified Gadidae	.	.	.	.	.	.	.	.	.	.	.	.
TOTAL	21041	3401	2488	3379	3967	9247	8553	15829	19631	17831	11924	45841

Table 12. Abundances of zooplankton collected in 0.75 m ring net hauls from 20-10 m. Quantities are abundance m^2.

Taxon	Station Number											
	13	14	15	17	18	19B	20	21	23	24	25	26
Copepoda												
Acartia spp.	290	18	–[1]	.[2]	.	72	.	326	217	.	.	
Calanus cristatus	.	.	–	.	.		.	.	.	.	.	.
Calanus glacialis	145	597	–	181	507	485i	1013	1158	579	P[3]	724	72
Calanus hyperboreus	.	.	–	253	290	145	36	145	.	.	145	.
Calanus plumchrus	.	.	–	.			.		.	.	.	.
Centropages abdominalis	.	.	–	.		.	.	.	.	145	.	.
Derjuginia tolli	.	36	–	.	.	.	72	36	.	.	.	.
Eucalanus bungii bungii	.	.	–	.	.		.	.	.	.	.	.
Euchaeta glacialis	.	.	–	36	.		.	.	.	.	.	.
Eurytemora richingsi	.		–	.	.	.	.	.	.	.	.	.
Limnocalanus grimaldii	.	.	–	.	1557	72	.	.	.	.	.	
Metridia longs	.	.	–	145	72	.	.	.	.	.	.	
Microcalanus pygmaeus	.	.	–	3946	471	.	.	.	.	.	.	.
Oithona similis	9846	.	–	1194	72	72	P	2498	652	145	1303	652
Oncaea borealis	.	.	–	.	.	.	.	.	.	.	.	.
Pseudocalanus spp.	2172	2244	–	6190	4090	11946	2027	1665	1158	145	1701	217
Scaphocalanus magnus	.	.	–	.	.	.	.	.	.	.	.	.
unidentified Calanoida	.	.	–	.	290	72	.	.	.	.	36	72
unidentified Cyclopoida	.	.	–	2			.	.	.	.	.	.
unidentified Harpacticoida	290	.	–	.	.	.	72	181	290	434	72	217
miscellaneous nauplii	6805	18	–	145	398	3620	507	1376	579	579	615	434
Cirripedia												
Balanus spp. nauplii	24036	1140	–	36	109	217	1014	8362	14624	18534	2896	13176
Balanus spp. cyprids	5937	1267	–	.	.	290	1158	941	6009	6950	1303	7964

[1] No 20-0 m haul taken
[2] Not observed in sample
[3] P indicates present in sample but not subsample

Table 12. (continued)

Taxon	Station Number											
	13	14	15	17	18	19B	20	21	23	24	25	26
Euphausiacea												
Thysanoessa inermis	•	•		2	•	•	2	•	•	•	2	
Thysanoessa longipes	•	•		•	•	•	•	•	•	•	•	
Thysanoessa raschii	•	•		•	•	•	•	•	•	•	•	•
Thysanoessa spp. larvae	•	•		•	•	•	•	•	5	•	•	2
Ostracoda												
Conchoecia borealis maxima	•	•		•	•	•	•	•	•	•	•	•
Philomedes globosus	•	•		•	•	•	•	•	2	•	•	•
Cladocera												
unidentified Polyphemidae	•	•		•	•	•	•	•	•	•	2	•
Mysidacea												
Mysis litoralis	•	•		•	•	•	•	•	•	•	•	•
Mysis oculata	•	•		•	•	•	•	•	•	•	•	•
unidentified larvae	•	•		•	•	•	2	5	•	•	•	•
Decapoda												
Anomuran zoea	29	2	–	•	•	7	2	2	2	7	18	9
Brachyuran zoea	45	2	–	•	2	•	•	9	•	27	23	36
Caridea larvae	50	5	-	9	5	2	•	5	2	9	5	5
Amphipoda												
Gammaridea	2	7	–	•	•	16	34	5	•	2	23	2
Hyperiidea	2	7	-	2	2	2	2	•	•	•	•	2

Table 12. (continued)

Taxon	Station Number											
	13	14	15	17	18	19B	20	21	23	24	25	26
Polychaeta												
pelagic larvae	8833	471	-	36	796	2824	2389	2570	6371	4778	3005	10715
Appendicularia												
Fritellaria borealis	7240	18	-	326	869	3258	1.231	5792	1593	2027	1013	579
Oikopleura spp.	290	253	-	72	398	2172	1701	688	362	724	833	1158
Chaetognatha												
Sagitta elegans	2751	253	-	.	.	1231	724	5394	2100	1448	1013	1520
Hydrozoa												
Aeginopsis laurentii	.	.		.	.	.	2	.	.	.	.	.
Aglantha digitale	P	36		36	.	145	P	72	2389	3909	109	8398
Bougainvillia supercili-aris	.	.		.	.	.	.	.	.	.	.	.
Corymorpha flammea	.	.		2	.	.	.	.	.	.	.	.
Perigonimus yolidia-arcticae	.	7		.	.	.	.	.	.	.	.	.
Plotocnide borealis	.	.		.	.	.	.	.	.	.	.	.
Rathkea octopunctata	.	18		.	.	72	36	36	.	.	.	72
unidentified Hydrozoa	.	.		.	.	.		.	.	.	.	.
Scyphozoa												
Cyanea capillata	2	5	-	.	.	2	5	2	9	2	2	18
Ctenophora												
Beroe cucumis	.	9	0 -	.	.	.	.	.	.	.	.	-
unidentified Ctenophora	.	.		.	.	.	.	2	.	.	.	.

Table 12. (continued)

Taxon	Station Number											
	13	14	15	17	18	19B	20	21	23	24	25	26
Mollusca												
Spiratella helicina	.	.		290	615	.	.	290	.	145	72	.
Lamellibranch larvae	869	18	-	.	.	.	72	145	72	290	290	72
Gastropod veligers	.	18	-	.	.	.	36	72	.	145	72	72
Echinodermata												
unidentified larvae	.	.		.	1448	217	398	579	217	.	253	217
Pisces												
Boreogadus saida	.	2	-	.	.	2	.	.	.	.	.	.
Lumpenus sp.	.	.		.	.	.	.	.	.	.	.	.
unidentified Cyclopteridae	.	.		.	.	.	.	.	.	.	.	.
unidentified Gadidae	.	.		.	.	.	.	.	.	.	2	.
TOTAL	69634	6532	-	12903	11991	31307	12535	32356	37232	40445	15532	45681

Table 13. Abundances of zooplankton collected in 0.75 m ring net hauls from 50-o m. Quantities are abundance m^2.

Taxon	Station Number											
	13	14	15	17	18	19B	20	21	23	24	25	26
Copepoda												
Acartia spp.	–[1]							[2]	.	869		–
Calanus cristatus	–							.	.	.		–
Calanus glacialis	–							1883	3477	2318		–
Calanus hyperboreus	–							362	434	.		–
Calanus plumchrus	–							.	11	7		–
Centropages abdominalis	–							.	.	.		–
Derjuginia tolli								P[3]	.	.		–
Eucalanus bungii bungii								.	2	.		–
Euchaeta glacialis								.	.	.		–
Eurytemora rich.ingsi								.	.	.		–
Limnocalanus grimaldii									.	.		–
Metridia longa								.	.	.		–
Microcalanus pygmaeus								.	.	.		–
Oithona similis								4123	5505	5360		–
Oncaea borealis								.	.	.		–
Pseudocalanus spp.								10358	16804	4346		–
Scaphocalanus magnus								.	.	.		–
unidentified Calanoida								.	.	.		–
unidentified Cyclopoida								.	.	.		–
unidentified Harpacticoida								507	145	579		
miscellaneous nauplii								3332	4925	3911		
Cirripedia												
Balanus spp. nauplii								5505	13617	28248		
Balanus spp. cyprids	–							1086	5215	8402		

[1] No .50-o m haul taken
[2] Not observed in sample
[3] P indicates present in sample but not subsample

Table 13. (continued)

Taxon	Station Number											
	13	14	15	17	18	19B	20	21	23	24	25	26
Euphausiacea												
Thysanoessa inermis								•	•	•		
Thysanoessa longipes								•	•	•		
Thysanoessa raschii								•	•	•		
Thysanoessa spp. larvae								•	2	5		
Ostracoda												
Conchoecia borealis maxima								•	•	•		
Philomedes globosus								•	•	•		
Cladocera												
unidentified Polyphemidae								•	•	•		
Mysidacea												
Mysis litoralis								•				
Mysis oculata												
unidentified larvae												
Decapoda												
Anomuran zoea								7	.	25		
Brachyuran zoea								5	5	72		
Caridea larvae								5	.	14		
Amphipoda												
Gammaridea								•	5	5	-	-
Hyperiidea									2	2	-	-

Table 13. (continued)

Taxon	Station Number											
	13	14	15	17	18	19B	20	21	23	24	25	26
Polychaeta												
pelagic larvae								7533	18397	25785	-	-
Appendicularia												
Fritellaria borealis								7605	4780	3911	-	
Oikopleura spp.								217	.	724	-	
Chaetognatha												
Sagitta elegans					-			2608	2318	4201	-	-
Hydrozoa												
Aeginopsis laurentii								.		.		
Aglantha digitale								72	1449	4346		
Bougainvillea supercili-aris	-							.		.		
Corymorpha flammea	-							.	.	.		
Perigonimus yoldia-arcticae	-							.	.	.		
Plotocnide borealis								.	.	.		
Rathkea octopunctata								P	P	145		
unidentified Hydrozoa					-			7	.	.		-
Scyphozoa												
Cyanea capillata	-	-			-			2	9	11	-	-
Ctenophora												
Beroe cucumis												
unidentified Ctenophora									2	.	-	-

Table 13. (continued)

Taxon	Station Number											
	13	14	15	17	18	19B	20	21	23	24	25	26
Mollusca												
Spiratella helicina								507	P	.	-	
Lamellibranch larvae								1738	2028	3766	-	
Gastropod veligers										145	-	
Echinodermata												
unidentified larvae								1521	1593	579		
Pisces												
Boreogadus saida												
Lumpenus sp.												
unidentified Cyclopteridae												
unidentified Gadidae												
TOTAL								48983	80725	97776	-	

Table 14. Abundances of zooplankton collected in 0.75 m ring net hauls from 100-0 m. Quantities are abundance m^2.

Taxon	Station Number											
	13	14	15	17	18	19B	20	21	23	24	25	26
Copepoda												
Acartia spp.	–[1]							2				
Calanus cristatus												
Calanus glacialis								144;				
Calanus hyperboreus								579				
Calanus plumchrus												
Centropages abdominalis							–					
Derjuginia tolli								P[3]				
Eucalanus bungii bungii								2				
Euchaeta glacialis												–
Eurytemora richingsi												–
Limnocalanus grimaldii												
Metridia longa								P				
Microcalanus pygmaeus												
Oithona similis								3187				
Oncaea borealis												
Pseudocalanus spp.								31000				
Scaphocalanus magnus									–			
unidentified Calanoida												
unidentified Cyclopoida												
unidentified Harpacticoida								290				
miscellaneous nauplii								3187				
Cirripedia												
Balanus spp. nauplii								*6374*				
Balanus spp. cyprids								*1449*				

[1] No 100-0 m haul taken
[2] Not observed in sample
[3] P indicates present in sample but not subsample

Table 14. (continued)

Taxon	Station Number											
	13	14	15	17	18	19B	20	21	23	24	25	26
Euphausiacea												
Thysanoessa inermis								•				
Thysanoessa longipes												
Thysanoessa raschii												
Thysanoessa spp. larvae												
Ostracoda												
Conchoecia borealis maxima								•				–
Philomedes globosus												–
Cladocera												
unidentified Polyphemidae								•				
Mysidacea												
Mysis litoralis												
Mysis oculata												
unidentified larvae												
Decapoda												
Anomuran zoea								•				
Brachyuran zoea								14	–	–	–	–
Caridea larvae								•				
Amphipoda												
Gammaridea								9	–	–	–	–
Hyperiidea								7	–	–	–	–

Table 14. (continued)

Taxon	Station Number											
	13	14	15	17	18	19B	20	21	23	24	25	26
Polychaeta												
pelagic larvae								11010				
Appendicularia												
Fritellaria borealis								18253	-			
Oikopleura spp.								290	-			
Chaetognatha												
Sagitta elegans								2028				-
Hydrozoa												
Aeginopsis laurentii								•				
Aglantha digitale								27				
Bougainvillia supercili-aris								•				
Corymorpha flammea								2				
Perigonimus yoldia-arcticae								2				
Plotocnide borealis								•				
Rathkea octopunctata								P				
unidentified Hydrozoa								•				
Scyphozoa												
Cyanea capillata								5	-	-	-	-
Ctenophora												
Beroe cucumis								P	-	-	-	-
unidentified Ctenophora												

Table 14. (continued)

Taxon	Station Number											
	13	14	15	17	18	19B	20	21	23	24	25	26
Mollusca												
Spiratella helicina								1159	-			
Lamellibranch larvae												
Gastropod veligers												
Echinodermata												
unidentified larvae								*1739*				
Pisces												
Boreogadus saida												-
Lumpenus sp.												
unidentified Cyclopteridae	-	-										
unidentified Gadidae												
TOTAL								82062	-			

Table 15. Abundances of zooplankton collected in 0.75 m ring net hauls from 200-0 m. Quantities are abundance m^2.

Taxon	Station Number											
	13	14	15	17	18	19B	20	21	23	24	25	26
Copepoda												
Acartia spp.	-[1]							.[2]				
Calanus cristatus								.				
Calanus glacialis								6374				
Calanus hyperboreus								2318				
Calanus plumchrus								.				
Centropages abdominalis	-							.				
Derjuginia tolli								P[3]				
Eucalanus bungii bungii	-							.				-
Euchaeta glacialis								11				-
Eurytemora richingsi	-							.				
Limnocalanus grimaldii	-							.				
Metridia Longs								1738				
Microcalanus pygmaeus	-							.				
Oithona similis								9561				
Oncaea borealis								290				
Pseudocalanus spp.								58814				
Scaphocalanus magnus	-							5				
unidentified Calanoida	-							290				
unidentified Cyclopoida	-							.				
unidentified Harpacticoida	-							.				
miscellaneous nauplii								5505				
Cirripedia												
Balanus spp. nauplii	-							5213				
Balanus spp. cyprids	-							2027				

[1] No 200-0 m haul taken
[2] Not observed in sample
[3] P indicates present in sample but not subsample

Table 15. (continued)

Taxon	Station Number											
	13	14	15	17	18	19B	20	21	23	24	25	26
Euphausiacea												
Thysanoessa inermis								2	-			
Thysanoessa longipes	-							•				
Thysanoessa raschii												
Thysanoessa spp. larvae	-											
Ostracoda												
Conchoecia borealis maxima	-							23	-			
Philomedes globosus												
Cladocera												
unidentified Polyphemidae								•				
Mysidacea												
Mysis litoralis								•				
Mysis oculata								•				
unidentified larvae												
Decapoda												
Anomuran zoea								16	-	-	-	-
Brachyuran zoea								7	-	-	-	-
Caridea larvae								5	-	-	-	-
Amphipoda												
Gammaridea								57	-	-	-	-
Hyperiidea								7	-	-	-	-

Table 15. (continued)

Taxon	Station Number											
	13	14	15	17	18	19B	20	21	23	24	25	26
Polychaeta												
pelagic larvae								10720	-			
Appendicularia												
Fritellaria borealis								31290	-			
Oikopleura spp.								290	-			
Chaetognatha												
Sagitta elegans								2028	-		-	-
Hydrozoa												
Aeginopsis laurentii								•				
Aglantha digitale								27	-			
Bougainvillea supercili-aris								•				
Corymorpha flammea								•				
Perigonimus yoldia-arcticae								•				
Plotocnide borealis								•				
Rathkea octopunctata								•				
unidentified Hydrozoa								2	-			
Scyphozoa												
Cyanea capillata	-	-	-	-	-	-		•				
Ctenophora												
Beroe cucumis								2	-	-	-	-
unidentified Ctenophora												

Table 15. (continued)

Taxon	Station Number											
	13	14	15	17	18	19B	20	21	23	24	25	26
Mollusca												
Spiratella helicina								290	-	-	-	-
Lamellibranch larvae												
Gastropod veligers												
Echinodermata												
unidentified larvae								869	-			
Pisces												
Boreogadus saida												-
Lumpenus sp.												-
unidentified Cyclopteridae	-											
unidentified Gadidae												
TOTAL								137781				

Table 16. Abundances of zooplankton collected in bongo net hauls. Quantities are abundance/100 m^3.

Taxon	Station 20[1]		Station 25[2]	
	500 µ	333 µ	500 µ	333 µ
Copepoda				
Acartia spp.	.[3]	33		70
Calanus cristatus	.	.		9
Calanus glacialis	2933	4180	706;	5635
Calanus hyperboreus	38	.	133	348
Calanus plumchrus	.	.	.	
Centropages abdominalis	.	.	.	.
Derjuginia tolli	76	98	67	4
Eucalanus bungii bungii	.	.	.	
Euchaeta glacialis	.	.	.	.
Eurytemora richingsi	.	.		4
Limnocalanus grimaldii	.			
Metridia longs	.	.	.	
Microcalanus pygmaeus	.	.	.	.
Oithona similis	19	65	200	4939
Oncaea borealis	.	.	.	.
Pseudocalanus spp.	38	2874	267	5496
Scaphocalanus magnus	.	.	.	.
unidentified Calanoida	.	2	8	
unidentified Cyclopoida	.	.	.	.
unidentified Harpacticoida	.	196	.	139
miscellaneous nauplii	38	229	67	626
Cirripedia				
Balanus spp. nauplii	6286	9371	18267	24974
Balanus spp. cyprids	76	6759	467	13009

[1] Double oblique haul from 10-0 m.
[2] Double oblique haul from 20-0 m.
[3] Not observed in sample

Table 16. (continued)

Taxon	Station 20		Station 25	
	500 µ	333 µ	500 µ	333 µ
Euphausiacea				
Thysanoessa inermis	.	.	.	4
Thysanoessa longipes	.	.	8	.
Thysanoessa raschii	.	.	33	22
Thysanoessa spp. larvae		65	25	9
Ostracoda				
Conchoecia borealis maxima	.	.	.	.
Philomedes globosus	.	.	.	.
Cladocera				
unidentified Polyphemidae	.	.	.	
Mysidacea				
Mysis litoralis	.	2	8	9
Mysis oculata	.	2	17	.
unidentified larvae	2	4	.	.
Decapoda				
Anomuran zoea	14	12	50	44
Brachyuran zoea	36	35	142	126
Caridea larvae	41	33	108	57
Amphipoda				
Gammaridea	364	302	142	87
Hyperiidea	12	6	17	13

Table 16. (continued)

Taxon	Station 20		Station 25	
	500 μ	333 μ	500 μ	333 μ
Polychaeta				
pelagic larvae	171	3037	1467	7165
Appendicularia				
Fritellaria borealis	381	784	200	1809
Oikopleura spp.	P	131	400	67
Chaetognatha				
Sagitta elegans	762	1404	3867	2991
Hydrozoa				
Aeginopsis laurentii	.	.	.	.
Aglantha digitale	19	65	92	139
Bougainvillia supercili-aris	2	.	.	.
Corymorpha flammea	.	.	.	9
Perigonimus yoldia-arcticae	19	18	17	4
Plotocnide borealis	.	.	.	.
Rathkea octopunctata	19	2	.	.
unidentified Hydrozoa	10	.	17	.
Scyphozoa				
Cyanea capillata	5	.	33	9
Ctenophora				
Beroe cucumis	.	.	.	.
unidentified Ctenophora	.	4	8	.

Table 16. (continued)

Taxon	Station 20		Station 25	
	500 µ	333 µ	500 µ	333 µ
Mollusca				
Spiratella helicina	P	65	133	139
Lamellibranch larvae	.	.	.	139
Gastropod veligers	.	.	.	.
Echinodermata				
unidentified larvae	.	33	.	.
Pisces				
Boreogadus saida	10	6	33	17
Lumpenus sp.	2	6	.	.
unidentified Cyclopteridae	.	2	.	.
unidentified Gadidae	.	.	8	4

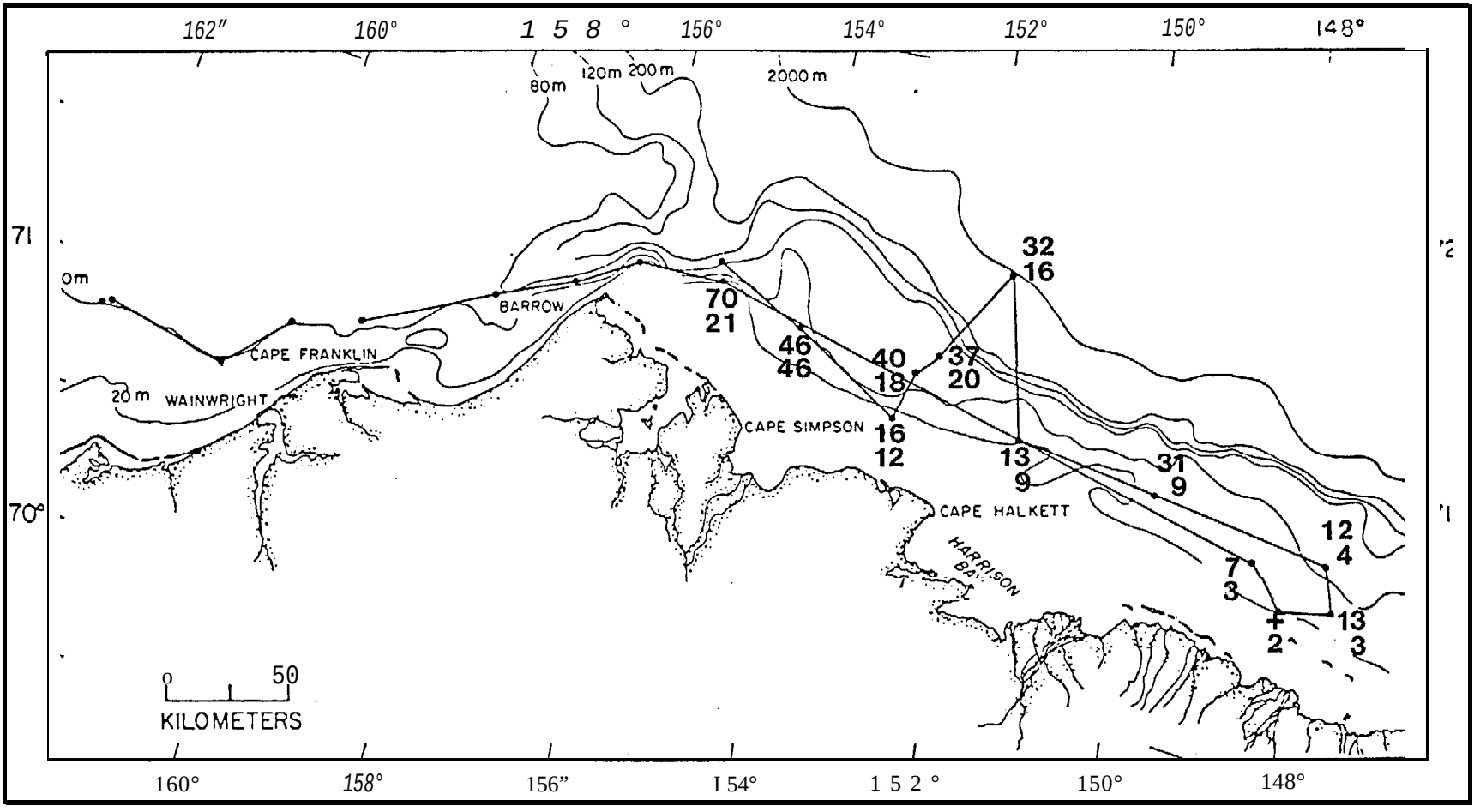


Fig. 13. Abundance of zooplankton (number $m^2 \times 10^2$) collected by USCGC *Glacier* in the Beaufort Sea, 18 Aug to 2 Sep 1976. Upper number represents 20-0 m haul; lower number represents 10-0 m haul. No 20-0 m haul was taken at station 15.

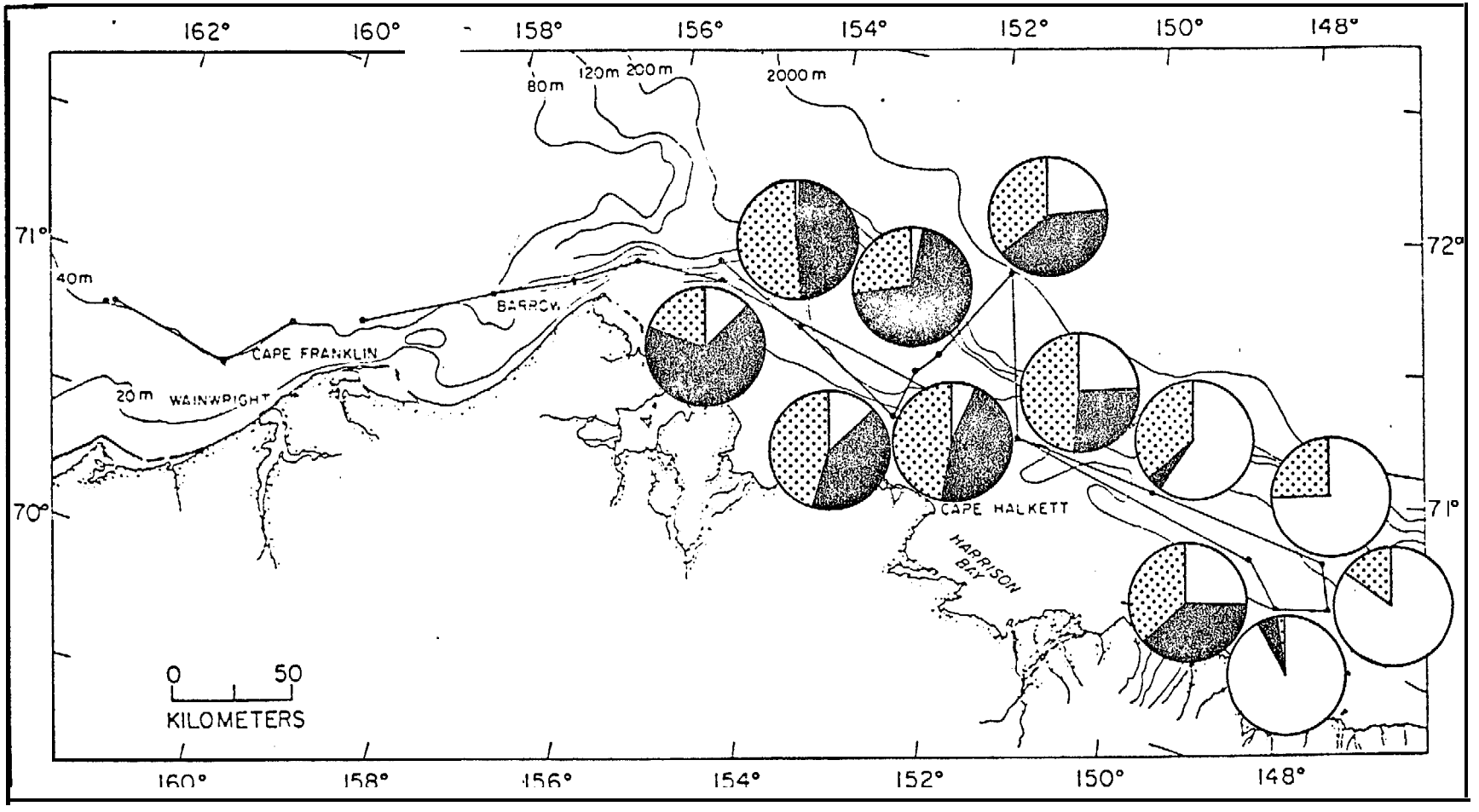


Fig. 14. Percentage of zooplankton composed of copepods (white), barnacle larvae (black), and all other zooplankton (stippled) from 10-0 m hauls.

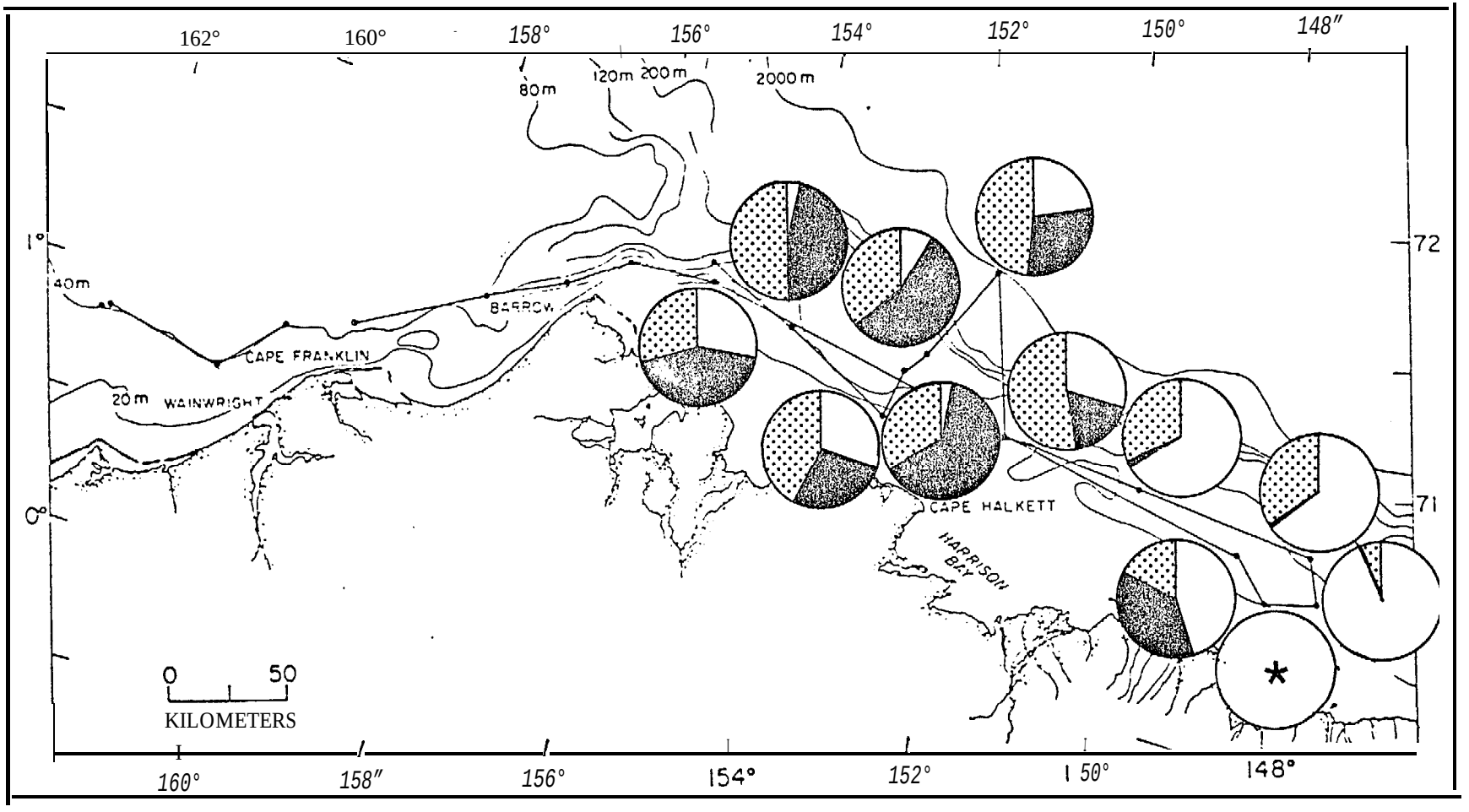


Fig. 15. Percentage of zooplankton composed of copepods (white), barnacle larvae (black) and all other zooplankton (stippled) from 20-0 m hauls.

*No 20-0 m haul was taken at station 15.

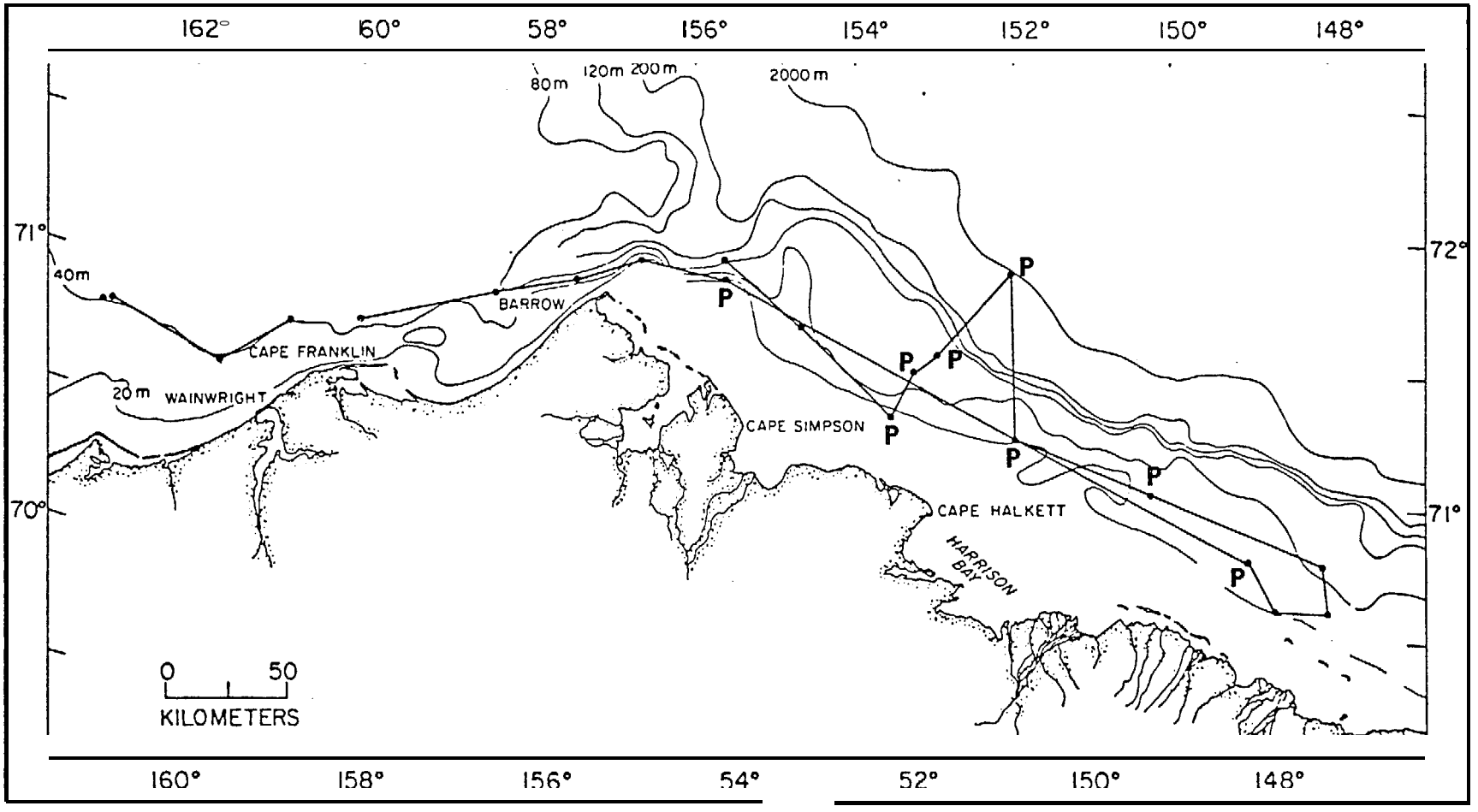


Fig. 16. Stations where *Acartia* spp. were present (P).

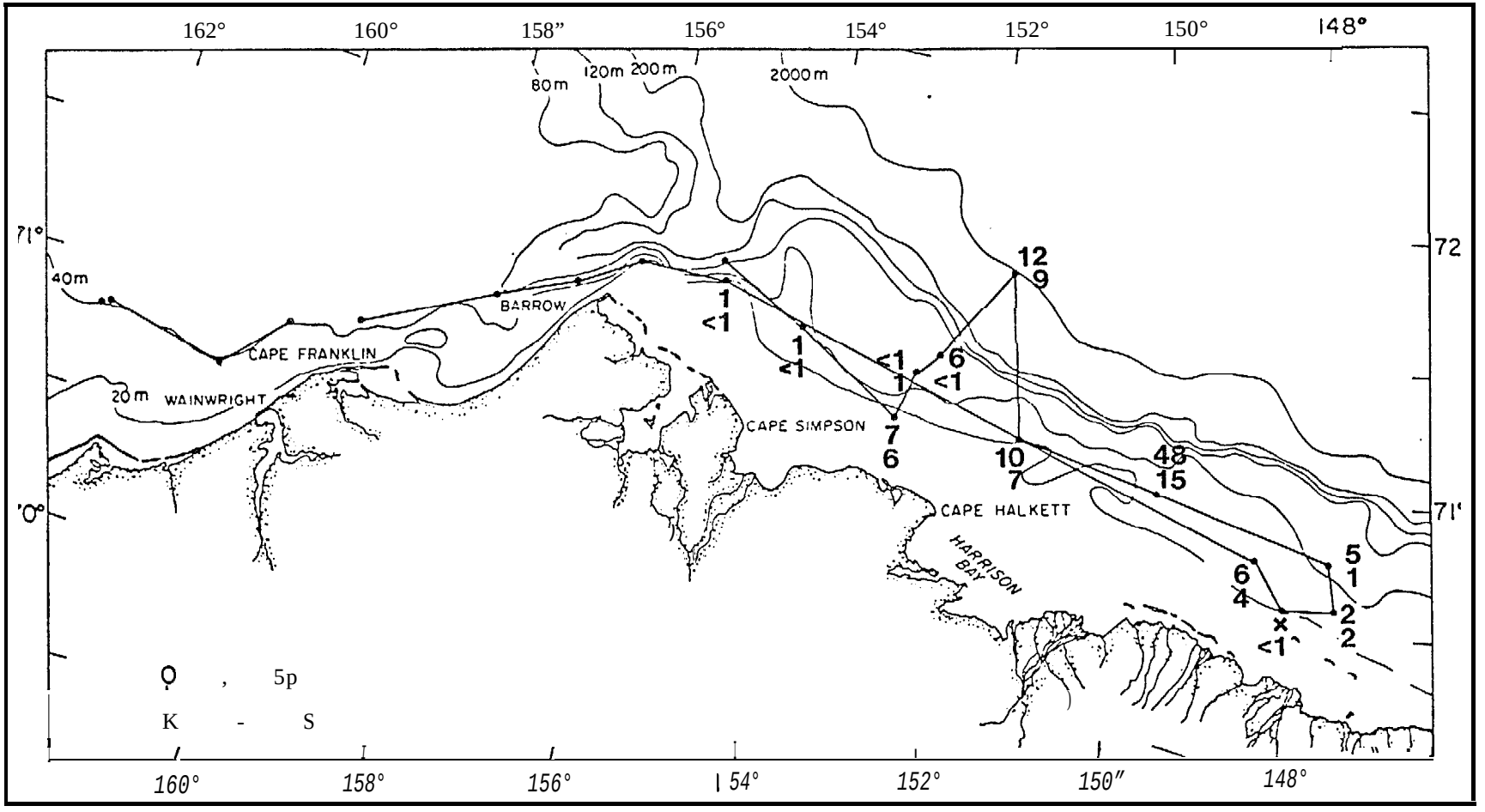


Fig. 17. Abundance of *Calanus glacialis* (number $m^2 \times 10^2$) . Upper number represents 20-0 m haul; lower number represents 10-0 m haul. No 20-0 m haul was taken at station 15.

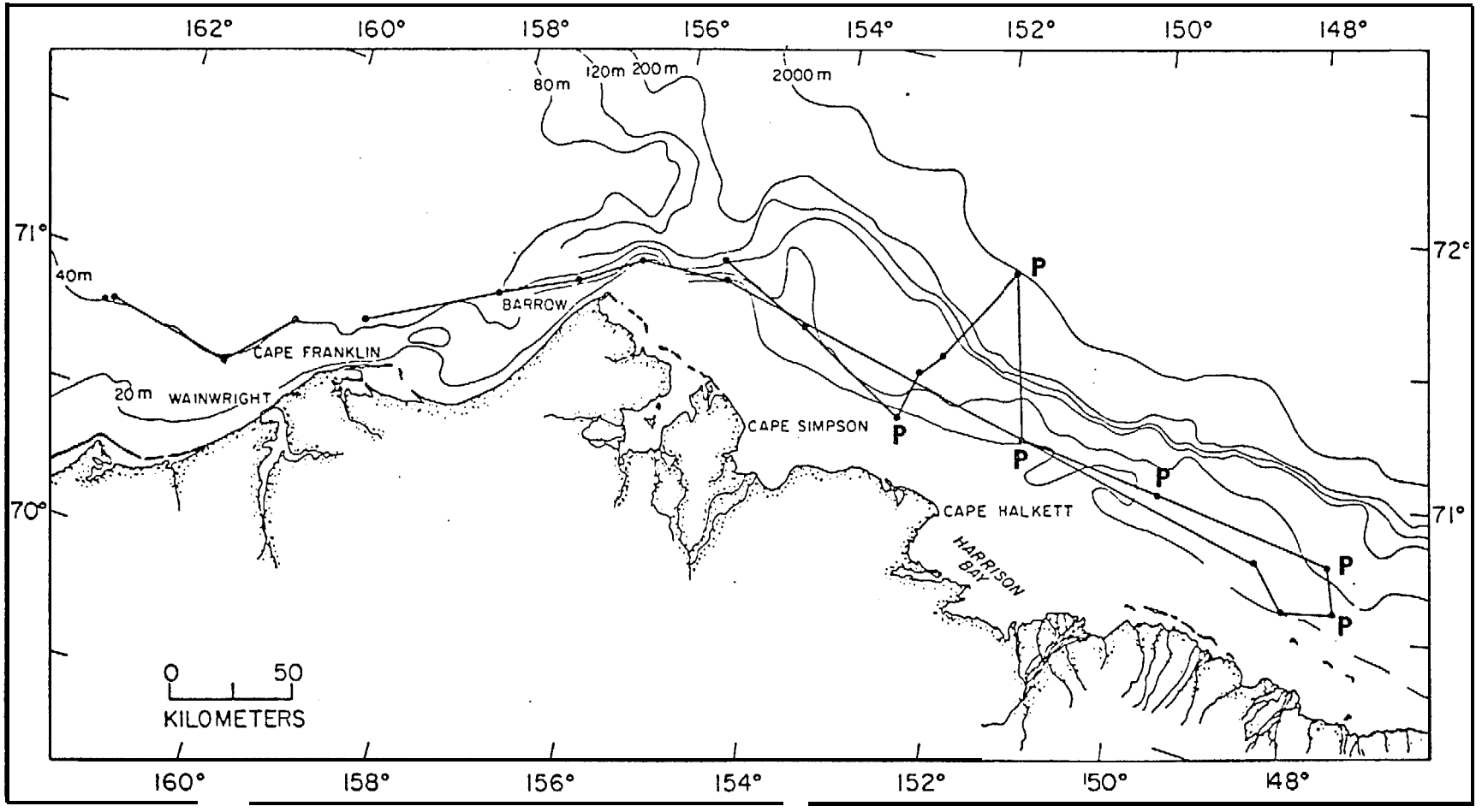


Fig. 18. Stations where *Calanus hyperboreus* was present (P).

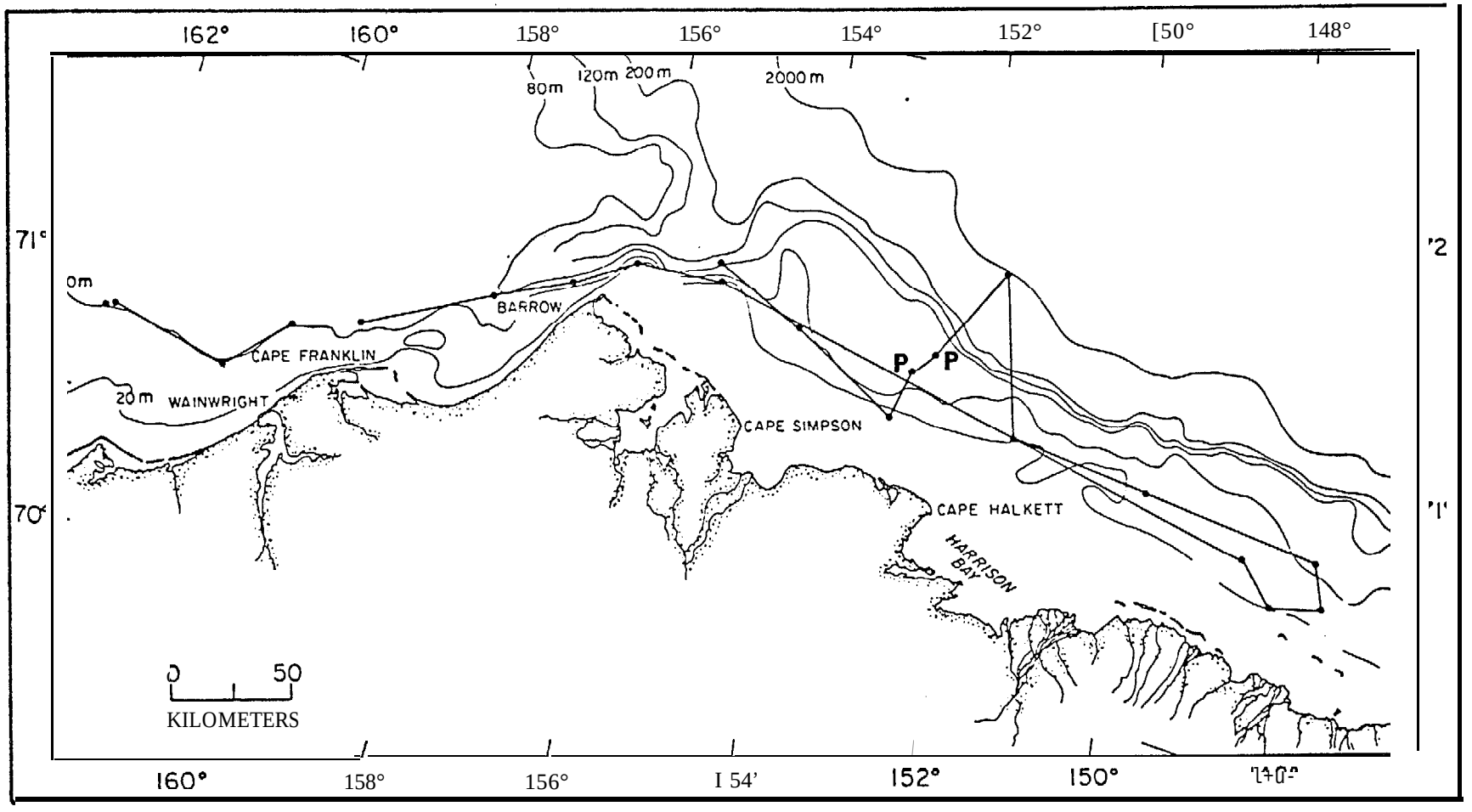


Fig. 19. Stations where *Calanus plumchrus* was present (P) in 50-0 m hauls.

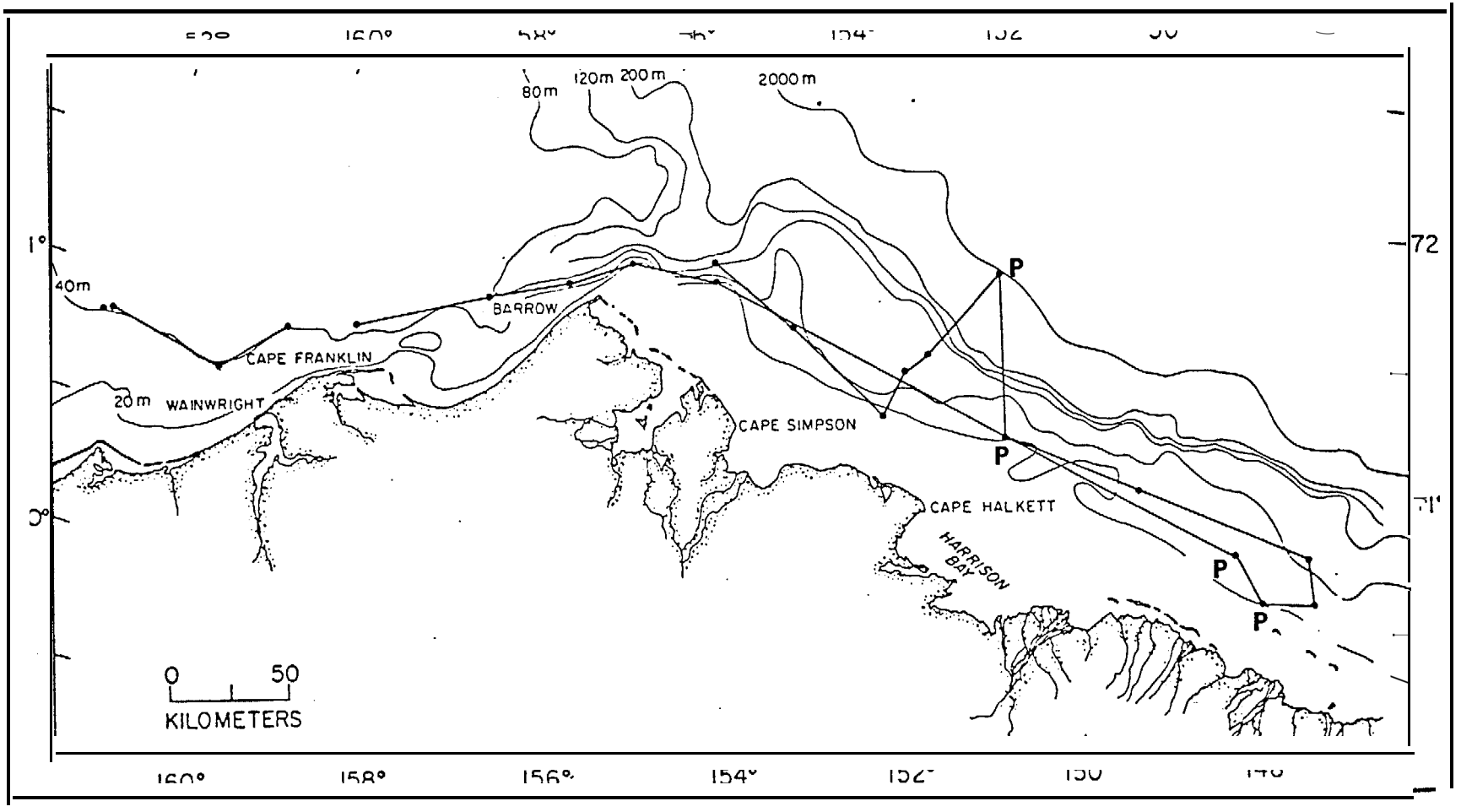


Fig. 20. Stations where *Derjuginia tolli* was present (P).

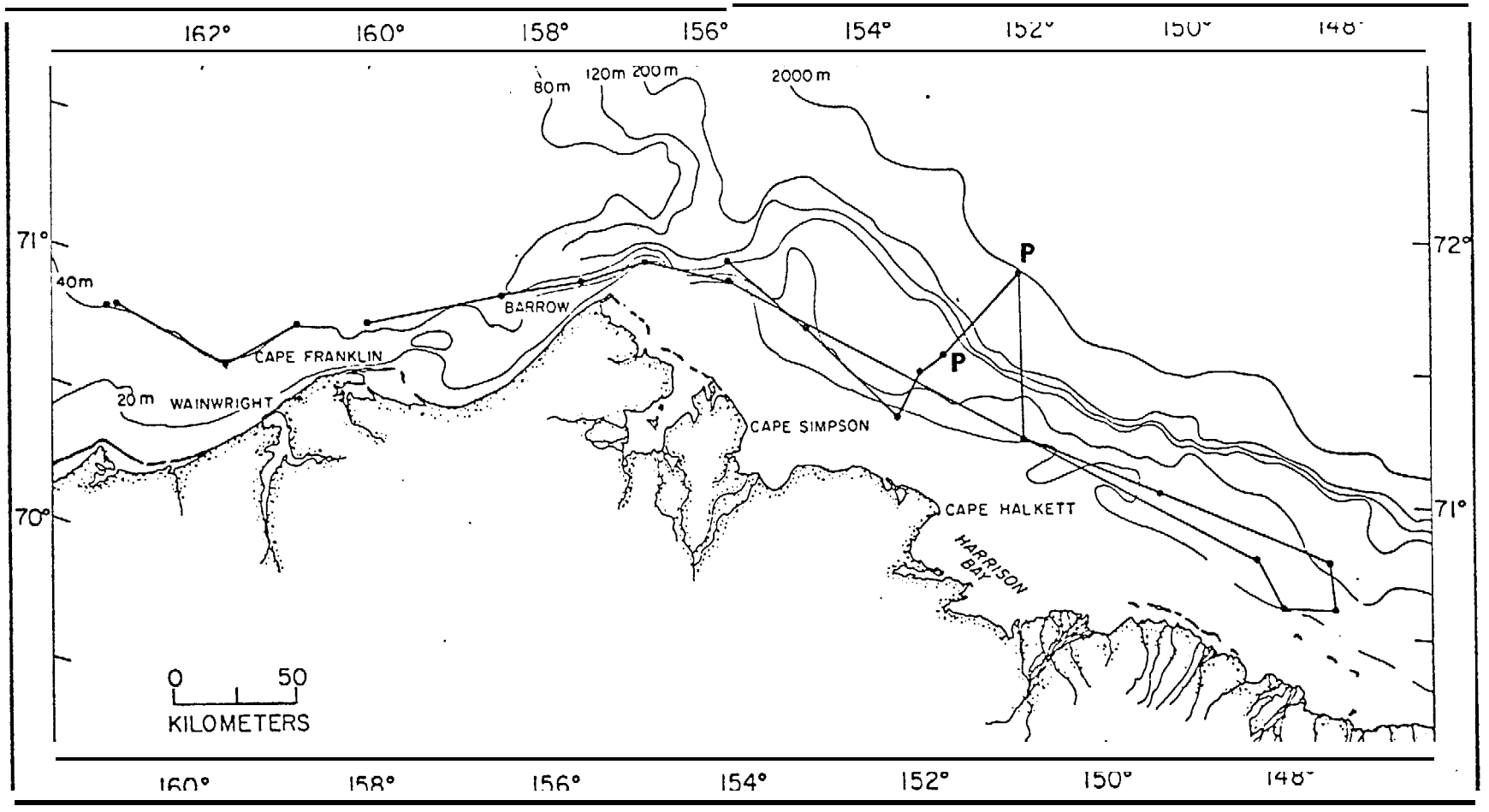


Fig. 21. Stations where *Eucalanus bungii bungii* was present (P). One individual was taken from a 100-0 m haul at station 21 and one individual was taken from a 50-0 m haul at station 24.

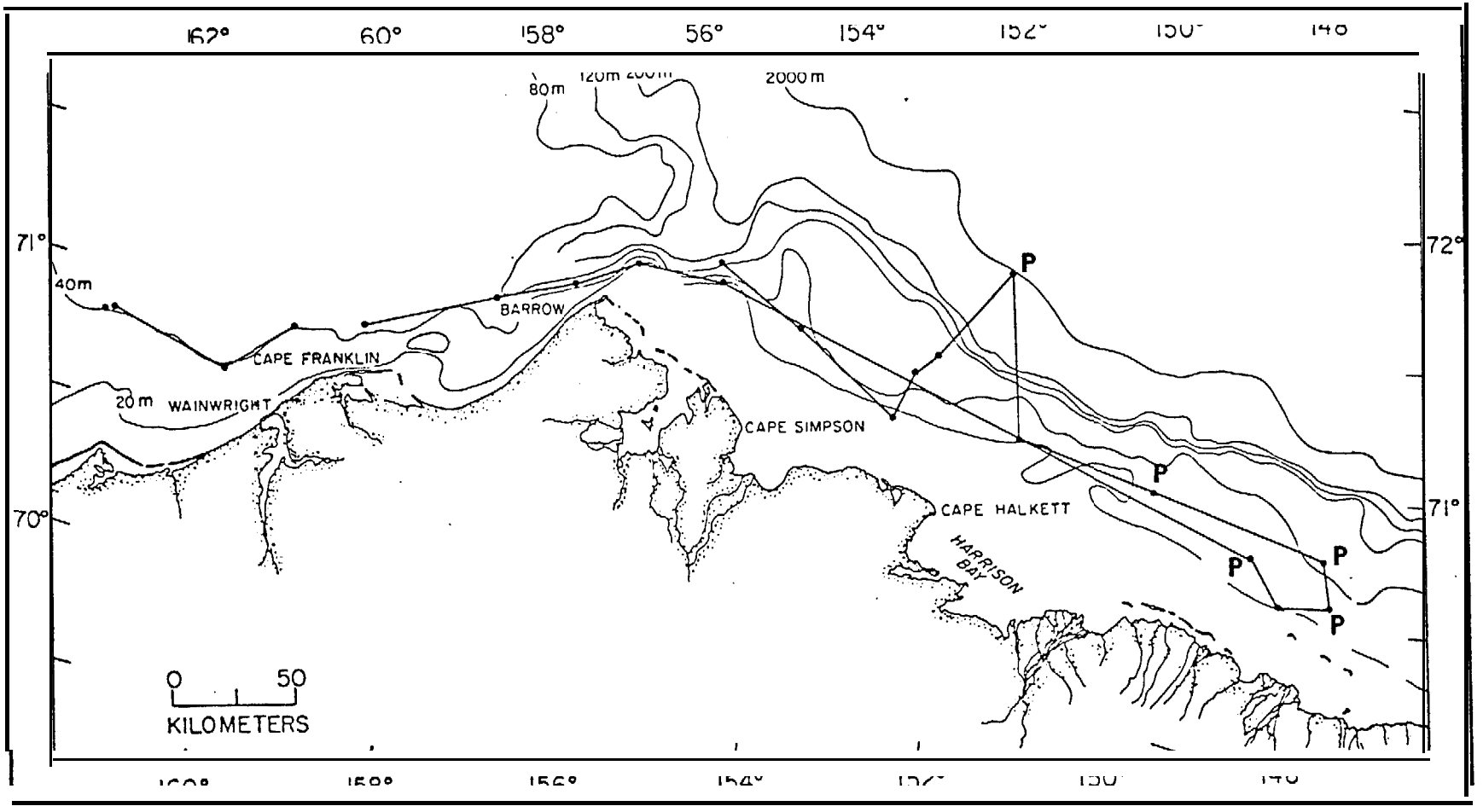


Fig. 22. Stations where *Limnocalanus grimaldii* was present (P).

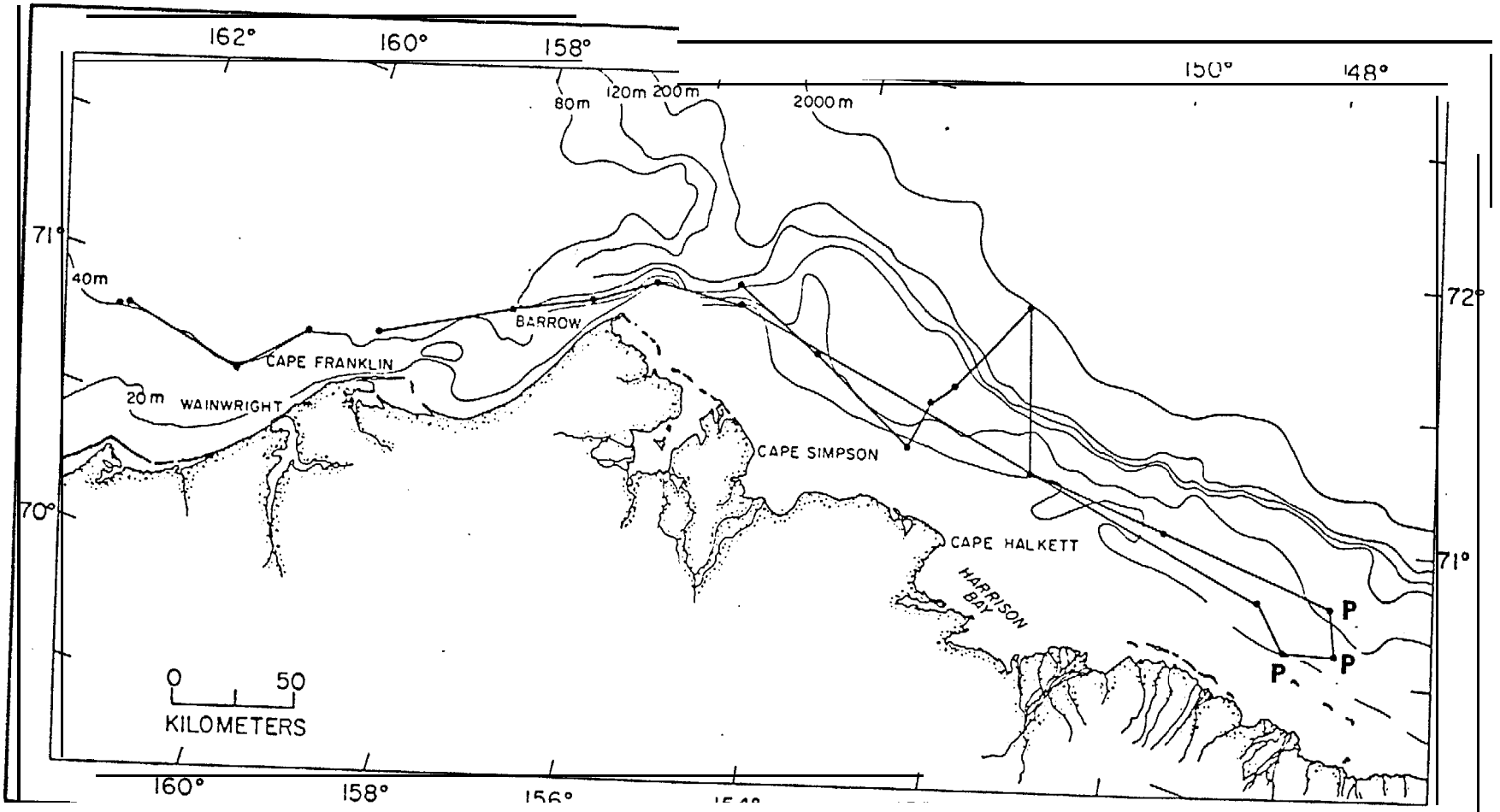


Fig. 23. Stations where *Microcalanus pygmaeus* was present (P).

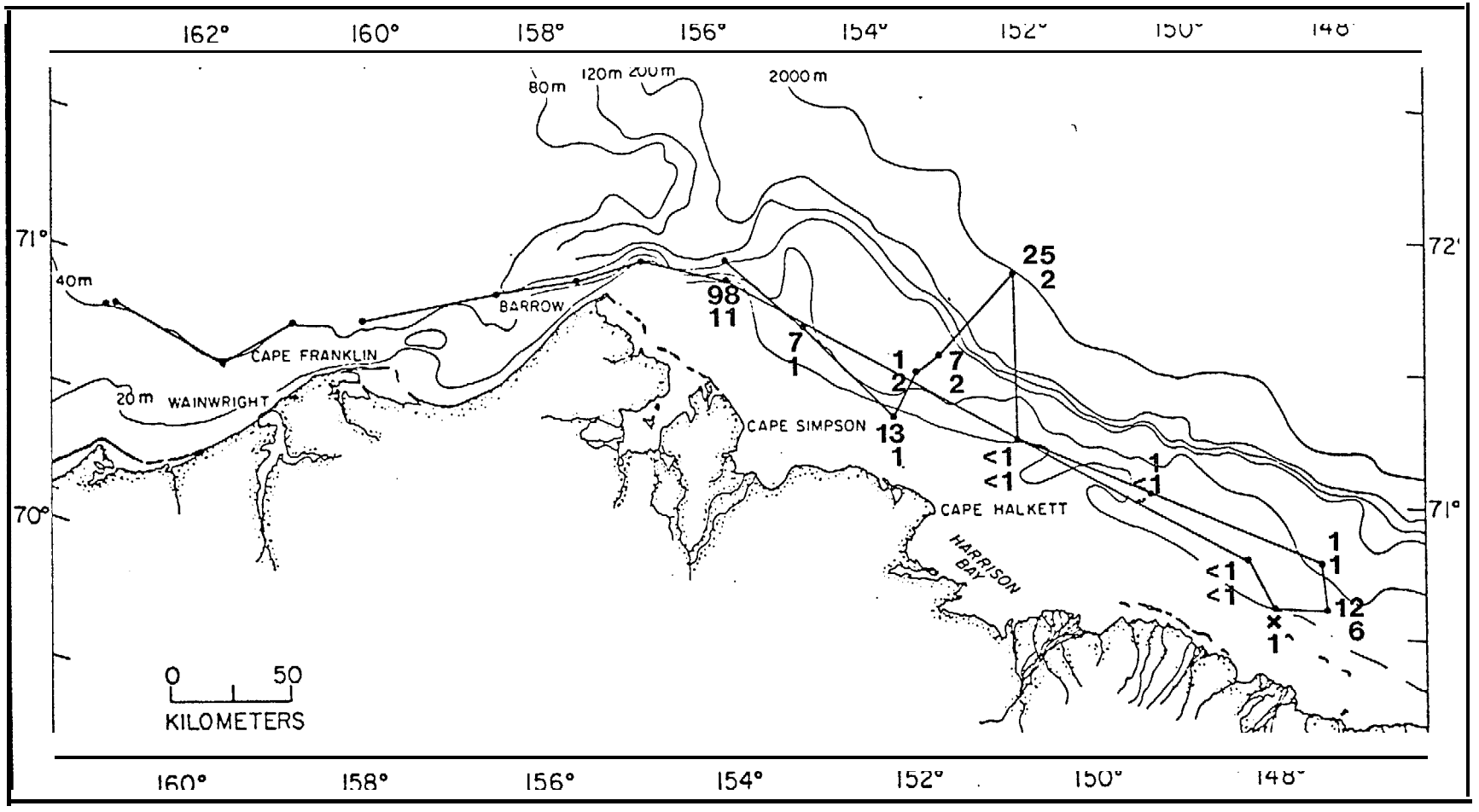


Fig. 24. Abundance of *Oithona similis* (number $m^2 \times 10^2$). Upper number represents a 20-0 m haul; lower number represents a 10-0 m haul. No 20-0 m haul was taken at station 15.

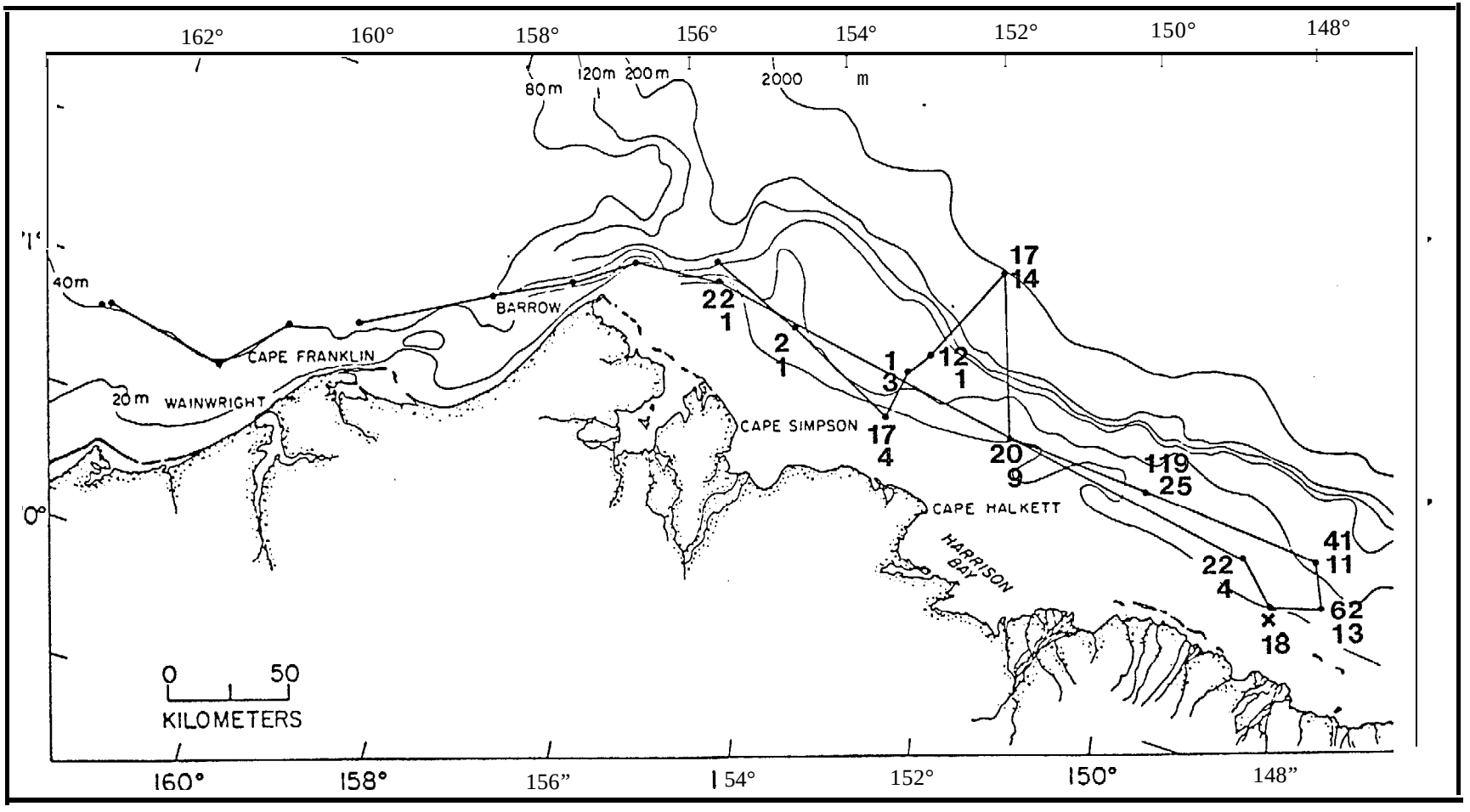


Fig. 25. Abundance of *Pseudocalanus* spp. (number m^2 x 102). Upper number represents 20-0 m haul; lower number represents 10-0 m haul. No 20-0 m haul was taken at station 15.

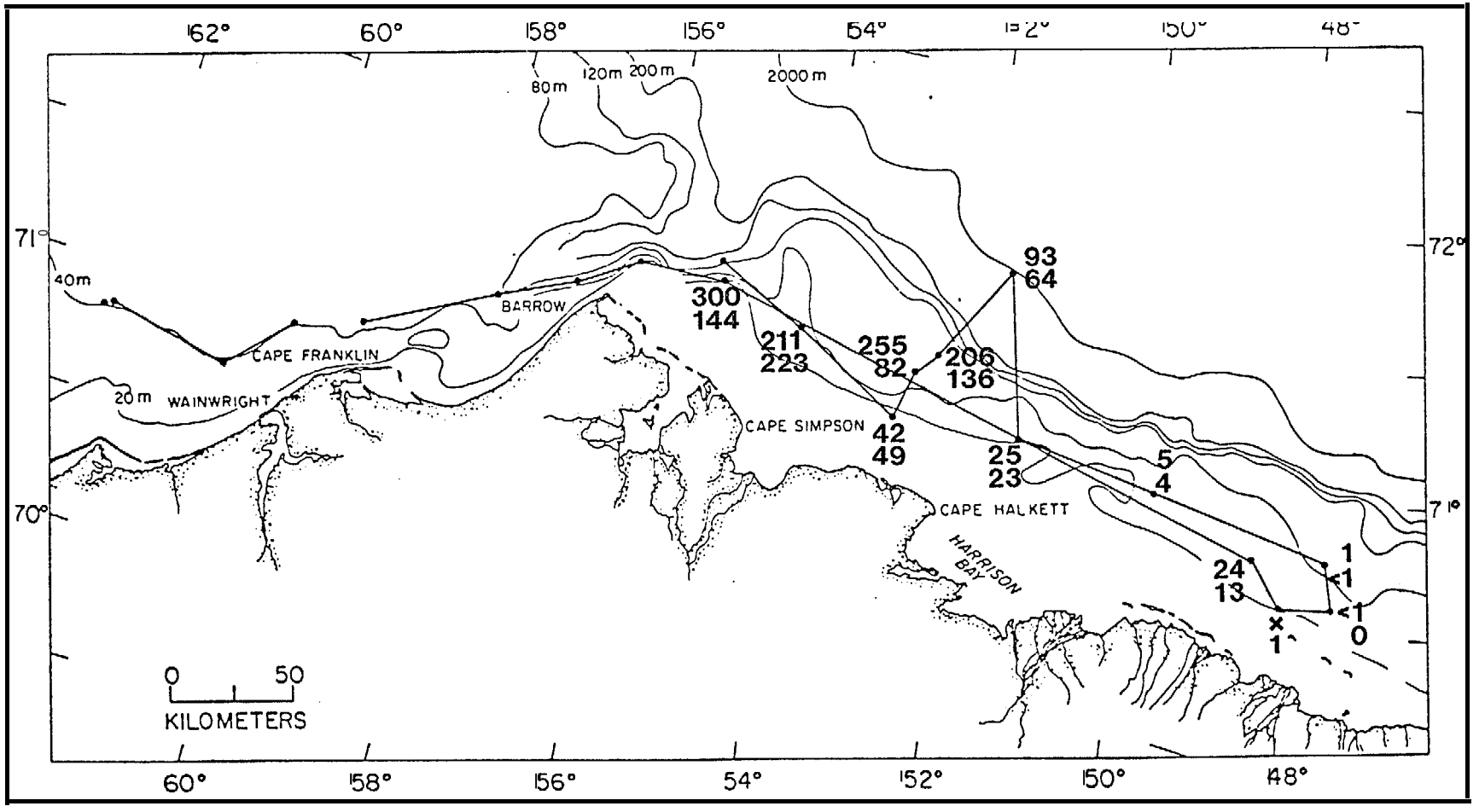


Fig. 26. Abundance of barnacle larvae (number $m^2 \times 10^2$). Upper number represents 20-0 m haul; lower number represents 10-0 m haul. No 20-0 m haul was taken at station 15.

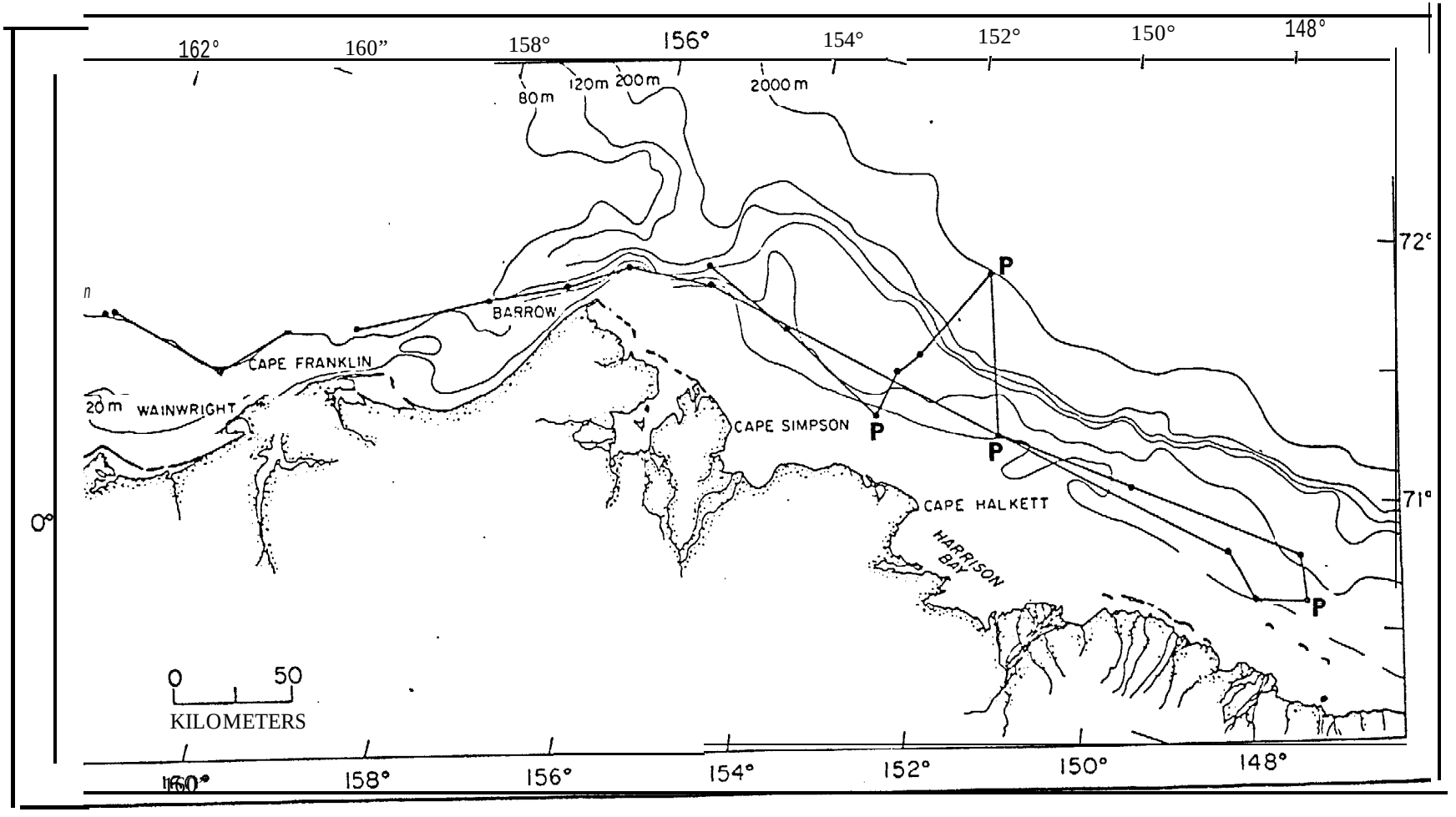


Fig. 27. Stations where *Thysanoessa inermis* was present (P).

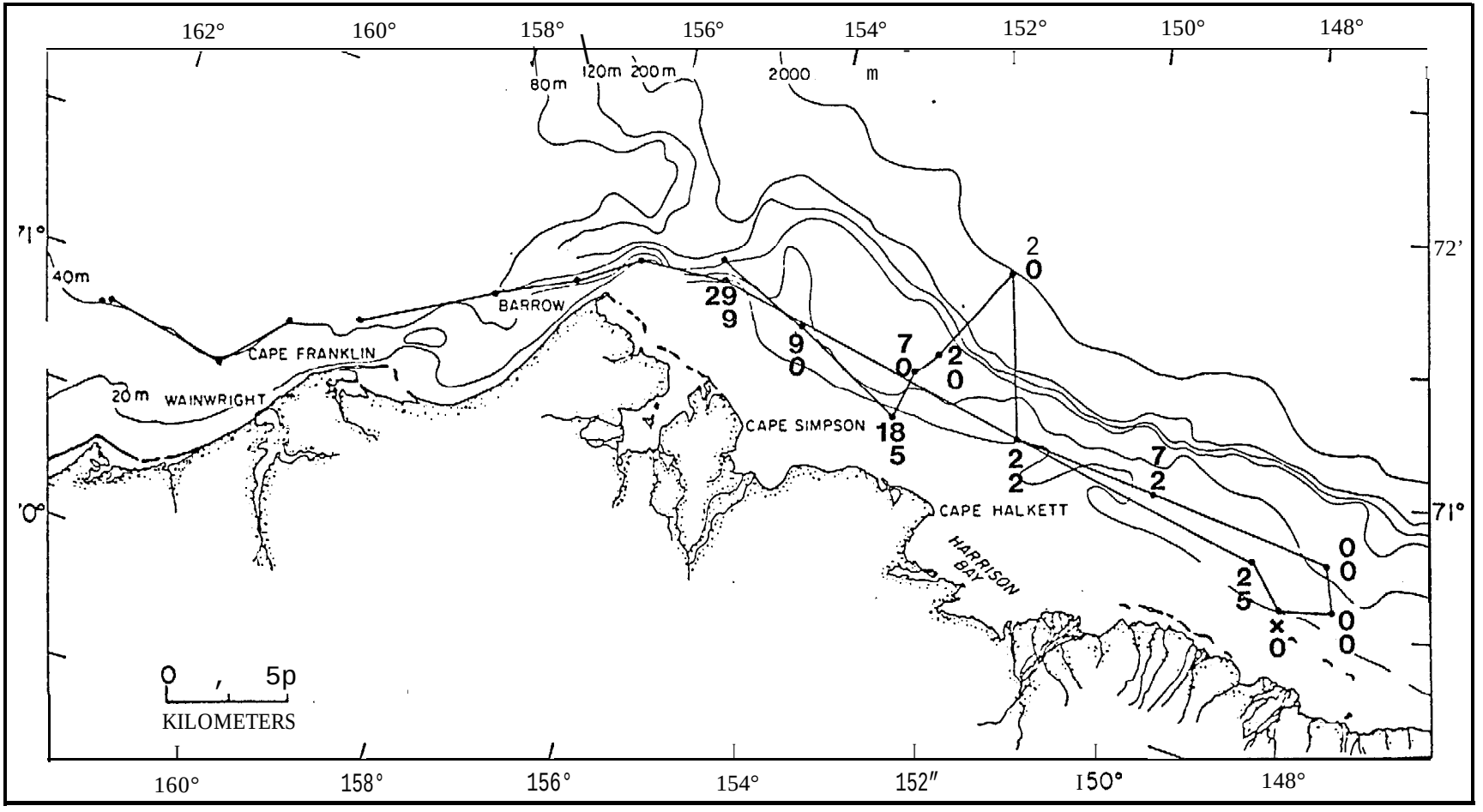


Fig. 28. Abundance of anomuran zoea (number m^2). Upper number represents 20-0 m haul; lower number represents a 10-0 m haul. No 20-0 m haul was taken at station 15.

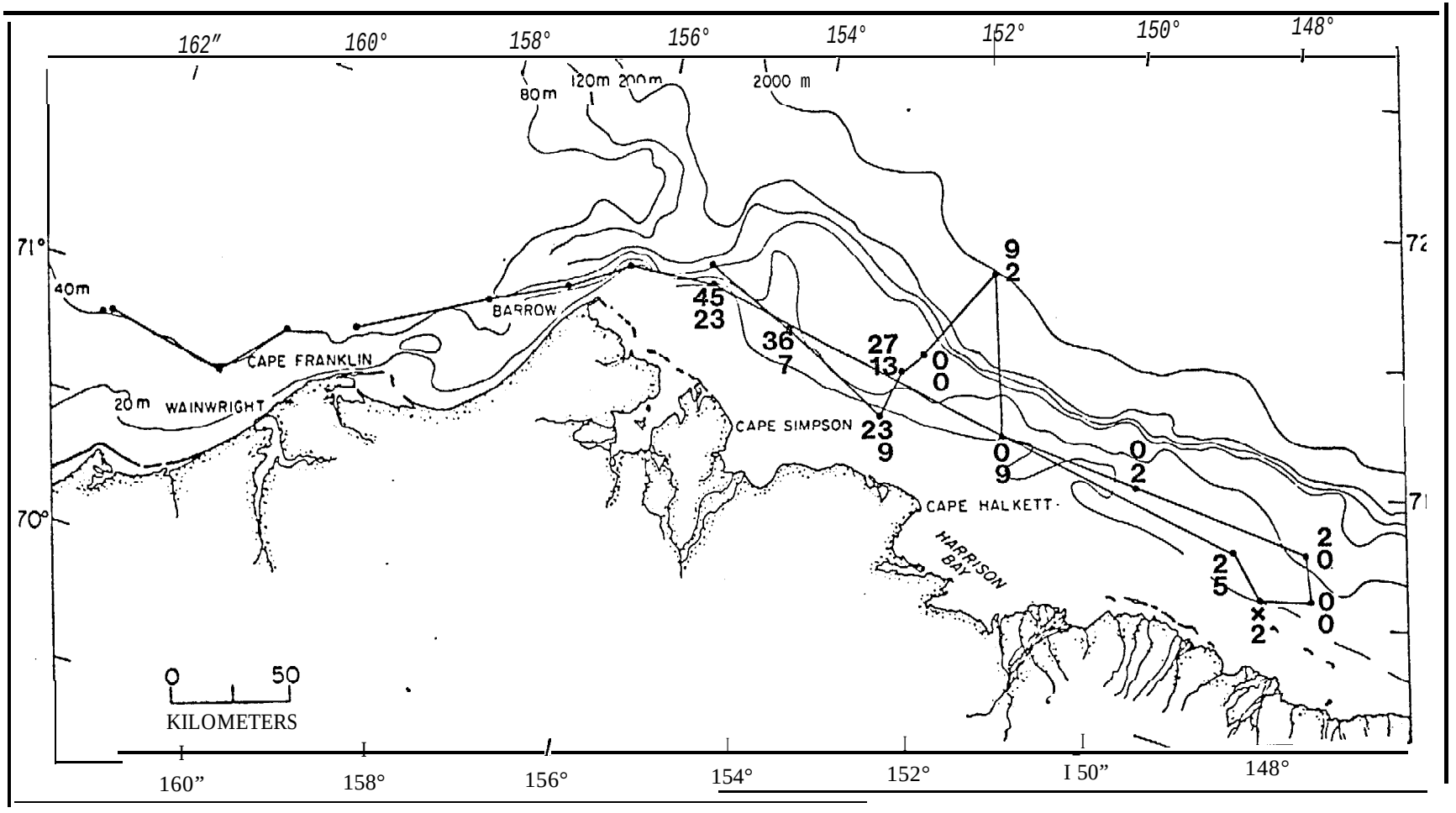


Fig. 29. Abundance of brachyuran zoea (number m^2). Upper number represents 20-0 m haul; lower number represents 10-0 m haul. No 20-0 m haul was taken at station 15.

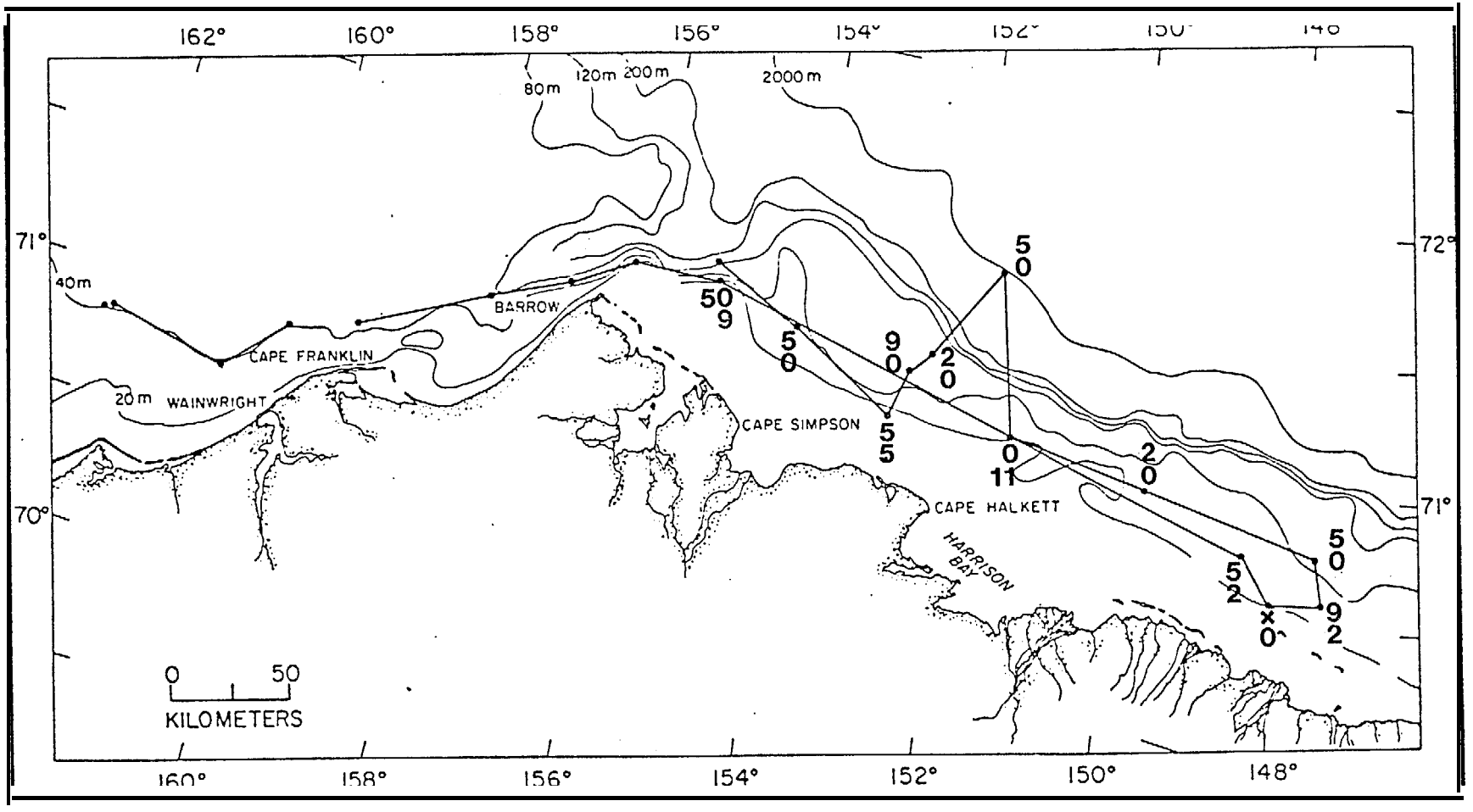


Fig. 30. Abundance of shrimp larvae (number m^2). Upper number represents 20-0 m haul; lower number represents 10-0 m haul. No 20-0 m haul was taken at station 15.

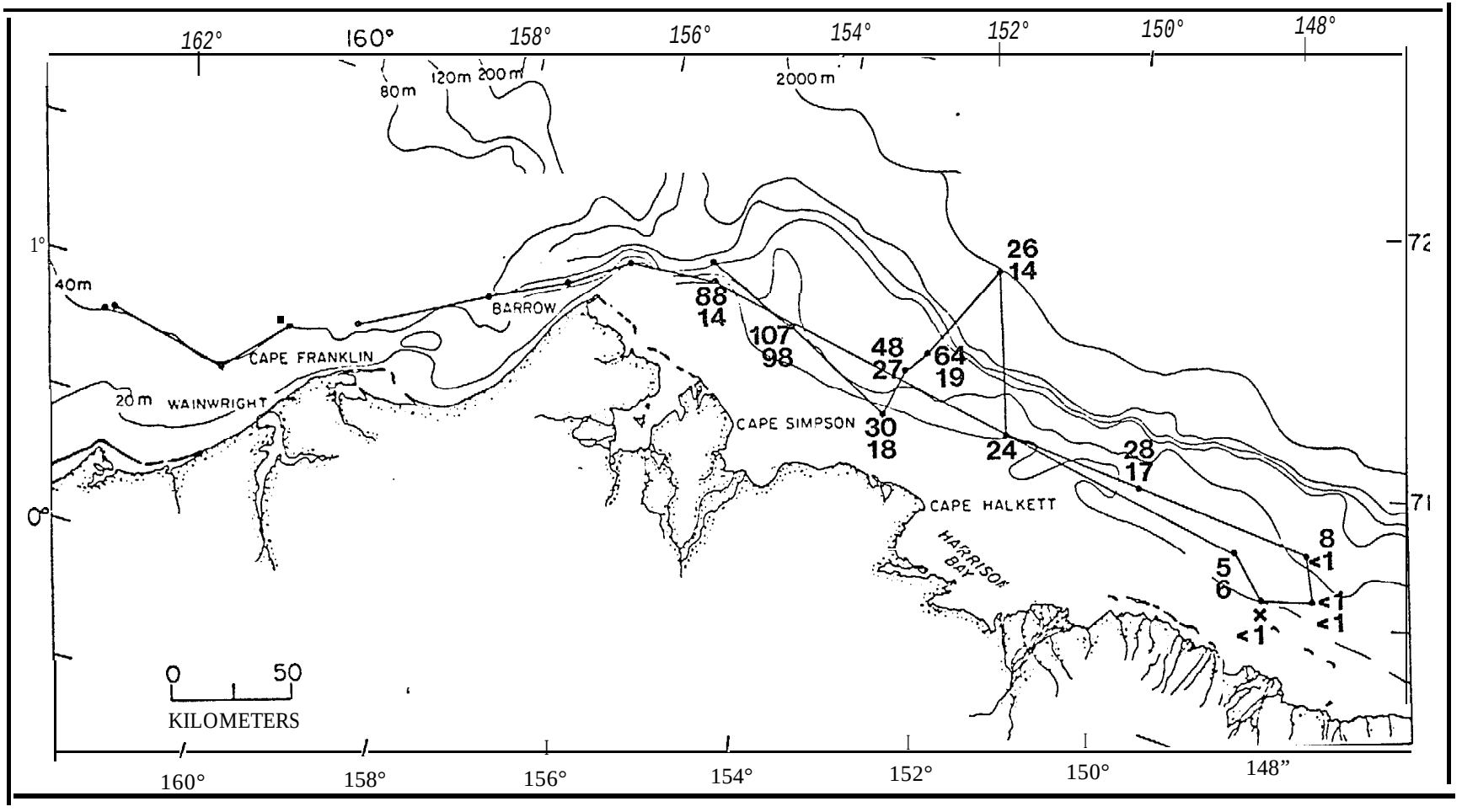


Fig. 31. Abundance of polychaete larvae (number $m^2 \times 10^2$) . Upper number represents 20-0 m haul; lower number represents 10-0 m haul. No 20-0 m haul was taken at station 15.

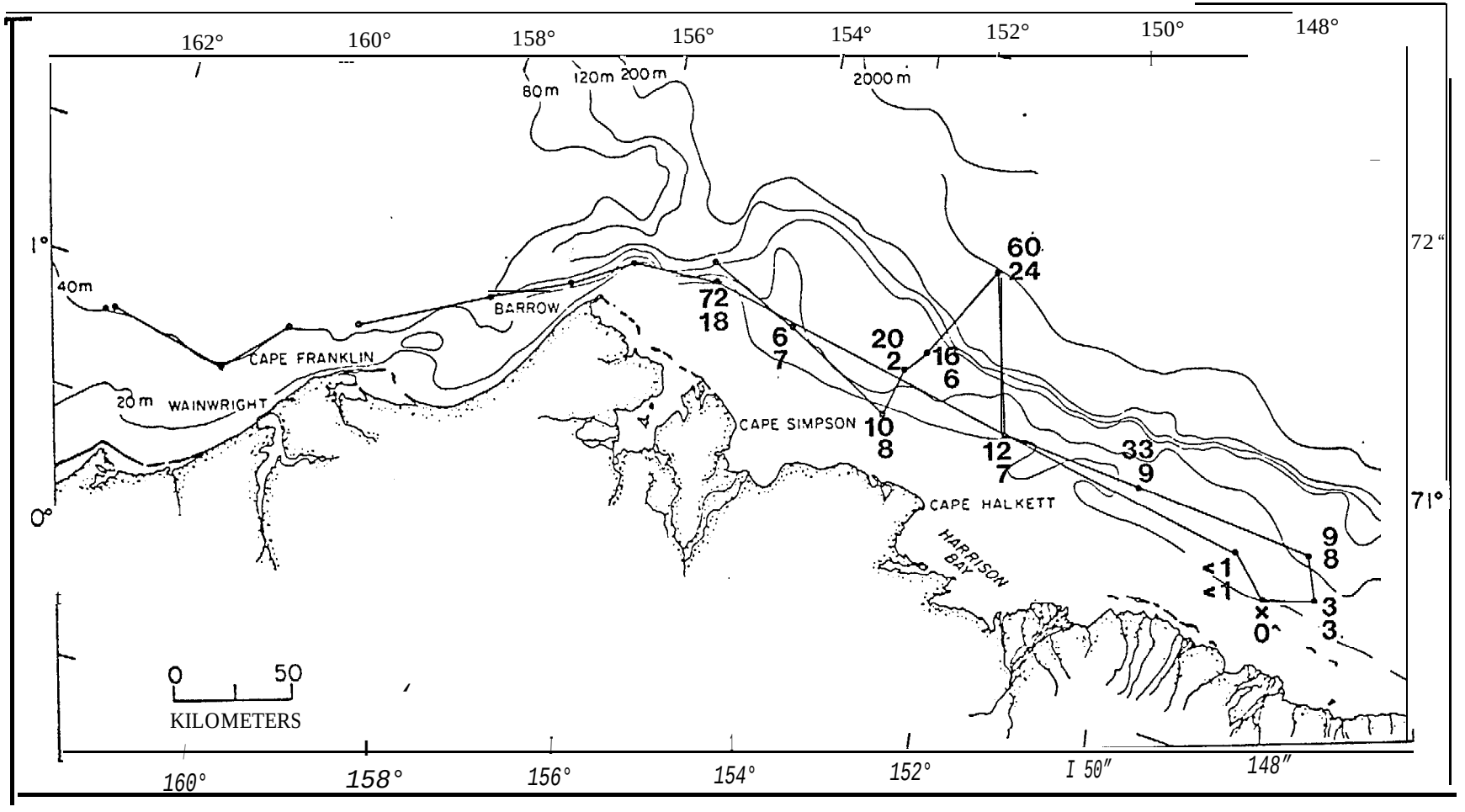


Fig. 32. Abundance of *Fritellaria borealis* (number m^2 x 102). Upper number represents 20-0 m haul; lower number represents 10-0 m haul. No 20-0 m haul was taken at station 15.

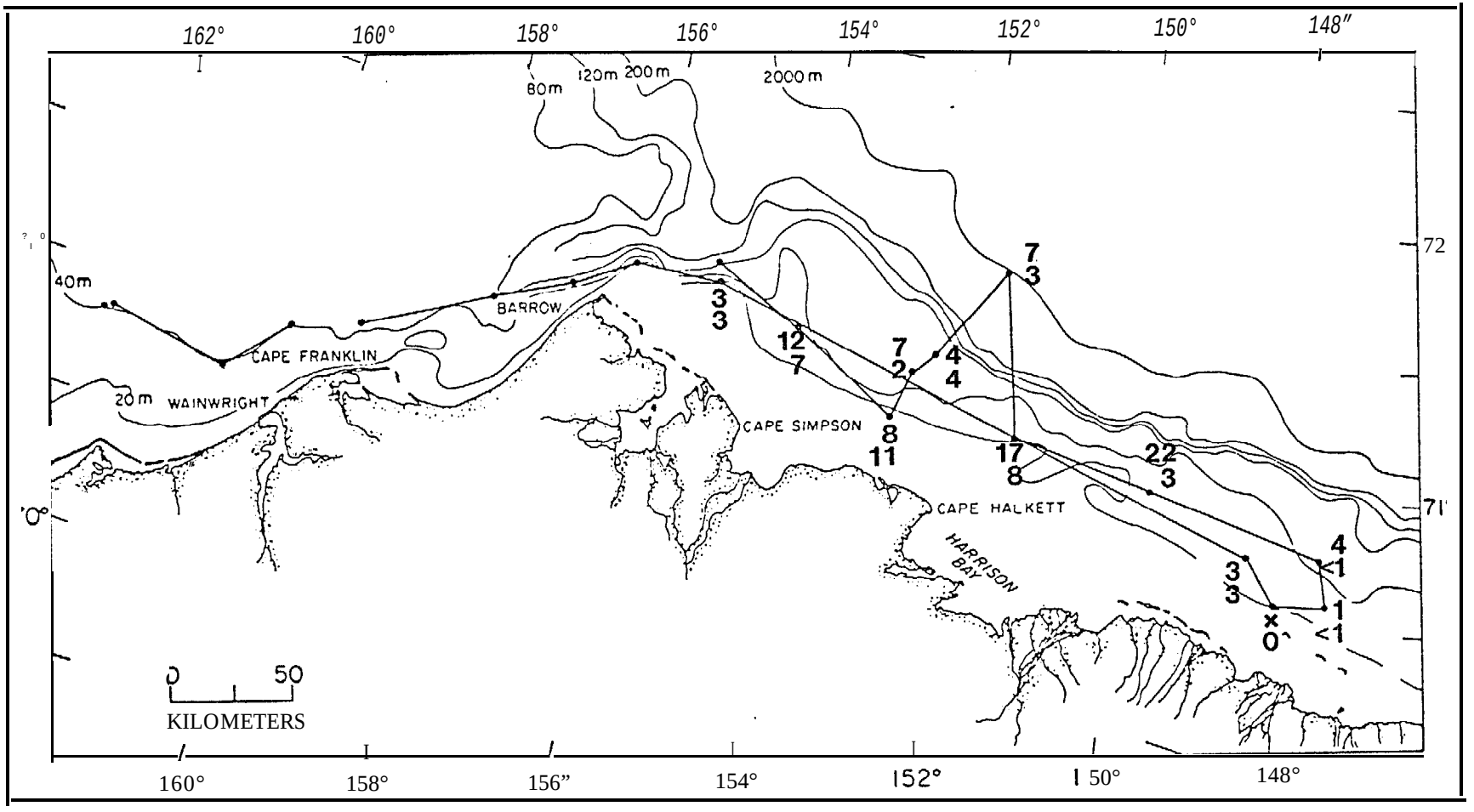


Fig. 33. Abundance of *Oikopleura* spp. (number $m^2 \times 10^2$). Upper number represents 20-0 m haul; lower number represents 10-0 m haul. No 20-0 m haul was taken at station 15.

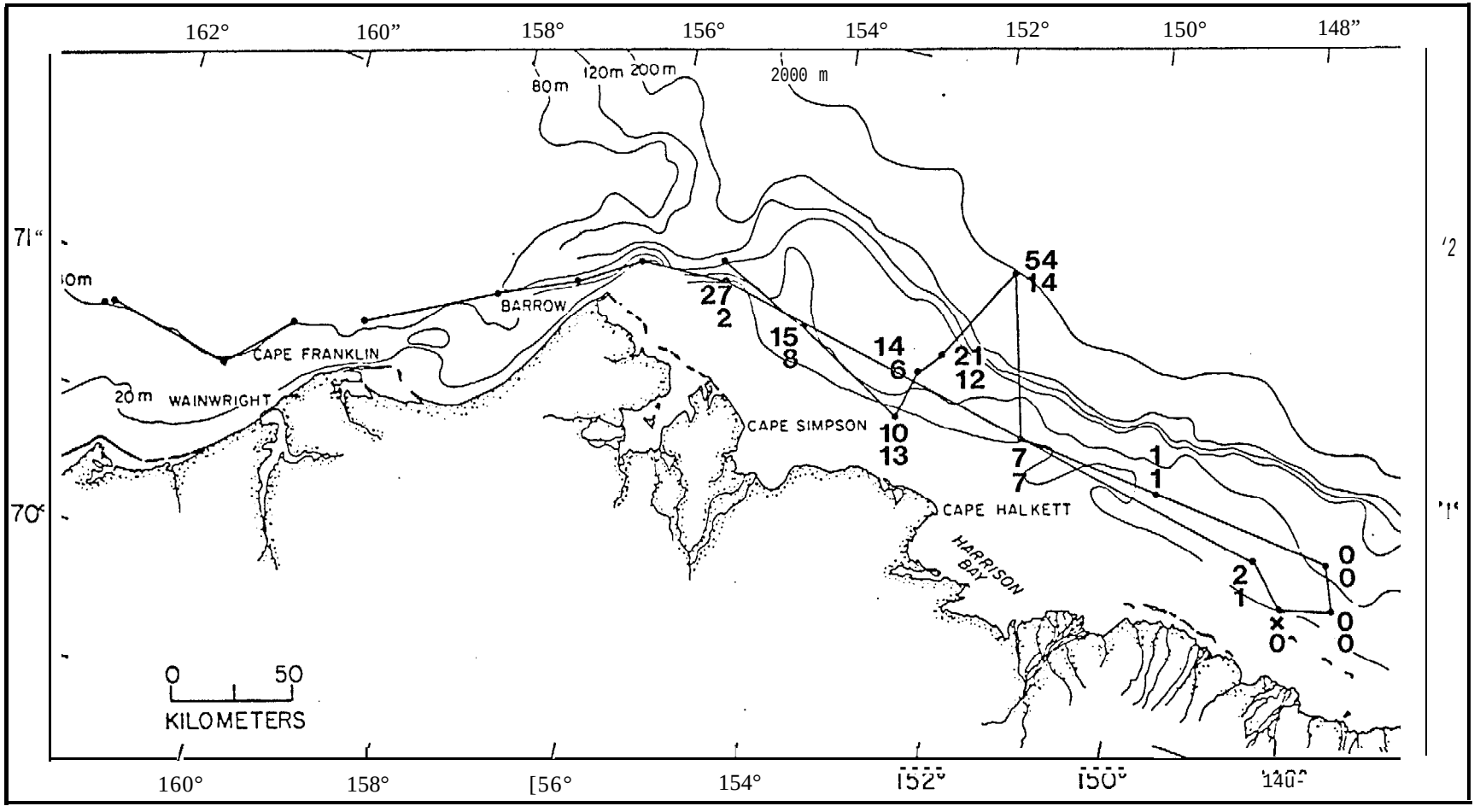


Fig. 34. Abundance of *Sagitta elegans* (number m^2 x 102). Upper number represents 20-0 m haul; lower number represents 10-0 m haul. No 20-0 m haul was taken at station 15.

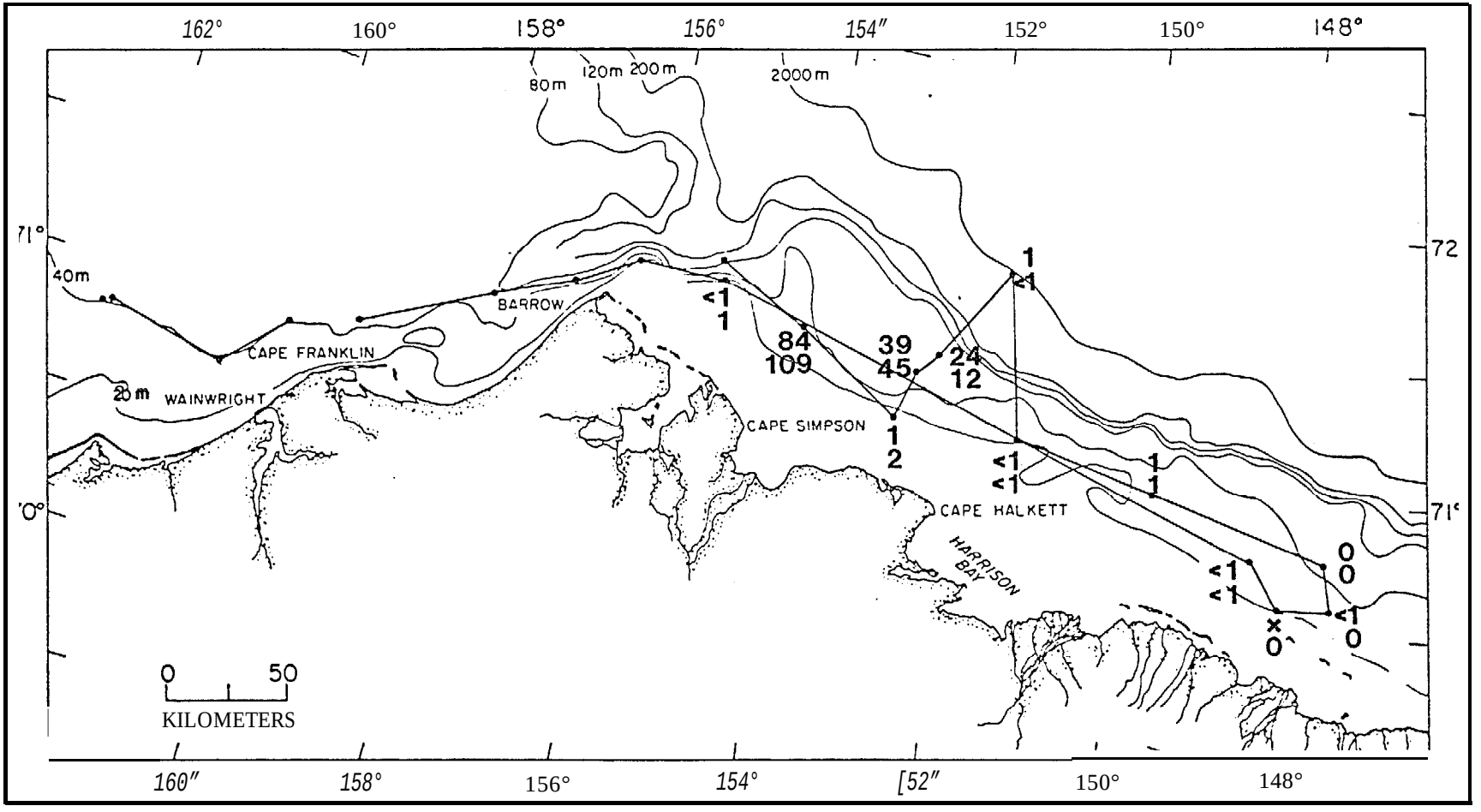


Fig. 35. Abundance of *Aglantha digitale* (number m^2 x 102). Upper number represents 20-0 m haul; lower number represents 10-0 m haul. No 20-0 m haul was taken at station 15.

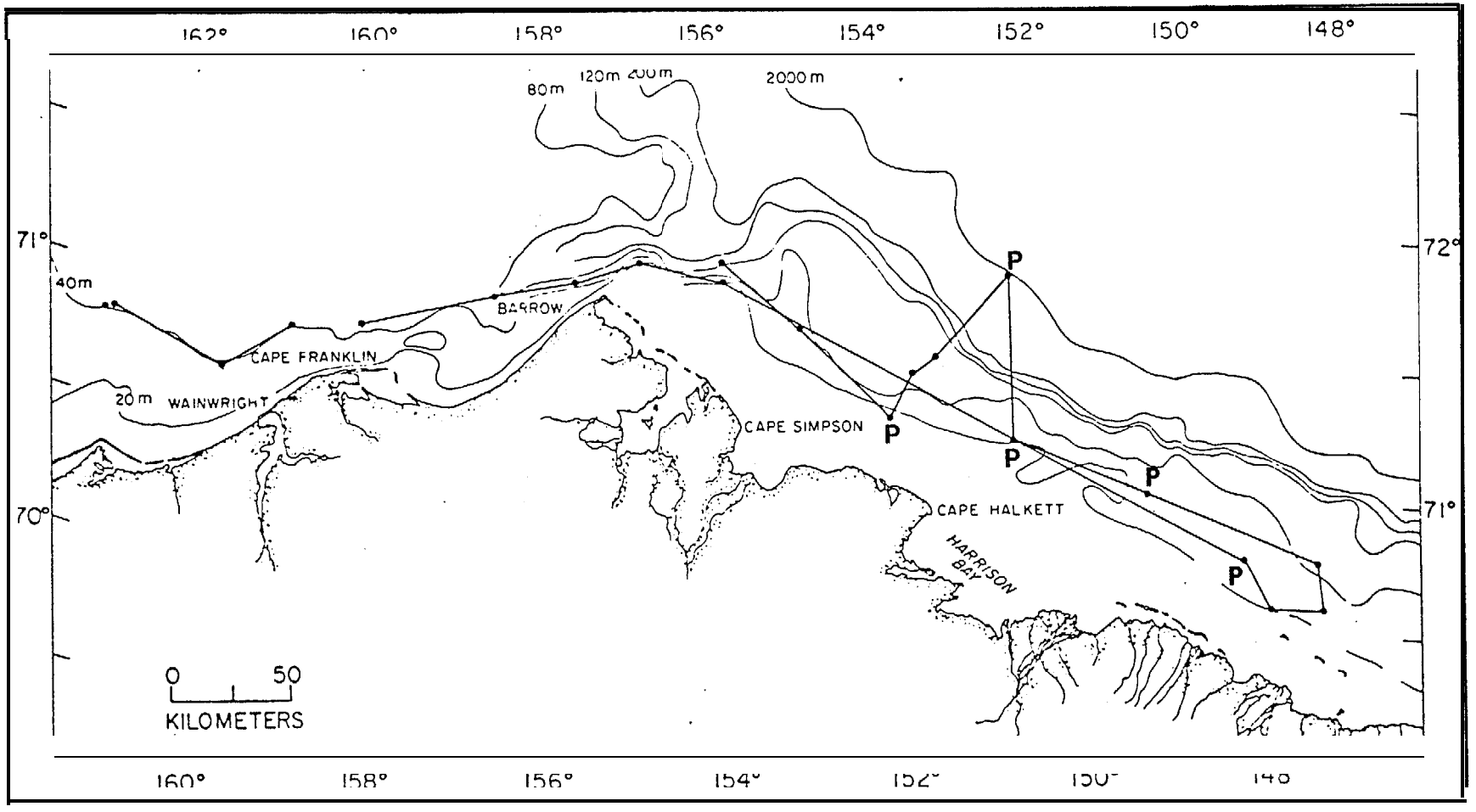


Fig. 36. Stations where *Perigonimus yoldia-arcticae* was present (P).

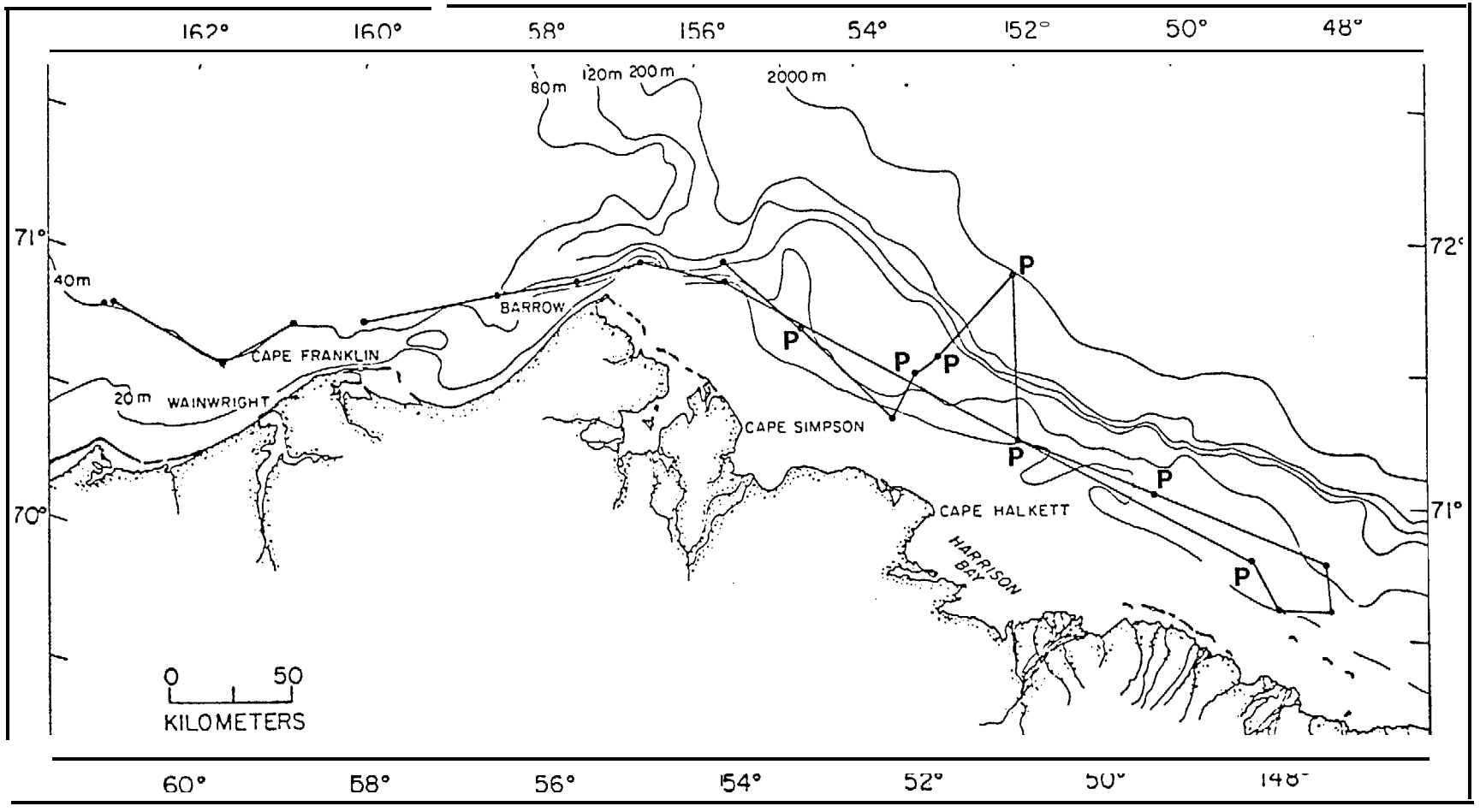


Fig. 37. Stations where *Rathkea octopunctata* was present (P).

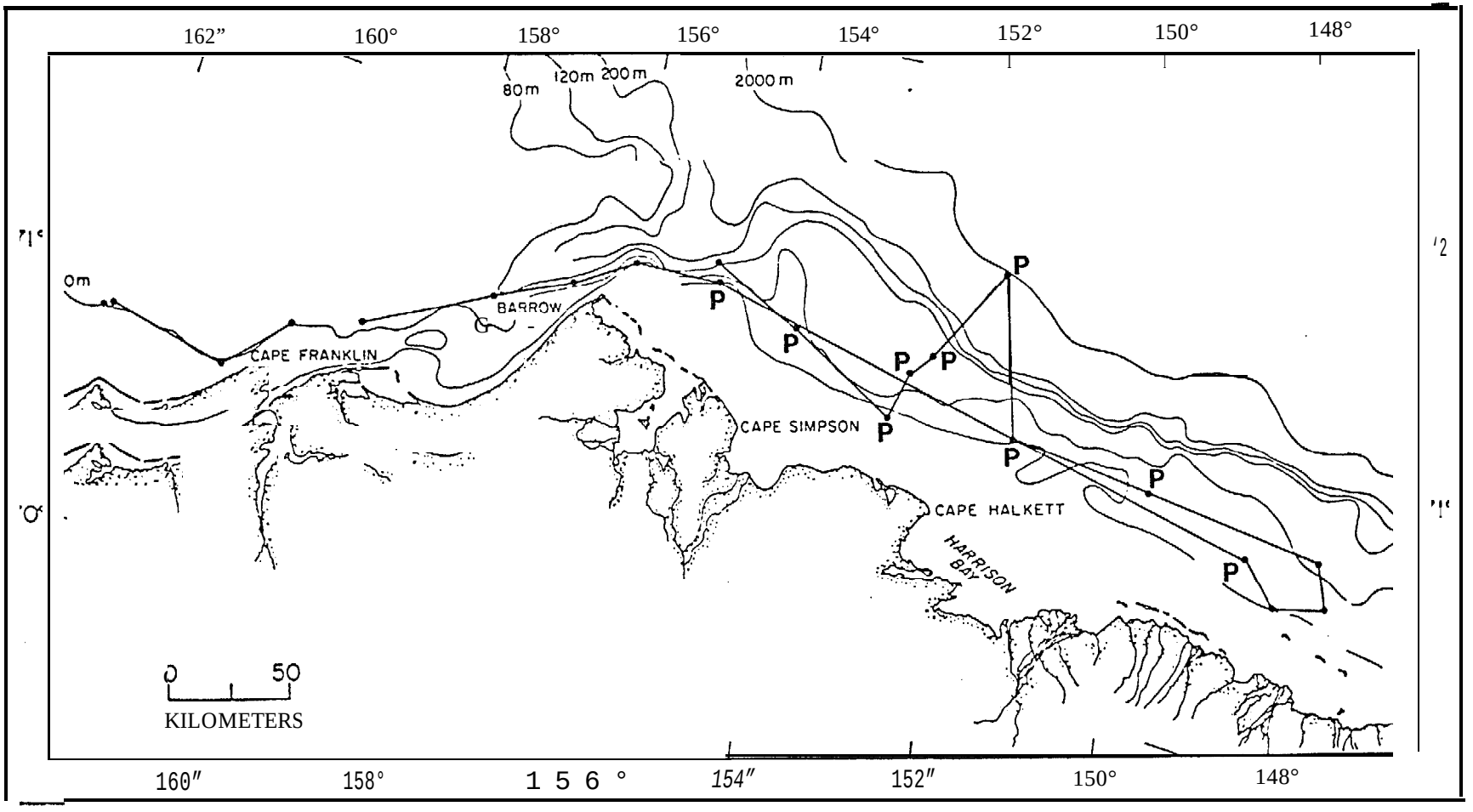


Fig. 38. Stations where *Cyanea capillata* was present (P) .

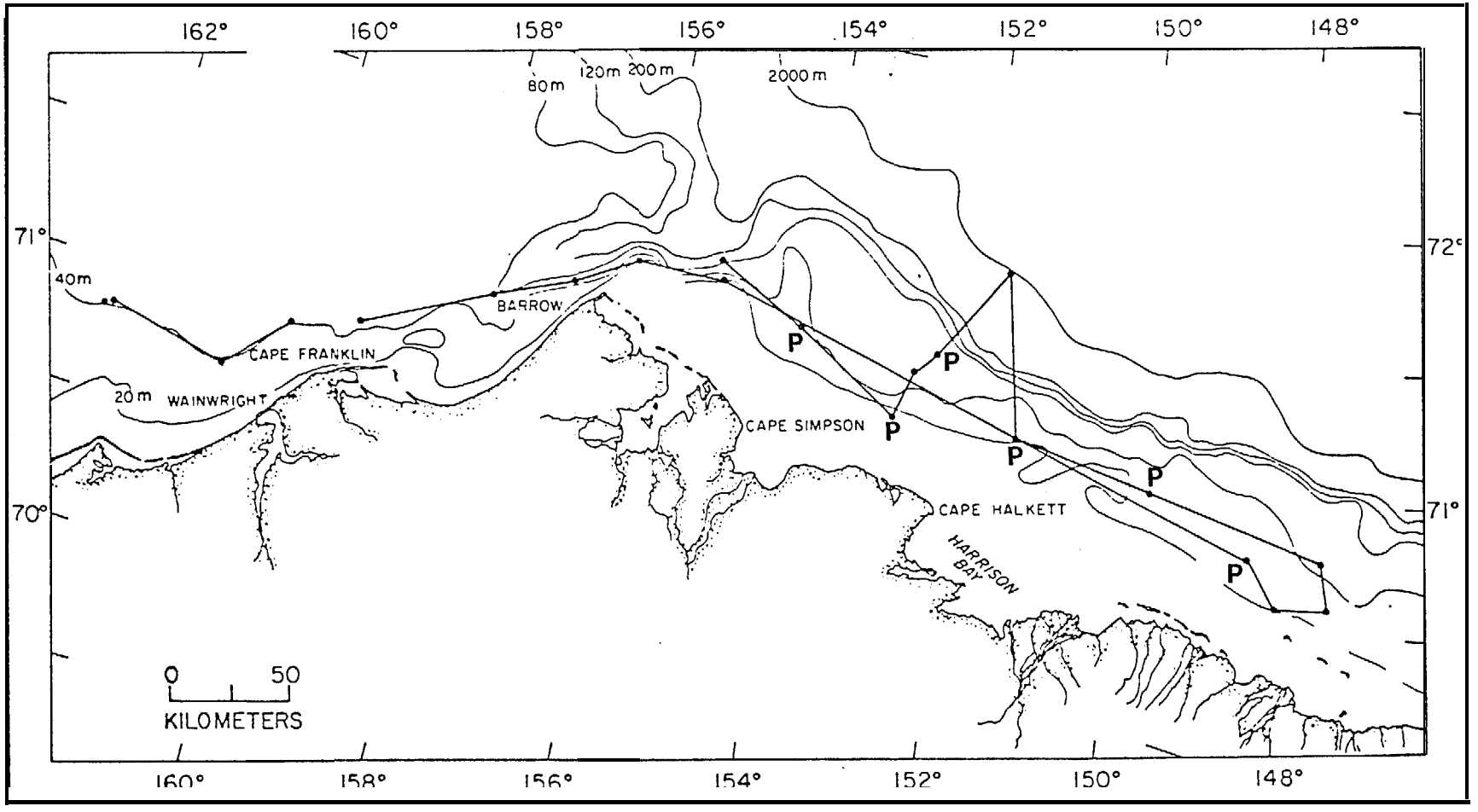


Fig. 39. Stations where *Boreogadus saida* was present (P).

Calanus cristatus Krøyer

This large copepod is abundant in the North Pacific and Bering Sea and is characteristically a bathypelagic species of cold waters (Brodskii 1950). It occurs in the Beaufort Sea as an expatriate from the Bering Sea. It was not present in vertical ring net hauls, but two stage V copepodites were collected in a bongo tow from 20 - 0 m at station 25.

Calanus glacialis Jaschnov

Calanus glacialis was one of three widespread, large, truly arctic calanoid species which occurred at all 12 stations (Fig. 17). Maximum abundances were found at station 19B for both 20 - 0 m and 10 - 0 m hauls. All developmental stages were present with stage II, 111 and IV copepodites generally most abundant. Adult females were present in small numbers. *Calanus glacialis* appears throughout the water column with large numbers present in the 200 - 0 m haul taken at station 21.

Calanus hyperboreus Krøyer

This large calanoid copepod is one of the dominant copepods of the Arctic Basin, and is usually found in large numbers in deeper water of the central Arctic. The species generally does not occur south of the northern Chukchi Sea (Brodskii 1950).

Calanus hyperboreus was observed at 6 stations, but did not appear in the western-most stations near the Pt. Barrow - Cape Simpson area (Fig. 18). Maximum abundances occurred at station 18 for *20 - 0* m and 10 - *0 m* vertical net hauls. Specimens observed were stage 1, II, 111, and IV copepodites. No stage V copepodites or adult females were found.

Calanus plumchrus Marukawa

Calanus plumchrus is another expatriate member of the Beaufort Sea plankton community usually found in abundance in the Bering Sea. It has been reported in the Pt. Barrow area, but disappeared from the plankton community by mid-August (Redburn 1974). This species was found in 50 - 0 m vertical net hauls only at stations 23 and 24 (Fig. 19). Five stage V copepodites were taken at station 23 while 1 female and 2 stage V copepodites were collected at station 24.

Centropages abdominalis Sato

This copepod appeared in only one sample collected at station 24 in a 20 - 0 m vertical ring net haul, Only stage V copepodites were observed. *Centropages abdominalis* is a neritic species at times abundant in the North Pacific off western Canada, in the Bering Sea, and in the southern Chukchi Sea, and, therefore, is probably indicative of Bering Sea water in the Beaufort Sea.

Derjuginia tolli (Linko)

A neritic species of slightly less saline waters, *Derjuginia tolli* occurred at four stations predominately as stage III, IV, and V copepodites (Fig. 20). No adult females were taken. Maximum abundance was found at station 15 in a 10 - 0 m vertical net haul. The occurrence of this species at station 21 and in samples collected from AIDJEX, 1975, indicate that *Derjuginia tolli* is widely distributed and may show a greater tolerance to higher salinity water than other characteristically neritic species.

Eucalanus bungii bungii Johnson

Only two specimens of this species were collected. At station 21, one adult female was taken in a 100 - 0 m vertical ring net haul while one stage V copepodite was taken from a 50 - 0 m haul at station 24 (Fig. 21). *Eucalanus bungii bungii* is a large copepod expatriated from the Bering Sea.

Euchaeta glacialis Hansen

This large carnivorous copepod is characteristically a deep-water species found in greater abundances in offshore plankton. One adult female and five copepodites (stages IV and V) were taken in a 200 - 0 m vertical ring net haul at station 21. Stage IV copepodites were also present in a 20 - 0 m vertical ring net haul at station 17.

No specimens of *Euchaeta norvegica*, previously reported from this area (Johnson 1956) were collected in either vertical or double oblique net hauls.

Eurytemora richingsi Heron and Damkaer

An unexpected member of the inshore plankton of the Beaufort Sea is *Eurytemora richingsi*. This new species was previously found in three of 54 samples collected from Fletcher's Ice Island (T-3) from May to September, 1968 (Heron and Damkaer 1976). Most of these samples were collected at depths greater than 500 m.

In the *Glacier* samples, one adult female was collected in a double oblique bongo net haul from 20 - 0 m at station 25, providing additional information on the distribution and ecology of this species. Identification was confirmed by Gayle Heron.

Limnocalanus grimaldii (Guerne)

Occurring primarily in the upper 10 m of the water column, this neritic, less saline water species was present in samples from five stations (Fig. 22). Though abundant at eastern stations, it was absent from samples collected at station 15. Maximum abundances were found at station 18 for both 20 - 0 m and 10 - 0 m hauls. Abundances at other stations were much lower. Adult females and males were most numerous, while stage III, IV, and V copepodites were also collected.

Metridia longa (Lubbock)

Metridia longs is primarily a deep-water copepod characteristically found in large numbers offshore at depths between 175 and 300 m, except during winter months when it is found in the upper 50 m of the water column (Tidmarsh 1973). This species was collected at stations 17, 18, and 21, although at station 21 it was collected only in 100 - 0 m and 200 - 0 m vertical ring net hauls. Maximum abundance occurred in the 200 - 0 m hauls at station 21. *Metridia longa* occurred in the upper 10 m of the water column only at station 17, where stage I and II copepodites were collected. Stage IV and V copepodites were most abundant in the deep hauls at station 21. Few adult females were present.

Microcalanus pygmaeus (G. O. Sars)

Microcalanus pygmaeus was found in samples collected at the eastern-most stations off Prudhoe Bay only (Fig. 23). Maximum abundances for both 20 - OmandlO- 0 m vertical ring net hauls were found at station 17. Stage V copepodites were most abundant, although adult females and males were also numerous. Stage III copepodites were the youngest developmental stage collected. The species is usually abundant in the offshore waters of the central Arctic.

Oithona similis Claus

Oithona similis was the only cyclopoid copepod collected in the upper 20 m at all 12 stations (Fig. 24). At some stations, it was the most numerous copepod species, reaching a maximum abundance at station 13. The species was poorly represented in samples collected from station 14. All developmental copepodite stages were observed, with stage IV and V copepodites generally most numerous. Adult females were most numerous at station 17, although few were ovigerous. A few adult males were found in some samples.

Oncaea borealis G. O. Sars

This cyclopoid copepod was collected only in the 200 - 0 m vertical ring net haul at station 21. Only adult females were found. *Oncaea borealis* was collected in large numbers in the upper 150 m of the water column from AIDJEX, 1975, and is widespread throughout the Arctic (Sars 1900, 1903).

Pseudocalanus spp.

By far the most abundant copepod category, *Pseudocalanus* spp. was collected at all *12* stations (Fig. 25). Two species, possibly three, comprise this category, but were grouped together in view of current taxonomic revision of the genus and difficulty in identifying juveniles. *Pseudocalanus minutus* (Krøyer) appeared to be the most abundant species. However, *Pseudocalanus major G. O.* Sars, a larger form characteristic of less saline water, was numerous at stations 14, 15, 17, and 18. Johnson (1956) also recognized a larger form but made no attempt to distinguish it from *P. minutus*.

Maximum abundances for *Pseudocalanus* spp. were found at station 19B. Stage III and IV copepodites predominated in the Prudhoe Bay area, while stage IV and V copepodites were numerous in other areas. Other developmental stages, including adult males, were collected, but in fewer numbers. More adult females were found in deeper hauls from station 21, but none was ovigerous.

Scaphocalanus magnus (Scott)

A widespread species, *Scaphocalanus magnus* occurs primarily in water deeper than 50 m. Only two specimens, an adult female and a stage V copepodite, were collected in the 200 - 0 m haul at station 21.

Unidentified copepoda

TWO species of calanoid copepods could not be identified. One species appeared to belong to the family Aetideidae and was especially prevalent at stations 15 and 18. Only stage III, IV, and V copepodites were collected. One species of cyclopoid copepod could not be identified because of small size and damaged specimens. Two species of harpacticoid copepods were collected, but no attempt was made to identify them to genus and species. Harpacticoids were collected from all stations except station 17.

Copepod nauplii

Copepod nauplii were collected at all stations with the exception of station 15. Maximum abundances were found at stations 13 and 19B. Most specimens collected were greater than 0.4 mm, although a large number of nauplii less than 4 mm were collected in samples containing large amounts of phytoplankton. This is in part reflected in those stations showing maximum abundances.

CIRRIPEDIA

Nauplii and cyprid larvae of *Balanus* SPP. were abundant at most stations, often comprising the largest percentage of the total zooplankton in the upper 20 m, except at Prudhoe Bay where they were poorly represented (Fig. 26). Maximum abundances for nauplii were found at station 13, while maximum abundances for cyprids were found at station 26, two weeks later. Redburn (1974) suggested that the developmental period between nauplius and cypris stage in the Barrow area was 31 days.

Balanus crenatus Bruguière and *Balanus balanus* Linnaeus have been reported in the Barrow area with *B. crenatus* being the most abundant (MacGinitie 1955).

EUPHAUSIACEA

Three species of euphausids were collected during the two-week sampling period. Although few numbers were present in our samples, euphausids are apparently an important part of the diet of the marine birds and mammals of

the area.

Thysanoessa inermis (Krøyer)

This species was the only euphausid caught in vertical ring net hauls. It was found at four stations, although never more than one individual was caught at a station (Fig. 27). Specimens collected were approximately 15 to 17 mm long. No specimens were collected in 10 - 0 m vertical net hauls. Johnson (1956) reported T. *inermis* at three stations in the Chukchi Sea, but not in the Beaufort Sea.

Thysanoessa raschii (M. Sars)

Thysanoessa raschii was caught only in a bongo tow from *20 - 0* m at station 25. Nine specimens were caught in the two nets, giving a concentration of 27/100 m^3. Specimens caught ranged from 14 to 17 mm in size. Johnson (1956) reported *T. raschii* to be the predominant euphausid of the area.

Thysanoessa longipes Brandt

One 14 mm specimen was collected in the 20 - 0 m double oblique bongo tow at station 25.

Thysanoessa spp. larvae

Thysanoessa spp. nauplii and calyptopid larvae were collected at stations 21, 23, 24, and 26, but were never very abundant.

OSTRACODA

Two species of ostracods were found. Johnson (1956) reported that ostracods of the area prefer deeper water,

Conchoecia borealis maxima Brady and Norman.

Ten specimens were collected at station 21 in the 200 - 0 m vertical ring net haul.

Philomedes globosus (Lilljeborg)

One specimen was collected in the 20 - 0 m vertical net tow at station 23.

CLADOCERA

One unidentified member of the family Polyphemidae was collected in the 20 - 0 m vertical ring net haul at station 25. This specimen was either *Podon leuckarti G. O.* Sars or *Evadne nordmanni* Loven, both of which are characteristically found inshore in less saline waters.

MY SIDACEA

TWO species of mysids were collected although adults and larger juveniles were caught in the bongo net hauls only.

Mysis litoralis (Banner) and *Mysis oculata* (Fabricius) were present in bongo net hauls from stations 20 and 25. Small *Mysis* spp. juveniles were present in vertical ring net hauls from stations 20 and 21. No gravid females of either species were found.

DECAPODA

The decapods were divided into three categories: anomuran crab zoea, brachyuran crab zoea, and caridea *or* shrimp larvae. Decapod larvae were never very abundant relative to other zooplankton categories, but were generally widespread throughout the sampling area.

Anomuran zoea were represented primarily by members of the family Paguridae, "although Redburn (1974) reported larvae of the king crab, *Paralithodes camtschatica* (family Lithodidae) near Pt. Barrow. Maximum abundances were found at station 13 in 20 - 0 m and 10 - 0 m hauls (Fig. 20). Anomuran zoea were absent from stations 15, 17, and 18 in the Prudhoe Bay area.

Brachyuran zoea were generally the most abundant decapods throughout the area, although relatively few were present in stations toward the east (Fig. 29). These zoea were represented primarily by members of the family Majidae and were probably the zoea of the snow crab, *Chionoecetes opilio (O.* Fabricius). No megalopa larval stages were found in the *Glacier*-76 samples.

Caridea, or shrimp larvae, were found at all stations except station 15 (Fig. 30). This category appeared to be primarily represented by members of the family Hippolytidae. Maximum abundances were found at stations 13 and 20. The large size, up to 10 mm, make these larvae prey for marine vertebrates in offshore areas where other prey are not available (Frost personal communication).

AMPHIPODA

Amphipods were grouped into two taxonomic categories, suborders Gammaridea and Hyperiidea. No attempt was made to identify specimens to genus and species.

Gammaridea

The gammarid amphipods were represented by three or four species, most of which occur in the top 10 m of the water column as under-ice organisms. Gammarid amphipods were collected at all 12 stations sampled, with maximum abundances found at station 20. No gravid females were collected.

Hyperiidea

Only one species was found representing this category. It was absent from all of the 10 - 0 m vertical net hauls, and was most abundant at station 14 in the 20 - 0 m vertical net haul.

POLYCHAETA

Pelagic larvae of polychaetes contributed a great deal to the meroplanktonic component of the zooplankton throughout the area, being second in importance to barnacle larvae. Polychaete larvae composed of trochophores, intermediate and late larval stages were present at all 12 stations, although in fewer numbers at the eastern stations (Fig. 31). Maximum abundances were found at station 26 for vertical net hauls.

Redburn (1974) reported that members of the families Phyllodocidae, Syllidae, and Polynoidae were abundant in the plankton off Pt. Barrow.

APPENDICULARIA

Fritellaria borealis Lohmann

One of two species found in the sampling area, *Fritellaria borealis* showed a widespread distribution, occurring at all stations except station 15 (Fig. 32). This small species showed maximum abundances at stations 13 and 21.

Oikopleura spp.

Questionable taxonomic characteristics resulted in grouping members of this larger appendicularian genus into one category. Although trunk lengths exceeded those of *Oikopleura labradoriensis* Lohmann, gastrointestinal characteristics did not match those of *Oikopleura vanhoeffeni* Lohmann.

Oikopleura spp. showed a widespread distribution, being absent only at station 15 (Fig. 33). Maximum abundances were found at stations 19B and 25. Most specimens collected were immature.

CHAETOGNATHA

Sagitta elegans Verrill

Sagitta elegans was the only chaetognath species collected during the sampling period. It was widely distributed throughout the area, although absent or sparse at those stations located near Prudhoe Bay (Fig. 34). Maximum abundances occurred at stations 13 and 21. Most specimens were immature, although mature specimens were always present. *Sagitta elegans* apparently did not occur at depths greater than 50 m at station 21.

CNIDARIA

Hydrozoa

Eight species of hydrozoa were collected in the sampling area, including one unidentified species. Only two species were present in appreciable numbers and were widespread in distribution.

Aeginopsis laurentii Brandt

A common circumpolar species, *Aeginopsis laurentii* was found in samples from only two stations. One 8 mm specimen was taken in a 10 - 0 m haul at station 18 while a 9 mm specimen was collected in a 20 - 0 m haul at station 20. *Aeginopsis laurentii* is a holoplanktonic hydrozoan spending its entire life in the plankton.

Aglantha digitale (Müller) var. *camtschatica* (Brandt)

This holoplanktonic species was by far the most numerous hydrozoan medusa. It occurred at 10 stations, primarily in the upper 10 m, although it was poorly represented in samples collected in the Prudhoe Bay area (Fig. 35). Maximum abundances were observed at station 26 for both 20 - 0 m and 10 - 0 m vertical net hauls. Stations 23, 24, and 26 showed large numbers of small, immature specimens, while at other stations, larger juveniles and mature specimens predominated.

Bougainvillia superciliaris (L. Agassiz)

This species was absent from all of the vertical ring net samples. One immature specimen was collected in a 10 - 0 m bongo net tow at station 20. Polyp colonies generally occur at depths of 1 to 17 m (Naumov 1960).

Corymorpha flammea Linko

Corymorpha flammea was poorly represented in the zooplankton of the area, occurring at only two stations. One immature medusa was collected at station 17 in a 20 - 0 m vertical haul, while another immature medusa was taken from the 100 - 0 m vertical haul at station 21.

Perigonimus yoldia-arcticae Birula

This hydrozoan medusa was found at five stations although in few numbers (Fig. 36). Maximum abundance was $7/m^2$ in a 20 - 0 m haul at station 14. At station 25, the species was taken in a bongo tow from 20 - 0 m.

Plotocnide borealis Wagner

A rare species, one immature medusa was collected in a vertical ring net haul from 10 - 0 m at station 19B. The polyp generation of this species is unknown (Naumov 1960).

Rathkea octopunctata (M. Sars)

This species was second in abundance to *Aglantha digitale* and was found in samples collected at seven stations (Fig. 34). Maximum abundances were found at stations 23 and 26. No mature specimens were found.

Unidentified hydrozoa

Included in this category are specimens too damaged to be identified. However, one immature specimen taken from a 50 - 0 m vertical ring net haul at station 21 might be *Coryne princeps* (Haeckel).

Scyphozoa

Cyanea capillata (Linnaeus)

Cyanea capillata was the only scyphozoan found in samples collected from the sampling area. The species was sparsely present at nine stations, and was absent in samples collected in the Prudhoe Bay area (Fig. 38). Maximum abundances were found at stations 4 and 6. Although capable of reaching 500 mm, specimens collected were 8 to 30 mm in diameter. The distribution of this species may be of some importance, as an association between it and the arctic cod *Boreogadus saida* has been suggested (Redburn 1974).

CTENOPHORA

Two species of ctenophores were found in samples collected from the area. However, one species remains unidentified because of the poor condition of preserved specimens. A quantitative analysis of the abundance of species of this phylum is difficult because of the poor preservation. Only complete or nearly complete specimens were counted.

Beroe cucumis Fabricius

Although present at four stations, *Beroe cucumis* was most abundant at station 14.

Unidentified ctenophores

Two unidentified ctenophores were found in vertical ring net samples collected at stations 21 and 23 and bongo net tows at stations 20 and 25.

MOLLUSCA

Spiratella helicina (Phipps)

This pteropod species was the most abundant and widespread representative of the Mollusca in the zooplankton population. It was present in samples collected from 10 stations. Maximum abundances were found at stations 17 and 18. Most specimens were small, generally < 0.5 mm, although

larger pteropods, 1 to 2 mm, were also present.

Unidentified larvae

Two categories of molluscan larvae were distinguished: lamellibranch or bivalve larvae and gastropod veligers.

Lamellibranch larvae were abundant at times although primarily below 10 m. Maximum abundances were found at stations 13, 21, 23, and 24. Lamellibranch larvae were found at eight of the 12 stations sampled.

Gastropod veligers were present in samples collected from six stations. Maximum abundances were found at stations 24 and 26.

ECHINODERMATA

This phylum was represented in the zooplankton samples by plutei larval stages of ophiuroids (brittle stars) and echinoids (sea urchins). Bipinnaria larvae were also found. Echinoderm larvae were present in samples collected from 10 stations with maximum abundances occurring at station 18 where large numbers of ophioplutei were the only echinoderm larvae encountered.

PISCES

Three or possibly four species of fish larvae were encountered in the sampling area, two of which were found only in bongo net samples from station 20. No fish eggs were collected.

Boreogadus saida (Lepechin)

The arctic cod *Boreogadus saida* was the most abundant and widespread fish larva observed. It occurred in vertical ring net samples at stations 14 and 19B in 20 - 0 m hauls, and at stations 23 and 26 in 10 - 0 m hauls (Fig. 39). No more than one larva was caught in any one vertical net haul. Specimens ranged from 11 to 14 mm in length.

Boreogadus saida was also caught in bongo net tows at stations 20 and 25. Seven larvae ranging from 9 to 16 mm were caught in a double oblique haul from 10 - 0 m at station 20. Seven larvae, caught at station 25 in a double oblique haul from 20 - 0 m, ranged in size from 14 to 18 mm.

Lumpenus sp.

This fish larva was present only in the bongo net tow at station 20 where 4 larvae were caught in a 10 - 0 m haul. Larvae were 15 to 16 mm in length.

Unidentified Cyclopteridae

This species, probably *Liparis* sp., was caught in bongo net tows at

stations *20* and 25. One 17 mm larva was caught in the 10 - 0 m haul at station 20, and a 28 mm specimen was collected in the 20 - 0 m haul at station 25.

Unidentified Gadidae

This category *was* represented at station 25 in vertical ring and bongo net hauls with one 19 mm larva collected in a 20 - 0 m ring net haul and two larvae, 21 and 24 mm, collected in the bongo net haul from 20 - 0 m. These fish larvae may be *Boreogadus saida*, although pigment patterns on these specimens do not match those described for this species.

VII. Discussion

A. Prudhoe Bay

Adverse ice conditions in the summer of 1975 prevented plankton sampling except for a fairly intensive program in September within Prudhoe Bay and in the lagoon area between Prudhoe Bay and the Midway Islands.

Carbon assimilation and chlorophyll a concentrations were generally variable throughout the study area except that higher values were usually found in deeper water, which agrees with the findings of Homer *et* aZ. (1974). Standing stock was also variable. *Chaetoceros furcellatus*, unidentified pennate diatoms, and unidentified flagellates were the most common organisms present. The pennate diatoms appeared to be species usually associated with the ice and comprising a large part of the ice algae community in spring. *Chaetoceros furcellatus* is also considered to be a spring species and frequently occurs with resting spores during ice breakup. Several species of the genus *Thalassiosira* were also present and are usually spring species. It appears that the phytoplankton community sampled in September 1975 consisted of species characteristic of the spring bloom that usually occurs about the time of ice breakup.

Other indications that the spring bloom was occurring in September were the relatively high nutrient concentrations, suggesting that the phytoplankton had not yet utilized the nutrients. The average nitrate plus nitrite concentration was about twice as high as that reported by Homer *et al. (1974)* for August 1972.

Homer *et al.* (1974) reported the presence of three phytoplankton communities within the Prudhoe Bay area. No such specific communities were found in this study. The most common taxa were distributed throughout the area and in the water column.

Annual variation in species composition, distribution and production in the shallow bay and the lagoon area inside the barrier islands in the Prudhoe Bay area is apparently a function of local weather and ice conditions along with available nutrient concentrations.

B. USCGC *Glacier*

1. Phytoplankton standing stock and productivity

Nearly all the species reported for the Chukchi and Beaufort seas (Bursa 1963, Homer 1969, Coyle 1974, Homer *et al.* 1974, Hsiao 1976) are common and widespread in north temperate and subarctic (as defined by Dunbar 1968) waters. Many species, especially pennate diatoms and flagellates, are only found in the epontic ice community in spring (Homer 1976) and are not listed in Table 6. Some species, including *Nitzschia frigida* Grunow and *Nitzschia grunowii* Hasle, are found in ice and in the water column. *Nitzschia frigida* is a dominant member of the ice community and is occasionally found in the water column, while *Nitzschia grunowii* is often a major component of the spring phytoplankton bloom in the water column.

Another major component of the spring bloom in the water column is *Porosira glacialis* (Grunow) Jorgensen, which was not common in the *Glacier*-76 samples. *Thalassiosira Antarctica* Comber was present at stations *15, 17,* and 18 near Prudhoe Bay. These two species have been tentatively called bipolar species by Hasle *(1974)* because they are found in extreme inshore waters or near ice in both polar regions. This distribution is difficult to explain, although Smayda (1958) suggested that bipolar distribution could be explained only if the species were cosmopolitan. Obviously more samples from low latitude oceanic areas must be examined before any decisions can be reached.

Chaetoceros furcellatus, *Ch. wighami*, included in *Chaetoceros* spp., and *Ch. septentrionalis* often occur in the water column either in spring or associated with ice. *Chaetoceros atlanticus*, *Ch. compresses, Ch. concavicornis*, *Ch. decipiens*, and *Ch. subsecundus* commonly occur in the Barrow area in summer.

Nitzschia closterium and *Leptocylindrus minimus* were abundant in Bering Sea water at stations *23* and *24*. *Nitzschia closterium* is an ubiquitous species, commonly found in temperate and Arctic waters, and is always present in nearshore waters of the Chukchi and Beaufort Seas (Bursa 1963, Homer 1969, Homer *et al.* 1974). *Leptocylindrus minimus* is the only species in *Glacier*-76 samples that has not been reported previously from the Beaufort Sea. Its distribution is not well known, but it has been reported from the Bering Sea (Ohwada 1972, Motoda and Minoda 1974). It is possible that *L. minimus* has been present in other Beaufort Sea samples, but not recognized because of its small size and superficial resemblance to broken *Chaetoceros* spines. Its presence in Beaufort Sea water indicates that it is probably an expatriate.

The diatom *Eucampia zoodiacus* Ehrenberg occurred more frequently in *Glacier*-76 samples than in earlier collections, but its distribution was more restricted, occurring mainly at the inshore stations 15, 17, and 18 near Prudhoe Bay. In WEBSEC-73 samples from the Beaufort Sea, it was found from Pt. McIntyre to Flaxman Island, offshore as well as inshore.

Small flagellates are difficult to identify in preserved phytoplankton samples because of poor preservation, small size, scattered reference material, and the enumeration technique, i.e., use of the inverted microscope and settling chambers. No preservative currently available will work equally well on the wide variety of organisms in a phytoplankton sample. Formalin appears to be as good as any other preservative and does not require a bleaching step as does Lugol's iodine. Many of the smaller flagellates, those < 10 μm in diameter, require study under the transmission electron microscope before positive identification can be made. Most of these organisms, therefore, have been grouped into size classes based on the length and diameter of the cells. Where possible, they have been identified to family or phylum.

Dinoflagellates are also often difficult to identify in inverted microscope counting chambers, because they frequently settle at odd angles, so that identifying characteristics cannot be seen. This is especially true of species having relatively heavy thecae or spines, including species of *Peridinium* and *Ceratium*. Other forms, which are usually smaller in size, have very thin thecae and may be poorly preserved as are flagellates. Many of the smaller forms have probably not been described in the scientific literature, and they have been grouped as undetermined Pyrrophyta.

The lack of information on species distributions based on adequate taxonomic data makes it difficult to separate the phytoplankton into categories based on hydrography. Most of the species listed in Table 6 are considered to be neritic species, but many of them, including species of *Thalassiosira*, *Chaetoceros*, *Nitzschia*, and *Navicula*, have been reported from the central Arctic as well (Kawamura 1967).

Hasle (1976) discusses early attempts to group phytoplankton by habitat and points out some of the difficulties. She also resorts to simple terminology such as "warm water" or "cold water" assemblages.

Our use of a constant light incubator, while practical for the conditions under which we were working, gives relative production. The average light value used here, ea. 2100 lux, is somewhat lower than the light levels reported by Alexander *et al.* (1974) for 6 m near Barrow when no ice is present. Photosynthetic efficiency was probably not inhibited by the light levels we used.

The temperature in our incubator was usually 5 to 7° C higher than the *in situ* temperature. This might have enhanced photosynthetic rates somewhat, but the low light levels probably compensated for the higher temperatures.

Some estimates of annual production in the Chukchi and Beaufort Seas have been made, primarily from data collected in shallow nearshore areas (Coyle 1974, Homer *et al.* 1974, Alexander 1974, and Hsiao 1976). Coyle (1974) and Homer *et al.* (1974) based their figures on data collected in Prudhoe Bay and the lagoon area between the coast

and the Midway Islands for the water column and on Barrow for the ice algae and benthic microalgae; therefore their estimates may be somewhat high. Total annual production within Prudhoe Bay was estimated to be < 10 g C $m^{-2} \cdot yr^{-1}$, and *ca.* 13 to 23 g C $m^{-2} \cdot yr^{-1}$ in the lagoon. Alexander (1974) estimated the annual production of the water column in Harrison Bay and Simpson Lagoon to be *ca.* 10 to 15 g C $m^{-2} \cdot yr^{-1}$.

Using the assumptions given below and Hsiao's (1976) average integrated productivity value of 28.14 mg C $m^{-2} \cdot yr^{-1}$ for inshore and offshore stations, annual production in the southern Beaufort *Sea* is about 8 g C $m^{-2} \cdot yr^{-1}$. In the eastern Canadian Arctic, Grainger (1971) reported annual production in excess of 40 g C $m^{-2} \cdot yr^{-1}$ from Frobisher Bay.

Estimates of annual production for the northeastern Chukchi Sea and western Beaufort Sea have been calculated using *Glacier*-76 data. The calculations assume 24 hr days in June and July, 20 hr days in August, and 15 hr days in September. It is also assumed that twice as much production occurs in June during the spring bloom as occurs later in the summer and that essentially no production occurs during other months. The ice algae and benthic microalgae have not been included in these estimates. In the northeastern Chukchi Sea, annual production is *ca.* 18 g c $m^{-2} \cdot yr^{-1}$, while in the western Beaufort Sea it is ea. 9 g C $m^{-2} \cdot yr^{-1}$.

2. Zooplankton

The zooplankton of the western Beaufort Sea may be grouped into 4 categories: species which are expatriates from the Bering and Chukchi Seas, species occurring throughout the Arctic Basin, species characteristically found in neritic, less saline environments, and species contributing meroplanktonic life history stages to the zooplankton. The abundance, distribution, and diversity of these categories is primarily a reflection of hydrographic conditions resulting from the clockwise circulation of the Polar Basin gyre, wind-driven upwelling, and from the easterly intrusion of warmer, more saline Bering Sea water.

The northward flow and subsequent easterly intrusion of Bering Sea water is not an unusual phenomenon in the western Beaufort Sea. Hufford (1973) has documented a warm, high salinity layer in 10 - 60 m of water in 10 of 16 years examined. This layer may extend as far east as 143° w. Hydrographic data during the summer of 1976 indicate an eastward extension of this layer to 1510 19.0' W (station 20).

Eastward extension of Bering Sea water is also indicated by the occurrence of expatriate copepod species *Calanus cristatus*, *Calanus plumchrus*, *Centropages abdominalis*, and *Eucalanus bungii bungii* (Johnson 1956). The cladocerans, *Evadne nordmanni* and *Podon leuckarti*, may also be expatriate species (Redburn 1974). These species were not found east of. station 20, thus substantiating hydrographic data. The absence of these species at stations 13 and 26 may be due to the small volumes of water filtered relative to their abundance.

Other species reported by Johnson (1956) in the western Beaufort Sea as coastal expatriates from the south were *Acartia clausi*, *Eurytemora herdmani*, and *Tortanus discaudatus*. Redburn (1974) found these species only when surface temperatures exceeded 7° C. These species were not found during the 1976 sampling period, possibly because surface temperatures were always less than 70 C.

The majority of species occurring throughout the Arctic Basin were well represented in the inshore zooplankton of the western Beaufort Sea. Included in this category are *Calanus glacialis*, *Oithona similis*, *Thysanoessa* spp., *Fritellaria borealis*, *Oikopleura* spp., *Sagitta elegans*, and *Boreogadus saida*. Redburn (1974) suggested that distributions and abundances of these species are less directly affected by advective processes than they are by biological interactions and characteristics of these species, including predation, food requirements, natural death and sinking, and reproductive success.

Amphipods in this region are primarily under-ice organisms and therefore influenced by the presence or absence of ice. The widespread distribution of amphipods during the 1976 sampling period may be due to adverse ice conditions and little open water during that period.

There remains some question as to the distribution of *Eurytemora richingsi*, although its presence at station 25 and in deep hauls offshore makes it appear to be a widespread, though rare, species.

Other widely distributed species showed distributions and abundances which were affected by advective processes. Johnson (1956) suggested zooplankton distributions in the Beaufort Sea are influenced by the prevailing circulation in the Polar Basin in which clockwise circulation introduces cold central Arctic water from the north into the eastern Beaufort Sea. Using data collected in 1972, Hufford (1974) described the presence of a wind-driven, upwelling regime on the eastern half of the North Alaskan shelf which apparently is not a regular feature of the shelf circulation (Mountain 1974). English and Homer (1976) reported *Scaphocalanus magnus*, *Heterorhabdus norvegicus*, and *Gaidius tenuispinus* in WEBSEC-72 samples collected from 50 m off Barter Island (1430 45′ W). These copepod species are characteristically deep water species in the central Arctic.

O'Brien and Hurlburt (1972) suggested that the upwelling regime proposed by Hufford (1974) should be accompanied by westward movement of water in the upwelling region, which will be in opposition to the easterly flow of Bering Sea water. The influence of this circulation regime is apparent in the Prudhoe Bay area, where copepods which are more abundant offshore or in deeper water, such as *Calanus hyperboreus*, *Euchaeta glacialis*, *Metridia longa*, and *Microcalanus pygmaeus*, were collected in 20 - 0 m net hauls in greatest abundance or only at stations in the Prudhoe Bay area in 1976.

Hand and Kan (1961) suggested a similar advective influence on the holoplanktonic hydrozoans *Aglantha digitale* and *Aeginopsis laurentii*

collected in 1950 and 1951. These species were poorly represented in the Prudhoe Bay area during the sampling period in 1976.

Aglantha digitale, however, may show a response to the intrusion of Bering Sea water. Large numbers of this species were reported at the easterly front of intruding Bering Sea water in 1950. Hand and Kan (1961) suggested a downward movement of water at this front with an accumulation of *A. digitale* as a result of attempts by this species to remain close to the surface. During 1976, large numbers of *A. digitale* were collected at stations where Bering Sea water occurred. Whether this accumulation of individuals is a result of downwelling or is the result of recruitment of juvenile medusae into the plankton cannot be determined with present data, although the presence of large numbers of juvenile *A. digitale* at station 26 suggests recruitment.

Some species collected during 1976 are characteristically found in the Beaufort Sea and are neritic in nature. *Pseudocalanus* spp. is the largest representative of this category occurring throughout the sampling area, but absent from waters of the central Arctic. *Pseudocalanus minutus* and *Acartia longiremis* are characteristic of those species whose distributions and abundances in the inshore environment are more likely influenced by biological phenomena.

Pseudocalanus major, *Derjuginia tolli*, and *Limnocalanus grimaldii* are neritic species whose distribution and abundances are primarily influenced by the extent of lower salinity water resulting from runoff and melt water. *Pseudocalanus major* was restricted to the eastern stations during 1976, while *Derjuginia tolli* showed a wider distribution resulting from a higher tolerance to more saline waters.

In addition to the extent of less saline water, the distribution of *Limnocalanus grimaldii* is apparently influenced by advective processes. Johnson (1956) found *L. grimaldii* off the Colville River (ea. 150° 30′ W) in 1950 when Bering Sea water extended to 143° W. English and Homer (1976) reported *L. grimaldii* in WEBSEC-72 samples collected off Barter Island (143° 45′ W). In the 1976 samples, *L. grimaldii* was found only east of the Colville River. This distribution pattern suggests that *L. grimaldii* is a more eastern species, whose distribution in the western Beaufort Sea is restricted by the easterly flow of Bering Sea water.

Meroplanktonic life history stages of barnacles, polychaetes, hydrozoans, gastropod, and echinoderms comprised the largest part of the zooplankton in the western Beaufort Sea. Johnson (1956) suggested that meroplanktonic production was greater in the Chukchi and western Beaufort seas than in the eastern Beaufort Sea because of the larger area of shallow water in the western areas. Except for echinoderm larvae, meroplanktonic larval stages were most abundant at stations 13 and 26 during 1976.

Maximum abundances of barnacle larvae were found northwest of Pt. Barrow in 1950 and 1951, suggesting that a sizeable portion of barnacle larvae in the western Beaufort Sea may be due to advection (Johnson 1956).

This would seem a plausible hypothesis as barnacle larvae diminished in abundance at the easternmost stations.

Abundances of barnacle larvae collected at offshore stations were similar in 1951 and 1952, but were greater at inshore stations in 1976. Cypris larvae were more abundant in 1951, while nauplii were more abundant in 1976, although samples for both years were collected the last two weeks in August. This is probably due to the later release of meroplanktonic larval stages associated with adverse ice conditions in 1976.

Hand and Kan (1961) suggested that meroplanktonic hydrozoan medusae were advected into the western Beaufort Sea from the Chukchi Sea. During 1976, most meroplanktonic hydrozoans were not found in sufficient numbers to describe distributions and responses to advective processes. *Rathkea octopunctata*, however, was widespread in the western Beaufort Sea in 1976 and many small individuals were found suggesting a locally reproducing population.

VIII. Conclusions

Conclusions listed here, especially for the phytoplankton, must be considered preliminary because so few data are available.

A. Phytoplankton

1. Individual phytoplankton species have widespread distributions in the nearshore Beaufort Sea, but standing stocks of phytoplankton are variable and patchy.

2. Some apparently expatriate species occur when Bering Sea water is found in the Beaufort Sea.

3. Primary production is variable and patchy, with highest production occurring between 5 and 20 m and where diatoms are the most abundant organisms.

B. Zooplankton

1. Zooplankton species can be grouped into four categories:

   a. Expatriates from the Bering and Chukchi seas;
   b. Species occurring throughout the Arctic Basin;
   c. Species from less saline, nearshore areas;
   d. Species contributing meroplanktonic stages.

2. Distribution of some species or larval groups is patchy and is influenced by hydrography.

3. Expatriate species occur when Bering Sea water is found in the Beaufort Sea.

4. Meroplankton comprise a large part of the zooplankton in the western Bering Sea.

5. Species utilized as food by birds and mammals generally were not caught by our sampling gear. The presence of ice prevented use of horizontally-towed nets and larger, faster moving species are able to avoid vertically-towed nets.

Ix. Needs for further study

Information currently available on the phytoplankton and zooplankton of the Beaufort Sea consists primarily of species distributions and abundances during the summer, usually August and early September, and usually west of Barter Island. This kind of information should be extended to include all seasons of the year and the area from Prudhoe Bay east at least to the Canadian border.

Essentially no data are available on life cycles of any phytoplankton or zooplankton species. A little information has been obtained from distribution and abundance surveys, but there have been no concerted efforts to determine life cycles of even the most common species.

No information is available on the vertical distribution of plankton species or on diel vertical migrations of zooplankton species in the Beaufort Sea.

No information is available on year-to-year variability of plankton populations, with the exception of the phytoplankton cycle in the nearshore water at Pt. Barrow.

There is very little information available on trophic dependencies. Some of the important food species for fish and mammals are amphipods, shrimps, euphausids, and Arctic cod, but distribution patterns, life cycles, and food habits of these organisms generally are not known. It is not known what role the ice algae play in the food web of the Beaufort Sea, although it has been suggested that this community lengthens the growing season by about two months (Homer 1976). In addition, Schell (personal communication) has suggested that the ice algae act as a nutrient pump, especially in water < 10 m deep, and that ice algae serve as food for grazers and also concentrate nutrients that will be released into the sediments or water column when the algal cells disintegrate, thus increasing the nutrient supply to benthic and planktonic microalgae.

Critical species or groups of species have not been identified. These critical species might be important food species, rare species that would be adversely affected by pollution, or abundant species.

Very little information is available on the effects of oil on plankton in the Arctic. Hsiao (1976) has shown that rates of primary production vary with type and concentration of oil, methods Of preparation Of oil-seawater mixtures, species composition of the plankton, and duration of exposure. Diatoms especially were inhibited by crude oils and mixtures of crude oils and Corexit (a compound used in oil spill clean-up). A slick of oil on the water surface would reduce light penetration, thus reducing photosynthesis and growth of phytoplankton. Organic pollutants might also contribute to changes in the species composition of the phytoplankton, changing the population from one composed of diatoms to one composed of microflagellates (Fisher 1976). This change in structure of the phytoplankton community could seriously affect other levels of the food chain. Some life cycle stages have been shown to be more sensitive to pollutants than other stages; in particular, larvae are often more susceptible than adults.

Environmental information should be collected at the same time as biological information. Knowledge of current regimes, for example, would help biologists determine dispersion patterns for plankton which could be important in repopulating an area after an oil spill.

x. Summary of 4th quarter operations

R.U. #359 had no field program during this quarter. Our activities consisted of finishing the laboratory analyses of samples, primarily sorting, counting, and identifying plankton samples, and working on data analysis for the final report.

XI. Bibliographies

Extensive bibliographies for phytoplankton and zooplankton have been compiled. All references have been checked, and key words identified; nearly all are available in the University of Washington library system, and UW call numbers are given along with the location in the UW library. Journal abbreviations are from the World List of Scientific Periodicals or follow the World List abbreviations for individual words where possible. Some publications have been written out in full to facilitate finding the reference. Bibliographic style generally follows the CBE Style Manual, third edition, American Institute of Biological Sciences, Washington, D. C. Foreign language references, journal abbreviations, library call numbers, and punctuation marks have been modified (use of capital letters, no umlauts, no degree signs, asterisks in place of quotation marks and apostrophes, etc.) to accommodate the computer.

Many of the references are taxonomic in nature and are not limited to Arctic taxa. The literature search has been designed to include references for the whole Arctic Ocean and peripheral waters, including the northern Bering Sea, Norwegian Sea, Denmark Strait, Baffin Bay, and Davis Strait, because it is impossible to separate the Beaufort Sea biologically from the rest of the Arctic.

The ichthyoplankton bibliography is not extensive and contains more references to adult fish than to larvae and juveniles. A more extensive bibliography for ichthyoplankton was done for R.U. #349 (English 1976). The present bibliography is limited primarily to the nearshore Beaufort Sea and streams entering into this area.

All three bibliographies are appended to this report, section XIV.

XII. Archived samples and unpublished data

Archived samples and unpublished data concerning zooplankton and phytoplankton are primarily from WEBSEC (Western Beaufort Sea Ecological Cruises) cruises sponsored by the U. S. Coast Guard from 1970 to 1973. Wing (1974) published the results of zooplankton collections made during the 1970 cruise in the eastern Chukchi Sea; Cobb and McConnell (unpubl. ins.) described the species composition, relative abundances, and distribution, of zooplankton from the 1971 cruise. Wing also collected zooplankton samples during the 1972 WEBSEC cruise. Some of these samples have been processed as part of the present OCSEAP project, and four tables included in our first annual report (R.U. #359), 1 April 1976 (English and Homer 1976), are reprinted here (Tables 17 to 20).

Homer collected phytoplankton standing stock and chlorophyll a samples during WEBSEC-73. All of the samples have been processed, but the results have not been published. Chlorophyll a and phytoplankton standing stock samples were collected in 1974 from Icy Cape to Barrow and from Barrow to Barter Island. The chlorophyll a samples have been analyzed, but the standing stock samples have not (Homer unpubl.).

Table 17. Number of fish larvae found in two WEBSEC-72 Isaacs-Kidd mid-water trawl samples

Station	Date	Depth (m)	Sample	Fish Larvae
009	7 Aug 72	0	AB 72-157	29
(70°30.8'N,		40	-159	15
144°27.0'W)		20	-160	0
010	7 Aug 72	20	-163	26
(70°19.3'N,		15	-164	38
144°46.5'W)		10	-165	59
		0	-166	272

Table 18. Fish eggs and larvae from two vertical net hauls

Station	Date	Depth (m)	Sample	Fish Larvae	Fish Eggs
005	5 Aug 72	500	AB 72-137	0	1
(70°51.7'N,		800	-138	0	1
143°45.4'W)					
010	7 Aug 72	30	-161	1	0
(70°19.3'N,					
144°46.5'W)					

Table 19. Copepods sorted from station 005, AB 72-132 (70°51.7'N, 143°45.4'W), 5 Aug 1972, 50 m. The total number of copepods was 1742.

Species	Stage	% Total
Calanus hyperboreus	VI ?	38.80
	V	19.17
	IV	2.46
	III	0.40
	I	0.11
Calanus glacialis	VI ♀	14.12
	V	3.32
	IV	0.74
	III	1.32
	II	0.74
	I	0.11
Metridia longa	VI ♀	4.53
	VI ♂	1.03
	V ♀	2.58
	V ♂	0.80
	IV ♀	0.92
	IV ♂	0.45
Euchaeta glacialis	VI ♀	0.86
	V ♀	0.63
	V ♂	0.63
	IV ♀	0.11
	IV ♂	0.11
	III	0.06
	II	0.23
	I	0.05
Pseudocalanus minutus	VI ♀	3.20
Staph.oealanus *magnus*	VI ♀	0.28
	V ♀	0.17
	V ♂	0.06
	IV ♀	0.06
Heterorhabdus norvegicus	VI ♀	0.46
	VI ♂	0.22
Gaidius tenuispinus	VI ♀	0.11
	VI ♂	0.11
	V ♀	0.17
	V ♂	0.11
	IV ?	0.06
Aetideopsis rostrata	VI ♀	0.29
Limnocalanus grimaldii	VI ♀	0.11
	VI ♂	0.06
	V ♀	0.06
	V ♂	0.06

Table 20. Copepods sorted from station 019, AB 72-199 (71°09.0'N, 146°29.0'W), 11 Aug 1972, 250 m. The total number of copepods was 265.

Species	Stage	% Total
Calanus hyperboreus	VI Q	2.64
	V	4.15
	IV	0.75
	III	0.75
Calanus glacialis	VI ?	4.15
	VI ♂	0.38
	V	3.01
	IV	9.81
	III	35.09
	II	8.30
	I	0.38
Metridia longs	VI ♀	3.01
	v ?	7.17
	V ♂	7.92
Euchaeta glacialis	VI ♂	0.38
	V ♀	0.38
	IV ?	0.38
	IV ♂	0.38
	III	0.38
Pseudocalanus minutus	VI ?	12.83
	v	0.75
Scaphocalanus magnus	VI ?	0.38

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XIV. Appendix: Bibliographies

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ALL REFERENCES HAVE BEEN VERIFIED; JOURNAL ABBREVIATIONS ARE FROM THE WORLD LIST OF SCIENTIFIC PERIODICALS; CALL NUMBERS ARE UNIVERSITY OF WASHINGTON NUMBERS; LOCATION IN THE UW LIBRARY SYSTEM IS GIVEN ACCORDING TO THE FOLLOWING ABBREVIATIONS:

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SECTION 2

Offshore

Marine Ecosystems Studies at AIDJEX in the Southeast Beaufort Sea

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I. Summary of objectives, conclusions, and implications with respect to OCS oil and gas development

The objective was to obtain a description of the plankton in the pelagic environment of the Beaufort Sea beyond the continental shelf during the summer season.

Nitrate depletion was observed in the upper 40-45 m in June and remained depleted throughout the summer. Within the same depth and time interval the phytoplankton population (estimated by chlorophyll a) was low, suggesting nutrient limitation. The disappearance of snow cover and formation of melt ponds resulted in a gradual increase in submarine light levels through July. Active growth of phytoplankton at the pycnocline (45 m) was observed. The highest chlorophyll a concentrations occurred at this depth in late July and' early August. Graduated light experiments indicated the phytoplankton population was adapted to low light levels. The zooplankton population was sampled and vertical distribution for eight species on eight dates is presented.

The impact on the Beaufort Sea beyond the continental shelf from the development of coastal oil and gas reserves is difficult to assess. Apart from a major oil spill, only slight concentrations of oil and its by-products might be expected to reach this area by ocean and wind circulation. Their presence might directly alter the albedo, the thermoconductivity of the ice, and rates of ice growth. The sensitivity of the ecosystem to changes in these parameters is not known.

II. Introduction

A. General nature and scope of study

The oceanic waters of the Beaufort Sea are separated from the northern coasts of Alaska and Canada by a 60 - 100 mile wide continental shelf. Proceeding seaward from the coastline, the marine ecosystem changes from a neritic environment to an oceanic one. The sea surface also changes. Inshore, the presence of shorefast and drifting sea-ice is highly seasonal. Offshore, the pack-ice becomes more concentrated and perennial. The Beaufort Sea thus provides two extremes: a shallow water, seasonal ice environment, and a deep water, perennial ice environment.

The Outer Continental Shelf Environmental Assessment Program included several studies describing the shallow water, seasonal ice environment, including fisheries (Roguski R.U. #233), benthos (Carey R.U. #6, Broad R.U. #356), microbial activity (Morita R.U. #190), and marine plankton (English and Homer R.U. #359). These efforts were concentrated in the 1975-1976 field seasons and some are still in progress. An additional part of the marine plankton studies (English and Homer R.U. #359) was conducted during summer 1975 at the Arctic Ice Dynamics Joint Experiment (AIDJEX) main camp, Big Bear. The research took place within the perennial ice zone over deep water.

B. Specific objective

The objective of the biological oceanography program at AIDJEX was to develop an understanding of the seasonal changes in abundance and distribution of planktonic components of the marine pelagic ecosystem. Equipment and time limitations resulted in emphasis on the primary producer level though zooplankton was also sampled regularly.

The research program was designed to progress toward the ultimate goal of understanding the marine ecosystem well enough to formulate a predictive model (Fig. 1). We are presently in the descriptive phase.

C. Relevance to problems of petroleum development

The energy fixed by photosynthesis is transferred through herbivorous zooplankton to arctic cod, waterfowl, seals, whales, and polar bears. Some of these are important to the subsistence and economic welfare of coastal natives. An understanding of primary and secondary production dynamics is a prerequisite to assessment of the impacts of oil development in the Arctic Ocean periphery. No previous ecosystems studies have been made in the deep water perennial ice zone of the southeastern Beaufort Sea.

The fate and consequence of oil spilled in the Arctic are largely unknown. Biodegradation would be slow due to the extremely low water temperatures. It is possible that oil would be trapped between ice floes or within brine channels and eventually swept out into the

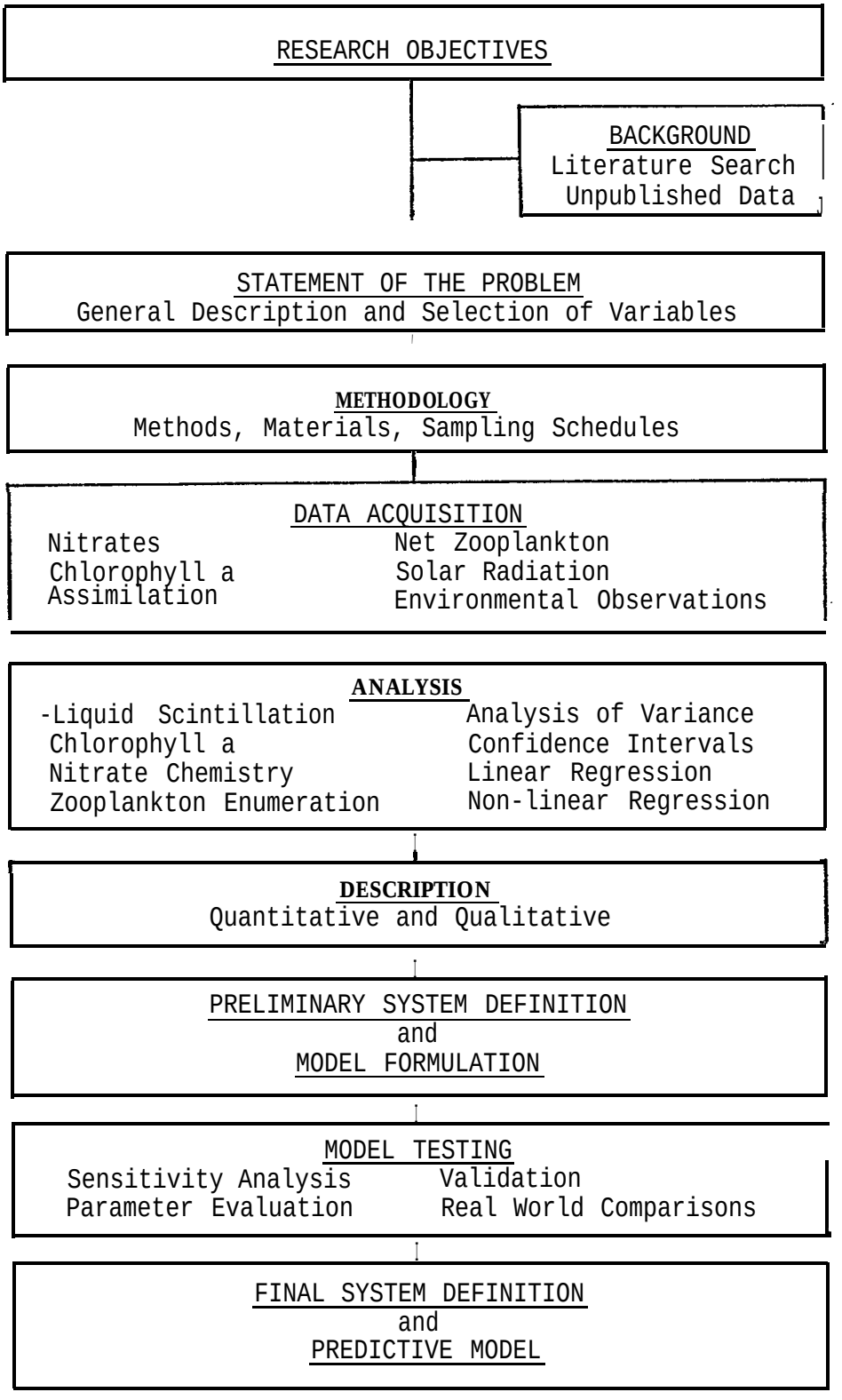

Fig. 1. Stages of the marine ecosystems studies at AIDJEX in the Southeast Beaufort Sea.

Pacific gyre of the Beaufort Sea. The oil could cause lowered albedos, reduction in thermoconductivity of the ice, and reduced rates of ice growth (Seelye Martin, seminar at UW, 22 May 1974). In addition, it could change the submarine light regime by reducing transmission properties of the overlying ice or open water areas. The sensitivity of the ecosystem to the latter type of perturbation will be tested in the modelling phase of this research.

111. Current state of knowledge

In the past 80 years, in excess of 40 expeditions and field programs have been staged in the Arctic Ocean or its periphery. Approximately 25 have yielded biological information (Table 1). Much of this information is descriptive in nature with only marginal efforts made to relate species to their environment or to each other (Shoemaker 1920, Farran 1936, Brodskii and Nikitin 1955, Barnard 1959, Hand and Kan 1961, Hülsemann 1963, Shirley 1966). Early attempts to associate higher levels of phytoplankton abundance with environmental factors emphasized the importance of light and temperature (Gran 1904, 1912). Later investigators discussed the effects of mixing and nutrient supply on phytoplankton development (Sverdrup 1929, Braarud 1935), and temperature and salinity on zooplankton distribution (Bigelow 1920, Bernstein 1932, Johnson 1956, Grainger 1965, Tibbs 1964).

Quantitative estimates of phytoplankton abundance, primary production, and zooplankton standing stocks and life cycles were made at the Soviet North Pole stations (Brodskii 1956) and the U. S. drift stations Alpha (English 1961, 1963; Johnson 1963 a, b), Bravo (Apollonio 1959, Grainger 1965), Arlis II (Kawamura 1967), and T-3 (Harding 1966, Hughes 1968, Hopkins 1969, English unpublished data). From these investigations emerged a general recognition of the components and processes of possible importance in determining changes in the marine ecosystem below the ice pack.

This understanding was based primarily on data collected in the central Arctic Ocean (north of 800 N) and in the western Beaufort Sea. With the exception of two studies on protozoa (Tibbs 1964) and medusae (Shirley 1966) at Arlis I, there is no published biological information for the oceanic perennial ice zone of the southeast Beaufort Sea where the AIDJEX platforms were located.

IV. Study area

The field program was conducted from 2 June to 1 October 1975 at the AIDJEX main camp, Big Bear. During this time, Big Bear drifted approximately 870 km in the southeast Beaufort Sea (Fig. 2). Sampling ended on 1 October when the main camp ice floe broke apart and camp members had to evacuate.

Table 1. Expeditions, years of field collections, authors and years of publications of marine biological studies in the Arctic Ocean

Expedition or Vessel	Dates	Papers Published
Fram	1893-1896	Sars 1900 Nansen 1902 Gran 1904 Gran 1912
Canadian Arctic	1913-1918	Shoemaker 1920 Willey 1920 Bigelow 1920
Maud	1922-1924	Sverdrup 1929
Sedov	1925-1929	Bernstein 1932
Øst	1929	Braarud 1935
Nautilus	1931	Farran 1936 Hardy 1936 Garstang and Georgeson 1936
NP-1	1937-1938	Shirshov 1938, 1944
Sedov	1937-1939	Bogorov 193"8, 1939, 1946a, b Shirshov 1944 Usachev 1946
N-169	1941	Shirshov 1944
NP-2	1950-1951	Brodskii and Nikitin 1955
Burton Island	1950-1951	Johnson 1956 Hand and Kan 1961
M.V. *Cancolim II*	1951	Grainger 1965
NP-2,3,4,5	1954-1957	Brodskii 1956
T-3	1954-1955	Barnard 1959 Green 1959 Knox 1959 Mohr 1959 Hülsemann 1963
Bravo	1957-1958	Apollonio 1959 Grainger 1965

Table 1. (continued)

Expedition or Vessel	Dates	Papers Published
Alpha	1957-1958	English 1961, 1963 Johnson 1963a, b
Seadragon	1960	Grice 1962
Arlis I	1960-1961	Tibbs 1964 Shirley 1966
Polar Continental Shelf Project	1960-1961	Grainger 1965
M.V. *Salvelinus*	1960-1962	Grainger 1965
Arlis II	1964	Shirley 1966 Kawamura 1967 Minoda 1967
T-3	1964 1966-74	Harding 1966 Hopkins 1969 Hughes 1968 Scott 1969

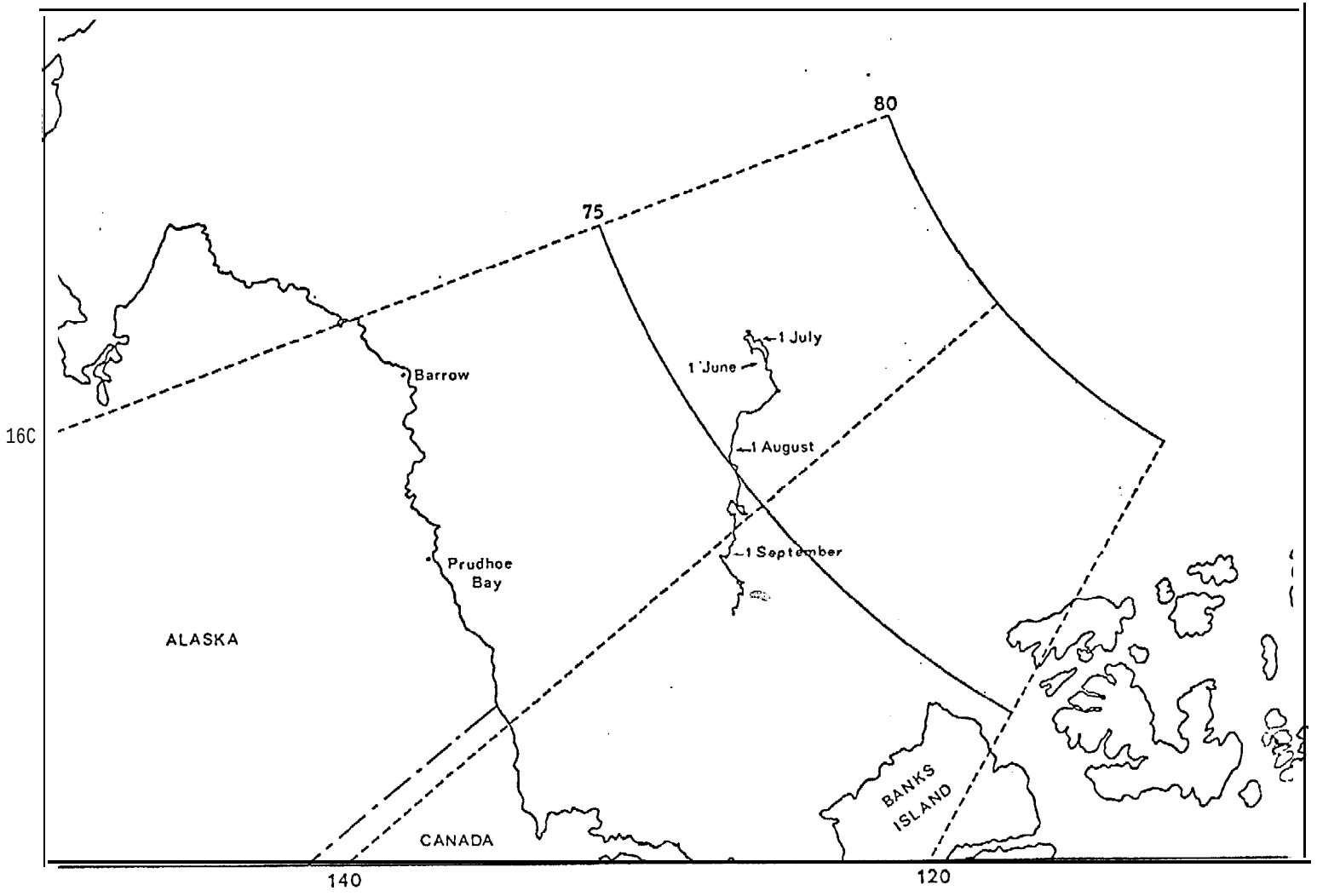

Fig. 2. Drift track of AIDJEX main camp, Big Bear, June through September 1975.

v. Rationale and methods of data collection

A. Rationale

We first formulated a general description of the ecosystem based on published and unpublished accounts. From this description, a suite of variables was selected to be measured in the field.

1. General description

Incoming solar radiation is low from October through February in the Arctic Ocean. Solar elevations and day length increase from late February until the summer solstice on 21 June. Although solar radiation also increases during this period, the amount that is transmitted to the water below the pack ice is very small. Maximum submarine radiation occurs in early to mid-July after the snow cover has melted and the ice surface is dominated by melt ponds which have a lower albedo than either snow or bare sea-ice.

Phytoplankton abundance in the water below the ice remains low throughout winter and spring. In response to higher levels of submarine radiation in late June and early July, phytoplankton biomass increases in the surface mixed layer (upper 25 - 50 m). The extent and duration of the development may depend on:

(1) availability of light, which is influenced by degree of melt, frequency of summer freeze-ups and snow storms, solar angle, day length, and timing of the first sustained autumn snowfall;

(2) availability of nutrients, which is influenced by initial spring nutrient concentrations, and their maintenance through turbulent mixing, convective overturn, and remineralization processes; and

(3) Losses of biomass from the phytoplankton population through sinking below the pycnocline, or from grazing by herbivorous zooplankton.

The major decrease in phytoplankton biomass usually occurs in the latter half of August, and low concentrations prevail throughout the ensuing dark period.

Though much is known about the species composition of the herbivorous zooplankton and their depth distribution, there are no studies showing the extent to which they interact with the phytoplankton populations. There is evidence from collections made in 1970-72 at T-3 (English, personal communication) of a general movement toward the surface from depths exceeding 100 - 200 m by *Calanus hyperboreus* early in the spring, and later by C. *glacialis*. The intensity with which they graze upon phytoplankton is not known.

2. Selection of variables

The biological variables selected for measurement included

chlorophyll a, phytoplankton cell numbers, radiocarbon assimilation, and net zooplankton. Environmental variables included reactive nitrate, incoming solar radiation, ice surface melt conditions, air temperature, wind speed, island movement, and seawater temperature and salinity.

B. Methods

1. Field observations

Water samples were taken with a 5-ℓ PVC water bottle. Subsamples were drawn for the determination of nitrate concentration (50 ml), radiocarbon assimilation (125 ml), chlorophyll a concentration (4-I.), and phytoplankton cell counts (120 ml).

The analysis of nitrate concentration was done on station using the methods of Strickland and Parsons (1968).

To determine assimilation potential, paired light and dark subsamples were inoculated with a known amount of ^{14}C and incubated in a 0 - 1° C water bath under controlled fluorescent lighting. The maximum light intensity was 117 microeinsteins.m^{-2} ● S-l. In graduated light experiments, nine additional bottles were treated and fitted with metal screens." The screens were constructed to transmit 2, 4, 6, 8, 14, 16, 19, 49, or 74% of the total light available. All incubation periods were 6 hours. The subsamples were filtered through 25 mm Millipore HA (0.45 μm) filters, and the filters were placed in liquid scintillation vials. Radioactive uptake was measured using a Packard Tri-Carb Liquid Scintillation Spectrometer with Aquasol (New England Nuclear) as the scintillation cocktail.

The subsamples drawn to determine chlorophyll *a* concentration were filtered using 0.47 μm glass fiber filters treated with saturated $MgCO_3$ solution. The filters were frozen for later analysis (Strickland and Parsons 1968).

Subsamples designated for phytoplankton cell counts were fixed in 4% formalin.

Zooplankton was sampled with depth-to-surface vertical tows using a non-closing conical l-m diameter ring net with 73 μm mesh. Samples were preserved in 4% buffered formalin. Large copepods were first sorted from the whole sample, counted, and identified. Small copepods and nauplii were sorted from a known volume of the sample. Copepods were counted and identified to species; nauplii were counted and separated into size classes (< 0.3 mm and > 0.3 mm). Zooplankton counts were adjusted to depth increment (0 - 50, 50 - 75, 75 - 150 m) and volume filtered by the l-m ring net assuming 100% filtration efficiency.

Zooplankton and chlorophyll a samples were taken and assimilation potential was measured every 3 days (Table 2). The vertical zooplankton net tows were taken from 10, 20, 30, 40, 50, 75, 100, and 150 m to the surface. Chlorophyll a and assimilation potential were measured

Table 2. Sampling program at AIDJEX main camp during summer 1975

Variable	Type of Sampling	Depths	Frequency
Nitrate	Depth profile	10-70 m, 10 m intervals	3-6 day intervals
		46-64 m, 2 m intervals	Eight times
		80 and 100 m	Seven times
	Helicopter transect	10 and 20 m	Once
Chlorophyll a	Depth profile	3 m, 5-60 m, 5 m intervals	3 day intervals
		46-64 m, 2 m intervals, and 80 m, 100 m	3-6 day intervals
	'Replications	5, 10, 20, 30 m	*7-10* day intervals
	Helicopter transect	10 and 20 m	Once
Assimilation	Depth profile	3 m, 5-50 m, 5 m intervals, and 60 m	3 day intervals
	Replications	5, 10, 20, 30 m	7-10 day intervals
	Graduated light	5, 10, 20, 30 m	3 day intervals
	In situ	10 m	22 times
Zooplankton	Vertical tows	10, 20, 30, 40, 50, 75, 100, 150 m to surface	3 day intervals
Solar radiation	400 to 700 nm	1 m above ice surface	30 second intervals

at 12 depths from 3 to 60 m. Less frequently, chlorophyll a was measured at 12 depths from 46 to 100 m. Nitrates were measured in the upper 40m every3 to 6 days, and to 100 m less frequently. Graduated light experiments at *5, 10, 20, and 30* m *were* run every 3 days.

Ten replication experiments were run at four depths (5, 10, 20, and 30 m) every7 to 10 days. In each experiment, four water samples were taken within 5 min from the same depth. Two subsamples for the determination of assimilation potential and one subsample for the determination of chlorophyll a were drawn from each water sample.

Twenty-two *insitu* assimilation experiments were conducted. For each experiment a water sample from 10 m was taken and 6 to 9 subsamples were drawn. These subsamples were inoculated with ^{14}C and separated into three groups of 2 or 3 bottles per group. Each group was taken to one of three prepared locations and lowered to 10 m. The first location was the center of a melt pond which was 4 m in diameter, with a freshwater depth of 25 cm covering ice 1.6 m thick. The second location was an area of bare ice, 2.3 m thick, and situated 80 m from the melt pond. The third location was a lead, 100 m wide, 50 m from locations one and two. The bottles were suspended at each site for six hours, and then processed as previously described. Due to mishaps, only 19 of the 22 experiments allow inter-site comparisons.

Chlorophyll a and nitrate were sampled on 3 and 4 August along helicopter transects from main camp to the two satellite camps, Caribou and Blue Fox. Distance covered was 75 miles. Samples from 10 and 20 m were taken every 7 - 10 miles.

Solar radiation (400 to 700 nm) was measured daily at 1 m above the ice surface using a quantum meter (Model LI-COR-185, Lambda Instruments Corp.). Melt conditions were logged daily and aerial photographs were taken by helicopter as scheduling and conditions permitted. Air temperature, wind speed, island movement, and seawater temperature and salinity were recorded by other research teams on AIDJEX.

2. Data analysis

Data analysis of chlorophyll a and assimilation potential measurements from depth profiles, replication experiments and *in situ* incubations has been completed (Table 3). All chlorophyll *a* and assimilation potential data were transformed by taking logarithms to the base 10 to make variances and means independent.

The ten assimilation measurements of each graduated light experiment were fitted to a curvilinear assimilation-light relation (Steele 1962):

$$P = P_{max} \cdot I_{rel}/I_k \cdot e^{1-I_{rel}/I_k} ,$$

where P is assimilation (mg C $m^{-3} \cdot hr^{-1}$); P_{max} is calculated maximum

Table 3. Summary of samples taken and analyzed

Type	Number Taken	Number Analyzed
Zooplankton	994	24
Phytoplankton Standing Stock	209	0
Chlorophyll *a*	1096	1096
Radiocarbon Assimilation	2941	2941
Nitrate	272	272

assimilation (mg C m^{-3} . hr^{-1}); I_{rel} is light intensity expressed as a fraction of 117 microeinsteins · $m^{-2}.s^{-1}$; and I_k is relative light intensity at which P_{max} occurred. The curve fitting procedure required substitution of paired assimilation and light measurements into the equation and iterative adjustment of P_{max} and I_k to minimize the sum of squared differences between calculated and observed P. Measured assimilations were then divided by the calculated P_{max} to allow relative comparison of curves from different depths and days.

Additional comparisons were made by calculating the initial slopes of the curves. First, light measurements were converted to W · m^{-2} using the relation 1 microeinsteins·$m^{-2}.s^{-1}$ ≅ 0.22W " m^{-2} of photosynthetically active radiation (PAR), where 1 microeinstein ≅ 6.02 x 10^{17} quanta, and 1 W = 2.77 x 10^{18} quanta · s^{-1} (Morel and Smith 1974). The initial slope (mg C - mg Chl a^{-1} · hr^{-1} · (W .m^{-2})$^{-1}$) was calculated as the partial derivative of P from the fitted curve with respect to I_{rel} as I_{rel} approaches zero:

$$\text{Initial slope} = e \cdot P_{max} / (I_k \cdot I_m \cdot \text{Chl } a) ,$$

where I_m is full light intensity (W . m^{-2}); and Chl a is mg Chl a m^{-3}.

The assimilation number (mg C · mg Chl a^{-1} · hr^{-1}) is the ratio of observed assimilation potential to chlorophyll a concentration. Assimilation numbers were calculated for all depth profiles and graduated light experiments. Since the means and variances of initial slopes and assimilation numbers were positively correlated, they were transformed by taking logarithms to the base 10 before further analysis.

Data for chlorophyll a and assimilation potential depth profiles, graduated light experiments, assimilation potential replication experiments, and zooplankton counts have been submitted in previous reports (Appendices). Data for nitrate determinations, chlorophyll *a* replications, *in situ* assimilations, and the helicopter transects are submitted in this report.

3. Variance analysis

The variability of chlorophyll a, assimilation potential, I_k, initial slope, and assimilation number arises from three levels. Each higher level contains variabilities associated with all lower levels in addition to that of the level itself. The first level, experimental error, includes variations in the physical or chemical treatment of the samples, and, for assimilation potential, light variations in the incubation chamber. The first level of error includes all variations introduced after the sample is brought to the surface. The second level of error is small-scale patchiness introduced from variations in measured properties over distances of less than several meters. This level has no temporal component. The third level of error includes the combined effects of temporal changes in the measured property, advective changes resulting from large scale patchiness (> 10's of meters), and differential motions of the ice with respect to the water.

The magnitudes of the two lowest levels of error were estimated using results of replication experiments for chlorophyll *a* and assimilation. A one-way analysis of variance was done on replicated chlorophyll a subsamples from a single depth. For each depth there were 10 experiments of four replicates each. The resulting mean square error (MSE) is an estimate of the combined variability of experimental and small-scale patchiness error. A nested one-way analysis of variance was done on assimilation potential measurements from a single depth. For each depth there were 10 experiments with 4 water samples per experiment and 2 replicate observations per water sample. The resulting MSE estimates experimental error.

The third or highest level of error was estimated for chlorophyll a, assimilation potential, assimilation numbers, I_k, and initial slope. This was done by dividing the 4-month sampling period into equal time intervals and pooling observations within each interval. Five-day intervals were selected for chlorophyll a, assimilation potential, and assimilation numbers, and two-day intervals were selected for I_k and initial slopes. All chlorophyll a measurements made from a single depth in the same time interval were pooled, including samples from depth profiles and graduated light experiments. Measurements of assimilation potential were pooled similarly. Initial slopes and I_k values were pooled" from the four sampled depths (5, 10, 20 and 30 m). Assimilation numbers from all samples in the upper 30 m were pooled.

One-way analyses of variance were done on the grouped data to determine the within group mean square error (MSE). The MSE term is an estimate of the combined effects of variation due to experimental, small-scale patchiness, spatial, and temporal errors. Ninety-five percent confidence intervals (CI) about cell means for chlorophyll *a*, assimilation potential, I_k, and initial slope were calculated as:

$$CI = \overline{X} \times / \div \text{ antilog } (t_{0.05\ df} \cdot (MSE/n)^{\frac{1}{2}}) ,$$

where $\overline{X}$ equals the geometric mean, n equals the number of samples in a time cell, and df equals the within group degrees of freedom. Confidence intervals for assimilation numbers were determined as:

$$CI = \overline{X} \pm t_{0.05,df} \cdot (MSE/n)^{\frac{1}{2}} ,$$

where $\overline{X}$ equals the arithmetic mean. Sample size (n) was typically 3 or 4 for chlorophyll a and assimilation potential, 4 for I_k and initial slope, and 7 for assimilation number.

A one-way analysis of variance was done on each *in situ* assimilation experiment for which an inter-site comparison was available. There were 2 or 3 sites, with 2 or 3 replicates for each site,

The zooplankton counts have not been analyzed statistically. Solar radiation measurements and phytoplankton standing stock samples have not been analyzed.

VI. Results

A. Nitrate

Nitrate concentrations were below detectable limits in the upper 40 m throughout the summer (Table 4). Samples taken during the helicopter transects showed that nitrate depletion in the upper 20 m was widespread (Table 5). At the bottom of the pycnocline, 48 to 52 m, nitrate was undetectable until early September. Trace amounts (< 1.0 µg at ℓ^{-1}) were measured at 42 m by late September. Concentrations increased with depth across the pycnocline at 50 to 60 m. Nitrate at 100 m was >10.0 µg at ℓ^{-1}. At 1.0 µg at ℓ^{-1} concentrations, experimental error results in the correct value being within ± 0.05 µg at ℓ^{-1} of the measured value (Strickland and Parsons 1968).

B. Chlorophyll *a*

Chlorophyll a concentrations in the upper 40 to 45 m were about 0.10 mg m^{-3} in early June. Chlorophyll a in this depth range declined in late June and remained below 0.03 mg m^{-3} throughout July and August. Similar low chlorophyll a concentrations were found along the helicopter transect (Table 5). Concentrations increased in the upper 40 to 45 m in late September (Figs. 3 and 4). During July and August, a major increase in chlorophyll a occurred in the pycnocline at 58 to 64 m. At mid-summer the concentrations in this depth range were above 0.25 mg m^{-3}, but declined thereafter. Chlorophyll a below 70 m remained less than 0.10 mg m^{-3}.

The total chlorophyll a integrated over the upper 100 m showed two peaks (Fig. 5). The first, of about 6.0 mg m^{-3}, occurred in early June due to increased chlorophyll a in the upper 40 m. Following a decline to less than 2.0 mg m^{-3} in late June, a second peak of about 6.8 mg m^{-3} occurred in early August due to the chlorophyll a increase at the pycnocline.

A one-way analysis of variance performed on the transformed chlorophyll a data pooled into 5-day intervals indicates that at the 4 depths analyzed, there is a highly significant ($P < 0.01$) variance component added between time periods {Appendix B). The variability of the chlorophyll a concentrations pooled into individual time periods is 20 to 31% of the total variability. The 95% confidence intervals about 5-day means extend from about 71 to 140% of the means (Fig. 6). The analysis of variance performed on the chlorophyll a replications indicate that the combined effects of experimental and small-scale patchiness

Table 4. Nitrate concentrations (μg at ℓ^{-1}) measured at AIDJEX Main Camp Big Bear

Depth (m)	JUN 11	JUN 17	JUN 20	JUN 23	JUN 29	JUL 5	JUL 7	JUL 11	JUL 17	JUL 23	JUL 29	AUG 4	AUG 10	AUG 16	AUG 22	AUG 2$	SEP 30	SEP 6	SEP 12	SEP 22	SEP 2[illegible]
10	0.0	0.0	O*O	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	.0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0,	0.0	0.0	0.0	0.0	0.0	0.0
40	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	O*O	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
42																0.0	0.0	0.0	0.1	0.1	
44																0.0	0.0	0.0	0.0	0.2	
46		0.0						0.0				0.0				0.0	0.0	“0,4	0.4	0.7	
48								0.0				0.0				0.2	0.0	0.4	0.4	1.1	
50		0.0	0.0	0.0	0.0	,0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.5	0.0	0.8	1.0	1.9	
52							0.0	0.0				0.3				1.2	0.2	1.3	1.4	3.0	
54							0.1	0.2				0.5				1.9	0.3	1.8	2.1	3.3	
56						0.0	0.1	0.2	0.4	0.0	0.0	0.0	0.8			2.6	0.9	1.9	2.4	3.6	
58									0.4				1.2			2.4	1.3	2.1	2.1	4.3	
60		1.3	0,2	0.6	1.3	0.0	0.3	0.4	1.1	0.2	0.1	2.4	0.9	0.5	1.2	1.7	3.0	1.9	2.1	3.4	5.6
62									0.9				1.9				3.4	3.7	3.4	5.0	5.4
64						0.3	0.6	2.4	1.4				2.4				3.7	5.8	2.8	4.4	6.4
70		6.3			3.5	2.8	2.6	4.7	4.5	2.4	4.0	6.6	3.6			3.0	5.8	6.5			
80					7.4		5.8	8.4	6.6				7*O				10.1	10.2	10.2	9.6	10.8
100					11.0				10.5				12.2				13.5	14.8	14.3		13.3

Table 5. Nitrate and chlorophyll a measured at two depths during helicopter transects

Camp		Caribou					Big Bear				Blue Fox
Mileage		+35	+27	-I-18	+10	+4	0	+12	+22	i-32	+42
Nitrate (μg at ℓ^{-1})	10 m	0.0	0.0	0*0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	20 m	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chl a ($mg\ m^{-3}$)	10 m	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02
	20 m	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.01	0.02	0.02

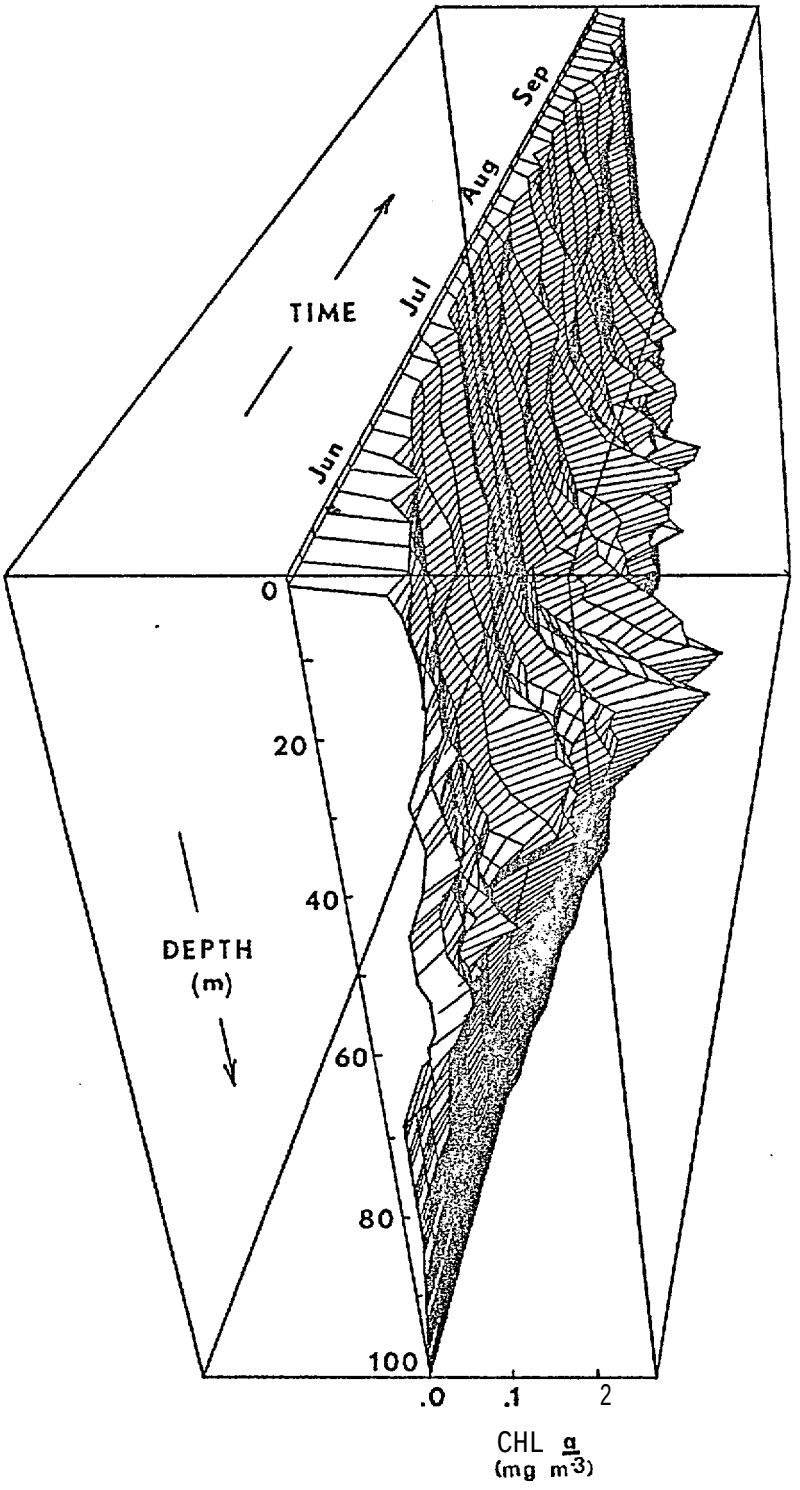

Fig. 3. Three dimensional plot of chlorophyll *a* at 0–100 m, June through September.

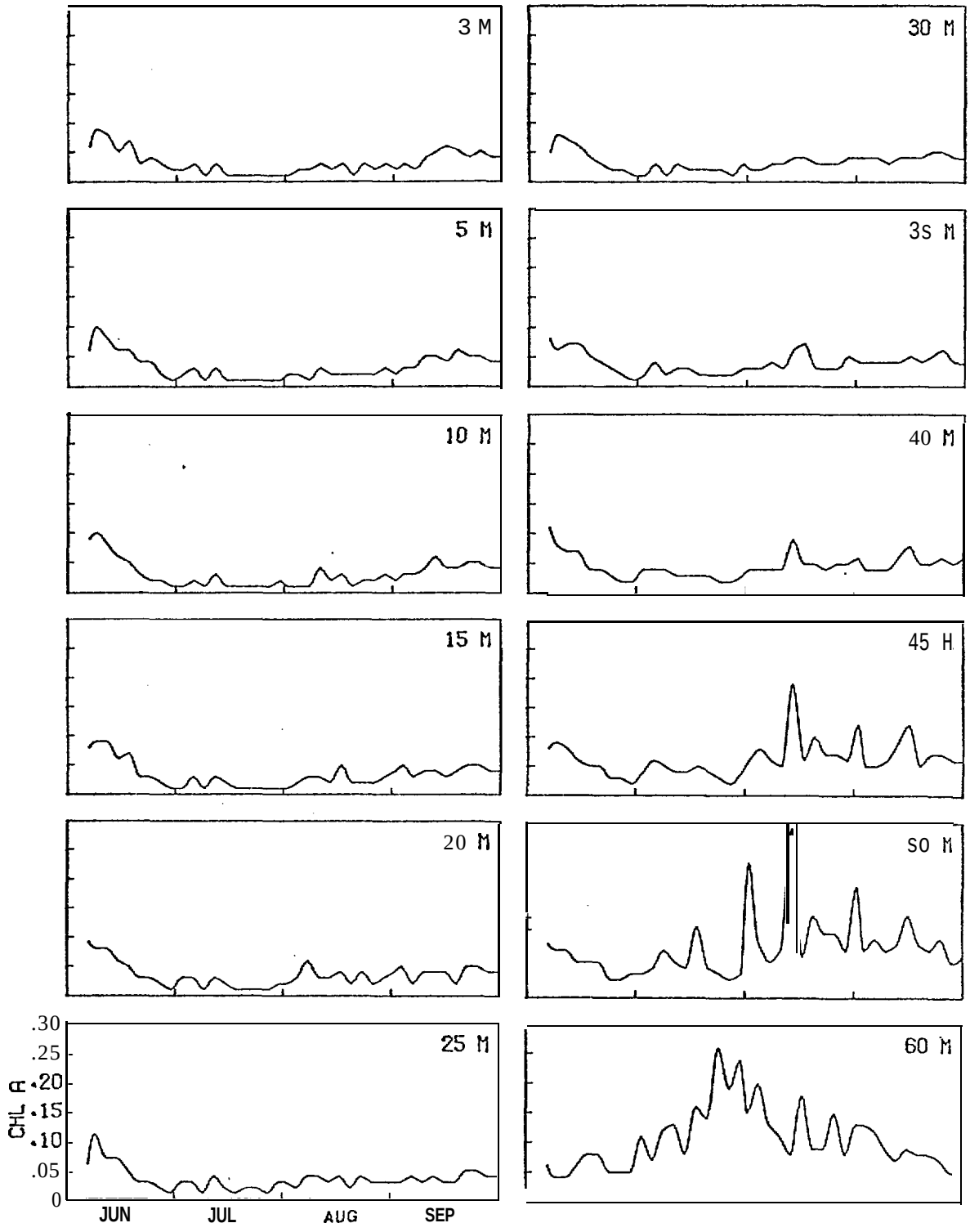

Fig. ft. Chlorophyll *a* (mg m^{-3}) over time at 12 depths.

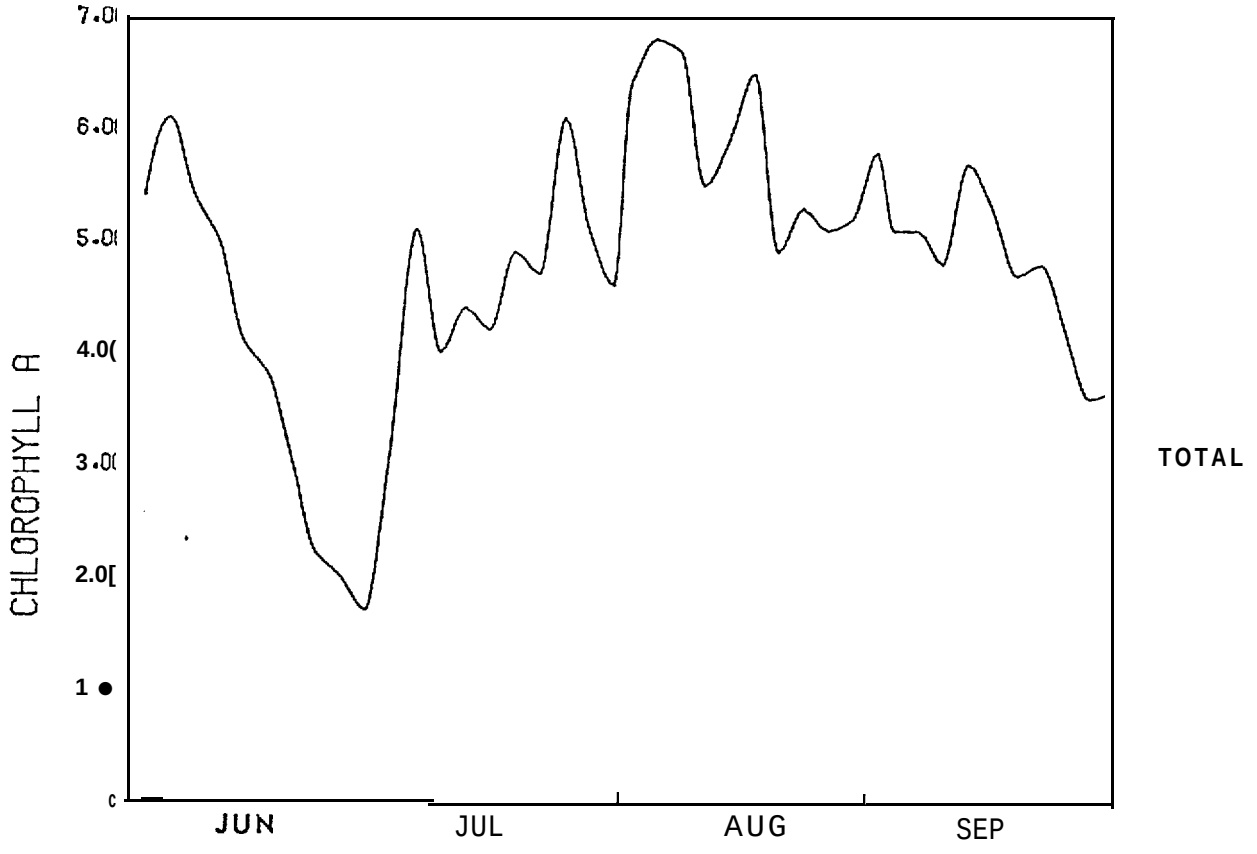

Fig. 5. Chlorophyll a (mg m^{-2}) integrated over the upper 100 m.

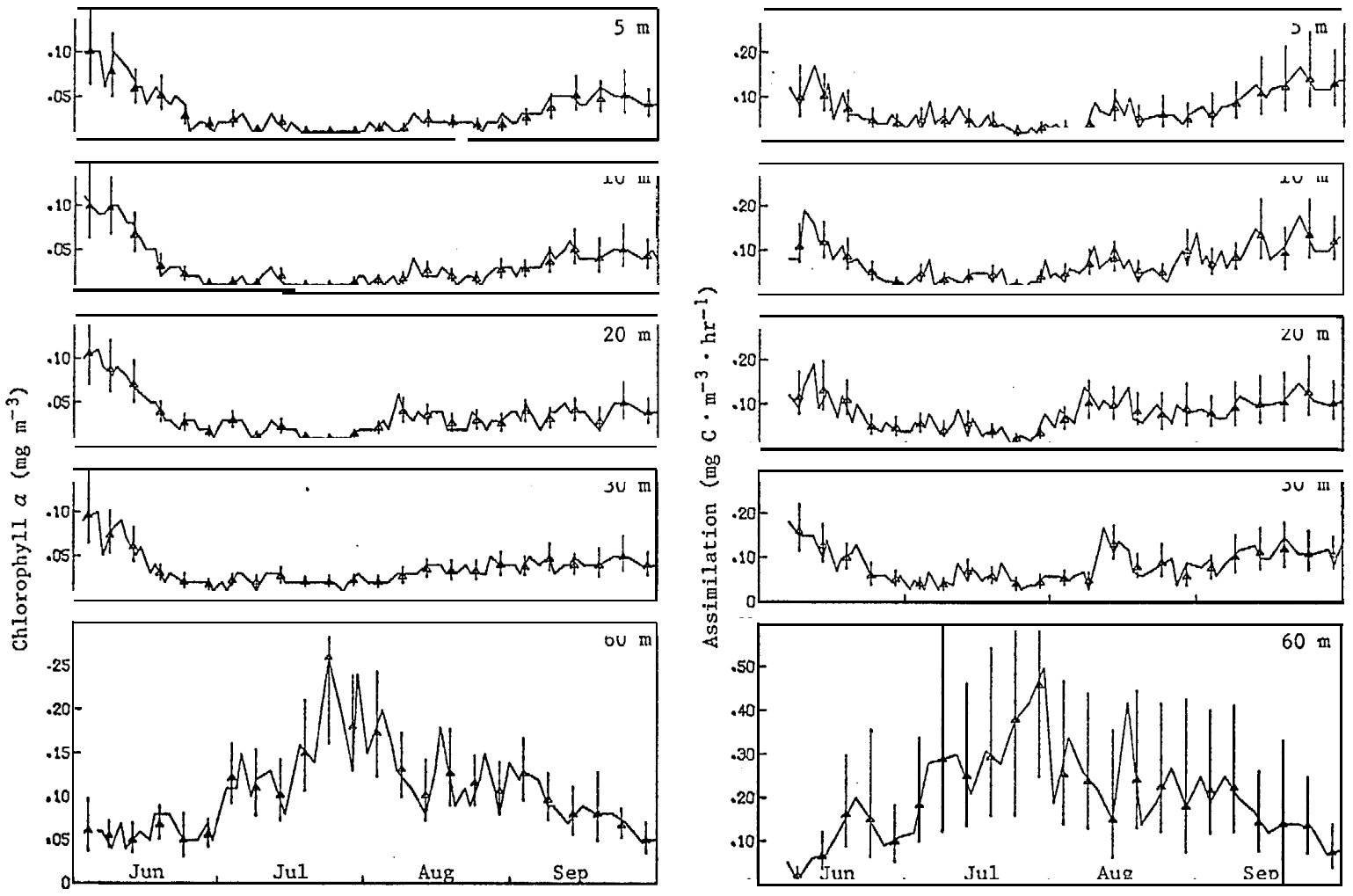

Fig. 6. Chlorophyll *a* and assimilation potential measured at five depths, with 5-day geometric means and confidence intervals.

error was only 5 to 14% of the variability of chlorophyll a concentrations pooled within 5-day intervals (Table 6 and Appendix B).

c. Assimilation potential

The assimilation potential of the upper 40 to 45 m was 0.1 - 0.2 mg C $m^{-3} \cdot hr^{-1}$ in early June (Fig. 7). The potential in this depth range declined in late June and remained below 0.1 mg C $m^{-3} \cdot hr^{-1}$ until late September, when it increased slightly. The major increase in assimilation potential occurred at the pycnocline in late July and early August (Fig. 8). Values of 0.48 - 0.50 mg C $m^{-3} \cdot hr^{-1}$ were measured during this period. Assimilation potential decreased at these depths through the rest of the summer.

The analysis of variance performed on the transformed assimilation potential data pooled into 5-day intervals indicates that at the 4 depths analyzed, there is a highly significant ($P < 0.01$) variance component between time periods (Appendix A). The variability of the assimilation potential pooled within each time interval is 33 to 41% of the total variability. The 95% confidence intervals of 5-day means extend from about 68 to 147% of the mean (Fig. 6).

The nested analysis of variance performed on the assimilation potential replications indicates there is a significant ($P < 0.05$) component of variance added between water bottle samples (Appendix A). The variability due to experimental error was about 35-57% of that found among samples pooled within 5-day intervals. The variability due to small-scale patchiness errors was less than that due to experimental error. The combined effect of experimental and small-scale patchiness error is 47 - 90% of the variability of assimilation potential pooled within 5-day intervals.

D. Assimilation number

Assimilation numbers ranged from < 1.0 to 8.3 mg C·mg Chl $a^{-1} \cdot hr^{-1}$. Values were generally higher in July and August than in early or late summer (Fig. 11). The 95% confidence intervals about the means of the 5-day periods extend from about 80 to 125% of the mean. The regression of assimilation potential on chlorophyll a was highly significant ($P < 0.01$, $r = 0.90$) and resulted in a slope of 1.73 mg C·mg Chl $a^{-1} \cdot hr^{-1}$ for samples combined from 20, 40, and 60 m (Fig. 9).

E. Graduated light experiments

The curvilinear relation of assimilation versus light (Steele 1962) was fitted to 120 graduated light data sets (Fig. 10). I_k, converted from relative to absolute light intensity (W . cm^{-2}PAR) was 1.0 - 4.0 x 10^{-3} W · cm^2 (Fig. 11). Values were highest in August. The 95% confidence interval about the mean of the 2-day periods was the mean ± 0.8 x 10^{-3} W · cm^2.

Table 6. Chlorophyll a (mg m^{-3} x 100) measured during the replication experiments at four depths on 10 days

Date	Depth (m) 5				10				20				30			
0703	1.7	1.6	1.6	1.9	1.2	1.3	1.2	1.8	3.2	2.8	2.7	2.4	2.8	3.3	3.2	3.3
0712	2.1	2.2	2.4	2.7	1.5	1.8	1.5	1.5	2.3	2.3	2.1	2.1	2.6	3.6	3.3	2.9
0721	1.4	1.5	1.3	1.3	1.1	1.2	1.6	1.0	1.2	1.2	1.3	1.4	2.2	2.2	1.9	2.1
0731	1.3	1.4	1.3	1.3	1.7	1.8	1.7	1.6	1.8	1.8	1.7	1.8	3.0	2.9	2.8	2.9
0809	2.5	2.3	2.5	2.6	2.2	2.4	2.3	2.4	4.4	4.5	4.2	4.1	3.4	3.4	3.2	3.6
0818	1.4	1.7	1.6	1.4	1.8	1.5	1.4	1.5	2.0	2.6	2.2	2.2	3.2	2.9	3.0	2.8
0827	2.5	2.2	2.3	2.0	2.5	2.6	2.4	2.6	3.3	3.2	3.4	3.9	5.4	5.1	5.0	3.6
0905	3.4	3.3	3.3	3.8	3.0	3.2	3.1	3.3	3.6	3.8	3.9	4.3	5.6	4.4	4.8	4.4
0914	3.6	3.4	4.2	3.9	4.1	4.2	4.4	5.0	3.8	3.4	3.6	3.6	5.0	5.4	5.2	5.3
0929	4.4	4.2	5.3	4.2	5.1	5.4	5.1	5.1	3.9	4.1	4.0	4.4	4.0	3.8	3.6	3.5

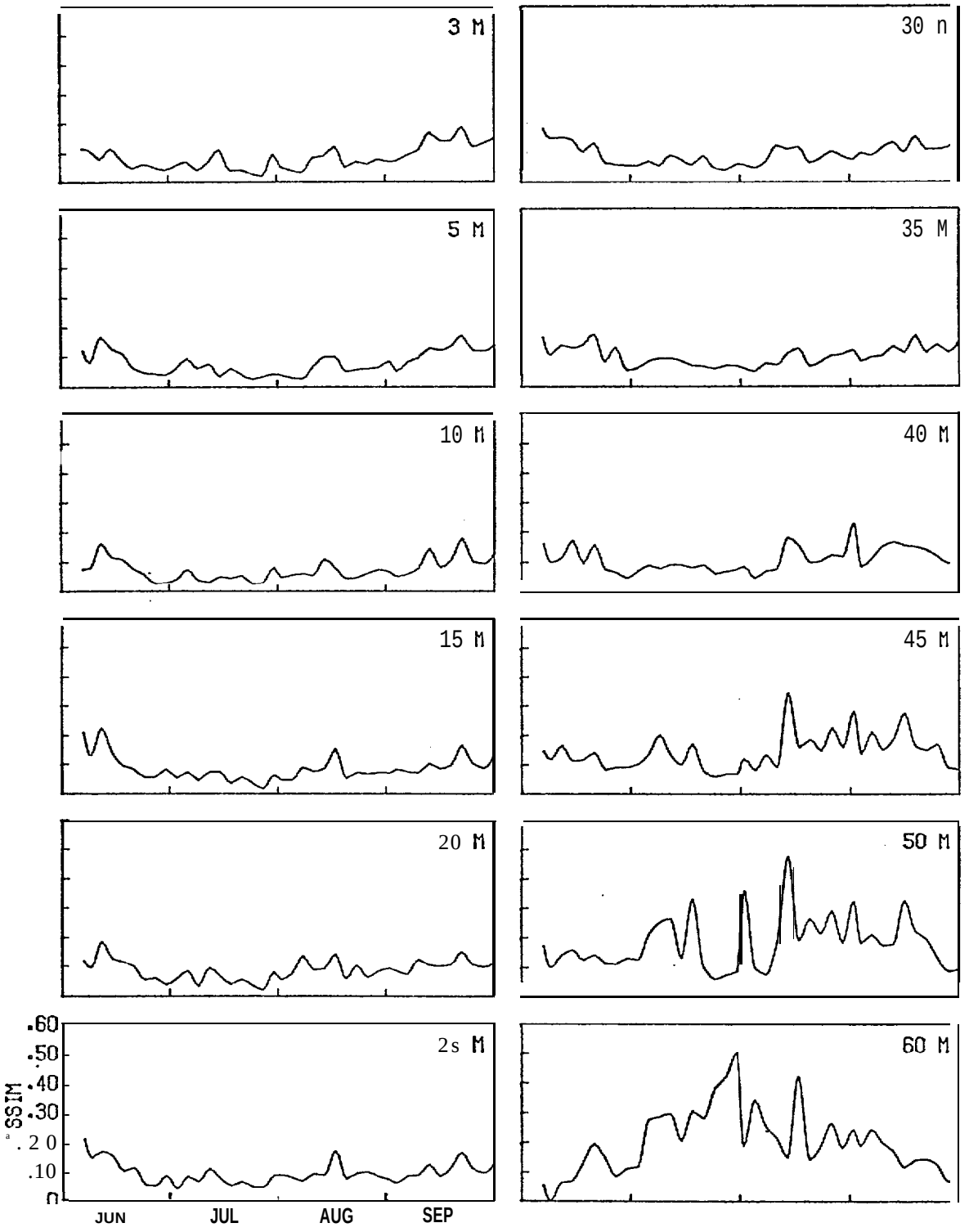

Fig. 7. Assimilation potential (mg C $m^{-3} \cdot hr^{-1}$) over time at 12 depths.

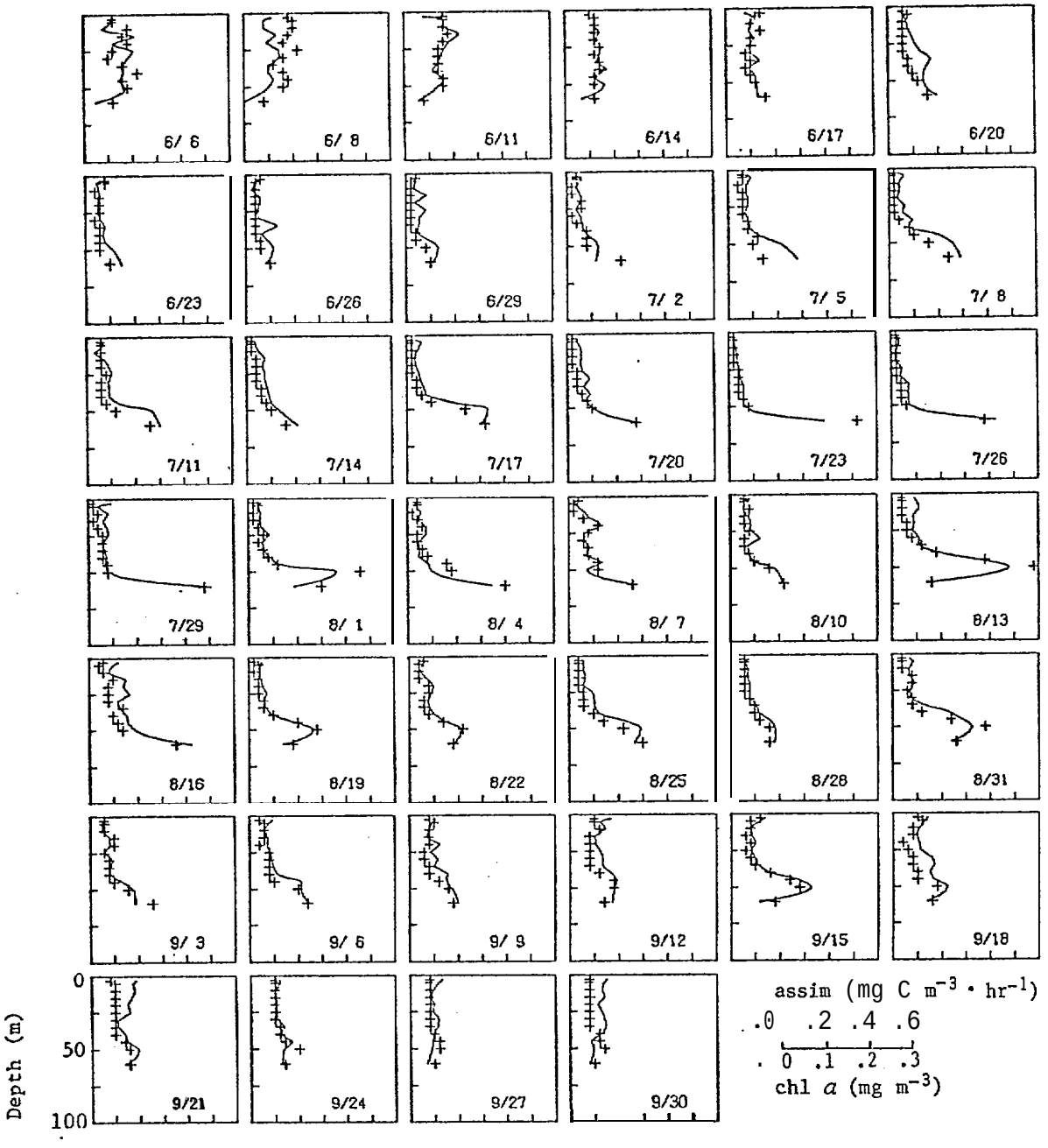

Fig. 8. Chlorophyll a depth profiles overlaid on assimilation potential depth profiles. (+) chl a (-) assim.

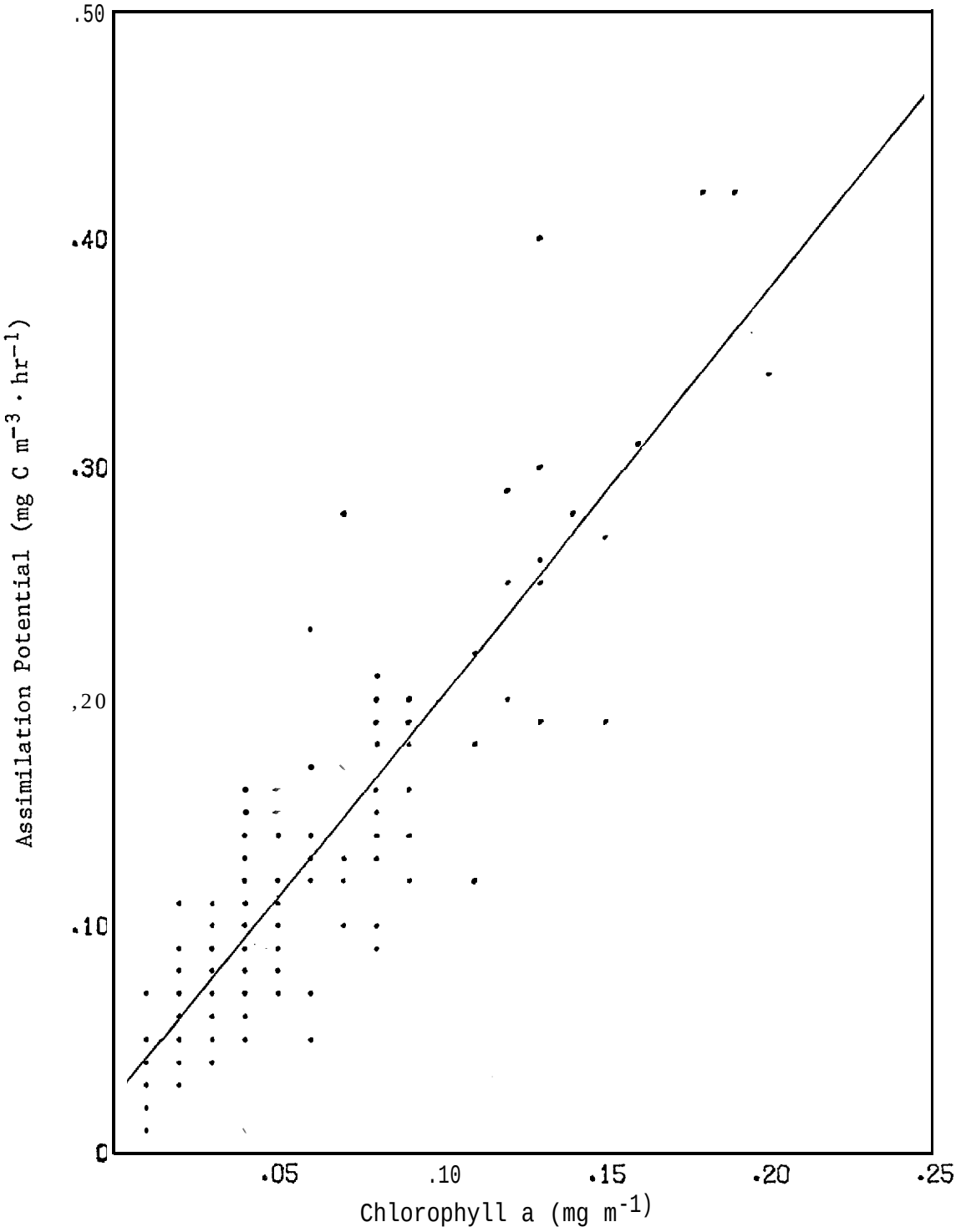

Fig. 9. Assimilation potential versus chlorophyll a measured at 20, 40 and 60 m. The regression line equation is: assim. = 1.73 Chl a + 0.026.

Fig. 10. Relative assimilation (P_r) versus relative light (I_r) for observations from graduated light experiments at five depths, Month and day are indicated to the left. The last five graphs are from 60 m.

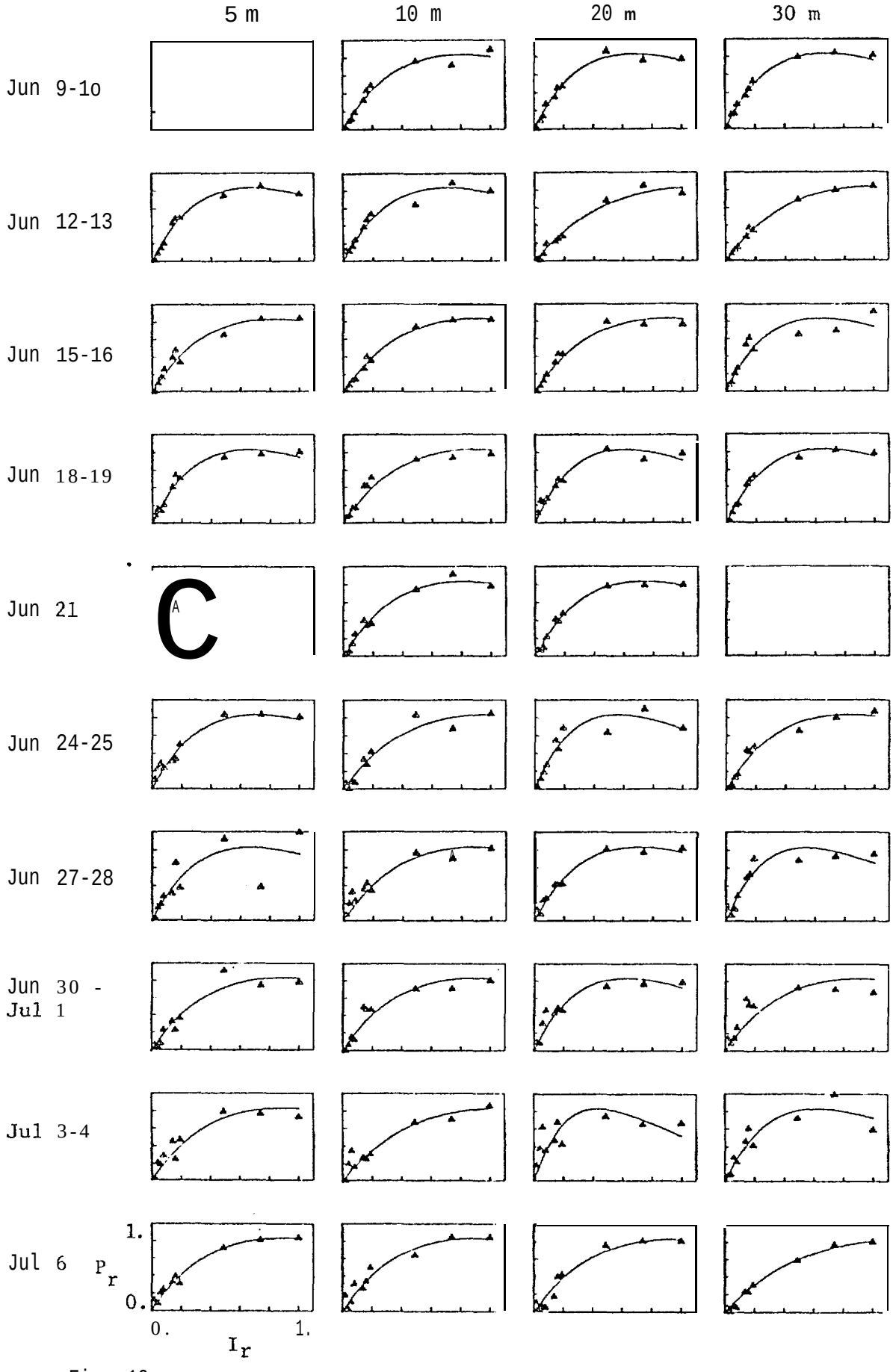
5 m
10 m
20 m
30 m
Jun 9-1o
Jun 12-13
Jun 15-16
Jun 18-19
Jun 21
Jun 24-25
Jun 27-28
Jun 30 -
Jul 1
Jul 3-4
Jul 6
P_r
1.
0.
0.
1.
I_r

Fig. 10.

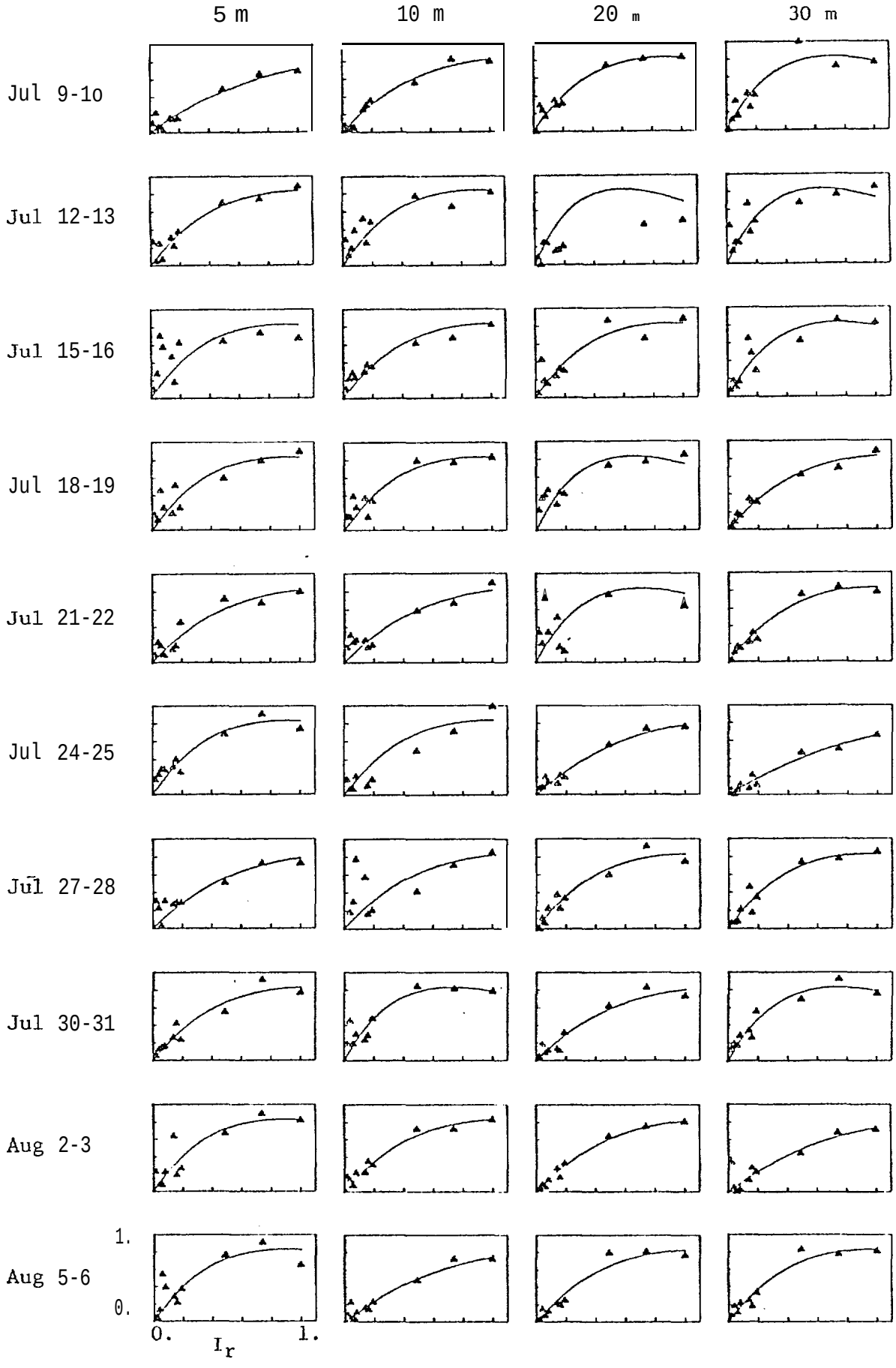

Fig. 10. (continued)

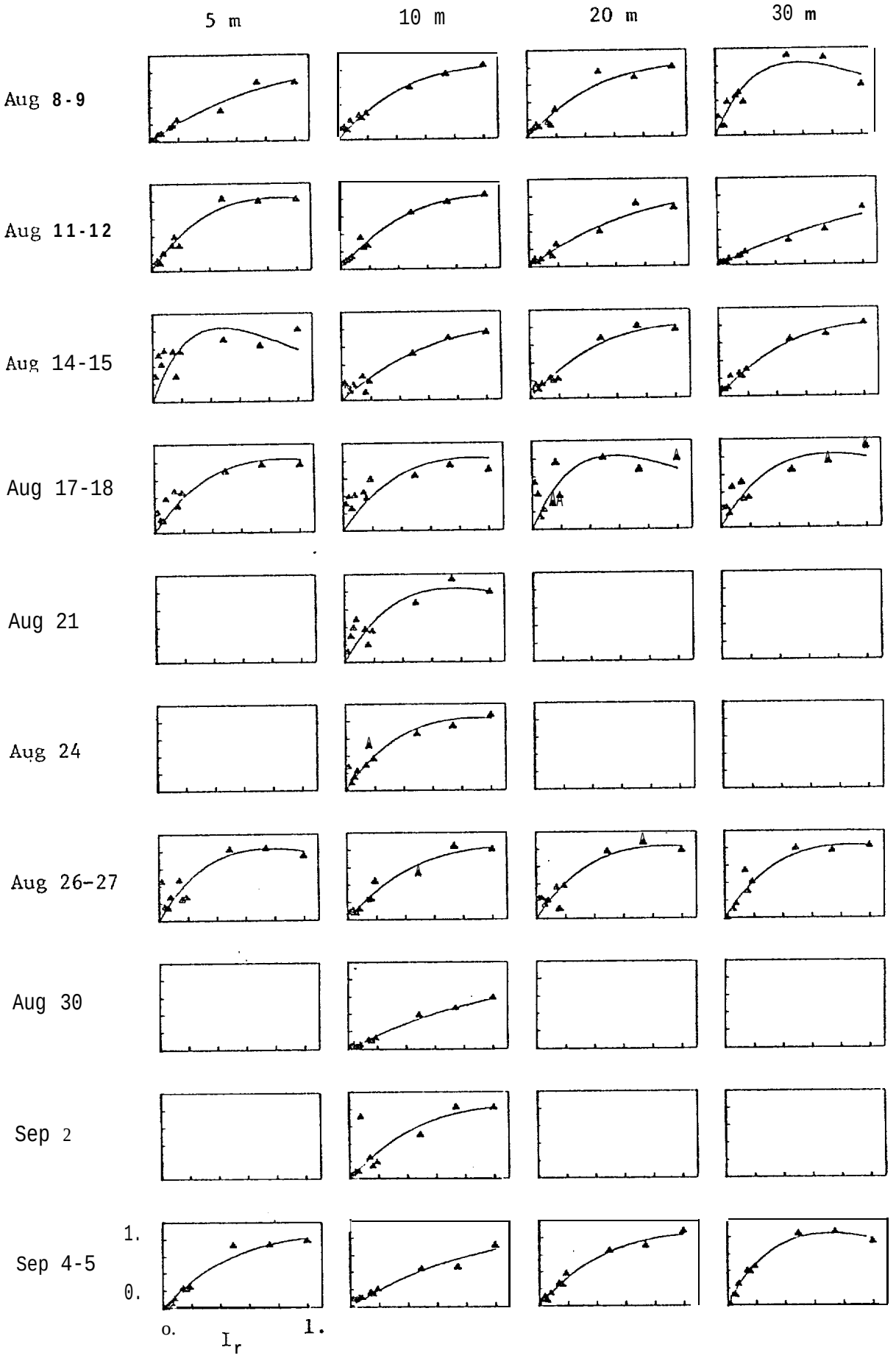

Fig. 10. (continued)

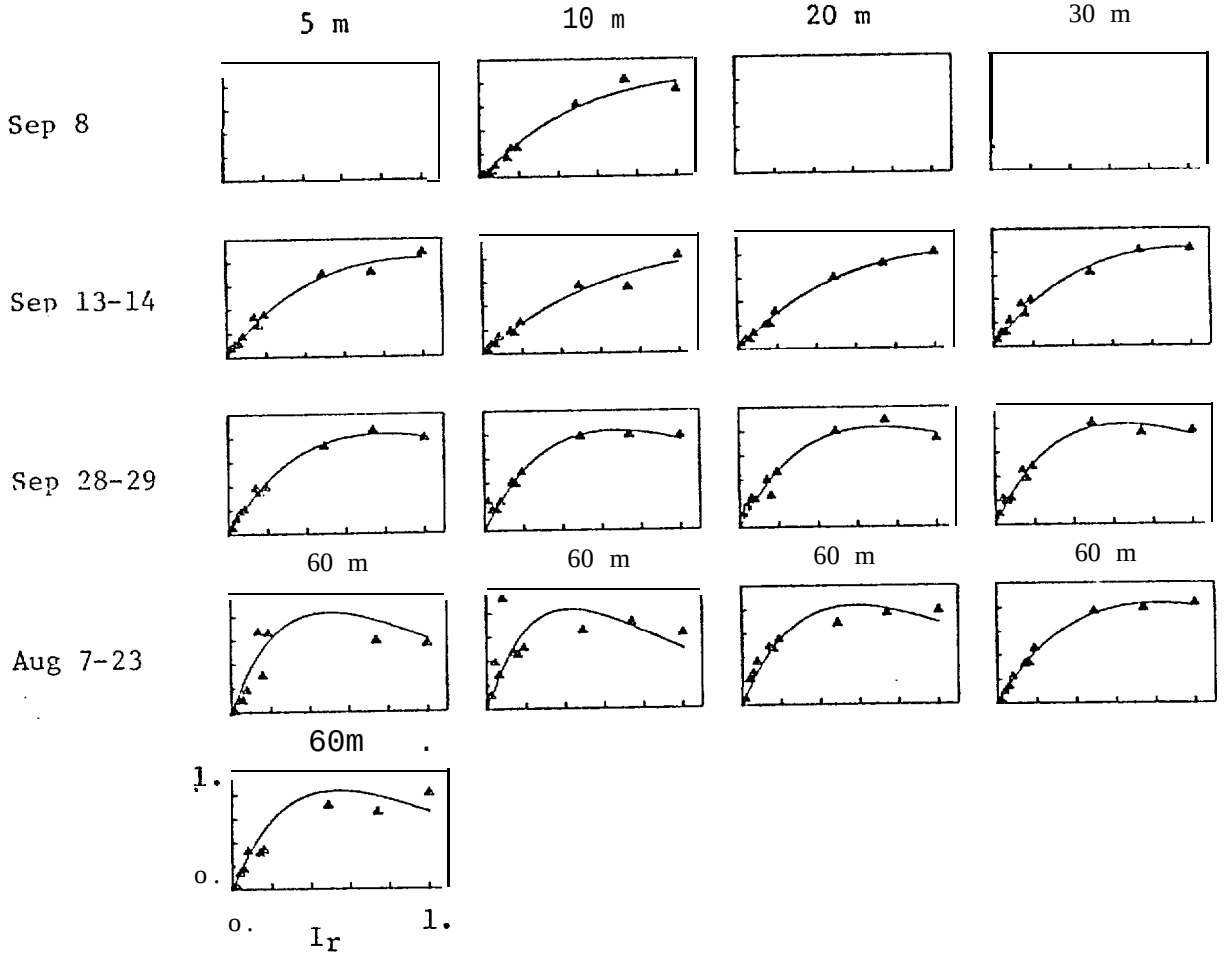

Fig. 10. (continued)

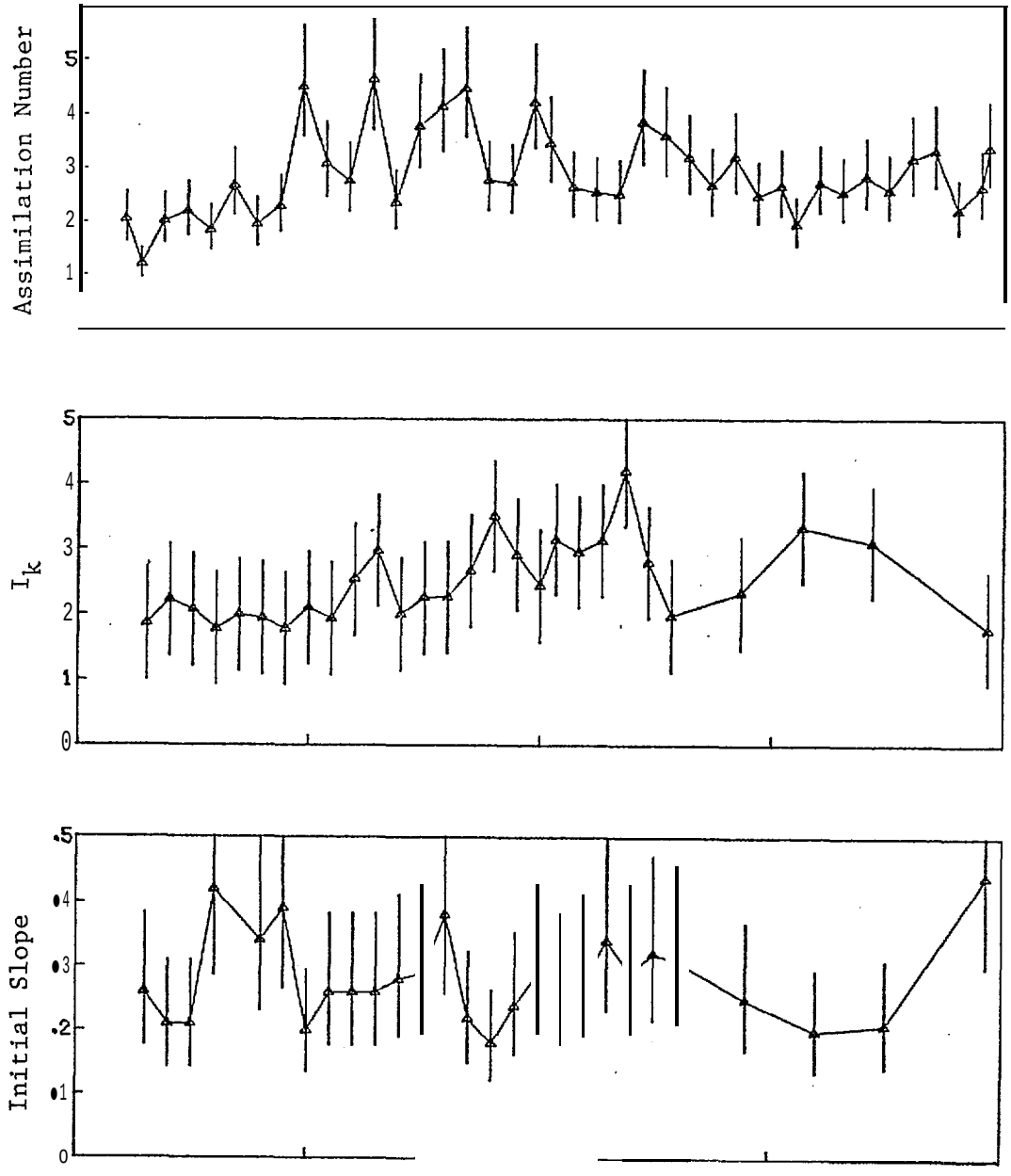

Fig. 11. Assimilation number (mg C·mg Chl a^{-1} · hr^{-1}), I_k (W · cm^{-2} X 10-3), and initial slope (mg C·mg Chl a^{-1} · (W . m^{-2})$^{-1}$. hr^{-1}) over time with means and confidence intervals.

Initial slopes ranged from 0.10 to 0.69 mg C mg Chl $a^{-1} \cdot (W \cdot m^{-2})^{-1} \cdot hr^{-1}$ (Fig. 11). Slopes were highest in the second half of June and at the end of summer. The 95% confidence intervals about the mean of the 2-day periods extend from about 68-147% of the geometric mean.

A slight photoinhibition at high light was noted in some experiments (e.g., 5 m on 12-13 June, Fig. 10).

F. *In situ* assimilation

In situ assimilation, averaging the 2 or 3 replicate observations per site, ranged from 0.005 mg C $m^{-3} \cdot hr^{-1}$ below bare-ice drafted with snow on 28 July, to 0.076 mg C $m^{-3} \cdot hr^{-1}$ below a melt pond skimmed with ice and some slushy snow on 14 August (Table 7). There was a significant ($P < 0.05$) variance component added between sites in only 6 of the 19 experiments where inter-site comparison was possible. *In situ* assimilation was generally the same for the pond and lead sites. Assimilation at the ice site was usually less than at the other sites.

G. Zooplankton

Twenty-two copepod species were identified (Table 8). The smaller species, *Microcalanus pygmaeus*, *Oithona similis*, and *Oncaea borealis*, were more abundant (Table 9). *Calanus glacialis* and *Euchaeta glacialis* were least abundant. Nauplii were much more abundant than adults. Males were rarely encountered except in *Oithonasimilis* and *Oncaea borealis.*

Calanus hyperboreus adult females were present in the upper 75 m all summer (Fig. 12). Stage I appeared in mid-July and was present in the upper 75 m until mid-August. Stage II appeared in mid-August and remained until mid-September. Stage III was most abundant in September. Stages IV and V were present throughout the summer in the upper 50 m.

Calanus glacialis adult females were most abundant in July (Fig. 13). Stage I appeared in mid-July, and stages II and 111 appeared in early September and mid-August. Stage IV (possibly individuals that overwintered) was present in June and early July. Stage V was most abundant in July, though present all summer.

Euchaeta glacialis adult females were present after mid-July (Fig. 14). Stage II was present in early summer, mainly in the 50 to 75 m stratum. Stages III and IV were abundant in August and September. Stage V was present from late June onward. Except for stages II and 111, this species was generally below the mixed layer (0 - 50 m).

Metridia longa adult females and males were present all summer (Fig. 15). Stage III was present mainly in September. Stages IV and V were present all summer. The species was generally below 75 m.

Table 7. Surface characteristics of the melt pond, lead, and bare ice sites during *in situ* incubations, and the associated average assimilation (mg C $m^{-3} \cdot hr^{-1}$). An asterisk denotes a significant ($P < 0.05$) added variance component between sites.

	Pond		Lead		Ice	
Date	Character	Assim.	Character	Assim.	Character	Assim.
0722	Skim ice	0.010	Open	0.009	Snow veneer, bright white	0.006
0723	Open	0.007	Open	0.011	Snow veneer, bright white	0.013
*0725	Open	0.007	Open	0.011	Melting greyish ice	0.008
0726	Skim ice	0.008	Ice bergs but open	0.009	Snow veneer, bright white	0.008
*0728	Ice and snow	0.008	Open	0.007	Snow drifts	0.005
*0729	Snow, ice and slush	0.043	Ice bergs but open	0.021	Fresh snow, 6-7 cm	0.034
0801	2 cm ice, 1/3 snow covered	0.042	Open	0.024	Fresh snow, 5-6 cm	
0803	Split by lead		Ice raft	0.014	Frost and snow, 4-5 cm	0.012
*0807	New pond, skim ice	0.022	50% mush	0.030	Snow, 2-5 cm	0.021
0809	Snow drifted		Open	0.039	Wind-blown snow, greyish	0.036
0811	Clear, some ice chunks	0.051	Open	0.047	Snow veneer	0.040
0812	Open	0.044	Open	0.052	Bright white, frosty	0.049
0813	Open	0.025	Open	0.030	Snow frosted	0.026
0814	Skim ice, some slush-snow	0.076	Open	0.061	Snow frosted	0.052

Table 7. (continued)

Date	Pond		Lead		Ice	
	Character	Assim.	Character	. Assim.	Character	Assim.
0815	Skim ice, grey slush	0.033	Open	0.040	Snowy, melting	0.032
0816	Open	0.066	Open	0.050	Melting	0.053
0818	Skim ice	0.030	Skim ice	0.026	Frosted	0.020
*0821	4 cm ice	0.030	2 cm ice	0.025	Melting, grey	0.025
*0824	Blue ice	0.019	Open	0.024	Frosty white	0.021
0902	Drifted snow		Open	0.053	Drifted snow	
0908	Drifted snow		Ice and snow	0.059	Drifted snow	
0914	Drifted snow		Mush, drifted snow	0.053	Drifted snow	

Table 8. Copepods identified in samples taken at AIDJEX

Aetidiopsis multiserrata
Calanus glacialis
Calanus hyperboreus
Chiridius obtusifrons
Derjuginia tolli
Euchaeta glacialis
Gaidius brevispinus
Gaidius tenuispinus
Heterorhabdus compactus
Heterorhabdus norvegicus
Lubbockia glacialis
Metridia longs
Microcalanus pygmaeus
Microcalanus sp.
Oithona similis
Oncaea borealis
Oncaea notopus
Scaphocalanus magnus
Scolecithricella minor
Spinocalanus longicornis
Spinocalanus sp.
Temorites brevis
unidentified copepoda

Table 9. Maximum numbers of animals per 100 m^3 for species and stages collected at AIDJEX

Species	♀	♂	V	IV	III	II	I
Calanus hyperboreus	417	0	143	99	832	239	109
Calanus glacialis	69	2	38	5	20	41	76
Euchaeta glacialis	41	2	41	10	90	36	0
Metridia longa	239	5	265	66	132		
Microcalanus pygmaeus	4455	0	10182	15273	31818	38818	27364
Oithona similis	7000	1273	7318	3500	3818	7000	20682
Oncaea borealis	5091	21636	*Oncaea* spp. juveniles 39773				
Oncaea notopus	1061	0					

Nauplii - small	371148
Nauplii - large	9866
Nauplii - total	373545

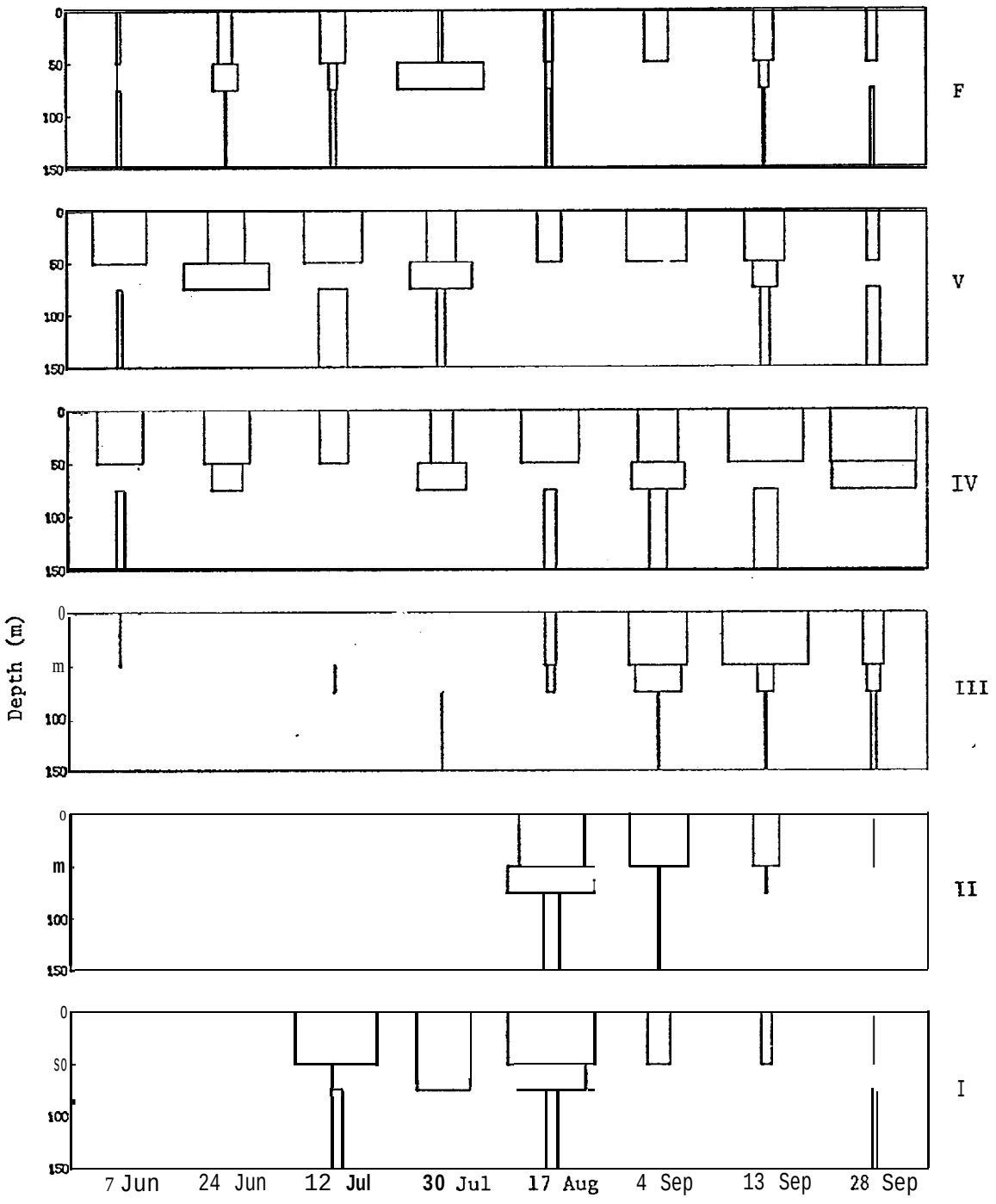

Fig. 12. Relative abundance of *Calanus hyperboreus*, females and stages I to V for 3 depth intervals and 8 dates. The width of rectangles indicates the relative abundance at depths and dates within life history stages.

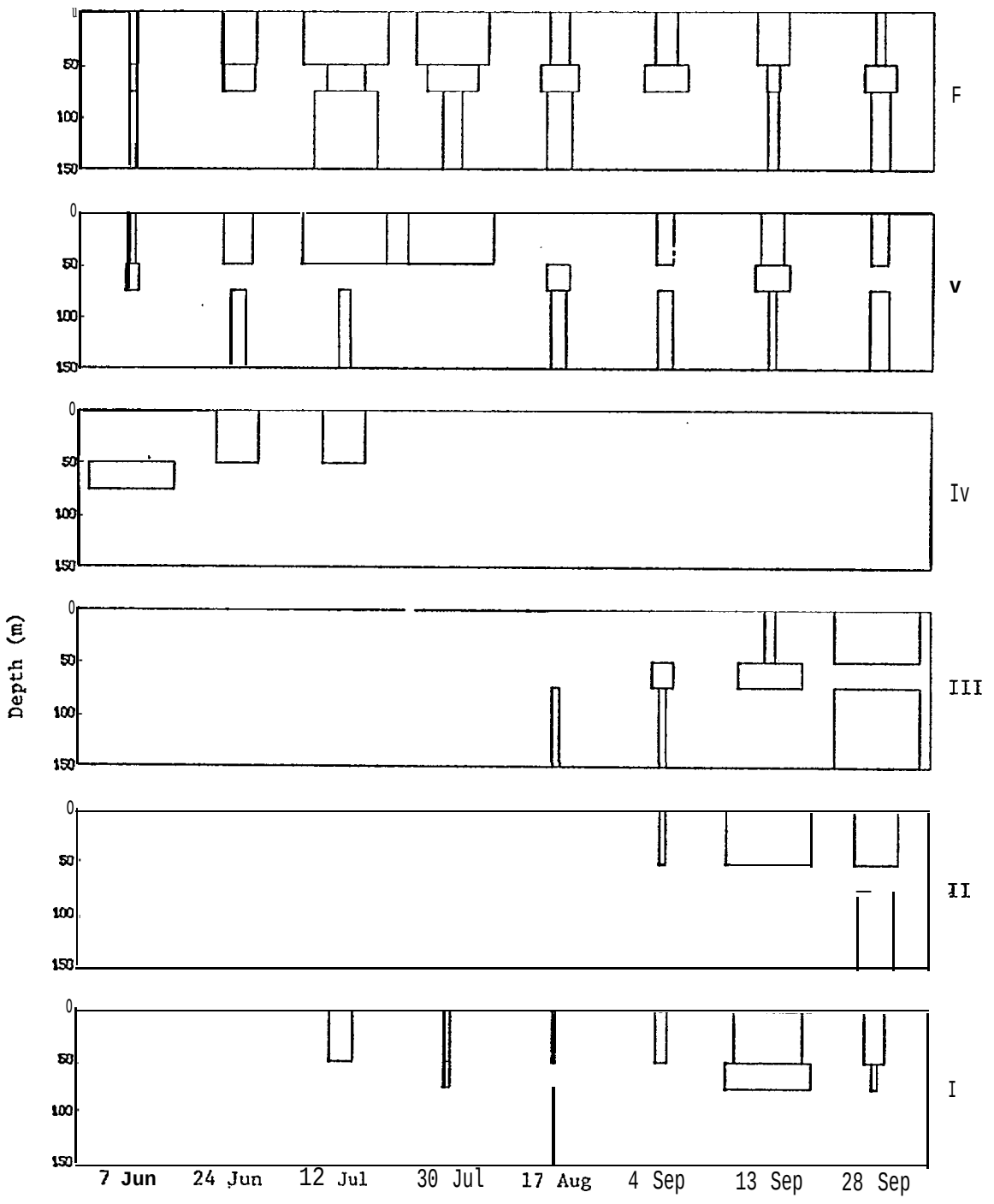

Fig. 13. Relative abundance of *Calanus glacialis*, females and stages I to V, for 3 depth intervals and 8 dates. The width of rectangles indicates' the relative abundance at depths and dates within life history stages.

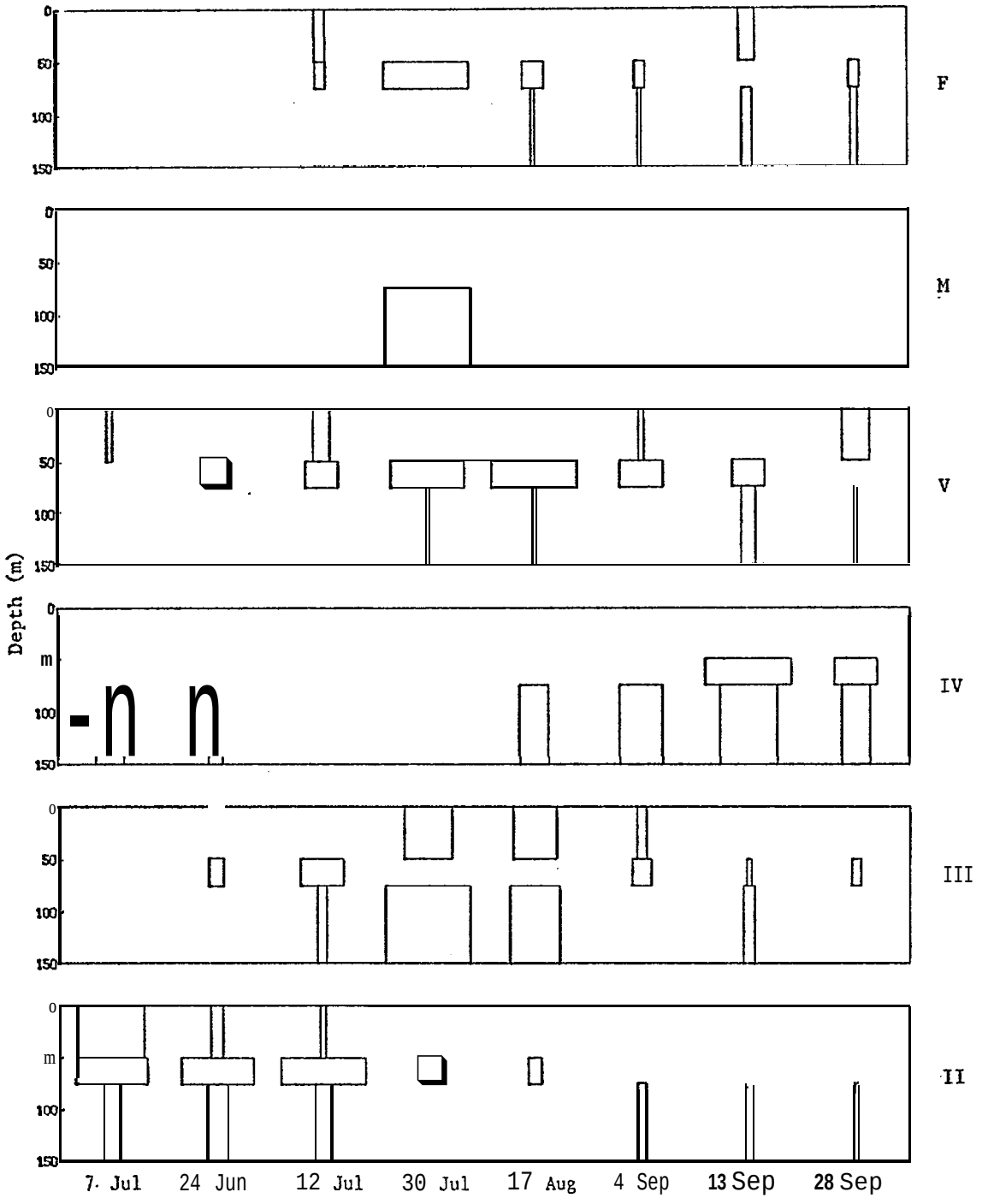

Fig. 14. Relative abundance of *Euchaeta glacialis*, females, males, and stages II to V, for 3 depth intervals and 8 dates. The width-of rectangles indicates the relative abundance at depths and dates within life history stages.

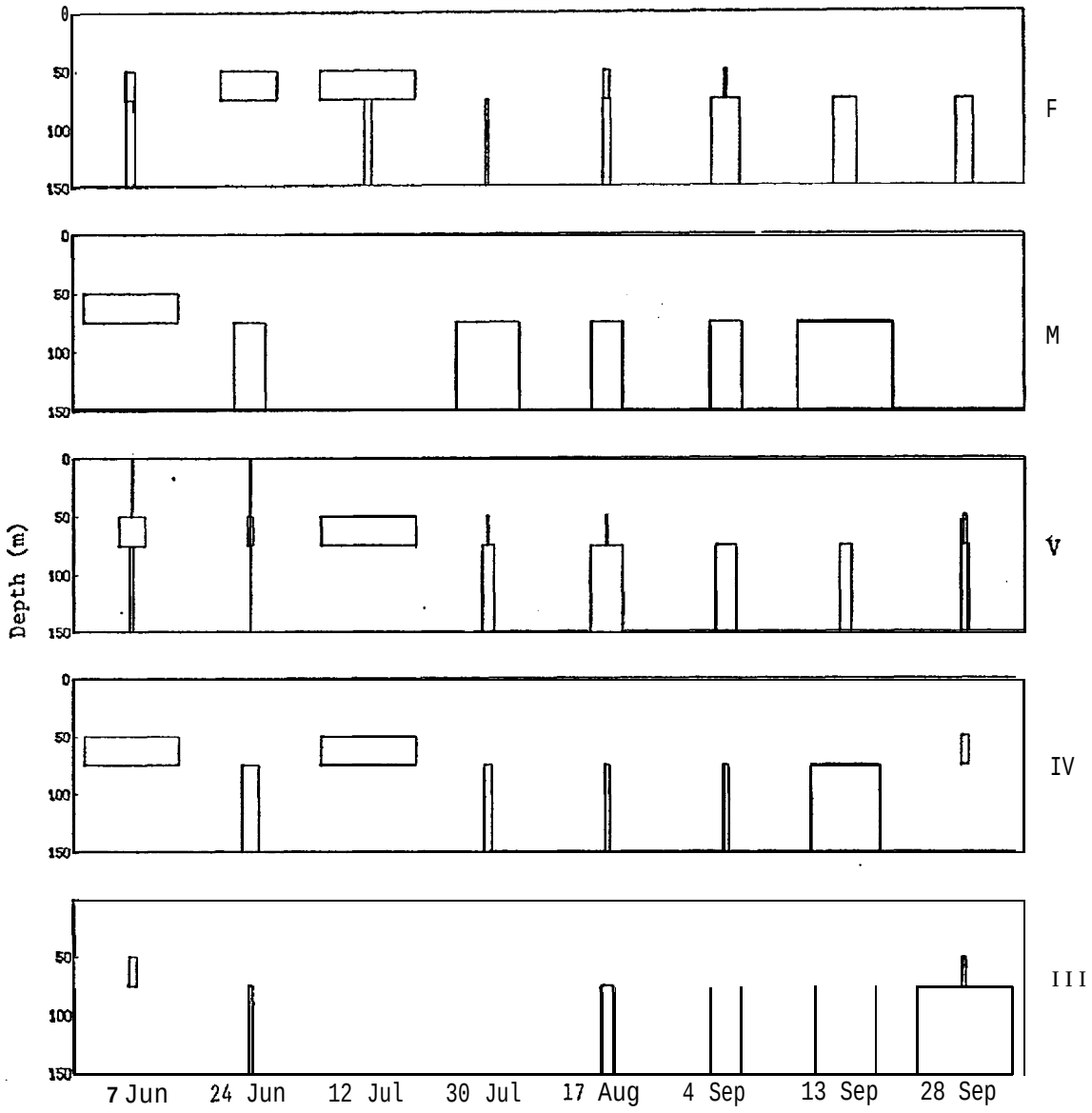

Fig. 15. Relative abundance of *Metridia longa*, females, males, and stages III to IV, for 3 depth intervals and 8 dates. The width of rectangles indicates the relative abundance at depths and dates within life history stages.

Microcalanus pygmaeus adult females were present, usually below 50 m, all summer (Fig. 16). Stages I through V were present all summer and generally remained above 50 m. Stage I was in greatest abundance in late June, stage II in late July, and stages III and IV in mid-September.

Oithona similis adult females and males were most abundant in the 50 to 75 m stratum, whereas the juveniles were generally in the upper 50 m (Fig. 17). Stages I through V were present all summer.

Oncaea borealis adult females and males were present all summer, the females being somewhat deeper than the males (Fig. 18), *Oncaea notopus* females were abundant in early summer and remained deep (Fig. 18). *Oncaea* spp. juveniles were present in the upper 50 m all summer.

Large and small copepod nauplii were present all summer and mainly associated with the upper mixed layer (Fig. 19). In general, the juveniles and nauplii were in the upper 75 m. There was a pattern of development shared in common by *Calanus hyperboreus*, *C. glacialis*, and *Microcalanus pygmaeus*, wherein the juveniles passed from stage I through stage III during the summer. *Euchaeta glacialis* juveniles passed from stage II through stage IV during the summer.

H. Environmental observations

Air temperatures increased and remained near the freezing point about 22 June (Fig. 20). In late July, temperatures temporarily decreased, snow accumulated, and pond surfaces froze. These conditions lasted until late August when a brief rainy period caused a slight melting of the surface. The autumn snow began to increase in September as temperatures decreased. Though there was a brief rise in temperature to near freezing in the first half of September, snow continued to accumulate.

Observed changes in the ice cover can be delineated roughly into eight periods:

1-22 June: pre-melt, crusty, snowy, bright white surface

22 June - 1 July: heavy melting, melt ponds increasing, intermittent rains

2-9 July: maximum meltwater (40 to 60%), intermittent snow

10-15 July: pond drainage, increased leads, intermittent snow

16-25 July: little change, grey ice, pond surfaces frozen, some snow

26 July - 19 August: heavy snow accumulation, ponds drifted over, bare ice covered with snow

20-20 August: brief rain, warm melt period, grey ice, slight melt water accumulation

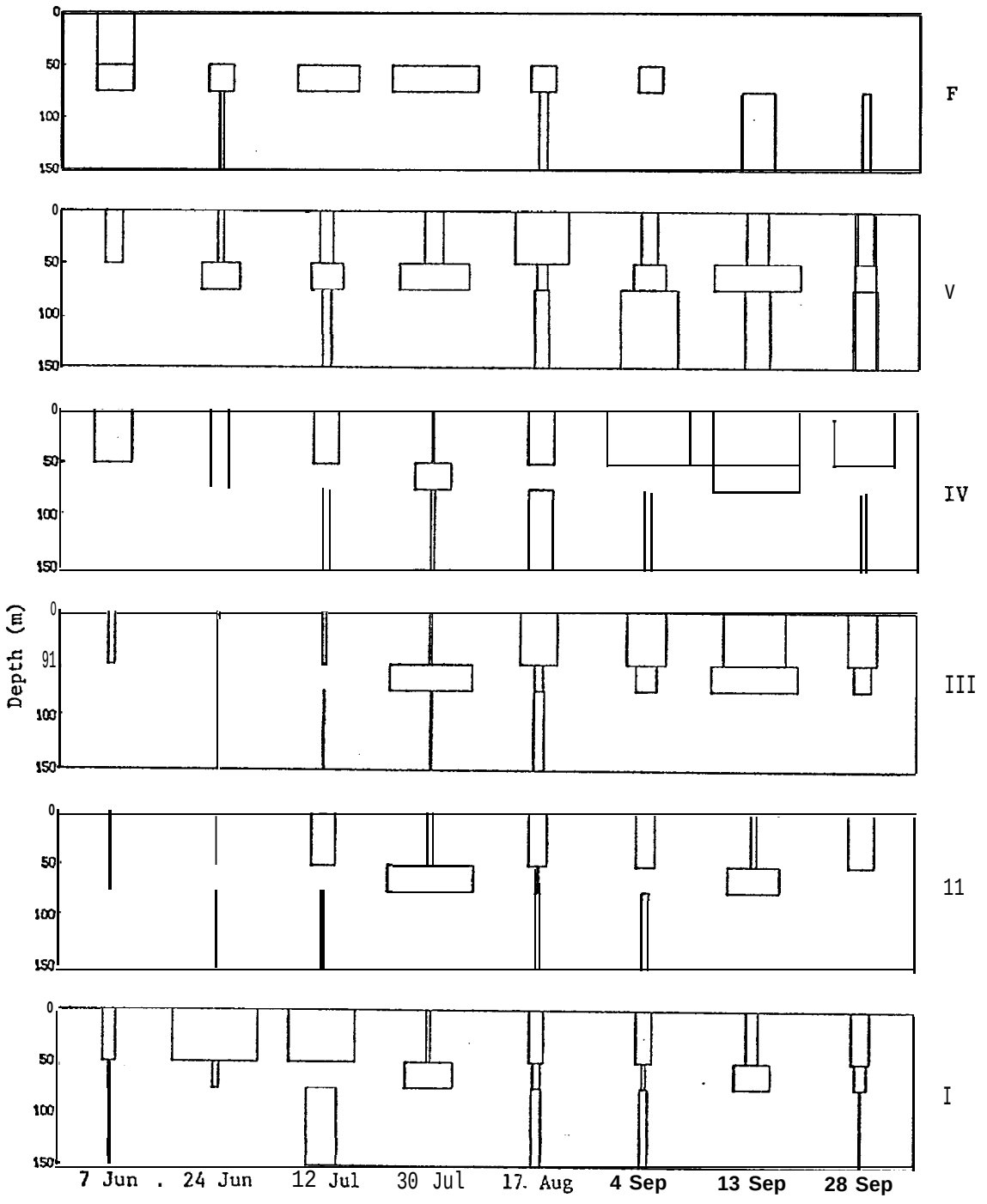

Fig. 16. Relative abundance of *Microcalanus pygmaeus*, females and **stages** I to V, for 3 depth intervals and 8 dates. The width of rectangles indicates the relative abundance at depths and dates within life history stages.

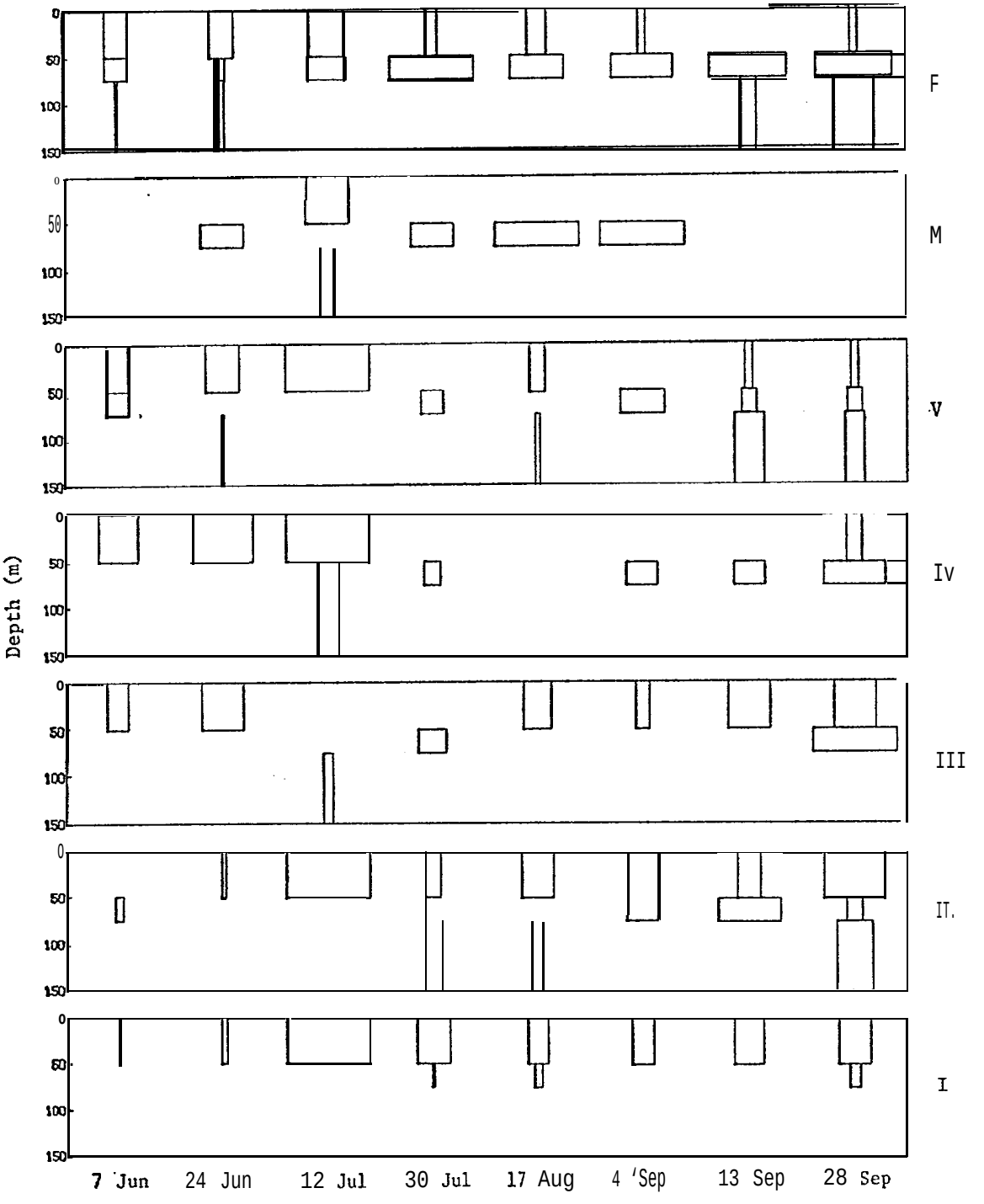

Fig. 17. Relative abundance of *Oithona similis*, females, males, and stages I to V, for 3 depth intervals and 8 dates. The width of rectangles indicates the relative abundance at depths and dates within life history stages.

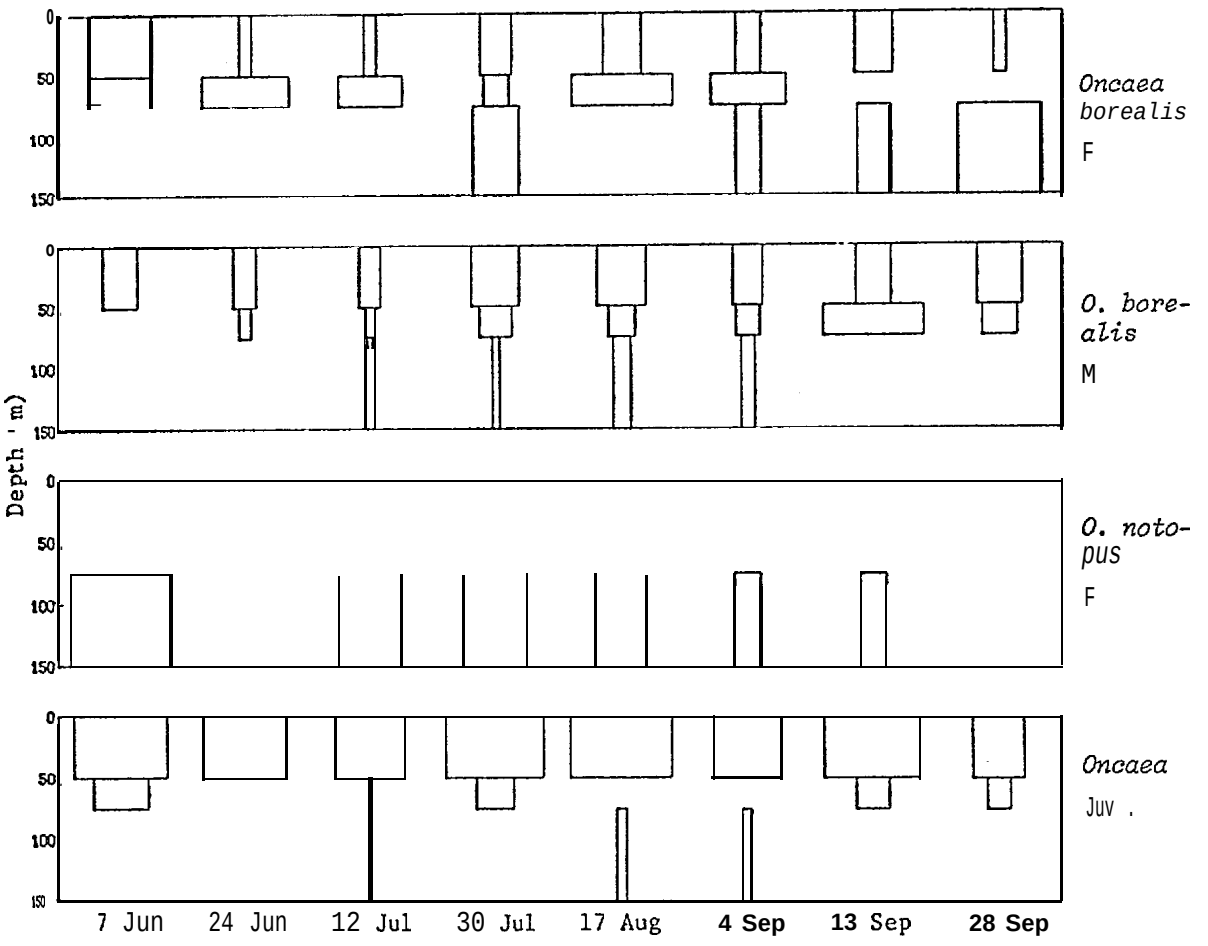

Fig. 18. Relative abundance of *Oncaea borealis*, females and males; O. *notopus*, females; and *Oncaea* spp. copepodite stages, for 3 depth intervals and 8 dates. The width of rectangles indicates the relative abundance at depths and dates within life history stages.

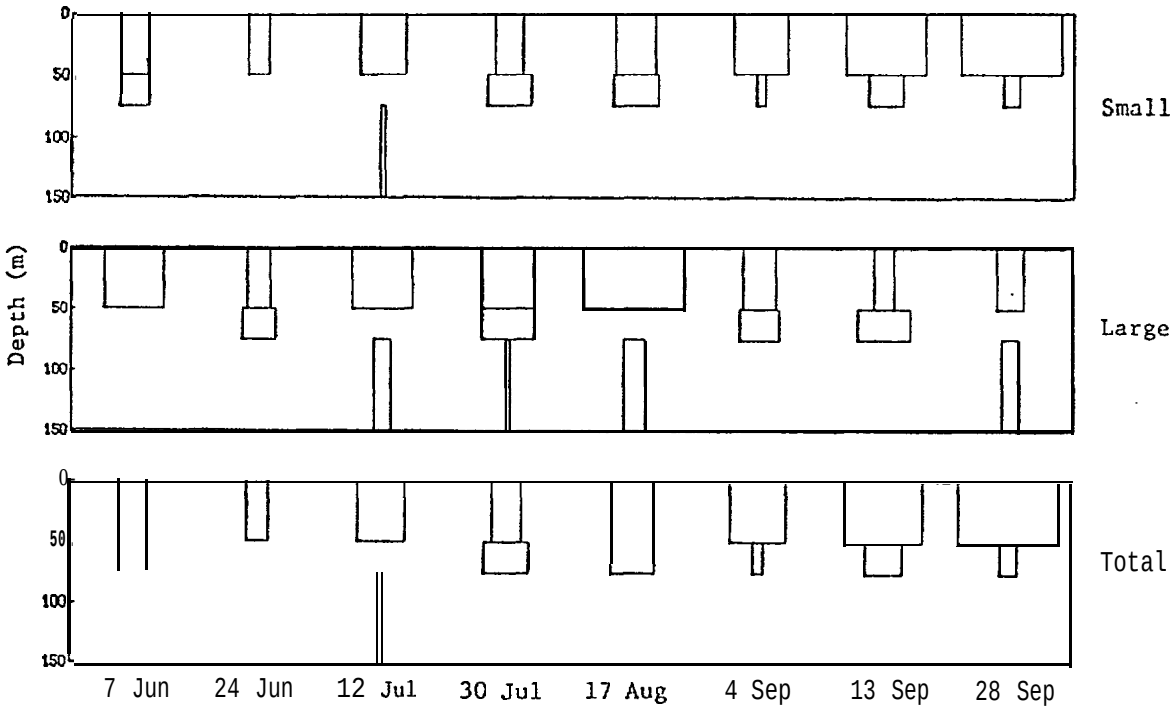

Fig. 19. Relative abundance of small, large, and total copepod nauplii, for 3 depth intervals and 8 dates. The width of rectangles indicates the relative abundance at depths and dates within life history stages.

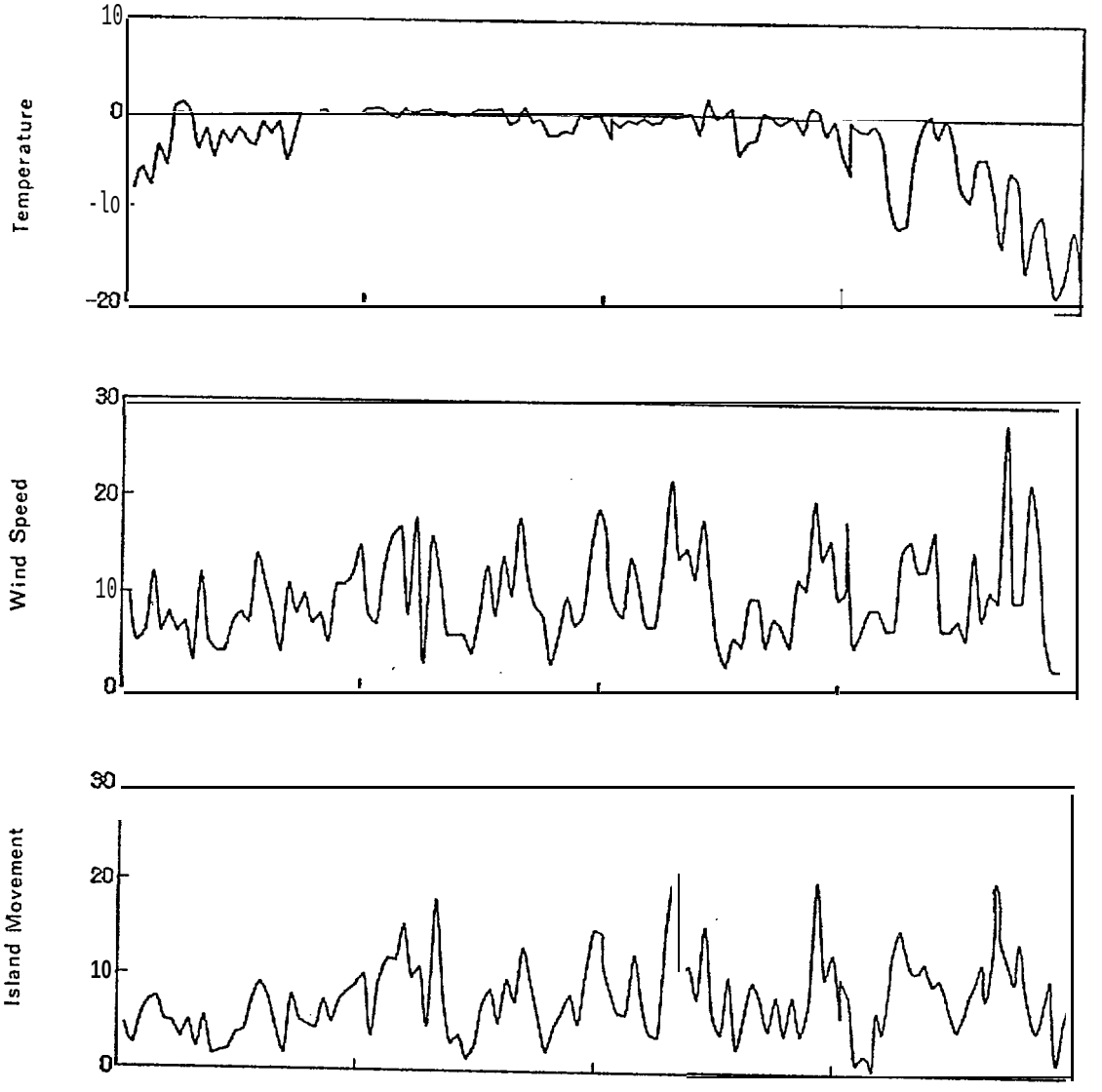

Fig. 20. Air temperature (°C), wind speed (knots), and island movement (km · day-l) recorded at AIDJEX main camp.

30 August - 30 September: final snow build-up, ponds and bare ice all snow-covered

Wind speed was rarely greater than 20 knots (Fig. 20). There were roughly seven periods of sustained high winds (> 12 to 13 knots). The initial and longest period was in late June and early July. The highest winds were recorded in late September. The response time of the ice movement (Fig. 20) to the increased winds was on the order of hours.

A sharp salinity increase marked the base of the mixed layer. There were small incremental steps in salinity within the mixed layer itself. From June through mid-July, the bottom of the mixed layer was generally at 50 to 60 m. At present, we do not have the temperature and salinity data for the remainder of the summer. The depth of the subsurface chlorophyll a maximum during July and August was at 55 to 60 m. Nitrate concentrations increased substantially at these depths. We inferred from these two variables that the sharp increase in density remained at about 50 to 60 m all summer long, though there were varying degrees of shallower density stratification.

VII. Discussion

Our observations commenced on 2 June and ended on 30 September. Experience on Fletcher's Ice Island, T-3, has shown this time interval to encompass the annual active growth of phytoplankton in the ice-covered areas of the Arctic Ocean. The initial chlorophyll a concentrations in the upper 40 m in June 1975 were 0.06 to 0.11 mg m^{-3}. In early June at T-3, chlorophyll *a* in the upper 40 m averaged 0.10 mg m^{-3} in 1968, 0.05 mg m^{-3} in 1971, 0.09 mg m^{-3} in 1972, and 0.02 mg m^{-3} in 1973. Though these initial concentrations were comparable, the pattern of development during late June and July was markedly different at AIDJEX compared to T-3. The 1975 summer increase in phytoplankton occurred at the pycnocline (50 to 60 m). On T-3, the active growth occurred in the upper 40 m, and maximum concentrations were found in late July. In 1975, phytoplankton in the mixed layer declined in late June and remained low until September.

A major difference between T-3 and AIDJEX was the nutrient regime. Our first measurements of nitrate were not made until 11 June. At that time and until mid-September, there was no detectable nitrate in the upper 40 In. June nitrate concentrations on T-3 averaged about 0.5 - 3.0 µg at ℓ^{-1}. Conceivably, nitrate mixed into the upper 40 to 50 m through turbulence and convective processes during the winter was depleted during the initial spring phytoplankton activity. Whether there were ever any substantial concentrations of nitrate prior to June is unknown.

We propose that the growth of phytoplankton at the pycnocline effectively limited the flux of nutrients across the density gradient

into the mixed layer and that this lack of nutrients severely curtailed the phytoplankton development that would normally have occurred above 40 m. *Visual* microscopic examination of *Thalassiosira* and *Chaetoceros* Spp. cells lend support to this argument. During mid-summer, cells taken from the upper 50 m were very pale in color compared to those in the pycnocline. Toward the end of summer, as nitrate spread into the upper 50 m, chlorophyll a increased and the cells were golden brown and healthy.

The development of phytoplankton at the pycnocline was stimulated by changes in the surface of the pack ice allowing greater transmission of incident radiation to the waters below. The most rapid increase in chlorophyll *a* was during the late June ablation of snow and the development of melt ponds and frequent rainy periods during July. During this period the average surface albedo generally declines to about 50 to 60% (Weller and Holmgren 1974). Considering the floe ice to average 3 m in thickness (Maykut and Untersteiner 1971) and have an absorption coefficient of 1.1 m^{-1} (Weller 1968), the radiation at the ice-water interface is about 1 to 2% of the radiation incident on the ice. Using 0.04 m^{-1} for the absorption coefficient of water (Smith 1973), the light at 50 to 60 m depth is only 0.1 *to* 0.2% of the incident radiation.

The phytoplankton populations seemed particularly well adapted to these low light intensities. This conclusion is supported by the values of I_k, initial slope and assimilation number. The I_k's determined for 1975 were 2.0 to 2.5 x 10^{-3} $W \cdot cm^{-2}$. Ryther (1956) reported values, converted to W .cm'^{2} PAR (1 ft-c natural sunlight = 4.6 x 10^{-6} $W \cdot cm^{-2}$ PAR, Strickland 1958), of 4.6x 10^{-3} W. cm'^{2} for diatoms and 11.0 x 10^{-3} $W \cdot cm^{-2}$ for dinoflagellates. Initial slopes for 1975 were generally 0.20 to 0.30 mg C·mg Chl a^{-1} ● hr-l .$(W \cdot m^{-2})^{-1}$. Platt (1969) reported initial slopes for coastal populations of 0.01 to 0.20, and Parsons and Takahashi (1973) reported slopes of 0.09 to 0.10 for Arctic and Antarctic waters. Assimilation numbers for 1975 were mainly 2.0 to 4.0 mg C· mg Chl $a^{-1} \cdot hr^{-1}$. These are comparable to values reported by Parsons and Takahashi (1973). The above indicates that the phytoplankton populations observed in 1975 were able to use low light intensities with high efficiency.

The best period for growth was during July. On 26 July, lowered temperatures put skim ice on ponds and snow rapidly accumulated. The ponds were rapidly covered with drifted snow. This period of lowered submarine light levels lasted until about 20 August. Then, for about a week, warmer temperatures and some rain caused the ice surface to melt and turn greyish. There was a slight accumulation of melt water, but most ponds remained snow-filled.

Chlorophyll a abundance at the pycnocline did not increase in the second half of August. Sun elevations were low and days short this time of year. Through September, phytoplankton abundance at depth declined. Nutrients not utilized at the pycnocline were spread into the

mixed layer during periods of higher winds, contributing to the brief fall increase in phytoplankton above 30 m.

The pattern of early summer and late fall development of phytoplankton in the mixed layer, coupled with a mid-summer development in the pycnocline, resulted in generally high amounts of total chlorophyll a throughout the summer. Only in late June did any substantial decrease occur .

The sampling done by helicopter enroute to the satellite camps indicates observations at main camp may be representative of a broad geographic area. At mid-summer, the chlorophyll a values were low and nitrate not dectected over this 75-mile transect. This indicates that nutrients may be limiting over large areas. The results further suggest that the variability in observations due to short term island movement may be small.

The zooplankton counts show that the juveniles of several of the copepods advanced through 3 to 4 stages during the summer. This period of higher food abundance was probably important to the survival of the cohort. Unfortunately, our sampling program was constrained in time and space, and changes due to migration in and out of the sample space cannot be assessed. Nor can conclusions be drawn about the survival in the fall or over-wintering process.

VIII . Conclusions

A. The phytoplankton populations in the upper *40* m remained low during summer and were probably nutrient-limited. Nitrate was not detected in this depth range through July and August.

B. The period of increased submarine light was confined to late June through July. This was also the period when active growth of phytoplankton occurred at the pycnocline. This growth inhibited nutrient transfer to the mixed layer.

C. Phytoplankton was low and nitrate was not detected in the mixed layer over a large area.

D. Graduated light experiments indicated the phytoplankton were well adapted to low light intensities. In comparison to other oceanic areas, I_k was low, initial slope was high, and assimilation numbers were average,

E. Statistical analysis of chlorophyll *a* and assimilation potential indicated that the combined effects of variability due to experimental and small-scale patchiness errors was a much higher proportion of the variability within 5-day

intervals for assimilation than for chlorophyll a.

F. Though the surface conditions associated with the three *in situ* incubation sites were very different, a significant difference between assimilation measured at the different sites could only be shown in 32% of the experiments.

G. Eight species of copepods, *Calanus hyperboreus, C. glacialis, Euchaeta glacialis, Metridia longs, Microcalanus pygmaeus, Oncaea borealis, O. notopus,* and *Oithona similis,* were the most abundant calanoids out of 22 species identified.

H. Smaller species of copepods, *Microcalanus pygmaeus, Oithona similis,* and *Oncaea borealis,* were more abundant than larger copepods. Nauplii were more abundant than adults. Males of all species were rarely encountered except in *Oithona similis* and *Oncaea borealis.*

I. "In general, juveniles and nauplii were in the upper 75 m.

J. Juveniles of *Calanus hyperboreus, C. glacialis,* and *Microcalanus pygmaeus* passed from stage I through stage III during the summer. *Euchaeta glacialis* juveniles passed from stage II through stage IV during the summer.

IX. Recommendations

A longer time series is required for this region to allow the assessment of trophic dependencies and seasonal changes of the vertical distributions of zooplankton. A sequence of zooplankton samples throughout the year, to depths of 300 m, could be enumerated to species and stages within species to elucidate the over-wintering process, and determine survival rates and the critical periods of development.

Herbivore development may depend on the depth and timing of increased phytoplankton activity. Therefore it is important to know if significant yearly differences occur in the cycle of phytoplankton abundance due to summer melt patterns, nutrient fluxes, mixing, or other environmental factors. The continued evaluation of the changes in the character of the pack ice surface, as well as the nutrient regime and mixing processes in the mixed layer, would allow assessment of important driving forces of the marine ecosystem. It should include a synoptic sampling program in order to assess small and large scale patchiness.

If no platform could be put in the perennial ice zone, it would still be very useful to make helicopter or aircraft transects from the edge of the ice northward. These could be made hi-weekly, if not more frequently, throughout the summer, to evaluate the development of

chlorophyll a and nutrients. These transects, along with icebreaker transects from the coast to the edge of the pack ice, would furnish information useful to determining geographic differences in the dynamics of the marine ecosystem, especially those associated with the transition from the coastal shelf systems to the deep oceanic type.

Sampling of the various environmental properties as well as the phytoplankton and zooplankton populations at close intervals in time and depth would allow the variability in these dimensions to be assessed. This assessment would allow a more efficient field program to be formulated.

Only with the estimation of variability inherent in the environment and several complete time series of samples will we be in a position to attempt an evaluation of short and long term changes that may be attributable to resource development on the outer shelf.

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A. Assimilation — Page Number

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Table 1. Analysis of variance of the transformed radiocarbon assimilation potentials pooled into 5-day time cells at 4 depths

Depth	Source	Pooled DF	Pooled SS	Pooled MS	Pooled F
5 m	Between time cells	22	3.090	0.140	5.0*
	Within time cells	44	1.242	0.028	
	Total	66	4.332		
10 m	Between time cells	22	3.408	0.155	7.3*
	Within time cells	50	1.067	0.021	
	Total	72	4.475		
20 m	Between time cells	22	2.678	0.122	5.3*
	Within time cells	45	1.027	0.023	
	Total	67	3.705		
30 m	Between time cells	22	2.273	0.103	7.1*
	Within time cells	44	0.644	0.015	
	Total	66	2.917		

* $P < 0.01$ $F_{0.01}(22,44) \approx 2.24$ $F_{0.01}(22,50) \approx 2.22$

Table 2. Analysis of variance of the transformed radiocarbon assimilation potentials at 4 depths for 10 replication experiments

Depth	Source	DF	SS	MS	F
		Replication			
5 m	Between days	9	6.561	0.729	48.0*
	Among water bottles	30	0.456	0.015	1.3
	Within water bottles	40	0.464	0.012	
	Total	79	7.481		
10 m	Between days	9	7.290	0.810	61.4*
	Among water bottles	30	0.397	0.013	1.8**
	Within water bottles	40	0.298	0.008	
	Total	79	7.985		
20 m	Between days	9	5.011	0.557	17.1*
	Among water bottles	30	0.977	0.033	2.6**
	Within water bottles	40	0.499	0.013	
	Total	79	6.488		
30 m	Between days	9	0.957	0.106	4.2*
	Among water bottles	30	0.767	0.026	5.1*
	Within water bottles	40	0.202	0.005	
	Total	79	1.926		

*$P < 0.01$ $F_{0.01}(30,40) \simeq 2.20$ $F_{0.01}(9,30) \simeq 3.06$

** $p < 0.05$ $F_{0.05}(9,30) \simeq 2.21$ $F_{0.05}(30,40) \simeq 1.74$

Table 3. Depth series ^{14}C assimilation experiments

Explanation of Table Values:

1.	Date:	Month, day, year of experiment
2s	Standard:	Total activity (microcuries) added to water sampled
3.	Time:	Duration (hours) of incubation
4.	Eff :	Liquid scintillation external standard (e.g. 13) and resultant percentage counting efficiency (e.g. 75.6)
'5.	Depth:	Depth (m) of water sampled
6.	Light:	Light intensity (microeinsteins $m^{-2}sec^{-1}$) in incubation box during experiment
7.	Assim:	Light, dark, and net assimilation ($mgCm^{-3}hr^{-1}$)
8.	Chl a:	Measured chlorophyll a (mg m^3) of incubated water sample
9.	Normalized:	Assimilation normalized on chlorophyll and assimilation normalized on light intensity

Table 3 (cont.)

DATE 6/ 6/75 STANDARD 7.70 MC/AMP TIME 6.0 HR EFF 13/75.6

DEPTH (M)	LIGHT (ME/M2/S)	ASSIM (MGC/M3/HR) L	D	N	CHL A (MG/M3)	NORMALIZED A/C	A/L
3	116	.12	.01	.11	.06	1.91	.00099
5	118	.13	.01	.12	.06	1.98	.00101
10	120	.09	.01	.08	.09	.85	.00064
15	121	.22	.01	.21	.08	2.62	.00173
20	120	.13	.01	.12	.09	1.32	.00099
25	119	.21	.01	.20	.06	3.41	.00172
30	110	.19	.01	.18	.05	3.60	.00164
35	112	.17	.01	.16	.08	2.03	.00145
40	114	.17	.01	.16	.11	1.47	.00142
45	116	.16	.01	.15	.08	1.85	.00127
50	117	.18	.01	.17	.09	1.92	.00147
60	116	.06	.01	.05	.06	.83	.00043

DATE 6/ 8/75 STANDARD 7.70 MC/AMP TIME 6.0 HR EFF 13/75.6

DEPTH (M)	LIGHT (ME/M2/S)	ASSIM (MGC/M3/HR) L	D	N	CHL A (MG/M3)	NORMALIZED A/C	A/L
3	116	.12	.01	.11	.09	1.23	.00096
5	118	.09	.01	.08	.10	.80	.00068
10	120	.09	.01	.08	.10	.80	.00067
15	121	.14	.01	.13	.09	1.46	.00108
20	120	.10	.01	.09	.08	1.16	.00077
25	119	.15	.01	.14	.11	1.29	.00120
30	110	.16	.01	.15	.08	1.84	.00134
35	112	.11	.01	.10	.06	1.75	.00094
40	114	.12	.02	.10	.08	1.25	.00087
45	116	.13	.01	.12	.09	1.34	.00104
50	117	.11	.01	.10	.08	1.25	.00086
60	116	.01	.01	.00	.04	.02	.00001

DATE 6/11/75 STANDARD 7.70 MC/AMP TIME 6.0 HR EFF 13/75.6

DEPTH (M)	LIGHT (ME/M2/S)	ASSIM (MGC/M3/HR) L	D	N	CHL A (MG/M3)	NORMALIZED A/C	A/L
3	116	.10	.02	.08	.08	.99	.00069
5	118	.18	.02	.17	.08	2.09	.00142
10	120	.18	.01	.16	.08	2.05	.00137
15	121	.24	.01	.23	.09	2.50	.00186
20	120	.20	.01	.19	.08	2.34	.00156
25	119	.18	.01	.17	.07	2.36	.00139
30	110	.17	.02	.15	.07	2.14	.00136
35	112	.16	.02	.14	.07	1.95	.00122
40	114	.13	.01	.12	.07	1.64	.00101
45	116	.19	.02	.17	.08	2.09	.00144
50	117	.15	.01	.14	.08	1.77	.00121
60	116	.07	.01	.06	.04	1.59	.00055

Table 3 (cent.)

DATE 6/14/75 STANDARD 7.70 MC/AMP TIME 6.0 HR FFF 14/75.9

DEPTH (M)	LIGHT (ME/M2/S)	ASSIM (MGC/M3/HR) L	D	N	CHL A (MG/M3)	NORMALIZE A/C	A/L
3	116	.13	.02	.11	.05	?.29	.00099
5	118	.14	.01	.13	.06	?.(I9	.00106
10	120	.13	.01	.12	.06	1.93	.00097
15	121	.15	.01	.14	.06	>.35	.00117
20	120	.14	.01	.13	.06	2.11	.00106
25	119	.16	.01	.15	.07	2.09	.00123
30	110	.16	.01	.14	.06	2.37	.00129
35	112	.15	.02	.13	.07	1.84	.00115
40	114	.18	.01	.17	.07	?.47	.00151
45	116	.13	.01	.11	.06	1.91	.0000'2
50	117	.17	.01	.16	.06	2.67	.001-37
60	116	.08	.01	.07	.06	1.15	.00060

DATE 6/17/75 STANDARD 7.70 MC/AMP TIME 6.0 HR FFF 36/74.3

DEPTH (M)	LIGHT (ME/M2/S)	ASSIM (MGC/M3/HR) L	D	N	CHL A (MG/M3)	NORMALIZED A/C	A/L
3	116	.09	.01	.08	.07	1.10	.00066
5	118	.12	●II?	.11	.06	1.81	.00092
10	120	.12	.01	.11	.05	?.16	.00090
15	121	.11	.01	●09	.07	1.34	.00078
20	120	.13	.01	.12	.0s	7.33	.00097
25	119	.12	.02	●10	.05	1.97	.00083
30	110	.12	.02	.10	.04	2.53	.00092
35	112	.15	.01	.14	.05	2*75	.00123
40	114	.11	.01	.10	.04	2.38	.00084
45	116	.13	.01	.12	.05	?.38	.00103
50	117	.14	.01	.13	.06	2.09	.00107
60	116	.14	.01	●17	.08	1.62	.00112

DATE 6/20/75 STANDARD 7.70 MC/AMP TIME 6.0 HR FFF 33/75.7

DEPTH (M)	LIGHT (ME/M2/S)	ASSIM (MGC/M3/HR) L	D	N	CHL A (MG/M3)	NORMALIZED A/C	A/L
3	116	.07	.02	.05	.03	1.63	.00042
5	118	.08	.02	.06	.04	1.55	.00053
10	120	.09	.02	.08	.03	2.54	.00063
15	121	.09	.01	.08	.03	2.76	.00068
20	120	.11	.01	.10	.03	3.25	.00081
25	119	.12	.01	.11	.03	3.63	.00092
30	110	.15	●n?	.]7	.03	4.41	.00120
35	112	.18	.01	●17	.04	4.34	.00155
40	114	.17	.01	.16	.04	3.94	.00138
45	116	.16	.01	.14	●05	?.87	.00124
50	117	.16	.01	.14	.06	?.39	.00123
60	116	.21	.01	.20	.08	2.45	.00169

Table 3 (cont.)

DATE 6/23/75 STANDARD 7.70 MC/AMP TIME 5.8 HR EFF 27/78.4

DEPTH (M)	LIGHT (ME/M2/S)	ASSIM (MGC/M3/HR) L	D	N	CHL A (MG/M3)	NORMALIZED A/C	A/L
3	116	.08	.02	.06	.04	1.55	.00054
5	118	.07	.02	.05	.04	1.18	.00040
10	120	.07	.02	.06	.02	2.90	.00048
15	121	.07	.02	.06	.03	1.85	.00046
20	120	.07	.02	.05	.03	1.78	.00045
25	119	.06	.01	.05	●03	1.76	.00044
30	110	.07	.01	.06	.02	3.24	.00059
35	112	.09	.01	.08	●03	2.74	.00073
40	114	.09	.01	●07	.03	2.49	.00066
45	116	.10	.01	.08	.03	2.80	.00073
50	117	●13	.01	.12	●03	3.85	.00099
60	116	.16	.01	.15	.05	2.97	.00128

DATE 6/26/75 STANDARD 7.70 MC/AMP TIME 6.0 HR EFF 25/79.3

DEPTH (M)	LIGHT. (ME/M2/S)	ASSIM (MGC/M3/HR) L	D	N	CHL A (MG/M3)	NORMALIZED A/C	A/L
3	116	.07	.02	.05	.03	1.76	.00046
5	118	.05	.01	.04	.02	2.11	.000-46
10	120	.04	.02	.03	.02	1.40	.00023
15	121	.07	.01	.06	.02	2.78	.00046
20	120	.07	.02	.06	.02	2.97	.00049
25	119	.06	.01	.05	.92	2.39	.00040
30	110	.07	.01	.06	.02	2.90	.00053
35	112	.14	.01	.13	.02	6.51	.00116
40	114	.08	.01	.07	.02	3.29	.00058
45	116	●10	.01	.09	●03	3.06	.00079
50	117	.12	.01	.11	.03	3.76	.00097
60	116	.10	.01	.09	.05	1.70	.00073

DATE 6/29/75 STANDARD 7.70 MC/AMP TIME 6.0 HR EFF 24/78.6

DEPTH (M)	LIGHT (ME/M2/S)	ASSIM (MGC/M3/HR) L	D	N	CHL A (MG/M3)	NORMALIZED A/C	A/L
3	116	.06	.02	.04	.02	2.12	.00037
5	118	.05	.01	.04	.01	3.99	.00034
10	120	.05	.02	.03	.01	3.09	.00026
15	121	.10	.01	.08	.01	Q*37	.00069
20	120	.06	.02	.04	.01	3.67	.00031
25	119	.09	.01	.08	.01	8.24	.00069
30	110	.07	.02	●06	.01	5*53	.00050
35	112	.07	.01	●0F	.01	5.41	.00048
40	114	.07	.02	.05	.02	2.35	.00(-)41
45	116	.11	.01	●0Q	.02	4.63	.00080
50	117	.15	.01	.13	.04	3.30	.00113
60	116	.12	.01	.11	.05	2.26	.00027

Table 3 (cont.)

DATE 7/ 2/75 STANDARD 7.50 MC/AMP TIME 6.0 HR EFF 14/75.9

DEPTH (M)	LIGHT (ME/M2/S)	ASSIM (MGC/M3/HR) L	D	N	CHL A (MG/M3)	NORMALIZED A/C	A/L
3	116	●on	.02	.06	.02	?*84	.00049
5	118	.07	.01	.06	.02	3.11	.00053
10	120	.05	.01	. 0	4 .01	4.04	.00034
15	121	●06	.01	.05	.01	5.27	.00044
20	120	.07	.01	●06	.03	1.92	.00048
25	119	.05	.01	.04	●03	1.30	.00033
30	110	.07	.01	.05	.01	5.40	.00049
35	112	.07	.01	.06	.02	3.11	.00056
40	114	.08	.01	.07	.04	1.76	.00062
45	116	.11	.01	●II-I	.04	?.57	.00088
50	117	.14	●01	.13	.04	3.16	.00108
60	116	.13	.01	.12	.11	1.07	.00101

DATE 7/ 5/75 STANDARD 7.50 MC/AMP TIME 6.0 HR EFF 35/74.8

DEPTH (M)	LIGHT (ME/M2/S)	ASSIM (MGC/M3/HR) L	D	N	CHL A (MG/M3)	NORMALIZED A/c	A/L
3	116	.09	.02	.07	.03	?.38	.00062
5	118	.11	●n]	●0C-J	.03	3.10	.00079
10	120	.09	.02	●OR	.02	3.75	.00063
15	121	.09	.02	.07	.03	?.45	.00061
20	120	.10	.01	.08	.03	?.75	.00069
25	119	.10	.02	.08	●03	?.64	.00067
30	110	.08	.01	.07	.03	2.32	.00063
35	112	.10	.01	.08	.04	?.11	.00075
40	114	.11	.02	●oa	.04	?*?3	.00078
45	116	.16	.02	.14	.06	?.31	.00120
50	117	.23	●01	.21	.05	4.26	.00182
60	116	.29	●f-)]	.28	.07	3.98	.00240

DATE 7/ 8/75 STANDARD 7.50 MC/AMP TIME 6.0 HR EFF 34/75.2

DEPTH (M)	LIGHT (ME/M2/S)	ASSIM (MGC/M3/HR) L	D	N	CHL. A (MG/M3)	NORMALIZED A/C	A/L
3	116	.06	.02	.04	.01	4.13	.00036
5	118	.08	.02	.06	.01	5.99	.00051
10	120	.06	.02	●04	.01	3.92	.00033
15	121	.06	.02	.04	.01	4.40	.00036
20	120	.05	.02	.03	.01	3.16	.00026
25	119	.08	.01	.06	.01	6.21	.00052
30	110	.07	.01	.05	.01	5.45	.00050
35	112	.11	.01	.09	.02	4.71	.00084
40	114	.09	.02	.08	.04	1.96	.00069
45	116	.22	.01	.20	f)%	4.06	.00175
50	117	.27	.02	.25	●OR	3.18	.00217
60	116	.30	.01	.29	.12	?.40	.00248

Table 3 (cont.)

DATE 7/11/75 STANDARD 7.50 MC/AMP TIME 6.5 HR EFF 33/75.7

DEPTH (M)	LIGHT (ME/M2/S)	ASSIM (MGC/M3/HR) L	D	N	CHL A (MG/M3)	NORMALIZED A/C	A/L
3	116	.09	.02	.07	.03	2.32	.00060
5	118	.09	.02	.08	.03	2.53	.00064
10	120	.05	.02	.03	.03	1.06	.00026
15	121	.09	.02	.07	.03	2.47	.00061
20	120	.11	.02	.09	.03	3.10	.00078
25	119	.12	.02	.11	.04	2.64	.00089
30	110	.10	.01	.09	.03	3.00	.00082
35	112	.11	.01	.09	.03	3.12	.00084
40	114	.11	.02	.00	.03	3.08	.00081
45	116	.16	.02	.11	.04	2*40	.00117
50	117	.28	.02	.27	.06	4.45	.00228
60	116	.31	.02	.30	.13	2.30	.00258

DATE 7/14/75 STANDARD 7.50 MC/AMP TIME 6.0 HR EFF 28/77.9

DEPTH (M)	LIGHT. (ME/M2/S)	ASSIM (MGC/M3/HR) L	D	N	CHL A (MG/M3)	NORMALIZED A/C	A/L
3	116	.05	.01	.04	.01	3.52	.00030
5	118	.05	.01	.04	.01	3.53	.00030
10	120	.06	.01	.05	.01	5.06	.00042
15	121	.00	.01	.07	.02	3.70	.00061
20	120	.08	.01	.07	.02	3.30	.00055
25	119	.10	.02	.07	.02	3.66	.00062
30	110	.09	.01	.08	.02	3.76	.00068
35	112	.10	.01	.09	.03	2.84	.00076
40	114	.10	.01	.09	.03	3.05	.00080
45	116	.12	.02	.10	.04	2.51	.00086
50	117	.14	.01	.13	.05	2.63	.00113
60	116	.22	.01	.21	.08	2.58	.00178

DATE 7/17/75 STANDARD 7.50 MC/AMP TIME 6.0 HR EFF 29/77.5

DEPTH (M)	LIGHT (ME/M2/S)	ASSIM (MGC/M3/HR) L	D	N	CHL A (MG/M3)	NORMALIZED A/C	A/L
3	116	.06	.02	.04	.01	4.07	.00035
5	118	.07	.01	.06	.01	5.96	.00051
10	120	.06	.01	.05	.01	4.56	.00038
15	1.21	.05	.01	.03	.01	3.42	.00028
20	120	.05	.01	.04	.01	3.82	.00032
25	119	.07	.02	.05	.01	4.89	.00041
30	110	.07	.01	.06	.02	2.85	.00052
35	112	.08	.01	.07	.02	3.52	.00063
40	114	.10	.02	.08	.03	2.71	.00071
45	116	.19	.01	.17	.05	3.46	.00149
50	117	.31	.01	.33	.12	2.77	.00284
60	116	.32	.01	.31	.16	1.92	.00265

Table 3 (cont.)

DATE 7/20/75 STANDARD 7.50 MC/AMP TIME 6.0 HR FFF 32/76.1

DEPTH (M)	LIGHT (ME/M2/S)	ASSIM (MGC/M3/HR) L	D	N	CHL A (MG/M3)	NORMALIZED A/C	A/L
3	116	.06	.02	.04	.01	4.12	.00036
5	118	.06	.02	.04	●01	4.12	.00035
10	120	.07	.01	.06	.01	5.54	.00046
15	121	.07	.01	●06	.01	5.62	.00046
20	120	.07	.01	.05	.01	5.44	.00045
25	119	.08	.01	.06	.02	3.13	.0 0053
30	110	●10	.01	.09	.02	4.43	.00081
35	112	.08	.01	.07	.02	3.38	.000 60
40	114	.11	.01	●on	.03	3.06	.00080
45	116	.09	.01	.08	.04	1.95	.00067
50	117	.11	.01	●1Γ)	.05	1.98	.0 0085
60	116	.29	.01	.28	.14	?*01	.00242

DATE 7/23/75 STANDARD 7.50 MC/AMP TIME 6.0 HR FFF 35/74.8

DEPTH (M)	LIGHT. (ME/M2/S)	ASSIM (MGC/M3/HR) L	D	N	CHL A (MG/M3)	NORMALIZED A/C	A/L
3	116	.(-)4	.02	.03	.01	2.74	.00024
5	118	.04	.01	.0?	.01	?.47	.00021
10	120	●04	.01	.03	.01	2.81	.00023
15	121	.05	.02	.04	.01	3.51	.00029
20	120	.06	●0?	.03	.01	7.46	.00029
25	119	.06	.01	.04	.02	2.25	.00038
30	110	.06	.02	.05	.02	2.28	.00042
35	112	.08	.02	.06	.02	?.99	.00053
40	114	.08	.01	.06	.02	3.13	.00055
45	116	●0R	.02	.06	.03	].97	.00051
50	117	.07.	.01	.06	●04	1.50	.00051
60	116	.39	.01	.38	.26	1.47	.00329

DATE 7/26/75 STANDARD 7.50 MC/AMP TIME 6.0 HR FFF 32/76.1

DEPTH (M)	LIGHT (ME/M2/S)	ASSIM (MGC/M3/HR) L	n	N	CHL A (MG/M3)	NORMALIZED A/C	A/L
3	116	.04	.02	.02	.01	1.9s	.00017"
5	118	.05	.01	.03	.01	3.42	.00029
10	120	.04	.01	●03	.01	3.02	.00025
15	121	.04	.02	.02	.01	1.68	.00014
20	120	●0/+	.02	.02	.01	1.97	.00016
25	119	.06	.01	.04	.01	4.42	● onf-177
30	110	.06	.02	.04	●01	3.67	.00033
35	112	.08	.01	.07	.02	3.51	.00063
40	114	.08	●f)l	.07	.0?	?.44	● f)f)nAfl
45	116	●0R	.01	.07	.02	3.48	.00060
50	117	.09	.02	.07	.03	2.45	.00063
60	116	.43	f)]	●4?	.19	?.22	.00364

Table 3 (cont.)

DATE 7/29/75 STANDARD 6.95 MC/AMP TIME 6.0 HR EFF 30/77.0

DEPTH (M)	LIGHT (ME/M2/S)	ASSIM (MGC/M3/HR) L	D	N	CHL A (MG/M3)	NORMALIZED A/C	A/L
3	116	.12	.02	.10	.01	9.59	.00083
5	118	.06	.02	.04	.01	4.22	.00036
10	120	.10	.01	.08	.02	4.11	.00069
15	121	.08	.01	.06	.01	6.30	.00052
20	120	.09	.01	.08	.02	3.94	.00066
25	119	.10	.01	.09	.03	2.80	.00071
30	110	.07	.01	.06	.03	2.01	.00055
35	112	.08	.01	.07	.03	2.30	.00062
40	114	.09	.01	.08	.03	2.52	.00066
45	116	.09	.02	.07	.04	1.73	.00060
50	117	.10	.01	.09	.04	2.15	.00074
60	116	.52	.02	.50	.24	2.10	.00435

DATE 8/ 1/75 STANDARD 6.95 MC/AMP TIME 5.0 HR EFF 24/78.6

DEPTH (M)	LIGHT (ME/M2/S)	ASSIM (MGC/M3/HR) L	D	N	CHL A (MG/M3)	NORMALIZED A/C	A/L
3	116	.07	.02	.05	.01	5.45	.00047
5	118	.05	.01	.04	.02	1.99	.00034
10	120	.07	.02	.05	.01	4.96	.00041
15	121	.06	.02	.05	.01	4.63	.00038
20	120	.08	.03	.05	.02	2.66	.00044
25	119	.11	.02	.09	.03	2.87	.00072
30	110	.08	.02	.06	.02	2.95	.00054
35	112	.08	.02	.06	.03	2.06	.00055
40	114	.10	.01	.09	.04	2.15	.00075
45	116	.14	.01	.12	.06	2.06	.00107
50	117	.38	.02	.36	.23	1.57	.00309
60	116	.20	.02	.19	.15	1.25	.00162

DATE 8/ 4/75 STANDARD 6.95 MC/AMP TIME 6.0 HR EFF 19/77.3

DEPTH (M)	LIGHT (ME/M2/S)	ASSIM (MGC/M3/HR) L	D	N	CHL A (MG/M3)	NORMALIZED A/C	A/L
3	116	.06	.02	.04	.02	2.03	.00035
5	118	.05	.02	.03	.02	1.43	.00024
10	120	.08	.02	.06	.01	5.64	.00047
15	121	.06	.01	.04	.02	2.25	.00037
20	120	.09	.02	.07	.03	2.45	.00061
25	119	.09	.02	.08	.02	3.84	.00065
30	110	.06	.01	.05	.02	2.36	.00043
35	112	.06	.01	.05	.03	1.65	.00044
40	114	.06	.01	.05	.04	1.15	.00040
45	116	.10	.02	.08	.08	1.03	.00071
50	117	.11	.02	.10	.09	1.07	.00082
60	116	.36	.01	.34	.20	1.72	.00297

Table 3 (cont.)

DATE 8/ 7/75 STANDARD 6.95 MC/AMP TIME 6.0 HR EFF 36/74.3

DEPTH (M)	LIGHT (ME/M2/S)	ASSIM (MGC/M3/HR) L	D	N	CHL A (MG/M3)	NORMALIZED A/C	A/L
3	116	.05	.02	.03	.02	1.65	.00028
5	118	.05	.02	.0?	●01	2.60	.00022
10	120	.07	.01	.06	.01	6.16	.00051
15	121	.11	.02	●0C]	.03	2.99	.00074
20	120	.15	●n]	.14	.06	2.27	.00113
25	119	.08	.01	.07	.04	1.63	.00055
30	110	.09	.02	.07	.03	2.23	.00061
35	112	.10	.02	.08	●04	1.95	.00070
40	114	.09	.92	.07	.04	1.78	.00063
45	116	.15	.01	.14	.06	2.28	.00118
50	117	.09	●n]	.08	.06	1.27	.00065
60	116	.28	*I-)1	.27	.13	2.07	.00232

DATE 8/10/75 STANDARD 6.95 MC/AMP TIME 6.0 HR EFF 31/76.6

DEPTH (M)	LIGHT (ME/M2/S)	ASSIM (MGC/M3/HR) L	D	N	CHL A (MG/M3)	NORMALIZED h/c	A/L
3	116	.11	.02	.08	.03	2.81	.00073
5	118	.08	.02	.07	.03	2.21	.00056
10	120	.08	.02	.06	.04	1.39	.00046
15	121	.09	.01	.08	●03	?.52	.00062
20	120	.10	.02	.09	●03	?*89	.00072
25	119	.11	.02	●(')Q	.04	2.24	.00075
30	110	.14	.02	.12	.03	4.11	.00112
35	112	.09	.02	●07	.03	2.39	.00064
40	114	.09	.02	.08	.04	1.93	.00068
45	116	.11	.01	.09	.05	1.86	.00080
50	117	.20	.02	.18	.08	2.28	.00156
60	116	.23	.02	.22	.11	1.96	.00186

DATE 8/10/75 STANDARD 6.95 MC/AMP TIME 6.0 HR EFF 32/76.1

DEPTH (M)	LIGHT (ME/M2/S)	ASSIM (MGC/M3/HR) L	D	N	CHL A (MG/M3)	NORMALIZED A/C	A/L
46	116	.10	.02	.08	.07	1.17	.00071
48	118	.20	.02	.18	.10	1.77	.00150
50	120	.19	.02	●]Q	.11	1.61	.00148
52	121	.24	.02	.22	●10	2.22	.00183
54	120	.25	.02	.23	●lo	2.26	.00189
56	119	.23	.02	.21	.10	?.13	.00179
58	110	.19	.01	.18	.08	2.24	.00163
60	112	.17	.01	.16	.09	1.79	.00144
62	114	.16	.01	.14	.09	1.57	.00124
64	116	.15	.01	.14	.10	1.37	.00119
80	117	.07	.01	.06	.06	1.02	.00052
100	116	.04	.01	.02	.04	.60	.00021

Table 3 (cont.)

DATE 8/13/75 STANDARD 6.95 MC/AMP TIME 6.0 HR EFF 28/77.9

DEPTH (M)	LIGHT (ME/M2/S)	ASSIM (MGC/M3/HR) L	D	N	CHL A (MG/M3)	NORMALIZED A/C	A/L
3	116	.11	.02	.09	.02	4.47	.00077
5	118	.12	.02	.10	.02	4s93	.00084
10	120	●13	.02	●II	.02	5.54	.00092
15	121	.11	●fI?	.09	.02	4.27	.00071
20	120	.11	.02	.09	.03	?.99	.00075
25	119	.10	.02	.08	.03	2.82	.00071
30	110	.13	.02	.11	●04	?.77	.00101
35	112	.13	.02	●II	.06	1.83	.00098
40	114	.20	.01	.18	.09	2.03	.00160
45	116	.36	.02	.34	.19	1.81	.00296
50	117	.50	●Q?	●4Q	●29	1.65	.00409
60	116	.17	.02	●IF	.08	1.87	.00129

DATE 8/16/75 STANDARD 6.95 MC/AMP TIME 6.0 HR EFF 28/77.9

DEPTH (M)	LIGHT (ME/M2/S)	ASSIM (MGC/M3/HR) L	D	N	CHL A (MG/M3)	NORMALIZED A/C	A/L
3	116	.14	.02	.12	.03	4.04	.00105
5	118	.12	.02	.10	.02	5.00	.00085
10	120	.10	.02	.08	.03	?.72	.00068
15	121	.17	.02	.15	.05	3.05	.00126
20	120	.16	.02	.14	.04	3.57	.00119
25	119	.19	.02	.17	.04	4.18	.00141
30	110	.13	.01	.1?	.04	?.96	.00108
35	112	.14	.01	.13	.07	1.81	.00113
40	114	.17	.02	.16	●05	3.12	.00137
45	116	.18	.02	.16	.06	?.67	.00138
50	117	.21	.02	.19	.07	?.74	.00164
60	116	.44	.02	.4?	.18	?.34	.00366

DATE 8/19/75 STANDARD 7.55 MC/AMP TIME 6.0 HR EFF 24/75.2

DEPTH (M)	LIGHT (ME/M2/S)	ASSIM (MGC/M3/HR) L	D	N	CHL 4 (MG/M3)	NORMALIZED A/C	A/L
3	116	.07	.02	.05	.01	5.08	.00044
5	118	.07	.02	.05	.02	2.50	.00042
10	120	.07	.02	.05	.01	4.53	.00038
15	121	.07	.02	.05	.02	?.54	.00042
20	120	.08	.02	.06	.02	?.81	.00047
25	119	.09	.02	.07	.02	3.60	.00060
30	110	.08	.01	.06	.03	7.14	.00058
35	112	.08	.02	.07	.03	2.26	.00061
40	114	.11	.01	.10	.05	1.98	.00087
45	116	.20	.01	.19	.10	1.88	.00162
50	117	.28	.02	.27	.14	1.91	.00223
60	116	.16	.01	.14	.09	1.58	.00123

Table 3 (cont.)

DATE 8/22/75 STANDARD 7.55 MC/AMP TIME 6.0 HR EFF 33/75.7

DEPTH (M)	LIGHT (ME/M2/S)	ASSIM (MGC/M3/HR) L	D	N	CHL A (MG/M3)	NORMALIZED A/C	A/L
3	116	.09	.02	.07	.03	2.35	.00061
5	118	.07	.02	.06	.02	2.85	.00048
10	120	.07	.02	.05	.02	2.41	.00040
15	121	.09	.02	.07	.02	3.59	.00059
20	120	.12	.02	.10	.04	2.53	.00084
25	119	.11	.02	.09	.04	2.29	.00077
30	110	.10	.02	.08	.03	2.64	.00072
35	112	.10	.01	.08	.03	2.75	.00074"
40	114	.12	.01	.10	.04	2.61	.00091
45	116	.16	.01	.15	●07	2.13	.00129
50	117	.24	.02	.21	.11	1.95	.00184
60	116	.20	.01	.19	.09	2.07	.00161

DATE 8/25/75 STANDARD 7.55 MC/AMP TIME 6.0 HR EFF 31/76.6

DEPTH (M)	LIGHT (ME/M2/S)	ASSIM (MGC/M3/HR) L	D	N	CHL A (MG/M3)	NORMALIZED A/C	A/L
3	116	.08	.02	.06	.02	3.11	.00054
5	118	.08	.02	.06	.02	3.01	.00051
10	120	.08	.02	.06	.02	3.15	.00052
15	121	.09	.02	.07	.02	3.32	.00055
20	120	.08	.02	.06	.02	3.06	.00051
25	119	.11	.02	.10	●03	3*2O	.00081
30	110	.12	.02	.10	.03	3.44	.00094
35	112	.12	.02	.10	.03	3.46	.00093
40	114	.14	.02	.12	.05	2.46	.00108
45	116	.24	.02	.23	.07	3.24	●00IQEJ
50	117	.31	.02	.29	.11	2.66	.00251
60	116	.29	.02	.27	.1s	1.78	.00230

DATE 8/28/75 STANDARD 7.55 MC/AMP TIME 6.1 HR EFF 36/74.3

DEPTH (M)	LIGHT (ME/M2/S)	ASSIM (MGC/M3/HR) L	D	N	CHL A (MG/M3)	NORMALIZED A/c	A/L
3	116	.10	.02	.08	.03	2.62	.00068
5	118	.08	.02	.06	.03	2.13	.00054
10	120	.09	.02	.07	.03	2.48	.00062
15	121	.09	.02	.07	.03	2.39	.00059
20	120	.10	.02	.08	●93	2.75	.00069
25	119	.10	.02	.08	.03	2.68	.00068
30	110	.10	.02	.09	.04	2.17	.00079
35	112	.12	.01	.11	●05	2.14	.00095
40	114	.14	.02	.12	.05	2.36	.00103
45	116	.18	.02	.16	.06	2.67	.00138
50	117	.20	.02	.18	.08	2.30	.00157
60	116	.20	.01	.18	.08	2.27	.00157

Table 3 (cont.)

DATE 8/31/75 STANDARD 7.55 MC/AMP TIME 6.0 HR EFF 21/77.8

DEPTH (M)	LIGHT (ME/M2/S)	ASSIM (MGC/M3/HR) L	D	N	CHL A (MG/M3)	NORMALIZED A/C	A/L
3	116	.09	.02	.07	.02	3.49	.00060
5	118	.10	.02	.08	.02	4.24	.00072
10	120	.09	.02	.07	.02	3*39	.00057
15	121	.09	.02	.07	.04	1.74	.00058
20	120	.11	.02	.09	.04	2.28	.00076
25	119	.09	.02	.07	.03	2.33	.00059
30	110	.09	.01	.08	.04	1.89	.00069
35	112	.14	.02	.12	.04	3.03	.00108
40	114	.24	.02	.23	.06	3.80	.00200
45	116	.30	.02	.28	.12	2.36	.00244
50	117	.34	.02	.33	.19	1.71	.00278
60	116	.26	.02	.25	.13	1.89	.00212

DATE 9/ 3/75 STANDARD 7.55 MC/AMP TIME 6.0 HR EFF 21/77.8

DEPTH (M)	LIGHT (ME/M2/S)	ASSIM (MGC/M3/HR) L	D	N	CHL A (MG/M3)	NORMALIZED A/C	A/L
3	116	.09	.02	.07	.03	2.46	.00064
5	118	.07	.02	.05	.03	2.67	.00043
10	120	.07	.02	.05	.03	1.74	.00043
15	121	.10	.02	.08	.05	1.67	.00069
20	120	.10	.02	.08	.05	1.66	.00069
25	119	.08	.02	.06	.03	1.96	.00049
30	110	.11	.02	.10	.04	2.44	.00089
35	112	.10	.01	.09	.04	2.09	.00075
40	114	.10	.01	.09	.04	2.11	.00074
45	116	.15	.02	.14	.05	2.77	.00119
50	117	.20	.02	.18	.08	2.28	.00156
60	116	.21	.02	.19	.13	1.44	.00162

DATE 9/ 6/75 STANDARD 7055 MC/AMP TIME 6.0 HR EFF 15/76.2

DEPTH (M)	LIGHT (ME/M2/S)	ASSIM (MGC/M3/HR) L	D	N	CHL A (MG/M3)	NORMALIZED A/C	A/L
3	116	.10	.01	.09	.02	4.60	.00079
5	118	.10	.01	.08	.03	2.71	.00069
10	120	.08	.02	.06	.03	2.02	.00051
15	121	.09	.01	.07	.03	2.46	.00061
20	120	.09	.01	.07	.02	3.56	.00059
25	119	.10	.02	.08	.04	2.08	.00070
30	110	.10	.01	.09	.04	2.22	.00081
35	112	.11	.01	.10	.04	2.44	.00087
40	114	.13	.01	.11	.04	2.83	.00099
45	116	.23	.01	.21	.05	4.27	.00184
50	117	.23	.02	.21	.10	2.13	.00182
60	116	.27	.02	.25	.12	2.05	.00212

Table 3 (cont.)

DATE 9/ 9/75 STANDARD 7.55 MC/AMP TIME 6.0 HR EFF 26/78.8

DEPTH (M)	LIGHT (ME/M2/S)	ASSIM (MGC/M3/HR) L	D	N	CHL A (MG/M3)	NORMALIZED A/C	A/L
3	116	.12	.02	.11	.04	2.70	.00093
5	118	.11	.02	.10	.05	1.92	.00081
10	120	.10	.02	.08	.04	2.00	.00067
15	121	.09	.02	.07	.04	1.77	.00059
20	120	.14	.02	.12	.04	3.12	.00104
25	119	.11	.02	.09	.03	2.87	.00072
30	110	.13	.01	.12	.03	3.84	.00105
35	112	.12	.02	.10	.04	2.56	.00091
40	114	.17	.02	.15	.04	3.86	.00135
45	116	.17	.02	.15	.06	2.54	.00131
50	117	.19	.01	.18	.08	2.20	.00150
60	116	.22	.02	.20	.09	2.22	.00172

DATE 9/12/75 STANDARD 7.55 MC/AMP TIME 6.0 HR EFF 24/78.6

DEPTH (M)	LIGHT (ME/M2/S)	ASSIM (MGC/M3/HR) L	D	N	CHL A (MG/M3)	NORMALIZED A/C	A/L
3	116	.19	.02	.17	.05	3.32	.00143
5	118	.15	.02	.13	.05	2.53	.00107
10	120	.17	.02	.15	.06	2.44	.00122
15	121	.12	.02	.10	.04	2.55	.00084
20	120	.12	.02	.10	.04	2.60	.00087
25	119	.14	.02	.12	.04	3.05	.00103
30	110	.15	.01	.13	.04	3.33	.00121
35	112	.15	.01	.13	.04	3.32	.00119
40	114	.18	.02	.17	.06	2.80	.00147
45	116	.21	.02	.19	.09	2.12	.00165
50	117	.20	.02	.18	.09	2.00	.00154
60	116	.19	.02	.17	.07	2.47	.00149

DATE 9/15/75 STANDARD 7.55 MC/AMP TIME 6.0 HR EFF 15/76.2

DEPTH (M)	LIGHT (ME/M2/S)	ASSIM (MGC/M3/HR) L	D	N	CHL A (MG/M3)	NORMALIZED A/C	A/L
3	116	.16	.02	.14	.06	2.32	.00120
5	118	.13	.01	.12	.04	3.00	.00102
10	120	.10	.02	.08	.04	2.05	.00068
15	121	.11	.02	.09	.03	2.84	.00070
20	120	.12	.02	.10	.04	2.51	.00084
25	119	.10	.02	.08	.03	2.78	.00070
30	110	.11	.01	.10	.04	2.49	.00091
35	112	.12	.01	.11	.05	2.23	.00100
40	114	.17	.01	.16	.08	1.95	.00137
45	116	.29	.01	.28	.12	2.30	.00238
50	117	.34	.01	.33	.14	2.34	.00280
60	116	.13	.01	.12	.09	1.29	.00100

Table 3 (cont.)

DATE 9/18/75 STANDARD 7.55 MC/AMP TIME 6.0 HR EFF 15/76.2

DEPTH (M)	LIGHT (ME/M2/S)	ASSIM (MGC/M3/HR) L	D	N	CHL A (MG/M3)	NORMALIZED A/C	A/L
3	116	.16	.02	.14	.05	2.80	.00121
5	118	.15	.02	.13	.06	2.22	.00113
10	120	.12	.02	.11	.04	2.70	.00090
15	121	.12	.02	.10	.04	2.43	.00080
20	120	.13	.01	.11	.02	5.26	.00088
25	119	.13	.02	.11	.03	3.69	.00093
30	110	.17	.01	.15	.04	3.80	.00138
35	112	.18	.01	.17	.04	4.20	.00150
40	114	.17	.02	.15	.05	3.03	.00133
45	116	.18	.01	.16	.05	3.29	.00142
50	117	.24	.02	.22	.09	2.48	.00191
60	116	.16	.02	.14	.08	1.77	.00122

DATE 9/21/75 STANDARD 7.55 MC/AMP TIME 6.3 HR EFF 14/75.9

DEPTH (M)	LIGHT (ME/M2/S)	ASSIM (MGC/M3/HR) L	D	N	CHL A (MG/M3)	NORMALIZED A/C	A/L
3	116	.21	.02	.19	.04	4.66	.00161
5	118	.19	.02	.17	.05	3.44	.00146
10	120	.20	.02	.18	.05	3.62	.00151
15	121	.19	.02	.17	.05	3.34	.00138
20	120	.17	.02	.15	.05	3.02	.00126
25	119	.18	.01	.16	.05	3.23	.00136
30	110	.13	.02	.11	.05	2.20	.00100
35	112	.12	.01	.11	.05	2.25	.00100
40	114	.15	.01	.14	.05	2.82	.00124
45	116	.16	.01	.15	.07	2.16	.00130
50	117	.21	.02	.20	.08	2.46	.00168
60	116	.16	.01	.14	.08	1.80	.00124

DATE 9/24/75 STANDARD 7.55 MC/AMP TIME 6.5 HR EFF 13/75.6

DEPTH (M)	LIGHT (ME/M2/S)	ASSIM (MGC/M3/HR) L	D	N	CHL A (MG/M3)	NORMALIZED A/C	A/L
3	116	.14	.02	.12	.05	2.39	.00103
5	118	.14	.02	.12	.05	2.39	.00101
10	120	.12	.02	.10	.05	2.06	.00086
15	121	.12	.02	.10	.05	2.04	.00084
20	120	.13	.02	.11	.05	2.14	.00089
25	119	.12	.02	.11	.05	2.15	.00091
30	110	.13	.02	.11	.05	2.19	.00099
35	112	.15	.01	.14	.06	2.31	.00124
40	114	.14	.02	.12	.06	2.00	.00105
45	116	.19	.01	.17	.07	2.46	.00149
50	117	.15	.01	.14	.10	1.36	.00116
60	116	.14	.01	.13	.07	1.81	.00109

Table 3 (cont.)

DATE 9/27/75 STANDARD 7.55 MC/AMP TIME 6.0 HR EFF 13/75.6

DEPTH (M)	LIGHT (ME/M2/S)	ASSIM (MGC/M3/HR) L	D	N	CHL A (MG/M3)	NORMALIZED A/C	A/L
3	116	.15	.02	.13	.04	3.30	.00114
5	118	.13	.02	.12	.04	2.93	.00099
10	120	.12	.02	.10	.04	2.38	.00079
15	121	.10	.01	.09	.04	2.18	.00072
20	120	.11	.01	.10	.04	2.43	.00081
25	119	.11	.01	.09	.04	2.35	.00079
30	110	.13	.01	.12	.04	2.91	.00106
35	112	.12	.01	.11	.04	2.84	.00102
40	114	.11	.01	.10	.05	1.92	.00084
45	116	.10	.01	.09	.06	1.53	.00079
50	117	.10	.01	.09	.06	1.47	.00075
60	116	.09	.02	.07	.05	1.36	.00059

DATE 9/30/75 STANDARD 6.35 MC/AMP TIME 6.0 HR EFF 23/78.3

DEPTH (M)	LIGHT (ME/M2/S)	ASSIM (MGC/M3/HR) L	D	N	CHL A (MG/M3)	NORMALIZED A/C	A/L
3	116	.16	.01	.15	.04	3.74	.00129
5	118	.15	.01	.14	.04	3.47	.00117
10	120	.14	.01	.13	.04	3.27	.00109
15	121	.15	.01	.14	.04	3.50	.00116
20	120	.14	.02	.11	.04	2.81	.00094
25	119	.14	.01	.13	.04	3.22	.00108
30	110	.15	.01	.14	.04	3.48	.00127
35	112	.16	.01	.15	.04	3.66	.00131
40	114	.15	.02	.13	.06	2.17	.00114
45	116	.10	.01	.09	.06	1.44	.00074
50	117	.11	.02	.09	.07	1.35	.00081
60	116	.09	.01	.08	.05	1.63	.00070

Table 4. Results of replicated ^{14}C assimilation experiments

Explanation of Table Values:

1.	Date:	Month, day, year of experiment
2.	Standard:	Total activity (microcuries) added to water sample
3.	Time:	Duration (hours) of incubation
4.	Eff:	Liquid scintillation external standard (e.g. 14) and resultant percentage counting efficiency (e.g. 75.9)
5.	Depth:	Depth (m) of water sampled
6.	Replicate assimilation:	Light, dark, and net assimilation ($mgCm^{-3}hr^{-1}$) for 8 experiments on water samples from same depth. (Darks were not replicated.)
7.	Mean net assimilation	Mean of 8 experiments ($mgCm^{-3}hr^{-1}$)
8.	Standard deviation:	Pertains to above 8 data values
9.	Standard error:	Pertains to mean of above 8 data values $\sqrt{\text{Std dev}/8}$
10.	Coefficient of variation:	Pertains to above 8 data values, the mean divided by standard deviation times 100%

Table 4 (cont.)

DATE 7/ 3/75 STANDARD 7.50 MC/AMP TIME 6.0 HR EFF 14/75.9

DEPTH 5 M REPLICATED ASSIMILATION (MGC/M3/HR)

LIGHT	.038	.038	.044	.037	.029	.047	.042	.036
DARK	.014	.014	.014	.014	.014	.014	●014	.014
NET	.025	.024	.031	.023	.015	.033	.029	.023

MEAN NET ASSIMILATION .0252 MGC/M3/HR
STANDARD DEVIATION .0056 MGC/M3/HR
STANDARD ERROR (N=8) .0020 MGC/M3/HR
COEFFICIENT OF VARIATION 22.10

DATE 7/ 3/75 STANDARD 7.50 MC/AMP TIME 6.0 HR EFF 14/75.9

DEPTH 10 M REPLICATED ASSIMILATION (MGC/M3/HR)

LIGHT	.044	.035	.039	.040	.034	.036	.042	.052
DARK	.013	.013	.013	.013	.013	.013	.013	.013
NET	.031	.022	.026	.027	.021	.023	.029	.039

MEAN NET ASSIMILATION .0273 MGC/M3/HR
STANDARD DEVIATION .0059 MGC/M3/HR
STANDARD ERROR (N=8) .0021 MGC/M3/HR
COEFFICIENT OF VARIATION 21.76

DATE 7/ 4/75 STANDARD 7.50 MC/AMP TIME 6.0 HR EFF 35/74.8

DEPTH 20 M REPLICATED ASSIMILATION (MGC/M3/HR)

LIGHT	.063	.062	.072	.061	.056	.059	●060	.068
DARK	●014	.014	.014	.014	.014	.014	●014	.014
NET	●040	.048	.008	.047	.042	.045	●047	.054

MEAN NETASSIMILATION .0424 MGC/M3/HR
STANDARD DEVIATION .0142 MGC/M3/HR
STANDARD ERROR (N=8) .0050 MGC/M3/HR
COEFFICIENT OF VARIATION 33.51

DATE 7/ 4/75 STANDARD 7.50 MC/AMP TIME 6.0 HR EFF 35/74.8

DEPTH 30 M REPLICATED ASSIMILATION (MGC/M3/HR)

LIGHT	.043	.051	.074	.072	.053	.052	.085	.080
DARK	.014	.014	●014	.014	.014	.014	●016	.014
NET	●029	.038	.060	.058	.040	.038	●071	.066

MEAN NET ASSIMILATION .0500 MGC/M3/HR
STANDARD DEVIATION .0156 MGC/M3/HR
STANDARD ERROR (N=8) .0055 MGC/M3/HR
COEFFICIENT OF VARIATION 31.??

Table 4 (cont.)

DATE 7/12/75 STANDARD 7.50 MC/AMP TIME 6.0 HR EFF 29/77.5

DEPTH 5 M REPLICATED ASSIMILATION (MGC/M3/HR)

LIGHT	.078	● 050	.050	.048	.048	.(-)40	.062	.054
DARK	.017	.017	.017	.(-)17	.017	.017	.017	.017
NET	.061	.044	.034	.031	.031	.023	● o&&	.038

MEAN NET ASSIMILATION .0385 MGC/M3/HR
STANDARD DEVIATION .0115 MGC/M3/HR
STANDARD ERROR (N=8) .0041 MGC/M3/HR
COEFFICIENT OF VARIATION 30.00

PATE 7/12/75 STANDARD 7.50 MC/AMP TIME 6.0 HR EFF 29/77.5

DEPTH 10 M REPLICATED ASSIMILATION (MGC/M3/HR)

LIGHT	.043	.035	.036	.042	.035	.036	● (14%	.049
DARK	.015	.015	.015	.015	.015	.015	.015	.015
NET	● OE'F?	.020	.021	● 1127	.020	.021	.031	.034

MEAN NET ASSIMILATION .0254 MGC/M3/HR
STANDARD DEVIATION .0055 MGC/M3/HR
STANDARD ERROR (N=8) .0019 MGC/M3/HR
COEFFICIENT OF VARIATION 21.65

DATE 7/13/75 STANDARD 7.50 MC/AMP TIME 6.0 HR EFF 28/77.9

DEPTH 20 M REPLICATED ASSIMILATION (MGC/M3/HR)

LIGHT	● 045	.043	.050	.051	.059	.055	● (157	.055
DARK	● OIQ	.018	.018	.018	.018	.018	● (-)tQ	.018
NET	.027	.025	.032	.033	.041	.937	● 030	.037

MEAN NET ASSIMILATION ● 0339 MGC/M3/HR
STANDARD DEVIATION .0055 MGC/M3/HR
STANDARD ERROR (N=8) ● 0019 MGC/M3/HR
COEFFICIENT OF VARIATION 16.09

DATE 7/13/75 STANDARD 7.50 MC/AMP TIME 6.0 HR EFF 29/77.5

DEPTH 30 M REPLICATED ASSIMILATION (MGC/M3/HR)

LIGHT	.068	.078	.069	.058	.094	.101	.054	.056
DARK	.015	.015	.015	.015	.015	.01s	.015	.015
NET	.053	.064	.054	.043	.080	.086	● 04(I	.041

MEAN NET ASSIMILATION .0576 MGC/M3/HR
STANDARD DEVIATION .0178 MGC/M3/HR
STANDARD ERROR (N=8) .0063 MGC/M3/HR
COEFFICIENT OF VARIATION 30.91

Table 4 (cont.)

DATE 7/21/75 STANDARD 7.50 MC/AMP TIME 6.0 HR EFF 30/77.0

DEPTH 5 M REPLICATED ASSIMILATION (MGC/M3/HR)

LIGHT	.039	.031	.041	.041	.037	.036	.048	.043
DARK	.013	.013	.013	.013	.013	.013	.013	.013
NET	.026	.017	.027	.027	.023	.023	.035	.030

MEAN NET ASSIMILATION .0261 MGC/M3/HR
STANDARD DEVIATION .0052 MGC/M3/HR
STANDARD ERROR (N=8) .0018 MGC/M3/HR
COEFFICIENT OF VARIATION 19.87

DATE 7/21/75 STANDARD 7.50 MC/AMP TIME 6.0 HR EFF 35/74.8

DEPTH 10 M REPLICATED ASSIMILATION (MGC/M3/HR)

LIGHT	.035	.038	.031	.033	.031	.037	.033	.039
DARK	.013	.013	.013	.013	.013	.013	.013	.013
NET	.022	.025	.018	.020	.018	.024	.020	.026

MEAN NET ASSIMILATION .0216 MGC/M3/HR
STANDARD DEVIATION .0032 MGC/M3/HR
STANDARD ERROR (N=8) .0011 MGC/M3/HR
COEFFICIENT OF VARIATION 14.65

DATE 7/22/75 STANDARD 7.50 MC/AMP TIME 6.0 HR EFF 30/77.0

DEPTH 20 M REPLICATED ASSIMILATION (MGC/M3/HR)

LIGHT	.025	.925	.035	.032	.052	.036	● o4L	.046
DARK	.013	.013	● 013	● 013	.013	.013	● (-)17	.013
NET	.011	● 012	.021	.019	.039	.023	● 03!!	.033

MEAN NETASSIMILATION .0235 MGC/M3/HR
STANDARD DEVIATION .0098 MGC/M3/HR
STANDARD ERROR (N=8) .0035 MGC/M3/HR
COEFFICIENT OF VARIATION 41.63

DATE 7/22/75 STANDARD 7.50 MC/AMP TIME 6.0 HR EFF 30/77.0

DEPTH 30 M REPLICATED ASSIMILATION (MGC/M3/HR)

LIGHT	.062	.057	.070	.058	.078	.050	.080	.099
DARK	.015	.015	.015	.015	.015	.015	.015	.015
NET	.047	.042	.055	.043	.063	.035	.065	.084

MEAN NET ASSIMILATION .0544 MGC/M3/HR
STANDARD DEVIATION .0160 MGC/M3/HR
STANDARD ERROR (N=8) .0057 MGC/M3/HR
COEFFICIENT OF VARIATION 29.43

Table 4 (cont.)

DATE 7/30/75 STANDARD 6.95 MC/AMP TIME 6.0 HR EFF 23/78.3

DEPTH 5 M REPLICATED ASSIMILATION (MGC/M3/HR)

LIGHT	.044	.036	.042	.055	.022	.050	.058	.045
DARK	.014	.014	.014	.014	.014	.014	.014	.014
NET	.030	.022	.027	.041	.008	.036	.044	.031

MEAN NET ASSIMILATION .0298 MGC/M3/HR
STANDARD DEVIATION .0115 MGC/M3/HR
STANDARD ERROR (N=8) .0041 MGC/M3/HR
COEFFICIENT OF VARIATION 38.59

DATE 7/30/75 STANDARD 6.95 MC/AMP TIME 6.0 HR EFF 24/78.6

DEPTH 10 M REPLICATED ASSIMILATION (MGC/M3/HR)

LIGHT	.056	.039	.051	.065	.101	.061	.048	.041
DARK	.015	.015	.015	.015	.015	.015	.015	.015
NET	.041	.024	.036	.049	.086	.046	.033	.026

MEAN NET ASSIMILATION .0424 MGC/M3/HR
STANDARD DEVIATION .0195 MGC/M3/HR
STANDARD ERROR (N=8) .0069 MGC/M3/HR
COEFFICIENT OF VARIATION 46.02

DATE 7/31/75 STANDARD 6.95 MC/AMP TIME 6.0 HR EFF 29/77.5

DEPTH 20 M REPLICATED ASSIMILATION (MGC/M3/HR)

LIGHT	● n74	.053	.136	.076	.138	.159	.172	.197
DARK	.015	.015	.015	.015	.015	.015	● 0]%	.015
NET	● n5R	.0.37	.120	.061	.123	.143	● 157	,182

MEAN NET ASSIMILATION .1102 MGC/M3/HR
STANDARD DEVIATION .0522 MGC/M3/HR
STANDARD ERROR (N=8) .0185 MGC/M3/HR
COEFFICIENT OF VARIATION 47.41

DATE 7/31/75 STANDARD 6.95 MC/AMP TIME 6.0 HR EFF 23/78.3

DEPTH 30 M REPLICATED ASSIMILATION (MGC/M3/HR)

LIGHT	.061	.083	.071	.055	.088	.059	● OR4	.078
DARK	● 01?	.01?	.012	.012	.012	.012	.012	.012
NET	● 049	.071	● o'i9	.042	.075	.047	● 072	.066

MEAN NET ASSIMILATION .0601 MGC/M3/HR
STANDARD DEVIATION .0128 MGC/M3/HR
STANDARD ERROR (N=8) .0045 MGC/M3/HR
COEFFICIENT OF VARIATION 21.32

Table 4 (cont.)

DATE 8/ 9/75 STANDARD 6.95 MC/AMP TIME 6.0 HR EFF 32/76.1

DEPTH 5 M REPLICATED ASSIMILATION (MGC/M3/HR)

LIGHT	.106	.098	●9R3	.097	.111	.116	.088	.105
DARK	.014	.014	.014	.014	●014	.014	.014	●014
NET	.093	●0Q5	●070	.083	.097	.102	●07<	.091

MEAN NET ASSIMILATION .0869 MGC/M3/HR
STANDARD DEVIATION .0111 MGC/M3/HR
STANDARD ERROR (N=8) .0039 MGC/M3/HR
COEFFICIENT OF VARIATION 12.74

DATE 8/ 9/75 STANDARD 6.95 MC/AMP TIME 6.0 HR EFF 32/76.1

DEPTH 10 M REPLICATED ASSIMILATION (MGC/M3/HR)

LIGHT	.127	.086	.098	.097	.105	.105	.088	.969
DARK	.015	.015	.015	.015	.015	.015	.015	.015
NET	.112	.071	.083	.082	.090	.090	.073	.054

MEAN NET ASSIMILATION .0817 MGC/M3/HR
STANDARD DEVIATION .0169 MGC/M3/HR
STANDARD ERROR (N=8) .0060 MGC/M3/HR
COEFFICIENT OF VARIATION 20.69

DATE 8/ 8/75 STANDARD 6.95 MC/AMP TIME 6.0 HR EFF 34/75.2

DEPTH 20 M REPLICATED ASSIMILATION (MGC/M3/HR)

LIGHT	.147	.127	.182	.137	.171	.190	.196	.17.2
DARK	.015	.015	.015	901s	.0]5	.015	.015	,915
NET	●133	.112	.168	.122	.157	.175	.181	.158

MEAN NET ASSIMILATION .1507 MGC/M3/HR
STANDARD DEVIATION .0254 MGC/M3/HR
STANDARD ERROR (N=8) .0090 MGC/M3/HR
COEFFICIENT OF VARIATION 16.84

DATE 8/ 8/75 STANDARD 6.95 MC/AMP TIME 6.0 HR EFF 32/76.1

DEPTH 30 M REPLICATED ASSIMILATION (MGC/M3/HR)

LIGHT	.047	.058	.044	.052	.104	.103	●07J.	.061
DARK	*916	.016	.016	.016	.016	.016	.016	.016
NET	●n32	.043	.029	.036	.089	.087	●061	.046

MEAN NET ASSIMILATION .0527 MGC/M3/HR
STANDARD DEVIATION .0238 MGC/M3/HR
STANDARD ERROR (N=8) .0084 MGC/M3/HR
COEFFICIENT OF VARIATION 45.16

Table 4 (cont.)

DATE 8/18/75 STANDARD 7.55 MC/AMP TIME 6.0 HR EFF 33/75.7

DEPTH 5 M REPLICATED ASSIMILATION (MGC/M3/HR)

LIGHT	.049	.054	.071	.052	.057	.060	.065	.057
DARK	.014	.014	.014	.014	.014	.014	.014	.014
NET	.035	.040	.057	.038	.043	.046	0%1	.042

MEAN NET ASSIMILATION .0441 MGC/M3/HR
STANDARD DEVIATION .0071 MGC/M3/HR
STANDARD ERROR (N=8) .0025 MGC/M3/HR
COEFFICIENT OF VARIATION 16.19

DATE 8/18/75 STANDARD 7.55 MC/AMP TIME 6.0 HR EFF 33/75.7

DEPTH10 M REPLICATED ASSIMILATION (MGC/M3/HR)

LIGHT	.042	.041	.040	.030	.044	.042	.054	.050
DARK	.015	.015	.015	.015	.015	.015	01<	.015
NET "	.028	.026	.026	.015	.030	.028	03Q	.035

MEAN NET ASSIMILATION .0282 MGC/M3/HR
STANDARD DEVIATION .0071 MGC/M3/HR
STANDARD ERROR (N=8) .0025 MGC/M3/HR
COEFFICIENT OF VARIATION 25.32

DATE 8/17/75 STANDARD 7.55 MC/AMP TIME 6.0 HR EFF 33/75.7

DEPTH 20 M REPLICATED ASSIMILATION (MGC/M3/HR)

LIGHT	CIP5	.066	.071	.078	.075	.096	o9fl	.094
DARK	.016	.016	.016	.016	.016	.016	0]<	.016
NET	fJ6Q	.050	.054	.062	.059	.(379	OB?	.077

MEAN NET ASSIMILATION .0666 MGC/M3/HR
STANDARD DEVIATION .0121 MGC/M3/HR
STANDARD ERROR (N=8) .0043 MGC/M3/HR
COEFFICIENT OF VARIATION 18.21

DATE 8/17/75 STANDARD 7.55 MC/AMP TIME 6.0 HR EFF 33/75.7

DEPTH 30 M REPLICATED ASSIMILATION (MGC/M3/HR)

LIGHT	.088	.068	.075	.079	.084	.095	.111	.075
DARK	.018	.018	.018	.018	.018	.018	.018	.018
NET	.070	.050	.056	.061	.065	.077	.093	.057

MEAN NET ASSIMILATION .0662 MGC/M3/HR
STANDARD DEVIATION .0138 MGC/M3/HR
STANDARD ERROR (N=8) .0049 MGC/M3/HR
COEFFICIENT OF VARIATION 20.84

Table 4 (cont.)

DATE 8/27/75 STANDARD 7.55 MC/AMP TIME 6.0 HR EFF 36/74.3

DEPTH 5 M REPLICATED ASSIMILATION (MGC/M3/HR)

LIGHT	.054	● 062	.076	.061	,062	.056	.073	.070
DARK	.018	.018	.018	.018	.018	.018	.018	.018
NET	.036	.044	.059	4044	.044	.038	.055	.053

MEAN NET ASSIMILATION .0467 MGC/M3/HR
STANDARD DEVIATION .0081 MGC/M3/HR
STANDARD ERROR (N=8) .0029 MGC/M3/HR
COEFFICIENT OF VARIATION 17.27

DATE 8/27/75 STANDARD 7.55 MC/AMP TIME 6.0 HR EFF 36/74.3

DEPTH 10 M REPLICATED ASSIMILATION (MGC/M3/HR)

LIGHT	● 113	.123	.126	.117	.156	.117	.147	.111
DARK	●f-)??	.017	.017	● r)17	.017	.017	● 017	.017
NET	.096	.106	.109	● loo	.139	.100	● 13n	.(-)94

MEAN NET ASSIMILATION .1092 MGC/M3/HR
STANDARD DEVIATION .0166 MGC/M3/HR
STANDARD ERROR (N=8) .0059 MGC/M3/HR
COEFFICIENT OF VARIATION 15.18

DATE 8/26/75 STANDARD 7.55 MC/AMP TIME 6.0 HR EFF 31/76.6

DEPTH 20 M REPLICATED ASSIMILATION (MGC/M3/HR)

LIGHT	.121	.081	.122	.102	.117	.128	.112	.131
DARK	.020	.020	.020	.020	.020	.020	.020	.020
NET	.101	.062	.102	.082	.097	.108	.092	.111

MEAN NET ASSIMILATION .0944 MGC/M3/HR
STANDARD DEVIATION .0160 MGC/M3/HR
STANDARD ERROR (N=8) .0057 MGC/M3/HR
COEFFICIENT OF VARIATION 16.96

DATE 8/26/75 STANDARD 7.55 MC/AMP TIME 6.0 HR EFF 36/74.3

DEPTH 30 M REPLICATED ASSIMILATION (MGC/M3/HR)

LIGHT	.065	.060	.107	.092	.093	.092	.107	.091
DARK	.015	.015	.015	.015	.015	.015	● O]<	,01s
NET	● ()'50	.045	● OQ2	.077	.068	.078	.092	.076

MEAN NET ASSIMILATION .0722 MGC/M3/HR
STANDARD DEVIATION .0173 MGC/M3/HR
STANDARD ERROR (N=8) .0061 MGC/M3/HR
COEFFICIENT OF VARIATION 23.97

Table 4 (cont.)

DATE 9/ 5/75 STANDARD 7.55 MC/AMP TIME 6.0 HR EFF 15/76.2

DEPTH 5 M REPLICATED ASSIMILATION (MGC/M3/HR)

LIGHT	.095	.098	.110	.135	.191	.127	.135	.127
DARK	.015	.015	.015	.015	.015	.015	.015	.015
NET	.080	●003	.095	.120	.176	.112	.120	.113

MEAN NET ASSIMILATION .1123 MGC/M3/HR
STANDARD DEVIATION .0301 MGC/M3/HR
STANDARD ERROR (N=8) .0106 MGC/M3/HR
COEFFICIENT OF VARIATION 26.78

DATE 9/ 5/75 STANDARD 7.55 MC/AMP TIME 6.0 HR EFF 15/76.2

DEPTH 10 M REPLICATED ASSIMILATION (MGC/M3/HR)

LIGHT	.116	.125	.101	.088	.096	.121	.084	.088
DARK	.013	.013	.013	.013	.013	.013	.013	.013
NET	.103	.113	.099	.075	.083	.109	.071	.075

MEAN NET ASSIMILATION .0898 MGC/M3/HR
STANDARD DEVIATION .0163 MGC/M3/HR
STANDARD ERROR (N=8) .0058 MGC/M3/HR
COEFFICIENT OF VARIATION 18.17

DATE 9/ 4/75 STANDARD 7.55 MC/AMP TIME 6.0 HR EFF 21/77.8

DEPTH 20 M REPLICATED ASSIMILATION (MGC/M3/HR)

LIGHT	.086	.070	●095	.096	.078	.083	●104	.091
DARK	.015	.015	.015	●n15	.015	.01s	●015	.015
NET	●071	.055	.070	.081	.063	.068	.089	.076

MEAN NET ASSIMILATION ●07]8 MGC/M3/HR
STANDARD DEVIATION .0103 MGC/M3/HR
STANDARD ERROR (N=8) .0036 MGC/M3/HR
COEFFICIENT OF VARIATION 14.37

DATE 9/ 4/75 STANDARD 7.55 MC/AMP TIME 6.0 HR EFF 19/77.3

DEPTH 30 M REPLICATED ASSIMILATION (MGC/M3/HR)

LIGHT	.073	.068	.108	.110	.100	.118	●loo	.102
DARK	.015	.015	.015	.015	.015	●4-)15	●01'=!	.015
NET	●058	.053	.093	.095	.085	.102	.094	.087

MEAN NET ASSIMILATION .0836 MGC/M3/HR
STANDARD DEVIATION .0181 MGC/M3/HR
STANDARD ERROR (N=8) .0064 MGC/M3/HR
COEFFICIENT OF VARIATION 21.68

Table 4 (cont.)

DATE 9/14/75 STANDARD 7.55 MC/AMP TIME 6.0 HR EFF 15/76.2

DEPTH 5 M REPLICATED ASSIMILATION (MGC/M3/HR)

LIGHT	.109	●124	.133	.196	.170	.127	.193	.171
DARK	.013	.013	.013	.013	.013	.013	.013	.013
NET	.096	.111	.120	.183	.157	.113	●]7a	.158

MEAN NET ASSIMILATION .1395 MGC/M3/HR
STANDARD DEVIATION .0335 MGC/M3/HR
STANDARD ERROR (N=8) .0119 MGC/M3/HR
COEFFICIENT OF VARIATION 24.03

DATE 9/14/75 STANDARD 7.55 MC/AMP TIME 6.0 HR EFF 15/76.2

DEPTH 10 M REPLICATED ASSIMILATION (MGC/M3/HR)

LIGHT	.131	.080	.114	● 115	.100	.184	.111	.110
DARK	● 013	.013	.013	0013	.013	.013	●01?	.013
NET	●)\H	.067	.101	●101	●!)Q7	.171	●(397	.097

MEAN NET ASSIMILATION .1047 MGC/M3/HR
STANDARD DEVIATION .0303 MGC/M3/HR
STANDARD ERROR (N=8) .0107 MGC/M3/HR
COEFFICIENT OF VARIATION 28.97

DATE 9/13/7% STANDARD 7.55 MC/AMP TIME 6.0HR EFF 13/75.6

DEPTH 20 M REPLICATED ASSIMILATION (MGC/M3/HR)

LIGHT	.109	●1?]	.096	.097	.097	.107	.106	.101
DARK	.013	.013	.013	.013	.013	.013	●017	.013
NET	●?95	.107	.083	●!!Q3	.083	.094	●093	.088

MEAN NET ASSIMILATION .0907 MGC/M3/HR
STANDARD DEVIATION .0084 MGC/M3/HR
STANDARD ERROR (N=8) .0030 MGC/M3/HR
COEFFICIENT OF VARIATION 9.31

DATE 9/13/75 STANDARD 7.55 MC/AMP TIME 6.0 HR EFF 13/75.6

DEPTH 30 M REPLICATED ASSIMILATION (MGC/M3/HR)

LIGHT	.113	.125	.107	.114	.100	●117	.093	.096
DARK	.014	.014	.014	.014	.014	.014	●014	.014
NET	.099	.111	.093	●100	.086	.103	●07$7	.082

MEAN NET ASSIMILATION .0938 MGC/M3/HR
STANDARD DEVIATION .0111 MGC/M3/HR
STANDARD ERROR (N=8) .0039 MGC/M3/HR
COEFFICIENT OF VARIATION 11.86

Table 4 (cont.)

DATE 9/29/75 STANDARD 6.35 MC/AMP TIME 6.0 HR EFF 23/78.3

DEPTH 5 M REPLICATED 455 IMILATION(MGC/M3/HR)

LIGHT	.159	.173	●]afj	.129	.166	.164	.167	.160
DARK	.015	.015	.015	.015	.015	.015	.015	.015
NET	.143	.158	.120	● 113	.151	.149	.152	.145

MEAN NET ASSIMILATION .1413 MGC/M3/HR
STANDARD DEVIATION .0160 MGC/M3/HR
STANDARD ERROR (N=8) .0056 MGC/M3/HR
COEFFICIENT OF VARIATION 11.29

DATE 9/29/75 STANDARD b.35 MC/AMP TIME 6.0 HR EFF 23/78.3

DEPTH 10 M REPLICATED ASSIMILATION (MGC/M3/HR)

LIGHT	.145	.145	.164	.165	.166	.167	● 177	.164
DARK	.011	.011	.011	.011	● 011	● 011	● ()11	.011
NET	.134	.134	.153	.154	.155	.156	.161	.153

MEAN NET ASSIMILATION .1501 MGC/M3/HR
STANDARD DEVIATION .0102 MGC/M3/HR
STANDARD ERROR (N=8) .0036 MGC/M3/HR
COEFFICIENT OF VARIATION 6.82

DATE 9/28/75 STANDARD 6.35 MC/AMP TIME 6.0 HR EFF in/74.8

DEPTH 20 M REPLICATED ASSIMILATION (MGC/M3/HR)

LIGHT	.115	.123	.124	.140	.119	.135	.144	.097
DARK	.013	.013	.013	.013	.013	.013	● r)la	.013
NET	● 1(?2	● 110	.111	.127	.106	.123	● 131	.084

MEAN NET ASSIMILATION .1117 MGC/M3/HR
STANDARD DEVIATION .0152 MGC/M3/HR
STANDARD ERROR (N=8) .0054 MGC/M3/HR
COEFFICIENT OF VARIATION 13.64

DATE 9/28/75 STANDARD 6.35 MC/AMP TIME 6.0 HR EFF 11/75.1

DEPTH 30 M REPLICATED ASSIMILATION (MGC/M3/HR)

LIGHT	.098	.098	.096	.117	.125	.104	.162	.122
DARK	.014	.014	.014	.014	.014	.014	.014	.014
NET	.084	.084	.083	.104	.112	.091	.149	.108

MEAN NET ASSIMILATION .1018 MGC/M3/HR
STANDARD DEVIATION .0221 MGC/M3/HR
STANDARD ERROR (N=8) .0078 MGC/M3/HR
COEFFICIENT OF VARIATION 21.74

Table 5. Results of graduated light series ^{14}C assimilation experiments

Explanation of Table Values:

1.	Date:	Month, day, year of experiment
2.	Standard:	Total activities (microcuries) added to water sample
3.	Time:	Duration (hours) of incubation
4.	Eff:	Liquid scintillation external standard (e.g. 12) and resultant percentage counting efficienc (e.g. 75.4)
5.	Depth:	Depth (m) of water sample
6.	Dark Assim:	Dark bottle assimilation ($mgCm^{-3}hr^{-1}$)
7.	Light:	Light intensity (microeinsteins $m^{-2}sec^{-1}$) in incubation box during experiment
8.	Max:	Light intensity expressed as percentage of maximum light in box (i.e., % of 117 microeinsteins $m^{-2}sec^{-1}$)
9.	Assim:	Light, net assimilation ($mgCm^{-3}hr^{-1}$) and net assimilation normalized on, and expressed as a percentage of, the maximum net assimilation that occurred during the experiment
10.	Normalized:	Net assimilation normalized on light intensity

Table 5 (cont.)

DATE 6/ 9/75 STANDARD 7.70 MC/AMP TIME 6.0 HR EFF 12/75.4

DEPTH 10 M DARK ASSIM .01 MG/M3/HR

LIGHT (MF/M2/S)	MAX	ASSIM (MGC/M3/HR) L	N	MAX	NORMALIZED A/L
2.0	2	.02	.01	3	.00268
5.0	4	.03	.02	10	.00362
7.0	6	.04	.02	13	.00345
10.0	8	.05	.04	21	.00396
17.0	14	.08	●07	37	.00407
19.0	16	.10	.09	49	.00484
22.0	19	.12	.10	55	.90473
57.0	49	.17	.16	86	.00285
87.0	74	.16	.15	80	.00175
117.0	100	.20	.19	100	.00162

DATE 6/ 9/75 STANDARD 7.70 MC/AMP TIME 6.0 HR EFF 13/"[5.6

DEPTH 20 M DARK ASSIM .01 MG/M3/HR

LIGHT (MF/M2/S)	MAX	ASSIM (MGC/M3/HR) L	N	MAX	NORMALIZED A/L
2.0	?	.01	.00	1	.00067
5.0	4	.03	.02	10	.00308
7.0	6	.04	.02	16	.00353
10.0	8	.06	.05	32	.00488
1790	14	.07	.06	41	.00362
19.0	16	.09	.08	52	.00415
22.0	19	.09	.08	55	.00374
57.0	49	.16	.15	100	.00264
8700	74	.15	.13	88	.00153
117.0	100	.15	.14	90	.00115

DATE 6/10/75 STANDARD 7.70 MC/AMP TIME 6.0 HR EFF 14/75.9

DEPTH 30 M DARK ASSIM .01 MG/M3/HR

LIGHT (MF/M2/S)	MAX	ASSIM (MGC/M3/HR) L	N	MAX	NORMALIZED 4/L
2.0	2	.02	.00	2	.00167
5.0	4	.04	.03	18	.00546
7.0	6	.04	.03	20	.00428
10.0	8	.06	.05	32	.00480
17.0	14	●OR	.07	44	.00392
19.0	16	.09	.08	52	.(')0417
22.0	19	.11	.09	63	.00430
57.0	49	.15	.14	94	.00250
87.0	74	.16	.15	100	.00174
117.0	100	.16	.15	96	.(-)0125

Table 5 (cont.)

DATE 6/13/75 STANDARD 7.70 MC/AMP TIME 6.0 HR EFF 13/75.6

DEPTH 5 M DARK ASSIM .01 MG/M3/HR

LIGHT (MF/M2/S)	MAX	ASSIM (MGC/M3/HR) L	N	MAX	NORMALIZED A/L
2.0	2	.01	.00	1	.00067
5.0	4	.02	.01	11	.00241
7.0	6	.03	.02	17	.00277
10.0	8	.04	.03	24	.00267
17.0	14	.07	.06	51	.(-)0334
19.0	16	.08	.06	57	.00338
22.0	19	.08	.07	59	.00298
5?.0	49	.11	.10	88	.00172
87.0	74	.12	.11	100	.00128
117.0	100	.11	.10	90	.00086

DATE 6/12/75 STANDARD 7.70 MC/AMP TIME 6.0 HR EFF 13/75.6

DEPTH 10 M DARK ASSIM .01 MG/M3/HR

LIGHT (MF/M2/S)	MAX	ASSIM (MGC/M3/HR) L	N	MAX	NORMALIZED A/L
2.0	?	.03	.02	14	.00936
5.0	4	● n3	● Q2	13	.00348
7.0	6	.04	.03	18	.00363
10.0	8	.05	.04	27	.00368
17.0	14	.07	.06	43	.00350
19.0	16	● 08	.07	53	.00384
22.0	19	.10	.08	61	.00380
57.0	40	.11	.10	72	.00175
87.0	74	.15	.14	100	.00158
117.0	100	.14	.12	90	.00106

DATE 6/12/75 STANDARD 7.70 MC/AMP TIME 6.0 HR EFF 14/75.9

DEPTH 20 M DARK ASSIM .01 MG/M3/HR

LIGHT (MF/M2/S)	MAX	ASSIM (MGC/M3/HR) L	N	MAX	NORMALIZED A/L
2.0	2	.01	.00	3	.00133
5.0	4	.01	● nl-l	1	.00013
7.0	6	.02	● O]	9	.00133
10.0	8	.04	● n?	23	● oo?4il
17.0	14	.04	.03	25	.00157
19.0	16	.04	.03	29	.00161
22.0	19	.05	.03	32	.00154
57.0	49	.10	.08	80	.00146
87.0	74	.12	.10	100	.00120
?17.0	100	.11	● 0Q	90	.00080

Table 5 (cont.)

DATE 6/13/75 STANDARD 7.70 MC/AMP TIME 6.0 HR EFF 14/75.9

DEPTH 30 M DARK ASSIM .01 MG/M3/HR

LIGHT (MF/M2/S)	MAX	ASSIM (MGC/M3/HR) L	N	MAX	NORMALIZED A/L
2.0	2	.01	.00	1	.00067
5.0	4	●n7	.01	Y	.001?77
7.0	6	.03	.01	14	.00209
10.0	8	.03	.02	18	.00187
17.0	14	.04	.03	32	.00196
19.0	16	.06	.05	45	.00242
22.0	19	.05	.04	41	.00191
57.0	49	.10	.08	82	.00148
87.0	74	.11	.10	95	.00113
117.0	100	● ?1	.10	10U	.00088

DATE 6/15/75 STANDARD 7.70 MC/AMP TIME 6.0 HR EFF 14/75.9

DEPTH 5 M DARK ASSIM .01 MG/M3/HR

LIGHT (MF/M2/S)	MAX	ASSIM (MGC/M3/HR) L	N	MAX	NORMALIZED A/L-
?*(I	?	.01	.00	0	.0000(-)
5.0	4	.n]	●fll	11	.00107
7.0	6	.02	●A]	20	.00133
10.0	8	.02	.01	31	.00147
17.0	14	.03	.02	46	.00129
19.0	16	.04	.03	56	.00140
22.0	19	.03	.02	41	.00088
57.0	49	.05	.04	77	.00064
87.0	74	.06	.05	99	.00054
117.0	100	.06	.05	100	.00040

DATE 6/15/75 STANDARD 7.70 MC/AMP TIME 6.0 HR EFF 14/75.9

DEPTH 10 M DARK ASSIM .01 MG/M3/HR

LIGHT (MF/M2/S)	MAX	ASSIM (MGC/M3/HR) L	N	MAX	NORMALIZED A/L
2.0	2	.01	.00	2	.00067
5.0	4	.02	.01	9	.00147
7.0	6	.02	.01	15	.00181
10.0	8	.03	.01	18	.00147
17.0	14	.04	.03	33	.00157
19.0	16	.05	.04	49	.00210
22.0	19	.05	.04	43	.00161
57.0	49	.09	.07	90	.(-)0130
87.0	74	.09	.08	99	.00093
117.0	100	.09	.08	100	.00070

Table 5 (cont.)

DATE 6/16/7s STANDARD 7.70 MC/AMP TIME 6.0 HR EFF 15/76.2

DEPTH 20 M DARK ASSIM .01 MG/M3/HR

LIGHT (MF/M2/S)	MAX	ASSIM (MGC/M3/HR) L	N	MAX	NORMALIZED 4/L
2.0	2	.01	.00	0	.00000
5.0	4	.02	01	8	.90120
7*O	6	.02	.01	15	.00161
IO*O	8	0.3	.02	25	.00179
1700	14	.04	.03	42	.00180
19.0	16	.05	.04	54	.00206
22.0	19	.05	.04	54	.00178
57.9	49	n9	.07	100	.00128
87.0	74	.08	.07	96	.00081
117.0	100	.08	.07	96	.00060

DATE 6/16/75 STANDARD 7.70 MC/AMP TIME 6.0 HR EFF 35/74.8

DEPTH 30 M DARK ASSIM .01 MG/M3/HP

LIGHT (MF/M2/S)	MAY	ASSIM (MGC/M3/HR) I	N	MAX	NORMALIZED A/L
2.0	2	.02	.01	8	.00271
5.0	4	0?	.01	12	.00162
7*O	6	.03	.02	22	.00222
10.0	8	.03	.02	29	.00203
1-?.0	14	.05	.04	58	.00239
19.0	16	.06	.05	67	.00246
22.0	19	.05	.04	52	.00166
57.0	49	.06	.05	71	.00087
87.0	71,	.07	.05	76	.00061
117.0	100	.08	.07	10U	.00060

DATE 6/18/75 STANDARD 7.70 MC/AMP TIME 6.0 HR EFF 35/74.8

DEPTH 5 M DARK ASSIM .01 MG/M3/HR

LIGHT (MF/M2/S)	MAX	ASSIM (MGC/M3/HR) L	N	MAX	NORMALIZED A/L
2.0	?	.02	.01	12	.00338
5.0	4	.02	.01	20	.00230
7.0	6	.0?	.01	17	.00145
10.0	8	.03	.01	26	.00149
17.0	14	.04	.03	50	.00171
1?.0	16	.05	.04	67	.00206
22.0	19	.()'5	.04	63	.00166
57.0	49	.07	.05	92	.00094
87.0	74	.07	.06	97	.00065
117.0	100	.07	.06	100	.00050

Table 5 (cont.)

DATE 6/18/75 STANDARD 7.70 MC/AMP TIME 6.0 HR EFF 35/74.8

DEPTH 10 M DARK ASSIM .01 MG/M3/HR

LIGHT (MF/M2/S)	MAX	ASSIM (MGC/M3/HR) L	N	MAX	NORMALIZED A/L
2.0	2	.02	.01	9	.00304
5.0	4	.02	.01	12	.00162
7.0	6	●n3	●n]	21	.00213
10.0	8	.03	.02	22	.00156
17.0	14	.05	.04	53	.00219
19.0	16	●n5	.04	53	.00196
22.0	19	.06	.05	65	.00209
57.0	49	.08	.05	92	.00114
87.0	74	.08	.07	94	.00076
117.0	100	●nR	.07	100	.00060

DATE 6/19/75 STANDARD 7070 MC/AMP TIME 6.0 HR EFF 35/74.8

DEPTH 20 M DARK ASSIM .01 MG/M3/HR

LIGHT (MF/M2/S)	MAX	ASSIM (MGC/M3/HR) L	N	MAX	NORMALIZED A/L
2.0	?	●r)?	.01	13	.00406
5.0	4	.03	.02	30	.(')036S
7*O	6	●n-?	.02	28	.00242
10.0	8	.03	●n?	33	.00196
17.0	14	●I-Jr*	.03	49	.00175
19.0	16	.05	.04	60	.00189
?2.0	19	.05	.03	54	.00154
57.0	4Q	.07	.06	100	.00106
87.0	74	.06	.05	87	.00060
117.0	100	.07	.05	94	.00049

DATE 6/19/75 STANDARD 7.70 MC/AMP TIME 6.0 HR FFF 74/75.2

DEPTH 30 M DARK ASSIM .01 MG/M3/HR

LIGHT (MF/M2/S)	MAY	ASSIM (MGC/M3/HR) L	N	MAX	NORMALIZED A/L
2.0	?	.02	●I-)(-)	3	.00168
5.0	4	.03	●02	14	.00336
-?.o	6	.04	.03	23	.00384
10.0	R	.04	●n>	26	.00309
17.0	14	.07	.06	52	.00364
19.0	16	.08	.07	59	.00368
22.0	19	.09	.08	65	.00351
57.0	49	.12	.11	90	.00186
87.0	74	.13	.12	100	.00136
117.0	100	.13	.11	96	.00097

Table 5 (cont.)

DATE 6/21/75 STANDARD 7.70 MC/AMP TIME 6.0 HR EFF 27/78.4

DEPTH 5 M DARK ASSIM .01 MG/M3/HR

LIGHT (MF/M2/S)	MAX	ASSIM (MGC/M3/HR) L	N	MAX	NORMALIZED h/L
2.0	2	.01	.00	1	.00032
5.0	4	.01	.00	0	.00000
7.0	6	●()?	● 01	18	.00129
10.0	8	.02	.01	22	.00110
17.0	14	●03	●i-l?	38	.00114
19*O	16	.04	.03	61	.00163
22.0	19	●fit+	.02	43	.(-)0100
57.0	49	.06	.04	86	.00077
87.0	74	.06	.05	96	.00056
117.0	100	.06	.05	100	.00044

DATE 6/22/75 STANDARD 7.70 MC/AMP TIME 6.0 HR EFF 27/78.4

DEPTH 10 M DARK ASSIM .02 MG/M3/HR

LIGHT (MF/M2/S)	MAX	ASSIM (MGC/M3/HR) L	N	MAX	NORMALIZED A/L
2.0	?	.02	.00	3	.00097
5.0	4	.02	.00	6	.00077
7.0	6	.03	.01	15	.00138
10*O	8	.03	.02	28	.00174
17.0	14	.04	.03	44	.00163
19.0	16	●n4	.02	38	.00126
22.0	19	●n&	.03	41	.00117
57.0	49	.07	.05	82	.00091
97.0	74	●OR	.06	100	.00073
117.0	100	.07	.05	86	.00046

DATE 6/22/75 STANDARD 7.70 MC/AMP TIME 6.0HR EFF 27/78.4

DEPTH 20 M DARK ASSIM .02 MG/M3/HR

LIGHT (MF/M2/S)	MAX	ASSIM (MGC/M3/HR) L	N	MAX	NORMALIZED 4/L
2.0	2	.02	.01	9	.00258
5.0	4	.02	.00	8	.00090
7.0	6	.02	●01	12	.00101
10.0	8	.03	.02	27	.00155
17.0	14	.05	.03	52	.00175
19.0	16	.04	.03	49	.00149
22.0	19	.05	.03	60	.00155
57.0	49	.07	.06	98	.00098
87.0	74	.07	.06	99	.00065
117.0	100	.07	.06	100	.00049

Table 5 (cont.)

DATE 6/24/75 STANDARD 7.70 MC/AMP TIME 6.0 HR EFF 27/78.4

DEPTH 5 M DARK ASSIM .01 MG/M3/HR

LIGHT (MF/M2/S)	MAX	ASSIM (MGC/M3/HR) L	N	MAX	NORMALIZED A/L
2.0	?	.02	.01	13	.00258
5.0	&	●03	.01	27	.00219
7.0	6	.03	.01	34	.00194
10.0	8	.03	.01	27	.00110
17.0	14	●f?3	.01	37	.00087
19.0	16	.03	.02	40	.(0085
22.0	19	.04	.02	60	.00109
57*O	49	.05	.04	100	.00070
87.0	74	.05	.04	100	.00046
117.0	100	●0'i	.04	97	.00033

DATE 6/24/75 STANDARD 7.7(I MC/AMP TIME 6.0 HR EFF 27/78.4

DEPTH 10 M DARK ASSIM .01 MG/M3/HR

LIGHT (MF/M2/S)	MAX	ASSIM (MGC/M3/HR) L	N	MAX	NORMALIZED A/L
2.0	?	.02	.00	8	.00161
5.0	4	.01	.00	0	.00000
7.0	6	.02	.00	10	.00055
10.0	8	.02	.00	8	.00032
17.0	14	.03	.01	39	.00087
19.0	16	.03	.01	32	.00065
22.0	19	.03	.02	49	.00085
57.0	49	.05	● n4	98	.00066
87.0	74	.04	.03	80	.00035
117.0	100	.05	.04	100	.00033

DATE 6/25/75 STANDARD 7.70 MC/AMP TIME 6.0 HR EFF 27/78.4

DEPTH 20 M DARK ASSIM .01 MG/M3/HR

LIGHT (MF/M2/S)	MAX	ASSIM (MGC/M3/HR) L	N	MAX	NORMALIZED A/L
2.0	?	.02	.00	3	.00065
5.0	4	.02	.01	13	.00129
7*O	6	9(I?	.01	21	.00147
10.0	8	.03	.01	30	.00148
17.0	14	.04	.03	61	.00175
19.0	16	.04	.02	50	.00129
22.0	19	● n5	.04	76	.(-)0170
57.0	49	●05	●n3	71	.00061
87.0	74	.06	.05	100	.00056
11700	100	●05	.04	76	.00032

Table 5 (cont.)

DATE 6/25/75 STANDARD 7.70 MC/AMP TIME 6.0 HR FFF 24/78.6

DEPTH 30 M DARK ASSIM .01 MG/M3/HR

LIGHT (MF/M2/S)	MAX	ASSIM (MGC/M3/HR) L	N	MAX	NORMALIZED A/L
2.0	2	.01	.00	1	.00032
5.0	4	.02	.00	5	.00064
7.0	6	.02	.01	15	.00129
10.0	8	.03	.01	19	.00116
17.0	14	.04	.03	51	.00178
19.0	16	.04	.03	48	.0015?
22.0	19	.05	.03	55	.00149
57.0	49	.06	.05	75	.00079
87.0	74	.07	.06	92	.00064
117.0	100	.07	.06	100	.00051

DATE 6/27/75 STANDARD 7.70 MC/AMP TIME 6.0 HR FFF 24/78.6

DEPTH 5 M DARK ASSIM ● O1MG/M3/HR

LIGHT (MF/M2/S)	MAX	ASSIM (MGC/M3/HR) L	N	MAX	NORMALIZED A/L
2.0	2	.01	.00	2	.00064
5.0	4	.02	.01	15	.00180
7.0	6	.03	.01	1?	.00165
10*O	8	●rf3	.02	28	.00167
17.0	14	.03	.02	31	.00110
19.0	16	.05	.04	66	.00207
22.0	19	.04	.02	38	.00102
57.0	49	.07	● OF)	92	.00097
87.0	74	.04	f-)2	39	.00027
117.0	100	.07	.06	100	.00051

DATE 6/27/75 STANDARD 7.70 MC/AMP TIME 6.0 HR FFF 24/78.6

DEPTH 10 M DARK ASSIM .01 MG/M3/HR

LIGHT (MF/M2/S)	MAX	ASSIM (MGC/M3/HR) L	N	MAX	NORMALIZED 4/L
2.0	2	.02	.00	8	.00129
5.0	4	●02	.01	24	.00154
7*O	6	.03	.01	40	.00184
10.0	8	.02	.01	28	.00090
17.0	14	.03	.01	44	.00083
19.0	16	.03	.02	52	.00088
22.0	19	.03	.01	42	.00061
5-?.0	49	●(-)4	.03	94	.00053
87.0	74	.04	.03	86	.00032
117.0	100	.05	.03	100	.00028

Table 5 (cont.)

DATE 6/28/75 STANDARD 7.70 Me/AMP TIME 6.0 HR EFF 24/78.6

DEPTH 20 M DARK ASSIM .01 MG/M3/HR

LIGHT (MF/M2/S)	MAX	ASSIM (MGC/M3/HR) L	N	MAX	NORMALIZED A/L
2.0	2	● n?	.01	15	.00322
5.0	4	● 0?	.00	9	.00077
7.0	6	.03	.01	28	.0(")175
10.0	8	.03	.01	31	.00135
17.0	14	● 0fb	.02	50	.00129
19.0	16	.04	● OP	51)	.00115
22*O	19	.04	.02	51	.(-)(-)102
57*O	49	● i)6	.04	99	.00076
87*O	74	.05	● no	94	.00047
117.0	100	.06	.04	100	.00037

DATE 6/28/75 STANDARD 7.70 MC/AMP TIME 6.0HR EFF 24/78.6

DEPTH 30 M DARK ASSIM .01 MG/M3/HR

LIGHT (MF/M2/S)	MAX	ASSIM (MGC/M3/HR) L	N	MAX	NORMALIZED A/L
2.0	2	.02	.01	20	.00386
5.0	4	.02	.00	8	.00064
7.0	6	.02	.01	18	.00101
10.0	8	.03	.01	38	.00148
17.0	14	.04	.03	66	.00151
19.0	16	.04	.03	70	.00146
22.0	19	.05	.04	93	.00167
57.0	49	.05	.04	90	.00062
87.0	74	.05	.04	97	.00044
117.0	100	.05	.04	100	.00034

DATE 6/30/75 STANDARD 7.70 MC/AMP TIME 6.0 HR EFF 14/75.9

DEPTH 5 M DARK ASSIM .01 MG/M3/HR

LIGHT (MF/M2/S)	MAX	ASSIM (MGC/M3/HR) L	N	MAX	NORMALIZED A/L
2.0	2	.02	.00	6	.00100
5.0	4	.01	.00	4	.00027
7.0	6	.02	.00	8	.00038
10.0	8	.02	.01	25	.00080
17.0	14	.02	.01	35	.00067
19.0	16	.02	.01	25	.00042
22.0	19	.03	.01	40	.00058
57.0	49	.05	.03	100	.00056
87.0	74	.04	.03	81	.00030
117.0	100	.04	.03	85	.00023

Table 5 (cont.)

DATE 6/30/75 STANDARD 7.70 MC/AMP TIME 6.0 HR EFF 14/75.9

DEPTH 10 M DARK ASSIM .01 MG/M3/HR

LIGHT (MF/M2/S)	MAX	ASSIM (MGC/M3/HR) L	N	MAX	NORMALIZED A/L
2.0	2	.01	.00	0	.00000
5.0	4	.01	.00	8	.00(?27
7.0	6	.01	.00	19	.00048
10.0	8	.01	.00	15	.00027
17*O	14	.02	.01	62	.00063
19.0	16	.02	.01	58	.00053
22*O	19	.02	.01	58	.00045
57.0	49	.03	.02	88	.00027
87*O	74	.03	.02	88	.00018
117.0	100	.03	.02	100	.00015

DATE 7/ 1/75 STANDARD 7.70 MC/AMP TIME 6.0 HR EFF 14/75.9

DEPTH 20 M DARKASSIM ● OI MG/M3/HR

LIGHT (MF/M2/S)	MAX	ASSIM (MGC/M3/HR) L	N	MAX	NORMALIZED A/L
2.0	?	.02	.00	13	.00233
5.0	&	.02	.00	11	.00080
7.0	6	.03	.01	40	.00200
10.0	8	.03	.02	58	.00207
17.0	14	.03	.02	55	.00114
19.0	16	.04	.02	62	.00116
22.0	19	.03	.02	58	.00094
57*O	49	.05	.03	94	.00058
87.0	7(4	●05	.03	98	.00040
117.0	100	.05	.04	100	● f)oo30

DATE 7/ 1/75 STANDARD 7.50 MC/AMP TIME 6.0 HR EFF 14/75.9

DEPTH 30 M DARK ASSIM .01 MG/M3/HR

LIGHT (MF/M2/S)	MAX	ASSIM (MGC/M3/HR) L	N	MAX	NORMALIZED A/L
2.0	?	.02	.01	20	.(-)0?74
5.0	4	.01	.00	12	.00068
7.0	6	.02	.01	20	.00078
10.0	Q	.02	.01	37	.00103
17.0	14	.03	.02	83	.00137
19.0	16	.03	.02	73	● I901O8
22.0	19	.03	.02	71	.00090
57.0	49	.04	.03	100	.00049
87.0	74	.04	.03	98	.00031
117.0	100	.04	.03	93	.00022

Table 5 (cont.)

DATE 7/ 3/75 STANDARD 7.50 MC/AMP TIME 6.0 HR EFF 14/75.9

DEPTH 5 M DARK ASSIM .01 MG/M3/ii!?

LIGHT (MF/M2/S)	MAX	ASSIM (MGC/M3/HR) L	N	MAX	NORMALIZED 4/L
2.0	?	.01	.00	3	.00034
5.0	4	.02	.01	26	.00137
7.0	6	.02	.01	23	.00088
10.0	8	.02	.01	36	.00096
17.0	14	● 03	.02	56	.00089
19.0	16	● 0?	.01	31	.00043
22.0	19	● f13	.02	59	.00072
57*9	40	.04	.03	100	.00047
87.0	74	● (]4	.03	97	.00030
117.0	100	.04	.02	92	● 00021

DATE 7/ 3/75 STANDARD 7.50 MC/AMP TIME 6.0 HR EFF 14/75.9

DEPTH 10 M DARK ASSIM .01 MG/M3/HR

LIGHT (MF/M2/S)	MAX	ASSIM (MGC/M3/HR) L	N	MAX	NORMALIZED 4/I-
2.0	2	.01	.00	0	.00000
5.0	4	e02	.01	.22	.00137
7.0	6	.03	.01	40	.00176
10.0	8	.0?	.01	18	.00055
17.0	14	.02	.01	31	.00056
19.0	16	f)?	.01	29	.00047
22.0	19	● n?	● nl	36	.00050
57.0	49	I-)4	.02	78	.00042
87.9	74	.(-)4	.03	8"2	.00029
117.0	100	.04	● 03	1O(-J	.00026

DATE 7/ 4/75 STANDARD 7.50 MC/AMP TIME 6.0 HR EFF 35/74.8

DEPTH 20 M DARK ASSIM .02 MG/M3/HR

LIGHT (MF/M2/S)	MAX	ASSIM (MGC/M3/HR) L	N	MAX	NORMALIZED 4/L
2.0	2	.03	.01	25	.00625
5.0	4	● 04	.03	51	.00514
7.0	6	● (-)6	.04	84	.00605
10.0	8	.04	.02	48	.00?43
17.0	14	r-)5	.03	63	.00188
19.0	16	.06	.05	90	.00?41
22.0	19	● f15	.03	58	.00133
57.0	49	● f17	.05	100	● 00089
87.0	74	● P6	.04	88	.00051
117.0	100	.06	.05	89	.00039

Table 5 (cont.)

DATE 7/ 4/75 STANDARD 7.50 MC/AMP TIME 6.0 HR FFF 34/75.2

DEPTH 30 M DARK ASSIM .02 MG/M3/HR

LIGHT (MF/M2/S)	MAX	ASSIM (MGC/M3/HR) L	N	MAX	NORMALIZED A/L
2.0	?	.02	●(-)	b	.00138
5.0	4	.02	.00	8	.00069
7.0	6	.03	.01	27	.00168
10.0	8	i-)?	● n]	23	.00097
17.0	14	.04	.02	4'7	.00118
19.0	16	.04	.03	61	.00138
22.0	19	.04	.02	42	.00082
57.0	49	.05	.03	73	.00054
87.0	7(.	.06	.04	100	.00049
117.0	lot-l	.04	.03	60	.00022

DATE 7/ 6/75 STANDARD 7.50 MC/AMP TIME 6.0 HR FFF 34/75.2

DEPTH 5 M DARK ASSIM .01 MG/M3/HR

LIGHT (MF/M2/S)	MAX	ASSIM (MGC/M3/HR) L	N	MAX	NORMALIZED A/L
2.0	2	.02	.01	14	.00310
5.0	4	.02	.00	10	.00083
700	6	.02	.01	24	.00147
10.0	8	.03	.01	29	.00124
17*O	14	.03	.02	38	.00097
19.0	16	.03	.02	46	.00105
22.0	19	.03	.02	37	.00072
57.0	40	.05	.04	86	.00065
87.0	74	.06	.04	97	.00048
117.0	100	.06	.04	100	.00037

DATE 7/ 6/75 STANDARD 7.50 MC/AMP TIME 6.0 HR FFF 34/75.2

DEPTH 10 M DARK ASSIM .01 MG/M3/HR

LIGHT (MF/M2/S)	MAX	ASSIM (MGC/M3/HR) L	N	MAX	NORMALIZED A/L
2.0	2	.02	.00	21	.00241
5.0	4	.01	.00	3	.00014
7.0	6	.02	.00	12	.00039
in.o	8	.02	● n]	36	● ol-)rlR3
17.0	14	.02	.01	30	.00040
19.0	16	.02	.01	39	.00047
22.0	19	.03	.01	58	.00059
57.0	49	.03	● QZ	76	.00030
8'7.0	74	.04	● n?	100	.0(-)026
117.0	100	.04	.02	100	.00019

Table 5 (cont.)

DATE 7/ 7/75 STANDARD 7.50 MC/AMP TIME 6.0 HR EFF 34/75.2

DEPTH 20 M DARK ASSIM .01 MG/M3/HR

LIGHT (MF/M2/S)	MAX	ASSIM (MGC/M3/HR) L	N	MAX	NORMALIZED A/L
2.0	?	.02	.01	13	.00275
5.0	4	.* 02	.00	5	.00041
7*O	6	.02	.00	8	.00049
10.0	8	.02	.00	7	.00028
17.0	14	● 02	.01	22	.00053
19.0	16	.03	.02	48	.00105
22.0	19	.04	.02	52	● !lon97
57*O	49	.05	.04	93	.00068
87.0	7f,	● (76	.04	100	.00047
117.0	100	● f16	.04	100	.00035

DATE 7/ 7/75 STANDARD 7.50 MC/AMP TIME 6.0 HR EFF 33/75.7

DEPTH 30 M DARK ASSIM .01 MG/M3/HR

LIGHT (MF/M2/S)	MAX	ASSIM (MGC/M3/HR) L	N	MAX	NORMALIZED 4/L
2.0	2	.01	.00	7	.00103
5.0	4	● 01	.00	o	.00000
7.0	6	.02	.00	Y	.00039
10.0	8	.01	● nfl	7	.00021
17.0	14	.02	● n]	29	.00052
19.0	16	.02	.01	29	.00047
22.0	19	.02	.01	38	.00053
57.0	49	.03	.02	73	.00040
87.0	74	.04	.03	96	.00034
117.0	100	. 04	● q3	100	.00026

DATE 7/ 9/75 STANDARD 7.50 MC/AMP TIME 6.0 HR EFF 32/76.1

DEPTH 5 M DARK ASSIM .02 MG/M3/HR

LIGHT (MF/M2/S)	MAX	ASSIM (MGC/M3/HR) L	N	MAX	NORMALIZED A/L
2.0	2	.02	.01	14	.00307
5*O	4	.03	.01	32	.00273
7.0	6	.02	.00	8	.00049
10.0	8	.02	.00	6	.00027
17.0	14	.03	.01	22	.00056
19.0	16	.03	.01	21	.00047
22.0	19	.03	.01	22	.00043
57.0	4?	.05	.03	71	.00054
87.0	7/4	.06	.04	95	.00047
117.0	100	.06	.04	100	.00037

Table 5 (cont.)

DATE 7/ 9/75 STANDARD 7.50 MC/AMP TIME 6.0 HR EFF 33/75.7

DEPTH 10 M DARK ASSIM .02 MG/M3/HR

LIGHT (MF/M2/S)	MAX	ASSIM (MGC/M3/HR) L	N	MAX	NORMALIZED A/L
2.0	2	.02	.00	9	.00206
5.0	4	.02	.00	5	.00041
7.0	6	.02	.00	6	.00039
10.0	8	.02	.00	6	.00027
1780	14	.03	.01	31	.00081
19.0	16	.03	.02	3?	● f)of)137
22.0	19	.03	.02	4.3	.00087
57.0	49	● 05	.03	68	.(-)0053
87.0	74	● (-)6	● n&	100	● 000s1
117. (-)	100	.06	.04	9"?	.00037

DATE 7/10/75 STANDARD 7050 MC/AMP TIME 6.0 HR EFF 33/75.7

DEPTH 20 M DARK ASSIM .02 MG/M3/HR

LIGHT (MF/M2/S)	MAX	ASSIM (MGC/M3/HR) L	N	MAX	NORMALIZED A/L
2.0	2	.02	.00	0	.(-)0(-)00
5.0	4	.04	● O2	34	.00412
7.0	6	.03	.02	28	.(-)0235
10.0	8	.03	.01	2(1	.00117
17.0	14	● n4	.02	41	.00145
19.0	16	.04	.02	34	.00108
22.0	19	.04	● !)2	38	.00103
57. (I	49	.07	.05	90	.00094
87.0	74	.08	.06	98	.00067
117.0	100	.08	.06	100	.00051

DATE 7/10/75 STANDARD 7.50 MC/AMP "TIME 6.0 HR EFF 33/76.1

DEPTH 30 M DARK ASSIM .02 MG/M3/HR

LIGHT (v F/M Z/s)	MAX	ASSIM (MGC/M3/HR) L	N	MAX	NORMALIZED A/L
2.0	?	.02	.00	o	.00000
5.0	4	.02	.01	11	.00109
7.0	6	.03	.02	33	.00224
10.0	8	.03	.01	16	.00(-)75
17.0	14	.04	.02	41	.00116
19.0	16	.03	.01	26	.00065
22. (I	19	.04	.02	40	.00087
57.0	4?	.07	.05	100	.00084
87.0	74	.05	.03	73	.00(-)40
117*O	100	.05	.04	77	.(-)0031

Table 5 (cont.)

DATE 7/12/75 STANDARD 7.50 MC/AMP TIME 6.0 HR EFF 29/77.5

DEPTH 5 M DARK ASSIM .02 MG/M3/HR

LIGHT (MF/M2/S)	MAX	ASSIM (MGC/M3/HR) L	N	MAX	NORMALIZED A/L
2.0	?	.03	.02	30	.00905
5.0	4	.02	.00	5	.00067
7.0	6	.03	.02	27	.(-)0?3'3
10.0	8	● 0?	.00	5	.00047
17.0	14	● nil	.02	35	.00126
1790	16	● 03	.01	24	.00078
22.0	19	● n4	.03	43	.00119
57.0	40	● O7	.05	79	.00085
87.0	74	.07	.05	85	● oon59
117.0	100	.08	.06	100	.00052

DATE 7/12/75 STANDARD 7.50 MC/AMP TIME 6.0 HR EFF 29/77.5

DEPTH 10 M' DARK ASSIM .01 MG/M3/HR

LIGHT (MF/M2/S)	MAX	ASSIM (MGC/M3/HR) L	N	MAX	NORMALIZED A/L
2.0	2	.02	.01	36	.00503
5.0	4	.02	.00	14	.00080
7.0	6	.02	.01	24	.00096
10.0	8	● n-j	● n]	48	.00134
17.0	14	.03	.02	64	.00106
19.0	16	.02	.01	31	.00046
22.0	19	.03	● n?	60	.00076
57.0	49	.04	.03	9s	.00047
87.0	74	.04	● n?	81	.00026
117.0	100	.04	.03	100	.00024

DATE 7/13/75 STANDARD 7.50 MC/AMP TIME 6.0 HR EFF 28/77.9

DEPTH 20 M DARK ASSIM .02 MG/M3/HR

LIGHT (MF/M2/S)	MAX	ASSIM (MGC/M3/HR) L	N	MAX	NORMALIZED A/L
2.0	?	.02	.00	4	.00233
5.0	4	.02	.00	0	.00000
7.0	6	.03	.01	13	.00?00
10.0	8	.03	.01	13	.00140
17.0	14	.03	.01	8	.00051
19.0	16	.03	.01	8	.00049
22.0	19	.03	.01	11	.00055
57.0	49	.13	.11	100	.00194
87.0	74	.04	.03	23	.00029
117.0	100	.05	.03	25	.00024

Table 5 (cont.)

DATE 7/13/75 STANDARD 7.50 MC/AMP TIME 6.0 HR FFF 29/77.5

DEPTH 30 M DARK ASSIM .01 MG/M3/HR

LIGHT (MF/M2/S)	MAX	ASSIM (MGC/M3/HR) L	N	MAX	NORMALIZED A/L
2.0	2	● 04	.03	49	.01307
5.0	4	.02	.01	16	.00174
7.0	6	.03	.01	28	.00211
10.0	8	.03	● RI	28	.00147
17.0	14	.06	● nit	78	.00244
19.0	16	● n4	.02	42	.00116
22.0	19	● f)(+	.03	56	.00134
57.0	49	.06	.04	80	.(')0074
87.0	74	● (16	.05	90	.00055
117.0	100	.07	.05	100	.00045

DATE 7/15/75 STANDARD 7.50 MC/AMP TIME 6.0 HR FFF 28/77.9

DEPTH 5 M DARK ASSIM .01 MG/M3/HR

LIGHT (MF/M2/S)	MAX	ASSIM (MGC/M3/HR) L	N	MAX	NORMALIZED A/L
2.0	2	.02	.00	13	.00200
5.0	4	.03	.01	37	.00227
7.0	6	.04	.03	96	.00419
10.0	8	.04	.02	78	.00240
17.0	14	.03	.02	63	.00114
19.0	16	.02	.01	24	● (-)OQ3Q
22.0	19	.04	.03	85	.00118
57.0	49	.04	.03	87	● oor-147
87.0	74	.04	.03	100	.00035
117.0	100	.04	.03	91	.00024

DATE 7/15/75 STANDARD 7.50 MC/AMP TIME 6.0HR FFF 29/77.5

DEPTH 10 M DARK ASSIM .01 MG/M3/HR

LIGHT (MF/M2/S)	MAX	ASSIM (MGC/M3/HR) L	N	MAX	NORMALIZED A/L
2.0	2	.02	.01	12	.00302
5.0	4	.03	.01	26	.00255
7.0	6	.03	.02	34	.00239
10.0	8	.03	.01	27	.00134
17.0	14	.03	.02	36	.00103
19.0	16	.04	.02	45	.00116
22.0	19	.03	.02	42	● 001-IQ4
57.0	49	.05	.04	75	.00065
87.0	74	.05	.04	82	.00046
117.0	100	.06	.05	100	.00042

Table 5 (cont.)

DATE 7/16/75 STANDARD 7.50 MC/AMP TIME 6.0 HR EFF 29/77.5

DEPTH 20 M DARK ASSIM .02 MG/M3/HR

LIGHT (MF/M2/S)	MAX	ASSIM (MGC/M3/HR) L	N	MAX	NORMALIZED A/L
?*O	2	● 0?	.f-in	b	.00101
5.0	4	.04	.02	48	.00335
7.0	6	.03	.01	21	.00105
10.0	8	.02	.01	17	.00060
17.0	14	● n3	.01	27	.00055
19.0	16	.03	● PI	37	.00067
22.0	19	.03	.01	35	.00055
57.0	49	● []5	● f)3	98	.00060
87.0	74	.04	.03	75	.00030
117.0	100	.05	.03	100	.00030

DATE 7/16/75 STANDARD 7.50 MC/AMP TIME 6.0 HR EFF 29/77.5

DEPTH 30 M DARK ASSIM .0? MG/M3/HR

LIGHT (MF/M2/S)	MAX	ASSIM (MGC/M3/HR) L	N	MAX	NORMALIZED A/L
2.0	2	.02	.00	8	.00?01
5.0	4	.03	.01	20	.00201
7.0	6	.02	● I-I]	12	.00086
1(-).0	8	.03	.01	19	.00094
17.0	14	.05	● n4	76	.00221
19.0	16	.05	● n>	57	.00148
22.0	19	.03	.02	34	.00076
57.0	49	.05	.04	73	.00063
87*O	74	.07	● OS	100	.00057
117.0	100	.07	.05	96	.00041

DATE 7/18/75 STANDARD 7.50 MC/AMP TIME 6.0 HR EFF 29/77.5

DEPTH 5 M DARK ASSIM .01 MG/M3/HR

LIGHT (MF/M2/S)	MAX	ASSIM (MGC/M3/HR) L	N	MAX	NORMALIZED A/L
2.0	2	.02	.01	20	.00299
5*O	4	.02	● n(-)	13	.00080
7.0	6	.03	.02	51	.00218
10.0	8	.02	.01	29	.00086
17.0	14	.02	.01	22	.()(-)039
19.0	16	.03	● 02	58	.00091
22.0	19	.02	● fll	29	.00039
57.0	49	.03	.02	67	.00035
87.0	74	.04	.03	89	.00031
117.0	100	.04	● 03	100	.00026

Table 5 (cont.)

DATE 7/18/75 STANDARD 7.50 MC/AMP TIME 6.0 HR EFF 29/77.5

DEPTH 10 M DARK ASSIM .01 MG/M3/HR

LIGHT (MF/M2/S)	MAX	ASSIM (MGC/M3/HR) (.	N	MAX	NORMALIZED A/L
2.0	2	.02	.01	19	.00299
5.0	4	.02	.01	19	.00119
7.0	6	.03	.01	47	.00209
10.0	8	.02	.01	32	.00100
17.0	14	●03	.01	45	● OOOR?
19.0	16	.02	.01	19	.00031
22.0	19	●03	.01	40	.00057
57.0	49	.04	.03	96	.00052
87.0	74	●04	.03	94	.00034
117.0	100	.05	.03	100	.00027

DATE 7/19/75 STANDARD 7.50 MC/AMP TIME 6.0 HR EFF 29/77.5

DEPTH 20 M DARK ASSIM .01 MG/M3/HR

LIGHT (MF/M2/S)	MAX	ASSIM (MGC/M3/HR) (	N	MAX	NORMALIZED A / L
2.0	2	.03	.01	27	.00568
5.0	4	.03	● n2	42	.00361
7.0	6	.03	.02	4"7	.00286
10.0	8	●04	.02	53	.00227
17.0	14	.03	.01	34	.00086
19.0	16	.04	.02	50	.00113
22.0	19	.04	●Q2	48	.00094
57.0	49	.05	.04	86	.00064
87.0	74	.05	.04	91	.00045
117*O	100	.06	.04	100	.00037

DATE 7/19/75 STANDARD 7.50 MC/AMP TIME 6.0 HR EFF 30/77.0

DEPTH 30 M DARK ASSIM .02 MG/M3/HR

LIGHT (MF/M2/S)	MAX	ASSIM (MGC/M3/HR) (..	N	MAX	NORMALIZED A/L
2.0	2	.02	.00	4	.00101
5.0	4	.02	.01	10	.00108
7.0	6	.03	.01	20	.00154
10.0	8	.03	.01	18	.00094
17.0	14	.04	.02	39	.00123
19.0	16	.04	.02	35	.00099
22.0	19	●04	.02	35	.00086
57.0	49	●(lfl	.04	70	.00065
87.0	74	.06	.04	78	.00048
117.0	100	.07	.05	100	.00046

Table 5 (cont.)

DATE 7/21/75 STANDARD 7.50 MC/AMP TIME 6.0HR FFF 30/77.0

DEPTH 5 M DARK ASSIM .01 MG/M3/HR

LIGHT (MF/M2/S)	MAX	ASSIM (MGC/M3/HR) L	N	MAX	NORMALIZED A/L
2.0	2	●0?	.00	10	.(-)0134
5.0	4	.02	.01	28	.00147
7*O	6	.02	.01	23	.00086
10.0	8	.02	.00	10	.00027
1"?90	14	.02	●ofl	18	.00(-)27
19.0	16	●n?	●nl	23	.00032
22.0	19	.03	.01	5h	.00067
57.0	49	.04	.02	90	.00041
87.0	74	.04	.02	85	.00025
117.0	100	.04	.03	100	.00022

DATE 7/21/75 STANDARD 7.50 MC/AMP TIME 6.0 HR FFF 30/77.0

DEPTH 10 M DARK ASSIM .01 MG/M3/HR

LIGHT (MF/M2/S)	MAX	ASSIM (MGC/M3/HR) L	N	MAX	NORMALIZED A/L
2.0	2	.02	.00	19	.00200
5.0	4	.02	.01	34	.,(-)0147
7.0	6	.02	.01	25	.00076
10.0	8	.02	.01	28	.00060
17.0	14	.02	.01	28	.00035
19.0	16	.02	.00	19	.00021
22.0	19	.02	.00	22	●oor121
57.0	49	.03	.01	66	.00025
87.0	74	.03	.02	75	.00018
117.0	100	.03	.02	100	.00018

DATE 7/22/75 STANDARD 7.50 MC/AMP TIME 6.0 HR FFF 30/77.0

DEPTH 20 M DARK ASSIM .01 MG/M3/HR

LIGHT (MF/M2/S)	MAX	ASSIM (MGC/M3/HR) L	N	MAX	NORMALIZED A/L
2.0	2	.02	.01	32	.00268
5.0	4	.02	.00	20	.00067
7.0	6	.03	.01	68	.00"163
10.0	8	●02	.01	32	.00054
17.0	14	●n?	.01	48	.00(-)47
19.0	16	.02	.00	16	.00014
22.0	19	.02	.00	12	.00009
57.0	49	.03	.01	72	.00021
87.0	74	●03	.02	100	.00019
117.0	100	.02	.01	60	.00009

Table 5 (cont.)

DATE 7/22/75 STANDARD 7.50 MC/AMP TIME 6.0 HR EFF 31/76.6

DEPTH 30 M DARK ASSIM .0? MG/M3/HR

LIGHT (MF/M2/S)	MAX	ASSIM (MGC/M3/HR) L	N	MAX	NORMALIZED A/L
2.0	2	.02	.00	1	.00034
5.0	4	.02	.01	12	.00122
7.0	6	●(73	.01	20	.00145
10.0	8	.02	.01	18	.00088
17.0	14	●0?	.01	26	.00076
19.0	16	●OL	.02	39	.00104
22.0	19	.03	.01	3(-I	.00068
57*O	49	●I-)6	.05	91	.00080
87.0	74	●07	.05	100	.(-)0058
117.0	100	●I-)6	●n5	93	.00040

DATE 7/25/75 STANDARD 7050 MC/AMP TIME 6.0 HR EFF 34/75.2

DEPTH 5 M" DARK ASSIM .02 MG/M3/HR

LIGHT (MF/M2/S)	MAX	ASSIM (MGC/M3/HR) L	N	MAX	NORMALIZED 4/L
2.0	2	●I-)2	.00	19	.00204
5.0	4	.02	.01	25	.00109
7.0	6	.02	.01	31	.00097
10.0	8	●0?	.01	31	.00068
17.0	14	.02	.01	34	.00044
19.0	16	.03	.01	44	.00050
22.0	19	.02	.01	28	.00028
57*O	49	.03	.02	75	.(-)0(-)?9
87.0	74	.04	.02	100	.00025
117.0	100	●03	.02	81	.00015

DATE 7/25/75 STANDARD 7.50 MC/AMP TIME 6.0 HR EFF 35/74.8

DEPTH 10 M DARK ASSIM .01 MG/M3/HR

LIGHT (MF/M2/S)	MAX	ASSIM (MGC/M3/HR) L	N	MAX	NORMALIZED A/L
2.0	2	.02	.00	17	.00171
5.0	4	.02	.00	7	.00027
700	6	.02	.00	7	.00020
10*O	8	●0?	.00	20	.00041
17.0	14	.03	.02	100	.00121
1900	16	.02	.00	10	.00011
22.0	19	.02	.00	17	.00016
57.0	49	.02	.01	47	.00017
87.0	74	●03	.01	67	.00016
117.0	100	●03	.02	93	.00016

Table 5 (cont.)

DATE 7/24/75 STANDARD 7.50 MC/AMP TIME 6.0 HR EFF 35/74.8

DEPTH 20 M DARK ASSIM .02 MG/M3/HR

LIGHT (MF/M2/S)	MAX	ASSIM (MGC/M3/HR) L	N	MAX	NORMALIZED A/L
2.0	2	.02	.00	10	.00138
5.0	4	.02	.00	12	.00069
7.0	6	.02	.01	26	.00108
10*O	8	.02	.01	19	.00055
17.0	14	.02	.00	17	.00028
19.0	16	.02	.01	29	.00044
22.0	19	.02	.01	26	.00034
57.0	49	.04	.02	74	.00038
87.0	74	.04	.03	98	.00033
117.0	100	.05	.03	100	.00025

DATE 7/24/75 STANDARD 7.50 MC/AMP TIME 6.0 HR EFF 35/74.8

DEPTH 30 M. DARK ASSIM .02 MG/M3/HR

LIGHT (MF/M2/S)	MAY	ASSIM (MGC/M3/HR) L	N	MAX	NORMALIZED A/I
2.0	2	● 02	.00	8	.00138
5.0	4	● 02	.00	0	.00000
7.0	6	.02	.00	8	.00040
10.0	R	.02	.01	17	.00055
17.0	14	● 02	.00	10	.00020
19.0	16	.03	.01	33	● oof)5Q
22.0	19	.02	.01	17	.00025
57.0	49	.04	● QZ	71	.00041
87.0	74	.04	.03	7"7	.00029
11700	100	.05	.03	100	.0002??

PATE 7/27/75 STANDARD 7.50 MC/AMP TIME 6.0HR EFF 30/77.0

DEPTH 5 M DARK ASSIM .01 MG/M3/HR

LIGHT (MF/M2/S)	MAX	ASSIM (MGC/M3/HR) 1.	N	MAX	NORMALIZED A/L
2.0	2	.02	.01	42	.00497
5.0	4	.02	.01	31	.00146
7.0	6	.01	.00	3	.00009
10.0	8	.02	.01	42	.00099
17.0	14	.n?	.01	36	.00051
19.0	16	.02	.01	39	.(-)0049
22.0	19	● 0?	.01	39	.00042
57.0	49	.03	.02	69	.00029
87.0	74	.04	.02	100	.00027
117.0	100	.04	.02	100	.00020

Table 5 (cont.)

DATE 7/28/75 STANDARD 6.95 MC/AMP TIME 6.0 HR EFF 31/76.6

DEPTH10 M DARK ASSIM .01 MG/M3/HR

LIGHT (MF/M2/S)	MAX	ASSIM (MGC/M3/HR) L	N	MAX	NORMALIZED A/L
2.0	2	.01	-.00	-5	-.00072
5.0	4	.02	.01	22	.00115
7.0	6	● tl?	● Q]	35	.00134
10.0	8	.04	.02	92	.00245
17*O	14	.03	.02	68	.00106
19.0	16	.02	.01	19	.00027
22.0	19	● 0?	.01	24	.00029
57.0	49	.03	.01	49	.00023
87.0	74	● 04	.02	84	.00026
117.0	100	.04	● !-)3	100	.00023

DATE 7/27/75 STANDARD 7.50 MC/AMP TIME 6.0 HR EFF 31/76.6

DEPTH 20 M DARK ASSIM .01 MG/M3/HR

LIGHT (MF/M2/S)	MAY	ASSIM (MGC/M3/HR) I	N	MAX	NORMALIZED A/L
2.0	?	.01	.00	0	.00000
5.0	&	.02	.00	12	.00081
7.0	6	.02	● no	6	● OO02Y
10.0	8	.02	.01	24	.00081
17.0	14	● f)3	.01	41	.00079
19.0	16	.02	.01	24	.00043
22.0	19	f-)3	● n]	3 7	.00055
57*O	49	.04	.02	65	.00038
87.0	74	.05	.03	100	.(-)0039
117.0	100	.04	.03	82	.00023

DATE 7/27/75 STANDARD 6.95 MC/AMP TIME 6.0 HR EFF 31/76.6

DEPTH 30 M DARK ASSIM .02 MG/M3/HR

LIGHT (MF/M2/S)	MAX	ASSIM (MGC/M3/HR) L	N	MAX	NORMALIZED A/L
2.0	2	.02	.00	7	.00146
5.0	4	.02	.00	7	.00058
7.0	6	● f)z'	.00	9	.00052
10.0	8	.03	.01	24	.00095
17*O	14	.04	.02	54	.00124
19.0	16	● n2	.01	20	.00042
22.0	19	.03	.02	41	.00073
57*O	49	.05	.03	87	.00060
87.0	74	.05	.04	91	.00041
117*O	100	.06	.04	100	.00034

Table 5 (cont.)

DATE 7/30/75 STANDARD 6.95 MC/AMP TIME 6.0 HR EFF 23/78.3

DEPTH 5 M DARK ASSIM .01 MG/M3/HR

LIGHT (MF/M2/S)	MAX	ASSIM (MGC/M3/HR) L	N	MAX	NORMALIZED A/L
2.0	?	0?	.00	6	.00106
5.0	4	.02	(I(')	14	.00099
7.0	6	.02	.01	16	.00080
10*O	8	0?	.01	18	.00063
17*O	14	.02	.01	28	.00058
19.0	16	03	.02	46	.00085
22.0	19	02	.01	26	.00042
57.0	49	.04	.02	60	.00037
87.0	74	05	.04	100	.00040
117.0	100	04	.03	84	.00025

DATE 7/30/75 STANDARD 6.95 MC/AMP TIME 6.0 HR EFF 24/78.6

DEPTH 10 M DARKASSIM O? MG/M3/HP

LIGHT (MF/M2/S)	MAX	ASSIM (MGC/M3/HR) L	N	MAX	NORMALIZED 4/i_
2.0	?	.03	r-l]	23	.00491
5.0	4	.04	.02	53	.00463
7.0	6	.03	.01	2.3	.00140
10.0	8	.03	.02	35	.00154
17.0	14	.03	.01	27	.00070
19*O	16	.03	.01	34	.(-)0078
22.0	19	.04	Q2	56	.(-)0112
57.0	49	.06	04	100	..00076
87.0	74	.06	.04	97	.00048
117.0	100	.06	.04	94	.00035

DATE 7/31/75 STANDARD 6.95 MC/AMP TIME 6.0 HR EFF 29/77.5

DEPTH 20 M DARK ASSIM .02 MG/M3/HP

LIGHT (MF/M2/S)	MAX	ASSIM (MGC/M3/HR) L	N	M A X	NORMALIZED A/L
2.0	?	.02	.00	5	.00180
5*O	4	.03	.01	22	.00288
7.0	6	.02	0I	10	.00093
10.0	8	.0?	0]	14	.00094
1700	14	.03	.01	16	.00064
19.0	16	.02	.01	13	.00046
22.0	19	.04	03	38	.00115
57.0	49	.06	.05	75	.00087
87.0	74	OR	.07	100	oor-)7FJ
117.0	100	.07	.06	88	.00050

Table 5 (cont.)

DATE 7/31/75 STANDARD 6.95 MC/AMP TIME 6.0 HR EFF 29/77.5

DEPTH 30 M DARK ASSIM .01 MG/M3/HR

LIGHT (MF/M2/S)	MAX	ASSIM (MGC/M3/HR) L	N	MAX	NORMALIZED A/L
2.0	?	f)?	.01	14	.00399
5.0	4	● 03	.01	21	.00247
7.0	6	● n?	.01	19	.00155
1000	8	.03	.02	31	.00181
17.0	14	.03	.02	37	.00128
1900	16	● 07	.02	28	.00088
22.0	19	● (-)5	.04	60	.00162
57.0	49	● rt6	.04	75	.00078
87.0	74	● ln7	.06	100	.00068
117.0	100	● 06	.05	83	.00042

DATE 8/ 3/75 STANDARD 6.95 MC/AMP TIME 6.0 HR EFF 20/77.5

DEPTH 5 M DARK ASSIM .01 MG/M3/HR

LIGHT (MF/M2/S)	MAX	ASSIM (MGC/M3/HR) L	N	MAX	NORMALIZED A/l_
2.0	?	● f-)?	.00	25	.00213
5 . 0	4	.01	.00	8	.00028
700	6	.01	● no	8	.00020
10.0	8	.02	.00	25	.00043
17.0	14	.02	.01	71	.00071
19.0	16	● 0?	.00	21	.00019
22.0	19	.02	● QO	29	.00023
57.0	49	.03	.01	75	.00022
87.0	74	.03	.02	100	.00020
117.0	100	.03	.02	92	.00013

DATE 8/ 3/75 STANDARD 6.95 MC/AMP TIME 6.0 HR EFF 20/77.5

DEPTH 10 M DARK ASSIM .01 MG/M3/HR

LIGHT (MF/M2/S)	MAX	ASSIM (MGC/M3/HR) L	N	MAX	NORMALIZED A/L
2.0	?	.02	● n]	21	.00284
5*O	4	● O?	.00	16	.00085
7.0	6	.02	.00	8	.00030
10.0	8	.02	.01	26	.00071
17.0	14	.02	● f)]	26	.00042
19.0	16	.03	● O]	42	.00060
22.0	19	.02	● fll	37	.00045
57.0	49	.04	.02	87	.00041
87.0	74	.04	.02	87	.00027
117.0	100	.04	.03	100	.00023

Table 5 (cont.)

DATE 9/ 2/75 STANDARD 6.95 MC/AMP TIME 6.0 HR FFF 23/78.3

DEPTH 20 M DARK ASSIM.02 MG/M3/HR

LIGHT (MF/M2/S)	MAX	ASSIM (MGC/M3/HR) L	N	MAX	NORMALIZED A/L
2.0	2	●()?	.00	5	.00246
5.0	4	.03	.01	11	.00197
7.0	6	.02	.01	7	.00090
10.0	8	.03	.01	1b	.00148
17.0	14	.05	.03	33	.00178
19.0	16	●03	.02	20	.00096
22.0	19	.05	.04	41	.00170
57.0	49	.09	.07	79	".001?6
87.0	74	●1(-)	.08	93	.00097
117*0	100	●11	.09	100	.00078

DATE 8/ 2/75 STANDARD 6.95 Me/AMP TIME 6.0HR FFF 22/78.1

DEPTH 30 M DARK ASSIM .02 MG/M3/HR

LIGHT " (MF/M2/S)	MAX	ASSIM (MGC/M3/HR) L	N	MAX	NORMALIZED A/L
2.0	2	.04	● n3	48	.01472
5.0	4	.02	.00	7	.00086
7.0	6	.02	.00	0	.00000
10.0	8	.02	.00	5	.00029
17.0	14	.03	.01	19	.00068
19.0	16	.04	●Q?	38	.00125
22.0	19	.03	f)?	31	.00088
57.0	49	.05	●r14	62	.00067
87.0	74	.07	. 06	95	.00068
117.0	100	.08	.06	100	.00053

DATE 8/ 6/75 STANDARD 6.95 MC/AMP TIME 6.0HR FFF 76/74.3

DEPTH 5 M DARK ASSIM .01 MG/M3/HR

LIGHT (MF/M2/S)	MAX	ASSIM (MGC/M3/HR) L	N	MAX	NORMALIZED A/L
2.0	2	.01	.00	5	.00074
5.0	4	●(-)?	.00	14	.00089
7.0	6	●03	●Q?	60	.00264
19.0	8	.03	.01	43	.00133
17*O	14	●02	.01	31	.00057
19.0	16	.02	.01	24	.00039
22.0	19	●(-)3	.01	40	.00057
57.0	40	.04	.03	83	.00945
87.0	74	.04	.03	'100	.00036
117*O	100	.03	.02	71	.00019

Table 5 (cont.)

DATE 8/ 6/75 STANDARD 6.95 MC/AMP TIME 6.0 HR EFF 21/77.8

DEPTH 10 M DARK ASSIM .0] MG/M3/HR

LIGHT (MF/M2/S)	MAX	ASSIM (MGC/M3/HR) L	N	MAX	NORMALIZED A/L
2.0	?	.02	● I)1	11	.00283
5.0	4	.03	.02	3%	.00326
7.0	6	.01	.00	5	.00040
10.0	8	.02	.01	15	● f)oo78
17.0	14	.02	.01	23	.00071
19.0	16	.02	.01	21	.00056
22.0	19	.03	.02	32	.00074
57.0	49	.05	.03	66	.00060
87.0	74	.06	.05	100	.00059
117.0	100	.06	.05	100	.00044

DATE 8/ 5/75 STANDARD 6.95 MC/AMP TIME 6.0 HR FFF 20/77.5

DEPTH 20 M · DARK ASSIM .01 MG/M3/HR

LIGHT (MF/M2/S)	MAX	ASSIM (MGC/M3/HR) L	N	MAX	NORMALIZED A/L
2.0	2	.02	.00	2	.00072
5.0	4	.03	.01	18	.00?29
7.0	6	.02	.01	8	.00072
10.0	8	.02	● O1	15	.00093
1?.0	14	.03	.02	27	.00101
19.0	16	.03	.02	24	.00079
2',?.0'	19	.03	.02	31	.00088
57.0	49	.08	● O!3	98	.00108
87.0	74	.08	.06	100	'.00072
117.0	100	.07	.06	94	.00051

DATE 8/ 5/75 STANDARD 6.95 MC/AMP TIME 6.0 HR EFF 20/77.5

DEPTH 30 M DARK ASSIM .01 MG/M3/HR

LIGHT (MF/M2/S)	MAX	ASSIM (MGC/M3/HR) L	N	MAX	NORMALIZED A/L
2.0	?	.02	.01	9	.00255
5.0	4	.03	.01	22	.00247
7*O	6	● I)?	.01	13	.00104
10.0	8	● n3	.01	26	.00146
17.0	14	.03	.02	29	.00098
19.0	16	.03	.01	22	● r)0065
22.0	19	● 04	.02	40	.00103
57.0	49	.07	.06	100	.00100
87.0	74	.07	.05	94	.00061
117.0	100	.07	.06	97	.00047

Table 5 (cont.)

DATE 8/ 9/75 STANDARD 6.95 MC/AMP TIME 6.0 HR EFF 32/76.1

DEPTH 5 M DARK ASSIM .01 MG/M3/HR

LIGHT (MF/M2/S)	MAX	ASSIM (MGC/M3/HR) L	N	MAX	NORMALIZED A/L
2.0	?	0?	.00	3	.00145
5.0	4	0?	.00	5	.00087
7.0	6	.02	1?]	12	00155
10.0	8	.03	.01	13	.00123
1700	14	(-13	Q2	22	.00124
19.0	16	OL	.02	26	00130
2?.0	19	05	.03	36	00155
57.(-)	49	.06	.05	52	.00085
87.0	74	11	.09	100	.00107
117.0	100	II	.09	99	.00079

DATE 8/ 9/75 STANDARD 6.95 MC/AMP TIME 6.0 HR EFF 32/76.1

DEPTH 10 M DARK ASSIM .02 MG/M3/HR

LIGHT (MF/M2/S)	MAX	ASSIM (MGC/M3/HR) L	N	MAX	NORMALIZED 4/L
2.0	7	.03	.02	14	.90796
5.0	4	.03	f-)2	17	.00376
7.0	6	.03	.01	12	.00197
10.0	8	.04	.03	25	.00282
17.0	14	.05	.04	32	.00213
19.0	16	.05	.03	29	.00168
22.0	19	.05	n4	35	.00178
57.0	49	.09	.08	69	.00136
87.0	74	11	.10	88	.00112
117.0	100	.13	.11	100	.00095

DATE 8/ 8/75 STANDARD 6.95 MC/AMP TIME 6.0 H R EFF 35/74.8

DEPTH 20 M DARK ASSIM .01 MG/M3/HR

LIGHT (MF/M2/S)	MAX	ASSIM (MGC/M3/HR) L	N	MAX	NORMALIZED 4/L
2.0	2	.03	.01	9	.00590
5.0	4	.03	.02	12	.00324
7.0	6	.04	.02	17	.00326
10.0	R	.03	.02	14	.00192
17.0	14	.04	.03	20	.00160
19.0	16	.04	.02	17	.00116
22.0	19	.07	.05	39	.00238
57.0	49	.14	.12	93	.00217
87.0	74	.13	.11	84	.00129
117.0	100	.15	.13	100	.00114

Table 5 (cont.)

DATE 8/ 8/75 STANDARD 6.95 MC/AMP TIME 6.0 HR EFF 32/7 6.1

DEPTH 30 M DARK ASSIM .02 MG/M3/HR

LIGHT (MF/M2/S)	MAX	ASSIM (MGC/M3/HR) L	N	MAX	NORMALIZED A/L
2*O	2	.03	.01	23	.00591
5.0	4	.02	.01	12	.00118
7.0	6	.02	.01	12	.00084
10*0	8	.04	.02	42	.00214
17*O	14	.04	.03	49	.00148
19.0	16	● oh	.03	54	.00144
22.0	19	.04	.02	42	.00097
57.0	49	.07	.05	100	.00089
87.0	74	.06	.05	97	.00057
11790	100	.05	.03	62	.00027

DATE 8/ 7/75 STANDARD 6.95 MC/AMP TIME 6.0 HR EFF 34/75.2

DEPTH 60 M DARK ASSIM .02 MG/M3/HR

LIGHT (MF/M2/S)	MAX	ASSIM (MGC/M3/HR) L	N	MAX	NORMALIZED A/L
2.0	2	.02	● no	1	.00154
5.0	4	.06	● f)5	9	.00969
7.0	6	.06	.05	9	.00681
10.0	8	.10	.09	lb	.00877
17.0	14	.34	.32	58	.01892
19.0	16	.16	,15	26	.00765
22.0	19	.33	.32	57	.01437
5700	49	.57	.55	100	.00966
87.0	74	.30	● 28	52	.00327
117.0	100	.29	● ?7	49	.00233

DATE 8/12/75 STANDARD 6.95 MC/AMP TIME 6.0 HR EFF 28/77.9

DEPTH 5 M DARK ASSIM .01 MG/M3/HR

LIGHT (MF/M2/S)	MAX	ASSIM (MGC/M3/HR) L	N	MAX	NORMALIZED A/L
2.0	2	● 0?	.01	10	.00284
5.0	4	.02	.01	14	.00170
7.0	6	.02	.01	11	.00091
10.0	8	.03	.01	24	.00142
*17*0*	14	.04	.02	35	.00121
19.0	16	● f)4	.03	48	.00149
22.0	19	.04	.02	3s	.00094
*57*0*	49	.07	.06	100	.00105
87.0	74	.07	.06	96	.00066
117.0	100	● 07	.06	99	.00050

Table 5 (cont.)

DATE 8/1? /75 STANDARD 6.95 MC/AMP TIME 6.0 HR EFF 28/77.9

DEPTH 10 M DARK ASSIM .02 MG/M3/HR

LIGHT (MF/M2/S)	MAX	ASSIM (MGC/M3/HR) L	N	MAX	NORMALIZED A/L
2.0	?	.03	.01	9	.00355
5.0	4	●(-)3	r-I]	12	.00185
7.0	6	.03	.01	14	.00162
10*O	R	.03	.01	17	.00135
17*O	14	.05	●f13	43	.00?05
19*O	16	●r)&	.02	29	.00123
22*O	19	.05	.03	32	.00116
57*O	49	.08	.05	77	.00108
87.0	74	●09	.07	91	.00084
117.0	100	●10	.08	100	.00(169

DATE 8/11/75 STANDARD 6.95 MC/AMP TIME 6.0 HR EFF 29/77.5

DEPTH 20 M DARK ASSIM .02 MG/M3/HR

LIGHT (MF/M2/S)	MAX	ASSIM (MGC/M3/HR) L	N	MAX	NORMALIZED A/L
2*O	?	.02	.01	7	● r)0393
5.0	4	●03	.01	13	.00286
7.(-I	6	.02	.01	7	.00112
10.0	R	.03	●].	12	.00136
17.0	14	.04	●n?	22	.(-)0147
19.0	16	.04	.02	17	.00101
22.0	19	.06	.04	36	.00188
57*O	49	.08	● n5	56	.00113
87.0	74	.13	.11	100	.00131
117*O	100	.12	.11	93	.00091

DATE 8/11/75 STANDARD 6 0 9 5 MC/TIME 6.0 HR EFF 29/77.5

DEPTH 30 M DARK ASSIM .02 MG/M3/HR

LIGHT (MF/M2/S)	MAY	ASSIM (MGC/M3/HR) L	N	MAX	NORMALIZED A/L
2.0	2	.03	.01	5	.00435
590	4	.03	.01	6	.00203
7.0	6	.03	●fll	b	.00135
10.0	Q	.04	.02	11	.00181
17*O	14	.04	.02	15	.00145
19.0	16	.05	.03	17	.00149
22.0	19	.06	.04	23	.(-)0172
57.0	49	.09	●i17	4.3	.00127
87.0	7A	.12	.10	61	.00118
117*O	100	●]0	.17	100	.0014-!

Table 5 (cont.)

DATE 8/15/75 STANDARD 6.95 MC/AMP TIME 6.0 HR EFF 28/77.9

DEPTH 5 M DARK ASSIM .02 MG/M3/HR

LIGHT (MF/M2/S)	MAX	ASSIM (MGC/M3/HR) L	N	MAX	NORMALIZED A/L
2.0	2	.04	●[illegible]	35	.01007
5.0	4	.06	.04	65	.00733
7.0	6	.05	.03	52	.00421
10.0	8	●06	.04	71	.00403
17.0	14	●96	●[illegible]6	70	.00233
19.0	16	●04	.02	35	.00106
22.0	19	●06	.04	70	.00180
57.0	49	.07	.05	86	.00086
87.0	74	.06	.04	77	.00050
117.0	100	●OR	.06	100	.00049

DATE 8/15/75 STANDARD 6.95 MC/AMP TIME 6.0HR EFF 27/78.4

DEPTH 10 M DARK ASSIM .0? MG/M3/HR

LIGHT (MF/M2/S)	MAX	ASSIM (MGC/M3/HR) L	N	MAX	NORMALIZED A/L
2.0	?	.04	.02	25	.00751
5*O	4	.03	.01	20	.00243
7*O	6	.03	.01	13	.00112
10.0	8	●03	.01	23	.00136
17,0	14	.04	.02	35	.00122
19.0	16	.03	.01	12	.00038
22.0	19	.04	.02	27	.00075
57.0	49	.06	.04	69	.00023
87.0	74	.08	.06	92	.00063
117.0	100	.08	.06	100	.00051

DATE 8/14/75 STANDARD 6.95 MC/AMP TIME 6.2 HR EFF 27/78.4

DEPTH 20 M DARK ASSIM .02 MG/M3/HR

LIGHT (MF/M2/S)	MAX	ASSIM (MGC/M3/HR) L	N	MAX	NORMALIZED A/L
2.0	?	.03	.01	11	.00s53
5.0	4	.04	.02	18	.00387
7.0	6	.03	.01	12	.00178
10.0	8	.04	.02	20	.00208
17.0	14	.05	.03	28	.00175
19.0	16	.04	.02	24	.00131
22.0	19	.05	.03	27	.(-)0129
57.0	49	.11	.09	83	.00153
87.0	74	.12	.11	100	.00121
117.0	100	.12	.10	95	.00085

Table 5 (cont.)

DATE 8/14/75 STANDARD 6.95 MC/AMP TIME 6.0 HR EFF 28/77.9

DEPTH 30 M DARK ASSIM .02 MG/M3/HR

LIGHT (MF/M2/S)	MAX	ASSIM (MGC/M3/HR) L	N	MAX	NORMALIZED A/L
2.0	?	.03	.01	10	.00683
5.0	4	●n3	.01	Y	.00244
7.0	6	.04	.02	12	.00236
10*O	8	.06	.04	27	.00374
17*9	14	.06	.04	3.2	'.00?54
19.0	16	.06	●114	27	.00197
22.0	19	.07	.05	37	.00229
57*O	49	●I3	.10	77	.00184
87.0	74	●IL	.11	84	.00131
117.0	100	●16	.14	100	.00117

DATE 8/16/75 STANDARD 6.95 MC/AMP TIME 6.0 HR EFF 34/75.2

DEPTH 60 M. DARK ASSIM .02 MG/M3/HR

LIGHT (MF/M2/S)	MAX	ASSIM (MGC/M3/HR) L	N	MAX	NORMALIZED A/L
2.0	2	.09	.07	12	.03616
5.0	4	.26	.25	42	.04908
7.0	6	.20	.18	31	.02572
10.0	8	●AI	●%Q	100	.05886
17.0	14	.32	.30	51	.01774
19.0	16	● 31	.29	49	.01527
22.0	19	.35	.33	56	.01497
57.()	49	.44	.42	71	.00734
87.0	74	.48	●46	79	.00531
117.0	100	.42	.40	69	.00345

DATE 8/18/75 STANDARD -?.55 MC/AMP TIME 6.0 HR EFF 33/75.7

DEPTH 5 M DARK ASSIM .01 MG/M3/HR

LIGHT (MF/M2/S)	MAX	ASSIM (MGC/M3/HR) L	N	MAX	NORMALIZED A/L
2.0	?	.02	.01	31	.00538
5.0	4	.02	.01	19	.00135
7*O	6	●0?	.01	17	.00086
1000	R	.03	.02	50	.00175
17*O	14	.04	.02	62	.00127
19.0	16	● Q3	.01	38	.00071
22.0	19	.03	.02	60	.0009'5
57.0	49	●f)'i	.03	90	.00055
87.0	74	●I-)5	.03	100	.00040
117.0	100	.05	.03	100	.00030

Table 5 (cont.)

DATE 8/18/75 STANDARD 7.55 MC/AMP TIME 6.0 HR EFF 33/75.7

DEPTH 10 M. DARK ASSIM .01 MG/M3/HR

LIGHT (MF/M2/S)	MAX	ASSIM (MGC/M3/HR) L	N	MAX		NORMALIZED A/L
2.0	2	0-3	.01	4	1	.00605
5*O	4	.03	.02	52		.00309
7.0	6	.02	.01	34		.00144
10.0	8	.03	.02	55		.00161
17.0	14	Q3	.02	59		.00103
19.0	16	.03	.01	50		.00078
22.0	19	.04	.02	80		.(')0107
57..0	49	.04	.02	84		.00044
87.0	74	.04	.03	100		.00034
117.0	100	f)4	.03	93		.00024

DATE 8/17/75 STANDARD 7*55 MC/AMP TIME 6.0HR EFF 35/74.8

DEPTH 20 M DARK ASSIM .02 MG/M3/HR

LIGHT (MF/M2/S)	MAX	ASSIM (MGC/M3/HR) L	N	MAX	NORMALIZED A/L
2.0	?	.06	.05	65	.02315
5*O	4	.95	.03	49	.00694
7.0	6	n?J	.01	17	.00175
10.0	8	04	.02	28	.00197
17.0	14	.04	.03	36	.00148
19.0	16	.08	.07	94	.00351
22.0	19	.05	.03	47	.00152
57.0	49	.09	.07	10.0	.00124
87.0	74	.08	n+	84	.00068
117.0	100	.09	.07	98	.00059

DATE 8/17/75 STANDARD 7.55 MC/AMP TIME 6.0 HR FFF 33/75.7

DEPTH 30 M DARK ASSIM .02 MG/M3/HR

LIGHT (MF/M2/S)	MAX	ASSIM (MGC/M3/HR) L	N	MAX	NORMALIZED A/L
2.0	2	.04	.02	24	.00849
5.0	4	.04	.02	25	.00353
7*O	6	.03	.01	17	.00175
10.0	8	.05	.04	50	.00353
17.0	14	.06	.04	56	.00232
19.0	16	n&	Q2	35	.00129
22.0	19	.04	.03	38	.00120
5“?.0	49	.07	.05	72	.00088
87.0	74	.08	.06	82	.00066
117.0	100	.09	q7	100	.00060

Table 5 (cont.)

DATE 8/20/75 STANDARD 6.95 MC/AMP TIME 6.0 HR EFF 34/75.2

DEPTH 60 M DARK ASSIM .02 MG/M3/HR

LIGHT (MF/M2/S)	MAX	ASSIM (MGC/M3/HR) L	N	MAX	NORMALIZED A/L
2.0	2	.03	.01	6	.00579
5.0	4	.07	.05	28	.01050
7.0	6	.08	.06	34	.00915
10.0	8	.11	.09	46	.00864
17.0	14	.14	.12	62	.00686
19.0	16	.13	.11	60	.00589
22.0	19	.15	.13	70	.00593
57.0	49	.18	.16	87	.00286
87.0	74	.20	.18	98	00210
117.0	100	.21	.19	100	.00160

DATE 8/21/75 STANDARD 7.55 MC/AMP TIME 6.0 HR EFF 33/75.7

DEPTH 10 M DARK ASSIM .01 MG/M3/HR

LIGHT (MF/M2/S)	MAX	ASSIM (MGC/M3/HR) L	N	MAX	NORMALIZED A/L
2.0	2	.02	.01	13	.00436
5.0	4	.03	.02	32	.00429
7.0	6	.04	.03	42	.00402
10.0	8	.05	.03	51	.00349
17.0	14	.04	.03	40	.00158
19.0	16	.03	.01	21	.00074
22.0	19	.04	.03	38	.00116
57.0	49	.06	.05	71	.00085
87.0	74	.08	.07	100	.00078
117.0	100	.07	.06	84	.00049

DATE 8/23/75 STANDARD 7.55 MC/AMP TIME 6.0 HR EFF 32/76.1

DEPTH 60 M DARK ASSIM .02 MG/M3/HR

LIGHT (MF/M2/S)	MAX	ASSIM (MGC/M3/HR) L	N	MAX	NORMALIZED A/L
2.0	2	.03	.01	3	.00593
5.0	4	.06	.04	12	.00837
7.0	6	.08	.06	17	.00847
10.0	8	.11	.09	27	.00907
17.0	14	.16	.13	39	.00788
19.0	16	.16	.14	41	.00738
22.0	19	.21	.19	55	.00850
57.0	49	.34	.32	92	.00553
87.0	74	.35	.33	96	.00375
117.0	100	.36	.34	100	.00292

Table 5 (cont.)

DATE 8/24/75 STANDARD 7.55 MC/AMP TIME 7.1HR EFF 31/76.6

DEPTH 10 M DARK ASSIM .01 MG/M3/HR

LIGHT (MF/M2/S)	MAX	ASSIM (MGC/M3/HR) L	N	MAX	NORMALIZED 4/L
2.0	?	.02	.01	32	.00506
5.0	4	.02	.00	11	.00067
790	6	.02	.01	18	.00080
10.0	8	●n?	.01	26	.00084
17*O	14	●0?	.01	33	.00063
19.0	16	.03	.02	60	.001(-)1
.22.0	19	.03	.01	42	.00061
57.0	49	●n4	.02	75	● i-loo4?
87.0	7-4	.04	.03	86	.00032
117.0	100	●05	.03	100	.00027

DATE 8/27/75 STANDARD 7.55 MC/AMP TIME 6.0 HR EFF 35/74.8

DEPTH 5 M DARK ASSIM .02 MG/M3/HR

LIGHT (MF/M2/S)	MAX	ASSIM (MGC/M3/HR) L	N	MAX	NORMALIZED 4/L
2.0	2	.04	●02	54	.01086
5*O	4	.03	.01	19	.00149
7.0	6	.02	.01	17	.00097
10.0	8	.03	.01	32	.00129
17.0	14	.04	.02	56	.00132
19.0	16	.03	.01	29	.00061
2?.0	19	.03	.01	32	.00059
57.0	49	.06	.04	98	.00069
87.0	74	.06	.04	100	.00046
117*O	100	.05	.04	90	.00031

DATE 8/27/75 STANDARD 7.55 MC/AMP TIME 6.0 HR EFF 36/74.3

DEPTH 10 M DARK ASSIM .02 MG/M3/HR

LIGHT (MF/M2/S)	MAX	ASSIM (MGC/M3/HR) L	N	MAX	NORMALIZE A/L
2.0	?	.03	.01	10	.00512
5.0	4	.03	.01	13	.00259
7.0	6	.03	.01	9	.00127
10.0	8	.03	.01	14	.00143
17*O	14	.04	.03	27	.00157
19.0	16	.05	.03	29	.00151
22.0	19	.07	.05	52	.00239
57.0	49	.08	.06	63	.00110
87.0	74	.12	.10	1O(I	.00115
117.0	100	.11	.10	95	.00082

Table 5 (cont.)

DATE 8/26/75 STANDARD 7*55 MC/AMP TIME 6.0 HR FFF 31/76.6

DEPTH 20 M DARK ASSIM .02 MG/M3/HR

LIGHT (MF/M2/S)	MAX	ASSIM (MGC/M3/HR) L	N	MAX	NORMALIZED A/L
2.0	?	.05	.03	27	.01524
5*O	4	●05	.03	2 7	.00610
7.0	6	.04	.02	18	.(-)0293
10.0	Q	.05	.03	24	.00272
17.0	14	.07	.05	42	.(-)0?77
19*O	16	●03	.01	12	.00073
22.0	19	●07	● Q5	43	.00223
57.0	49	.12	.10	89	.00177
87.0	74	●13	.11	100	.00130
117.0	100	●1?	.10	89	.00087

DATE 8/26/75 STANDARD 7.55 MC/AMP TIME 6.0 HR FFF 31/76.6

DEPTH 30 M DARK ASSIM .02 MG/M3/HR

LIGHT (MF/M2/S)	MAX	ASSIM (MGC/M3/HR) L	N	MAX	NORMALIZED A/L
2.0	2	.02	.00	0	.00000
7.0	6	.03	.00	11	.00068
10.0	8	.03	.01	19	.00081
17.0	14	.05	.03	66	.00163
19.0	16	.04	.02	37	.00082
22.0	19	.04	.02	50	.00095
57.0	49	.06	●n4	9 7	.00071
87.0	74	.05	●04	94	.00045
117.0	100	.06	.04	100	● llot936

DATE 8/30/75 STANDARD 7.55 MC/AMP TIME 6.0 HR EFF 35/74.8

DEPTH 10 M DARK ASSIM .02 MG/M3/HR

LIGHT (MF/M2/S)	MAX	ASSIM (MGC/M3/HR) L	N	MAX	NORMALIZED A/L
2.0	?	.03	.01	6	.00407
5.0	4	.03	.01	9	.00244
7.0	6	.02	.01	5	.00087
1000	8	●n3	.01	9	.00115
17.0	14	.04	.02	18	.00144
19*O	16	.04	.02	16	.00111
22.0	19	.05	.03	21	.00130
57.0	49	.11	.09	66	.00156
87.0	74	.1?	.11	80	.00124
117.0	100	●15	.14	100	.00115

Table 5 (cont.)

DATE 9/ 2/75 STANDARD 7.55 MC/AMP TIME 6.0 HR EFF 21/77.8

DEPTH 10 M DARK ASSIM .0? MG/M3/HR

LIGHT (MF/M2/S)	MAX	ASSIM (MGC/M3/HR) L	N	MAX	NORMALIZED A/L
200	2	● 9?	.01	6	.00261
5.0	4	.02	.01	10	.00170
7.0	6	● f)?	.01	10	● f-Jo121
10.0	8	● 09	.08	86	.00750
17*0	14	● n4	.03	29	.00150
19.0	16	.03	.02	17	.00079
22.0	19	.04	.02	23	..000.92
57.0	49	.07	.05	61	● f)on93
87.0	74	● 10	.09	100	.0,0100
117.0	100	● 10	.09	99	.00074

DATE 9/ 5/75 STANDARD 7.55 MC/AMP TIME 6.0 HR EFF 15/76.2

DEPTH 5 M DARK ASSIM .01 MG/M3/HR

LIGHT (MF/M2/S)	MAX	ASSIM (MGC/M3/HR) L	N	MAX	NORMALIZED 4/L
2.0	?	● 01	.00	o	.00000
5.0	4	● 02	.00	2	.(-)0027
7.0	6	.02	.01	7	.00076
10.0	8	.03	.01	13	.00107
17.0	14	● n4	.02	29	.00137
19,0	16	.04	.02	27	.00112
22*O	19	.04	.02	31	.00112
57.0	49	.09	.07	93	.00131
87.0	74	.09	.08	94	.00087
117.0	100	.09	.08	100	.00068

DATE 9/ 5/75 STANDARD 7.55 MC/AMP TIME 6.0 HR EFF 15/76.2

DEPTH 10 M DARK ASSIM .0] MG/M3/HR

LIGHT (MF/M2/S)	MAX	ASSIM (MGC/M3/HR) L	N	MAX	NORMALIZED A/L
2.0	?	.03	.01	13	.00666
5.0	4	.02	.01	11	.00226
7.0	6	.03	.02	15	.00228
10.0	f?	.03	.01	14	.00147
1700	14	.04	● n?	24	.00145
19.0	16	.03	.02	21	.00112
22.0	19	.04	.03	28	.0013.?
57*O	49	.08	.06	61	.00110
87.0	74	.08	.07	63	.00075
117.0	100	.12	.10	100	● oo9@J3

Table 5 (cont.)

DATE 9/ 4/75 STANDARD 7.55 MC/AMP TIME 6.0 HR EFF 21/77.8

DEPTH 20 M DARK ASSIM .02 MG/M3/HR

LIGHT (MF/M2/S)	MAX	ASSIM (MGC/M3/HR) L	N	MAX	NORMALIZED A/L
2.0	2	.02	.01	7	.00261
5.0	4	.02	.01	13	.(-)0183
7*O	6	.02	.00	b	.00065
10.0	8	.03	.01	17	.00117
17.0	14	●04	.02	30	.00127
19.0	16	.04	.02	29	.00110
22.0	19	.05	.03	43	..00139
57.0	49	.07	.05	74	.00093
87.0	74	●07	.06	81	.00066
117.0	100	.09	.07	100	.00061

DATE 9/ 4/75 STANDARD 7.55 MC/AMP TIME 6.0 HR EFF 20/77.5

DEPTH 30 M DARK ASSIM .02 MG/M3/HR

LIGHT (MF/M2/S)	MAX	ASSIM (MGC/M3/HR) L	N	MAX	NORMALIZED A/L
.?.0	?	.02	.00	2	.00065
5.0	4	.02	.01	13	.00170
7.0	6	.02	.01	13	.00122
10.0	8	.03	.02	29	.00190
17*O	14	.05	.03	47	.00181
19.0	16	.05	.03	46	●!.)o15q
22.0	19	●ny	.03	52	.00158
57.0	49	.08	●f)6	98	.00114
87.0	74	.08	●07	100	.00076
117.0	100	.07	.06	87	.(-)0049

DATE 9/ 8/75 STANDARD 7.55 MC/AMP TIME 6.0 HR EFF 16/76.4

DEPTH 10 M DARK ASSIM .01 MG/M3/HR

LIGHT (MF/M2/S)	MAX	ASSIM (MGC/M3/HR) L	N	MAX	NORMALIZED A/L
2.0	2	.02	.00	4	.00199
5*O	4	.02	.01	5	.00106
7.0	6	.02	.01	6	.00095
10*O	8	.03	.01	12	.00126
17.0	14	.04	.02	20	.00129
19.0	16	.05	.03	30	.00171
22.0	19	.05	.03	31	.00151
57.0	49	.09	●Q9	75	.00142
87.0	74	.12	.11	100	.00124
117.0	100	.11	.10	90	.00083

Table 5 (cont.)

DATE 9/11/75 STANDARD 7.55 MC/AMP TIME 6.0HR FFF 26/78.8

DEPTH 60 M DARK ASSIM .02 MG/M3/HR

LIGHT (MF/M2/S)	MAX	ASSIM (MGC/M3/HR) L	N	MAX	NORMALIZED A/L
2.0	?	● fl?	.01	3	.00374
5.0	4	.05	.03	1.3"	.00598
7.0	6	.05	.04	16	.00525
10*O	8	.09	.07	32	,00707
17*O	14	.09	.07	30	.00409
19.0	16	● P9	.07	33	.00387
22.0	19	.24	.22	100	.01017
57.0	49	● 17	.15	69	.00270
87.0	74	.16	.14	63	.00163
117.0	100	.19	.17	78	.00149

DATE 9/14/75 STANDARD 7.55 MC/AMP TIME 6.0 HR FFF 15/76.2

DEPTH 5 M DARK ASSIM .01 MG/M3/HR

LIGHT (MF/M2/S)	MAX	ASSIM (MGC/M3/HR) L	N	MAX	NORMALIZED A/L
2.0	2	.02	.01	8	.00400
5.0	4	.02	● n]	12	.00226
7.0	6	.03	● n]	13	.00181
10.0	8	.03	.02	19	.00187
17.0	14	.05	.04	38	.00216
19.0	16	.04	.03	30	● 00151
22.0	19	.05	.04	40	.00176
57.(-)	49	.09	● O9	80	.00134
87.0	74	.09	.08	82	.00090
117.0	100	.11	.10	100	.00082

DATE 9/14/75 STANDARD 7.55 MC/AMP TIME 6.0 HR FFF]6/76.4

DEPTH 10 M DARK ASSIM .01 MG/M3/HR

LIGHT (MF/M2/S)	MAX	ASSIM (MGC/M3/HR) L	N	MAX	NORMALIZED A/L
2.0	?	.02	.01	5	.00266
500	4	.03	.01	10	.00239
7.0	6	.03	.01	10	.00171
10.0	8	● 03	.02	18	.00206
17.0	14	● n/i	.03	24	.00164
19*O	16	.04	.03	.21	.00133
22.0	19	.05	.04	32	.00172
57.0	49	● 10	.08	70	.00144
87.0	74	.09	.08	68	.00092
117.0	100	● I3	.12	100	.00100

Table 5 (cont.)

DATE 9/17/7% STANDARD 7.55 MC/AMP TIME 6.0 HR EFF 13/75.6

DEPTH 20 M DARK ASSIM .01 MG/M3/HR

LIGHT (MF/M2/S)	MAX	ASSIM (MGC/M3/HR) L	N	MAX	NORMALIZED A/L
2.0	?	.02	.01	6	.00268
5.0	4	.02	.01	11	.00215
7.0	6	.02	.01	11	.00144
10.0	8	.03	.02	17	.00161
17.0	14	.(14	.02	25	.00142
19.0	16	.04	.03	27	.00134
22.0	19	.05	.04	39	.00168
57.0	49	●f)R	.07	75	.00125
87.0	74	.10	.08	89	,(')0097
117.0	100	.11	.10	100	.00081

DATE 9/13/75 STANDARD 7.55 MC/AMP TIME 6.0 HR EFF 13/75.6

DEPTH 30 M· DARK ASSIM .01 MG/M3/HR

LIGHT (MF/M2/S)	MAX	ASSIM (MGC/M3/HR) L	N	MAX	NORMALIZED A/L
2.0	?	●0?	●n]	7	.00369
5.0	4	.03	.01	14	.00282
7*O	6	.03	.01	15	.00211
10.0	8	.04	.03	27	.00262
17.0	14	.06	.04	44	.00253
19.0	16	●05	.03	33	.00173
22.0	19	.06	.05	48	.00213
57.0	49	.09	.08	76	.00132
87.0	74	●11	.10	99	.00112
117.0	100	*11	.10	100	.00084

DATE 9/29/75 STANDARD 6.35 MC/AMP TIME 6.0 HR EFF 23/78.3

DEPTH 5 M DARK ASSIM .02 MG/M3/HR

LIGHT (MF/M2/S)	MAX	ASSIM (MGC/M3/HR) L	N	MAX	NORMALIZED A/L
2*O	2	.02	.01	6	.00462
5.0	4	.04	●II2	14	.(-)0447
7.0	6	.05	.03	21	.00473
10.0	8	.05	.04	2 4	.00370
17.0	14	.08	.07	45	.00408
19.0	16	●OR	.06	40	.00328
22.0	19	.09	.07	46	.00322
57.0	49	.15	.13	85	.00231
87.0	74	.17	.15	100	●0017$1
117.0	100	●16	.14	93	.00122

Table 5 (cont.)

DATE 9/29/75 STANDARD 6.35 MC/AMP TIME 6.0 HR FFF 23/78.3

DEPTH 10 M DARK ASSIM .0] MG/M3/HR

LIGHT (MF/M2/S)	ASSIM (MGC/M3/HR) MAX	L	N	MAX	NORMALIZED A/L
2.0	?	.05	.04	31	.02118
5.0	4	.04	.03	22	.(-)0585
7.0	6	.04	.03	22	.0(-) 4.29
10.0	8	.05	.04	31	.00416
17.0	14	.08	.07	51	.00408
19.0	16	.08	.07	49	.00353
22.0	19	.09	.08	61	.00378
57.0	49	.14	.13	98	.00234
87.0	74	.15	.14	100	.00156
11700	100	.14	.13	99	.00115

DATE 9/28/75 STANDARD 6.35 MC/AMP TIME 6.0 HR FFF 10/74.8

DEPTH 20 M D4RK ASSIM .01 MG/M3/HR

LIGHT (MF/M2/S)	ASSIM (MGC/M3/HR) MAX	L	N	MAX	NORMALIZED A/L
2.0	2	.03	.02	1.2	.00766
5.0	4	● f)4	f)?	20	.00500
7.0	6	● OF	.03	28	.00495
10.0	8	.05	.03	26	.00322
17.0	14	.07	.05	44	.00322
19.0	16	.05	.04	30	.00195
22.0	)0	.08	.06	52	.00293
57.0	4Q	.12	.11	90	.00194
87.0	74	.14	.12	100	.(')014?
117.0	100	.12	.10	83	.00088

DATE 9/28/75 STANDARD 6.35 MC/AMP TIME 6.0 Hi? FFF 11/75.1

DEPTH 30 M DARK ASSIM ,0] MG/M3/HR

LIGHT (MF/M2/S)	ASSIM (MGC/M3/HR) MAX	L	N	MAX	NORMALIZED 4/L
2.0	2	.02	.01	1 1	.00482
5* 0	4	●0G	.02	25	.00466
7.0	6	.03	.02	23	● f3079Q
10.0	8	.04	.02	26	.00241
17.0	14	.06	●0%	54	.00288
19.0	16	.06	.04	46	.00220
22.0	19	.07	.05	57	.00237
57.0	49	.11	●(19	100	.00161
87.0	74	.10	●08	89	.00094
117.0	100	.10	.08	92	.0007.2

		Page Number
B.	Chlorophyll *a*	
	Table 1.	130
	Analysis of variance of transformed chlorophyll a concentrations pooled into 5-day time cells at 4 depths	
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	Analysis of variance of the transformed chlorophyll a concentrations for 10 replication experiments at 4 depths	
	Table 3.	132
	Chlorophyll a concentrations measured at AIDJEX main camp	

Table 1. Analysis of variance of transformed chlorophyll a concentrations pooled into 5-day time cells at 4 depths

Depth	Source	Pooled DF	Ss	MS	F
5 m	Between time cells	23	5.574	0.242	12.9*
	Within time cells	51	0.954	0.019	
	Total	74	6.528		
10 m	Between time cells	23	6.153	0.268	14.1*
	Within time cells	53	1.004	0.019	
	Total	76	7.157		
20 m	Between time cells	23	4.539	0.197	13.1*
	Within time cells	53	0.800	0.015	
	Total	76	5.339		
30 m	Between time cells	23	2.591	0.113	8.0*
	Within time cells	51	0.720	0.014	
	Total	74	3.312		

* $P < 0.01$ $F_{0.01}(23,51) \simeq 2.18$ $F_{0.01}(23,53) \simeq 2.15$

Table 2. Analysis of variance of transformed chlorophyll a concentrations for 10 replication experiments at 4 depths

Depth	Source	DF	Ss	MS	F
		Replication .			
5 m	Between days	9	1.280	0.142	106.1*
	Within days	30	0.040	0.001	
	Total	39	1.320		
10 m	Between days	9	1.712	0.190	88. 3*
	Within days	30	0.065	o.002	
	Total	39	1.776		
	Between days	9	1.116	0.124	120.1*
	Within days	30	0.031	0.001	
	Total	39	1.147		
30 m	Between days	9	0.531	0.059	35.2*
	Within days	30	0.050	0.002	
	Total	39	0.581		

* $p < 0.01$ $\quad$ $F_{0.01}(9,30) \simeq 3.06$

Table 3. Chlorophyll a concentrations measured at AIDJEX main camp,

CHLOROPHYLL A (MG/M^3) FOR JUNE 1975

DEPTH (M)	2	5	8	11	14	17	20	23	26	29	DAY
3	.09	.10	.09	.08	.05	.07	.03	.04	.03	.02	
5	.10	.10	.10	.08	.06	.06	.04	.04	.02	.01	
10	.11	.09	.10	.08	.06	.05	.03	.02	.02	.01	
15	.11	.11	.09	.09	.06	.07	.03	.03	.02	.01	
20	.10	.11	.08	.08	.06	.05	.03	.03	.02	.01	
25	.08	.09	.11	.07	.07	.05	.03	.03	.02	.01	
30	.09	.10	.08	.07	.06	.04	.03	.02	.02	.01	
35	.08	.11	.06	.07	.07	.05	.04	.03	.02	.01	
40	.06	.08	.08	.07	.07	.04	.04	.03	.02	.02	
45	.06	.08	.09	.08	.06	.05	.05	.03	.03	.02	
46				.07		.06				.02	
48				.09		.05				.03	
50	.07	.10	.08	.07	.06	.06	.06	.03	.03	.03	
52				.06		.08				.03	
54				.05		.09				.04	
56				.05		.11				.04	
58				.04		.08				.08	
60		.06	.04	.04	.06	.05	.08	.05	.05	.07	
62				.04		.06				.05	
64				.04		.04				.03	
80				.02		.00				.01	
100				.00		.00				.00	

Table 3. (continued)

CHLOROPHYLL A (MG/M^3) FOR JULY 1975

DEPTH (M)	2	5	8	11	14	17	20	23	26	29 DAY
3	.02	.03	.01	.03	.01	.01	.01	.01	.01	.01
5	.02	.03	.01	.03	.01	.01	.01	.01	.01	.01
10	.01	.02	.01	.03	.01	.01	.01	.01	.01	.02
15	.01	.03	.01	.03	.02	.01	.01	.01	.01	.01
20	.03	.03	.01	.03	.02	.01	.01	.01	.01	.02
25	.03	.03	.01	.04	.02	.01	.02	.02	.01	.03
30	.01	.03	.01	.03	.02	.02	.02	.02	.01	.03
35	.02	.04	.02	.03	.03	.02	.02	.02	.02	.03
40	.04	.04	.04	.03	.03	.03	.03	.02	.02	.03
45	.04	.06	.05	.04	.04	.05	.04	.03	.02	.04
46		.10		.04		.06				.02
48		.11		.06		.07				.02
50	.04	.11	.08	.06	.05	.09	.05	.04	.03	.02
52		.11		.09		.10				.02
54		.13		.09		.10				.04
56		.12		.11		.13				.07
58		.11		.08		.12				.12
60	.11	.11	.12	.07	.08	.12	.14	.26	.19	.13
62		.12		.10		.13				.13
64		.12		.09		.14				.10
80		.03		.04		.05				.07
100		.01		.01		.02				.03

Table 3. (continued)

CHLOROPHYLL A (MG/M³) FOR AUGUST 1975

DEPTH (M)	1	4	7	10	13	16	19	22	25	28	31 DAY
3	.01	.02	.02	.03	.02	.03	.01	.03	.02	.03	*.02
5	.02	*.02	.01	.03	.02	.02	.02	.02	.02	.03	.02
10	.01	.01	.01	.04	.02	.03	.01	.02	.02		.02
15	.01	.02	.03	.03	.02	.05	.02	.02	.02	.03	.04
20	.02	.03	.06	.03	.03	.04	.02	.04	.02	.03	.04
25	.03	.02	.04	.04	*.03	.04	.02	.04	.03	.03	.03
30	.02	.02	.03	.03	.04	.04	.03	.03	.03	.04	.04
35	.03	.03	.04	.03	.06	.07	.03	.03	.03	.05	.04
40	.04	.04	.04	.04	.09	.05	.05	.04	.05	.05	.06
45	.06	.08	.06	.05	.19	.06	.10	.07	.07	.06	.12
46	.04		.06	.07	.19	.08	.07	.05	.08	.10	.07
48	.07		.06	.10	.14	.07	.10	.09	.08	.12	.09
50	.06	.09	.08	.11	.17	.10	.13	.12	.09	.11	.10
52	.08		.12	.10	.17	.10	.16	.14		.12	.11
54	.07		.12	.10	.14	.11	.16	.14	.12	.10	.18
56	.11		.10	.10	.14	.18	.15	.14	.14	.08	.17
58	.14		.14	.08	.09	.14	.10	.11	.12	.09	.14
60	.17	.20	.16	.09	.08	.13	.08	.11	.12	.11	.14
62	.26		.15	.09	.07	.14	.08	.10	.10	.09	.11
64	.24		.14	.10	.06	.12	.06	.10	.10	.07	.08
80	.05		.08	.06	.04	.06	.04	.04	.04	.05	.05
100	.03		.05	.04	.02	.04	.03	.03	.03	.02	.02

Table 3. . (continued)

CHLOROPHYLL A (MG/M) FOR SEPTEMBER 1975

DEPTH (M)	3	6	9	12	15	18	21	24	27	30 DAY
3	.03	.02	04	05	.06	.05	.04	05	.04	U4
5		.03	.05	.05	.04	.06	05	05	04	.04
10	.03	.03	.04	.06	.04	.04	.05	.05	04	04
15	.05	03	.04	.04	03	.04	.05	.05	.04	.04
20	.05	.02	.04	04	.04	.02	05	05	04	04
25	.03	.04	.03	.04	.03	03	05	*O5	.04	.04
30	.04	.04	.03	.04	04	.04	05	.05	004	.04
35	.04	.04	.04	.04	*O5	.04	.05	.06	*O4	.04
40	.04	.04	.04	.06	.08	.05	.05	06	05	.06
45	.05	05	.06	0Y	12	.05	.07	.07	.06	.06
46	.05	.06	06	.10	.08		.07	.08	.06	.06
48	.04	07	.07	.08	.08		.07	.08	07	.06
50	.06	.07	.07	.10	.08	.09	.08	07	.06	.05
52	.10	G8	.08	.12	.08		.08	.06	05	.05
54	.10	.09	.08	12	.08		.07	.07	.05	.05
56	.12	11	.09	.11	.08		.08	.05	05	.06
58	.11	12	.10	11	.08		07	.05	05	.04
60	.12	1;	.09	lo	.08	.08	.07	.05	.05	.06
62	.12	.12	.07	10	07		.06	04	.04	.0s
64	12	I1	.08	.09	.06		.06	.04	03	.04
80	03	04	.04	.04	.05		.03	.02	.02	02
100	.02	.02	02	U2	.03		02	01	(-)2	*O2

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C. Zooplankton

Table 1. *137*

Number of adult females and copepodite stages I-V for *Calanus hyperboreus*, *C. glacialis*, and *Euchaeta glacialis*

Table 1. Numbers of adult females and copepodite stages I-V for *Calanus hupęrboreus*, *C. glacialis*, and *Euchaeta glacialis* as sampled by 150–0 m net hauls-8 times during summer 1975

	June		July		August	September		
Stage \ Date	7	24	12	30	17	4	13	28
				Calanus hyperboreus				
Females	20	54	71	73	20	35	54	26
v	39	44	47	47	7	34	43	14
IV	22	16	3	14	23	42	48	57
III	0	0	0	0	43	319	371	138
II	0	0	0	0	115	32	8	0
I	0	0	0	0	5	0	0	0
				Calanus glacialis				
Females	7	16	63	40	24	7	17	17
v	1	7	10	13	6	6	9	8
IV	1	1	0	0	0	0	0	0
III	0	0	0	1	1	2	4	19
II	0	0	0	0	30	24	17	17
I	0	0	43	25	67	7	27	11
				Euchaeta glacialis				
Females	0	0	2	5	3	2	5	3
v	0	3	6	8	9	5	7	5
IV	2	1	0	0	2	3	6	3
III	0	3	15	65	39	8	8	2
11	21	13	12	2	1	2	2	1
I	0	0	0	0	0	0	0	0