SOUTH AFRICAN ASSOCIATION FOR
MARINE BIOLOGICAL RESEARCH

OCEANOGRAPHIC RESEARCH INSTITUTE

Investigational Report No. 20

Primary Production Studies in the Agulhas Current Region off Natal — June, 1965

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Joan Burchall

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Introduction

A survey of the Agulhas current region off Natal was conducted by the vessel, *RSA*, during June 1965. This survey was a collaborative effort between the National Physical Research Laboratory (Oceanography Division) of the Council for Scientific and Industrial Research and the Oceanographic Research Institute, and represents part of the Republic of South Africa's contribution to the I.I.O.E. programme. Representatives of the Oceanographic Research Institute participated to investigate productivity and species composition of phytoplankton communities. An account of qualitative studies is given by Thorrington-Smith (1968) in press.

Stations were positioned on five short transects (each about fifty miles long), and on one long transect (240 miles long) off Durban (Fig. 1). The five short transects were situated between the Tugela river mouth in northern Natal and Green Point which lies south of Durban. Each transect was covered twice during the initial stage of the cruise schedule. The long transect off Durban was also covered twice at a later stage and on both occasions bad weather prevented the vessel from reaching the last two stations.

Stations occupied for productivity studies were limited to two stations per day. Hence, less than five stations were occupied on each transect and only on rare occasions was a station occupied twice. A total of 25 stations were occupied for primary productivity studies (Fig. 1 and Table 1). At 15 stations, samples were obtained from five depths in the euphotic zone. At the remaining 10 stations only surface samples were obtained. These samples were intended for primary productivity determinations and hydrological determinations including: temperature, salinity, and inorganic nutrients (phosphorus, nitrite-nitrogen, nitrate-nitrogen and silica).

The cruise track was somewhat erratic at times due to the influence of changing current and wind velocity. Heavy seas were encountered throughout the cruise and as the roll of the vessel was pronounced in even a moderate sea, excessive strain was placed on all equipment. Furthermore, the drift relative to the surface water was a most disturbing feature. High drift speeds on station made it difficult to lower water samplers vertically. Another disadvantage on station was that the sampling position on deck was often such that a photometer could only have been lowered into the shadow of the vessel. It was not possible to re-position the vessel in order to expose the photometer to full sunlight. This meant that the sampling procedure had to be improvised by using depths ascertained for the previous station.

It is apparent that present knowledge of the phytoplankton and hydrology of the Agulhas current region near Durban, precludes more than a preliminary report at this stage of off-shore investigations. Extremely unfavourable weather and sea conditions which prevailed during the cruise limited the number of stations occupied, and errors were introduced by the practical difficulties of sampling aboard M.V. *RSA*. These factors alone make interpretation of the results difficult. However, with these reservations clearly in mind, the intention behind this report is to submit the results obtained for their descriptive value and to assist in future research in this region.

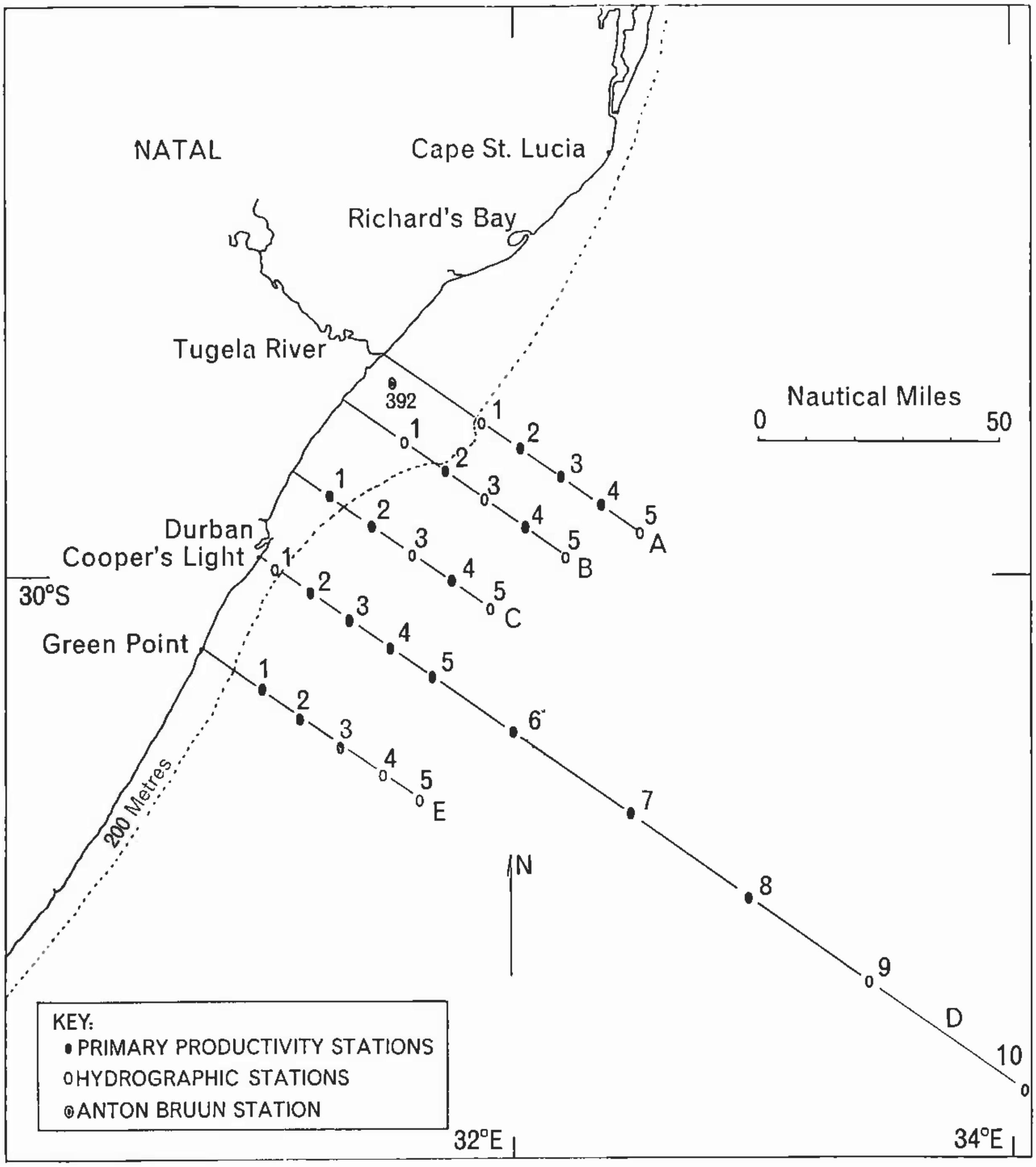

Fig. 1. Cruise track of M.V. RSA – June, 1965.

Methods

Primary production measurements

The rate of carbon assimilation by phytoplankton was measured by the C^{14} technique of Steemann Nielsen (1952). At each station occupied, water samples were obtained using van Dorn water samplers with a capacity of six litres. Samples were collected from five depths in the euphotic zone, namely from the surface and from those depths corresponding to 50%, 25%, 10% and 1% of the surface light intensity. These depths were established using a submarine photometer fitted with an Evans electroselenium type photocell, as described by Steemann Nielsen and Jensen (1957). When sea and weather conditions were unfavourable, only surface samples were taken.

Sample water from each depth was dispensed into three 125 ml glass bottles and to each bottle was added 1 ml of $NaHC^{14}O_3$ of activity 4 microcurie. Of the three sub-samples, two were exposed to sunlight in an incubator, and the third dark bottle similarly exposed was used as control. The incubator was supplied with circulating sea water which maintained the samples at sea surface temperature. Samples were incubated for 24 hours. The shipboard incubator consisted of five clear perspex tubes fitted with neutral density metal screens in order to simulate the light intensities of the depths sampled. Each tube was designed to accommodate four bottles. The tubes were inclined on a wooden support in an unshaded position on deck. This incubator was similar to that used on the R.V. *Anton Bruun*, which took part in the U.S. programme in biology for the I.I.O.E. (Ryther, Hall, Pease, Bakun and Jones, 1966).

After incubation all samples were filtered through membrane filters (group 2, Membranfilter, Göttingen). The filters were placed in special holders to prevent shrinkage during drying and then stored in plastic containers. These containers were placed inside metal cannisters containing silica gel.

In the laboratory ashore, the filters were exposed to fuming hydrochloric acid for 20 minutes to remove all traces of inorganic radioactive carbon. A Geiger-Müller counter tube with a Philips scaler (type 111.531) was used to measure the activity of both the phytoplankton samples and the radiocarbon solution. At each depth the activities of the illuminated bottles were averaged and a correction for non-photosynthetic uptake of C^{14} was applied by subtracting the dark bottle counts. The carbonate-carbon content of sea water was calculated for each depth using temperature and salinity data, and assuming a pH of 8.20. Primary productivity was calculated as milligrams of carbon assimilated per cubic metre per day ($mgC/m^3/day$). By integration, the production in the water column beneath one square metre surface was calculated and results were expressed as milligrams of carbon assimilated per square metre per day ($mgC/m^2/day$). The hours of daylight (to the nearest 0.25 hour) between sunrise and sunset were used in the calculations of daily production (Table 2).

Hydrographic data

Salinity

All salinity determinations were carried out at the regional laboratory of the Council for Scientific and Industrial Research, Durban. The determinations were carried out using a conductometric technique. The meter was calibrated with standard sea water and the salinity values, expressed as parts per thousand (‰) are considered to have an accuracy of at least 0.01 parts per thousand (Table 3).

Temperature

Graduated centigrade thermometers were mounted inside the van Dorn samplers. Temperatures were read immediately the samplers were brought to the surface (Table 3).

Inorganic Nutrients

Sample water from each depth was stored in polyethylene bottles in a deep freeze. All analysis of samples took place in the laboratory ashore using a Beckman DU spectrophotometer. The method used for the determination of inorganic phosphorus was that given by Murphy and Riley (1962), nitrate-nitrogen as given by Mullin and Riley (1955), nitrite-nitrogen as given by Rider and Mellon (1946), and silica as given by Mullin and Riley (1955). The concentration of inorganic nutrients has been expressed in each case in milligram atoms per cubic metre, (mg-at/m^3), (Table 3).

Hydrography

Agulhas current measurements

The Agulhas current of subtropical origin flows south-west off Natal following the edge of the continental shelf. There is evidence of a counter current near the coast but this feature is very variable (Anderson 1967, unpublished). On 15.5.65 on transect C, a tongue of north-flowing water projected under the Agulhas current surface water for a distance of nearly ten miles. Hence at C2 on this date, the surface water was south-flowing to a depth of about 60 metres with a north-flowing counter current to a depth of almost 200 metres. Below this depth the water was south-flowing as at the surface. On 20.6.65, again on transect C, the boundary between the north- and south-flowing water was almost vertical at a distance of 25 miles off-shore, and at C2 the current was entirely north-flowing. On 21.6.65 on transect D, 12 miles off-shore the boundary between north- and south-flowing water was almost vertical. At D2 on this date, the current at the surface was weakly north-flowing, changing to a south-flowing current at about 30 metres. A current section along transect D on 28.6.65 revealed that at all stations the water was entirely south-flowing, with no evidence of a counter current (Anderson 1965, unpublished).

On occasions there seemed to be a subsurface influx of water from the east in the region of 40 to 60 miles off-shore. According to Anderson (1965, unpublished), this may be due to the confluence of the Agulhas current with a different water mass, an inference which was borne out by temperature and salinity data.

Distribution of temperature and salinity

In general, the core of the Agulhas current was found to constitute a trough of warm water having a low salinity (Anderson 1965, unpublished). At D3 on 21.6.65, where the current velocity at the surface was more than 1.50 metres/second, surface temperature was 22.20°C and surface salinity 35.03°/$_{oo}$ (Table 3). The counter current near the coast is cooler than the Agulhas current but the hydrographic data indicates that it does not constitute a different water mass from that of the main Agulhas stream, but essentially forms part of the same system (Anderson 1965, unpublished).

Transect B was situated south-east of Tugela river mouth where the continental shelf widens to about 20 miles. B2 and B4 were occupied on 14.6.65. It is unknown to what extent, if any, the flow of fresh water from the Tugela river influences the hydrology of the area about 20 miles off-shore where B2 was situated. In terms of temperature and salinity, the water column at B4 was evenly mixed, whilst at B2 there were distinct changes with depth, salinity increasing from 35.23°/$_{oo}$ at the surface to 35.34 °/$_{oo}$ at about 55 metres, whilst temperature showed a corresponding decrease from 20.70°C at the surface to 15.70°C at about 55 metres (Table 3). The latter was the lowest temperature recorded during the cruise for any depth in the euphotic zone.

There were also very apparent changes in temperature and salinity in the region of the eastern boundary of the Agulhas current. It was found that on the surface there was often a drop in temperature and a rise in salinity somewhere between 45 and 65 miles off Durban. On 28.6.65 at D5, temperature was 21.75°C at the surface and salinity 35.21°/$_{oo}$. At D6 on 25.6.65, surface measurements of temperature and salinity yielded values of 19.65°C and 35.58°/$_{oo}$, respectively (Table 3). One of the highest salinity values of the cruise was obtained at D8 on 27.6.65, namely 35.57°/$_{oo}$. Surface temperature at this station was 19.80°C. These differences, particularly in salinity, indicate a different mass of water at the eastern boundary of the Agulhas current (Anderson 1965, unpublished).

Distribution of inorganic nutrients

Considerable variation both horizontally and vertically was obtained in the distribution of inorganic nutrients. Variation at stations over short periods of time was also encountered (Table 3). The results thus do not allow more than general observations on distribution.

Surface distribution

Inorganic phosphorus values ranged from 0.17-0.63 mg-at/m^3. During Cruise 1 of R.V. *Africana II* with the exclusion of coast stations 1-4 which were in an area of upwelling, the surface distribution of inorganic phosphorus ranged from 0.25-0.54 mg-at/m^3 (Mitchell-Innes, 1967). There is considerable agreement between the two sets of data. The lowest surface value of 0.17 mg-at/m^3 was obtained at B4 near the 'core' of the Agulhas current. On 25.6.65 high surface values of 0.57 and 0.56 mg-at/m^3 were obtained at D6 and D7, respectively, and at D5 only three days later, 0.63 mg-at/m^3, the highest surface value. These values were obtained during observations of a subsurface influx of a different water mass at the eastern boundary of the Agulhas current.

Inorganic nitrate-nitrogen values ranged from 0.78-5.07 mg-at/m^3. At D8 the surface value was relatively high at 3.85 mg-at/m^3. At this station the concentration of nitrite-nitrogen, 0.23 mg-at/m^3, was also relatively high, whilst the range of values for the entire cruise was 0.07-0.26 mg-at/m^3. The surface distribution of inorganic silica ranged from 0.11-3.65 mg-at/m^3.

Vertical distribution

Unusually high concentrations of inorganic nutrients were obtained at B2 on 14.6.65. These results confirm similar observations made on board R.V. *Anton Bruun* during September 1964 at station 392 (total depth about 50 metres) (Fig. 1). B4 was also occupied on the same day and the nutrient values were found to be much lower than those obtained at B2. A similar feature of distribution was also found on transect C the following day. Of the two stations occupied on transect C, C4 was almost at the 'core' of the Agulhas current, whilst C2 at a depth of about 370 metres was very much nearer the continental shelf. There was also a counter current at C2 on this date, projecting under the Agulhas current surface water at a depth of about 60 metres (Anderson 1965, unpublished). The general order of nutrient values obtained at C2 was higher than at C4, particularly in the lower region of the euphotic zone (Table 3).

The variation in concentration of inorganic nutrients at one station over short periods of time is illustrated by the results obtained at D3 (Table 3). On the second occasion that D3 was occupied, the concentrations of inorganic nutrients were generally much lower than when the station was first occupied nine days earlier. This feature of distribution alone almost precludes interpretation of the results, when so little information is actually available.

Primary production results

Primary production results are presented in Table 2. The highest value was obtained at station B2, lying south-east of Tugela river mouth in 281 metres. Values for the entire cruise ranged from this high value of 942 mg C/m^2/day to the lowest value of 17 mg C/m^2/day at station C4.

The highest surface measurement of primary productivity was obtained in the vicinity of the continental shelf, namely 119 mg C/m^3/day at D2, supported by the next highest value of 55 mg C/m^3/day at B2 (Table 2). These values are exceptionally high. The lowest measurements of surface primary productivity were obtained at the deeper stations, but on occasions when such stations were occupied twice at a time interval of a few days, surface values showed considerable variation, e.g. measurements of surface production at B4, C4, D5 and D7 (Table 2). This feature of surface distribution probably reflects something of the tremendous variation in position and flow rate of the Agulhas current from day to day (see hydrographic discussion, page 6).

It was apparent that primary production (mg C/m^2/day) was due essentially to photosynthetic activity in the upper region of the euphotic zone. Of the fourteen stations at which primary productivity was measured at five depths in the euphotic zone, in seven cases the highest rate of photosynthesis was at a depth of 50% light intensity, and in four cases at the surface (Table 2).

Winter characteristics of primary productivity

Only 25 stations were occupied in the area during June 1965 and thus the information available at present permits no more than a general analysis of primary productivity distribution during winter in the Agulhas current region. Essentially, the lowest measurements of primary production were obtained in the 'core' of the Agulhas current. Relatively higher measurements were obtained in the vicinity of the continental shelf and also at the eastern boundary of the Agulhas current. Nutrient determinations at stations on transects B and C revealed the greater fertility of continental shelf waters relative to the mainstream of the Agulhas current. High rates of primary production in inshore waters were associated with these areas of greater fertility, especially in the region south-east of Tugela river mouth.

At the present time it is not yet known to what extent land drainage effects influence the availability of nutrients in the vicinity of the continental shelf. The Tugela and the Umgeni rivers are the largest in Natal, but there are also numerous smaller rivers which flow into the Agulhas current near Durban. Sugar mills are sited on many of these smaller rivers and are responsible for the discharge of waste material which flows downstream to the estuarine zones. Little work has been done to monitor the effects of such discharge on local sea conditions, or to investigate the effects of land drainage from fertilised cane fields, through which most of the smaller rivers flow. However, preliminary investigations have shown that unusually high concentrations of nitrate-nitrogen are discharged from the Umhlali river (Kemp, Brand and Pretorius, 1966, unpublished). It may be that the enrichment effects of nutrients being poured into the sea are limited to small distances off-shore. Numerous large eddies are contained in the Agulhas current system, particularly in the area east of Durban and the effects of land drainage may be further influenced if strong currents flow along the shore line. Rivers discharging large volumes of water such as the Tugela, may affect the levels of nitrate-nitrogen and phosphorus far out to sea, but the extent to which enrichment actually takes place in off-shore waters is not yet known.

High concentrations of inorganic nutrients and high primary productivity characterised an area south-east of Tugela river mouth during the *RSA* cruise. These results support earlier observations in the same area obtained during cruise 7 of the R.V. *Anton Bruun* in September, 1964 (Ryther *et al.*, 1966). At station 392, situated south-east of Tugela river mouth although closer in-shore at a depth of 49 metres (Fig. 1), exceptionally high production rates of over 3000 mg C/m^2/day were measured. These measurements were supported by high nutrient values. A seasonal comparison may be made between the two sets of results, since the *Anton Bruun* cruise took place during spring. The results show a threefold increase in primary productivity from winter to spring.

During 1961, *Africana II* undertook a winter cruise in the south-west Indian Ocean (Mitchell-Innes, 1967). This 1961 survey took place in sub-tropical waters south of Madagascar over a much greater area than that covered during the *RSA* cruise, extending eastwards for about 900 miles. There is general agreement between the primary production measurements obtained during 1961 and those obtained during the 1965 survey. During 1961 all measurements ranged between 109-563 mg C/m^2/day, and almost 60% of 1965 measurements fall into this range of values. It must be stated that stations occupied during the cruise of M.V. *RSA* were closer in-shore than *Africana II* stations and that where primary production values were high on the latter cruise that these values were obtained in regions of upwelling and mixing. The highest measurement of primary production obtained during 1965 south-east of Tugela river mouth is comparable to the highest daily rate of carbon assimilation for all three cruises of *Africana II* (Mitchell-Innes, 1967). The latter was a value of 1079 mg C/m^2/day obtained approximately 100 miles off Port Elizabeth. It was obtained during a winter cruise in a region of upwelling.

Summary

A survey of primary organic production, chemistry and hydrography of the Agulhas current region off Natal was carried out during June 1965. Primary productivity values ranged from 17-942 mg C/m^2/day. Areas of high primary production were located in the vicinity of the continental shelf, and also at the eastern boundary of the Agulhas current where there was evidence of a sub-surface influx of a different water mass in the region 40-60 miles off-shore. Indications are that the area south-east of Tugela river mouth is highly productive.

Acknowledgments

I am grateful to Mr. F. P. Anderson, Head of the Oceanography Division of the National Physical Research Laboratory and senior scientist on the cruise, for permission to use current measurement data collected during the survey. I am also grateful to the late Dr. David H. Davies, former Director of the Oceanographic Research Institute (O.R.I.) for his endeavours in providing facilities for phytoplankton studies during his direction of research.

I would like to acknowledge the following: Miss Betty A. Mitchell-Innes, formerly of O.R.I., for reading and criticising the manuscript and for assisting me in the collection of samples during the survey; Dr. A. J. Alexander of the University of Natal, and Mr. W. D. Oliff of the National Institute for Water Research, for encouragement and guidance during the early stages in the preparation of this manuscript; Dr. A. E. F. Heydorn, present Director of O.R.I., for advice in the final preparation; Mr. B. A. Roets for technical assistance during the survey; and my colleagues at O.R.I. for their assistance.

Finally grateful acknowledgment is made to the Council for Scientific and Industrial Research for financial support through the Marine Research Unit.

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TABLE 1 **POSITION, DEPTH AND TIME FOR PRIMARY PRODUCTIVITY STATIONS**

Station	Position	Sounding metres	Date	Time
A 2	29° 34′S 32° 03′E	—	19.6.65	09 00
A 3	29° 40′S 32° 13′E	1330	13.6.65	13 30
A 4	29° 45′S 32° 22′E	1620	19.6.65	15 15
B 2	29° 37′S 31° 46′E	281	14.6.65	14 00
B 4	29° 53′S 32° 02′E	1468	14.6.65	09 45
B 4	29° 50′S 32° 05′E	1499	18.6.65	09 00
C 1	29° 44′S 31° 18′E	70	20.6.65	13 45
C 2	29° 50′S 31° 29′E	367	15.6.65	11 15
C 4	30° 03′S 31° 45′E	917	15.6.65	14 30
C 4	30° 03′S 31° 47′E	973	20.6.65	09 00
D 2	30° 05′S 31° 13′E	459	16.6.65	13 00
D 2	30° 03′S 31° 12′E	413	28.6.65	15 30
D 3	30° 10′S 31° 14′E	565	12.6.65	17 00
D 3	30° 10′S 31° 20′E	606	21.6.65	11 15
D 4	30° 23′S 31° 26′E	1116	12.6.65	12 45
D 4	30° 17′S 31° 22′E	956	26.6.65	13 30
D 5	30° 22′S 31° 42′E	2385	21.6.65	15 15
D 5	30° 21′S 31° 41′E	—	28.6.65	10 00
D 6	30° 32′S 32° 01′E	3009	25.6.65	15 45
D 7	30° 49′S 32° 29′E	2174	22.6.65	11 15
D 7	30° 48′S 32° 28′E	2174	25.6.65	11 30
D 8	31° 06′S 32° 57′E	—	27.6.65	14 00
E 1	30° 24′S 30° 59′E	628	17.6.65	09 00
E 2	30° 30′S 31° 10′E	—	11.6.65	10 40
E 3	30° 34′S 31° 20′E	1835	17.6.65	14 30

TABLE 2 **PRIMARY PRODUCTION DATA, JUNE 1965**

Station	Date	Sampling Depth metres	Organic Production	
			mg C/m³/day	mg C/m²/day
A 2	19.6.65	0	9.25	
A 3	13.6.65	0	4.30	
A 4	19.6.65	0	9.76	
B 2	14.6.65	0	55.03	942
		6	39.76	
		15	48.34	
		22	4.48	
		54	0.32	
B 4	14.6.65	0	0.30	38
		6	1.02	
		15	0.96	
		30	0.76	
		64	0.00	
B 4	18.6.65	0	4.64	
C 1	20.6.65	0	11.86	243
		8	8.16	
		15	5.66	
		26	3.80	
		50	1.54	

TABLE 2 CONTINUED

Station	Date	Sampling Depth metres	Organic Production	
			mg C/m³/day	mg C/m²/day
C 2	15.6.65	0	11.84	302
		8	15.93	
		15	5.41	
		26	7.05	
		38	1.16	
C 4	15.6.65	0	0.60	17
		8	0.99	
		15	0.22	
		26	0.28	
		50	0.00	
C 4	20.6.65	0	7.41	
D 2	16.6.65	0	118.92	
D 2	28.6.65	0	13.09	159
		7	3.38	
		14	3.44	
		28	2.20	
		61	0.13	
D 3	12.6.65	0	5.27	79
		10	0.77	
		18	1.26	
		30	1.30	
		63	0.29	
D 3	21.6.65	0	7.04	108
		8	3.13	
		15	4.64	
		26	0.63	
		45	0.62	
D 4	12.6.65	0	1.53	118
		10	2.29	
		18	1.90	
		30	0.95	
		63	0.30	
D 4	26.6.65	0	1.04	102
		7	0.98	
		14	3.77	
		28	1.47	
		61	1.07	
D 5	21.6.65	0	0.19	49
		8	2.73	
		15	1.83	
		26	0.40	
		55	0.19	
D 5	28.6.65	0	8.76	357
		7	12.47	
		14	2.35	
		28	7.08	
		61	2.89	
D 6	25.6.65	0	4.73	335
		8	6.54	
		15	3.89	
		26	9.81	
		55	2.46	

TABLE 2 CONTINUED

Station	Date	Sampling Depth metres	Organic Production mg C/m³/day	mg C/m²/day
D 7	22.6.65	0	0.84	
D 7	25.6.65	0	7.13	266
		8	13.16	
		15	6.42	
		26	3.73	
		55	0.46	
D 8	27.6.65	0	6.91	
E 1	17.6.65	0	20.02	
E 2	11.6.65	0	6.75	
E 3	17.6.65	0	3.39	

TABLE 3 HYDROLOGICAL DATA, JUNE 1965

Station	Date	Sampling Depth metres	Salinity ‰	Temp. °C	PO_4—P mg-at/m³	NO_3—N mg-at/m³	NO_2—N mg-at/m³	SiO_3—Si mg-at/m³
A 2	19.6.65	0	35.24	22.10	0.25	2.85	0.14	1.60
A 3	13.6.65	0	35.24	22.40	0.28	1.56	0.10	1.03
A 4	19.6.65	0	35.21	22.80	0.27	1.81	0.16	0.68
B 2	14.6.65	0	35.23	20.70	0.25	2.25	0.10	2.51
		6	35.34	20.60	0.53	2.06	0.14	2.62
		15	35.29	19.90	1.05	4.43	0.17	5.59
		22	35.34	18.70	0.64	104.30	0.10	6.16
		54	35.34	15.70	0.82	140.10	0.06	8.21
B 4	14.6.65	0	35.31	22.50	0.17	2.04	0.07	0.68
		6	35.31	22.45	0.27	1.37	0.08	0.46
		15	35.31	22.40	0.25	1.10	0.06	1.03
		30	35.31	22.20	0.17	1.28	0.08	0.23
		64	35.31	22.20	0.35	2.04	0.07	0.68
B 4	18.6.65	0	—	22.00	0.31	3.13	0.15	1.37
C 1	20.6.65	0	35.18	22.00	0.25	1.28	0.08	0.80
		8	35.16	22.00	0.45	0.92	0.08	1.37
		15	35.16	22.00	0.25	1.58	0.08	1.03
		26	35.16	22.00	0.44	0.96	0.07	1.71
		50	35.23	19.90	0.54	0.97	0.16	1.94
C 2	15.6.65	0	35.16	21.30	0.33	2.57	0.14	1.82
		8	35.17	21.20	0.32	2.55	0.11	3.31
		15	35.23	21.20	0.28	2.95	0.14	0.80
		26	35.30	20.60	0.28	2.20	0.12	1.25
		38	35.35	19.70	0.34	5.06	0.24	1.60
C 4	15.6.65	0	35.16	22.80	0.30	1.47	0.14	0.68
		8	35.28	22.80	0.22	1.44	0.05	1.14
		15	35.17	22.80	—	2.01	0.23	0.80
		26	35.13	22.80	0.19	1.72	0.06	0.34
		50	35.30	22.10	0.28	3.85	0.17	1.71
C 4	20.6.65	0	—	21.70	0.23	2.76	0.14	0.80
D 2	16.6.65	0	35.25	20.00	0.39	3.51	0.13	0.80
D 2	28.6.65	0	35.17	21.90	0.18	1.86	0.15	0.11
		7	35.16	21.90	0.29	—	0.19	0.23
		14	35.17	21.85	0.35	2.13	0.21	0.80
		28	35.27	21.70	0.28	1.03	0.27	0.11
		61	35.21	21.30	0.35	1.66	0.54	0.91

TABLE 3 CONTINUED

Station	Date	Sampling Depth metres	Salinity ‰	Temp. °C	PO_4—P	NO_3—N	NO_2—N	SiO_3—Si
					mg-at/m³			
D 3	12.6.65	0	35.21	22.20	0.51	5.07	0.13	1.71
		10	35.19	21.80	0.26	2.78	0.09	1.82
		18	35.21	21.60	0.57	3.70	0.13	1.94
		30	35.22	21.20	0.33	4.27	0.13	2.17
		63	35.34	20.20	0.64	8.50	0.12	4.67
D 3	21.6.65	0	35.03	22.20	0.47	1.52	0.09	0.11
		8	35.04	22.20	0.18	1.08	0.04	1.48
		15	35.05	22.20	0.15	1.59	0.06	1.14
		26	35.06	21.50	0.23	1.46	0.04	0.80
		45	35.09	20.80	0.11	6.64	0.08	0.80
D 4	12.6.65	0	35.19	23.10	0.52	1.94	0.08	1.48
		10	35.19	23.00	0.30	1.94	0.12	1.60
		18	35.19	22.80	0.43	1.66	0.11	1.37
D 4	26.6.65	0	35.16	22.45	0.34	0.78	0.26	3.65
		7	35.14	22.45	0.79	1.09	0.15	2.51
		14	35.14	22.45	0.44	0.95	0.14	2.39
		28	35.15	22.45	0.36	0.18	0.14	1.94
		61	35.18	22.30	0.70	0.48	0.18	2.62
D 5	21.6.65	0	35.22	22.05	0.34	2.55	0.16	1.37
		8	35.25	22.05	0.31	2.53	0.17	1.48
		15	35.21	22.05	0.84	2.48	0.17	1.37
		26	35.20	22.05	0.58	1.97	0.14	1.94
		55	35.21	22.05	0.24	1.73	0.16	1.48
D 5	28.6.65	0	35.21	21.75	0.63	—	0.13	0.23
		7	35.19	21.75	0.25	—	0.17	0.91
		14	35.25	21.75	0.63	—	0.19	2.17
		28	35.22	21.75	0.21	1.84	0.21	0.34
		61	35.25	21.70	0.06	—	0.18	0.80
D 6	25.6.65	0	35.58	19.65	0.57	0.92	0.14	3.42
		8	35.57	19.65	0.51	1.30	0.16	2.39
		15	35.59	19.65	0.40	0.95	0.16	1.25
		26	35.59	19.58	0.68	1.23	0.14	2.74
		55	35.59	19.50	0.43	1.03	0.16	2.17
D 7	22.6.65	0	35.48	20.50	—	1.15	0.13	0.34
		8	35.49	20.45	0.11	1.26	0.08	0.23
		17	35.49	20.40	0.05	0.30	1.10	0.23
D 7	25.6.65	0	35.51	20.30	0.56	2.45	0.18	1.25
		8	35.54	20.20	0.17	2.54	0.20	1.14
		15	35.51	20.20	0.14	2.85	0.17	1.37
		26	35.51	20.20	0.06	2.40	0.21	1.03
		55	35.51	20.20	0.09	3.08	0.21	1.60
D 8	27.6.65	0	35.57	19.80	0.23	3.85	0.22	1.60
E 1	17.6.65	0	35.13	21.00	0.28	2.95	0.12	1.94
E 2	11.6.65	0	35.20	21.80	0.54	2.17	0.20	1.94
E 3	17.6.65	0	35.13	22.20	0.31	3.63	0.09	0.80