OCEANOGRAPHICAL OBSERVATIONS
IN THE PACIFIC OCEAN IN 1965
H.M.A.S. *GASCOYNE*
Cruise G3/65

OCEANOGRAPHICAL CRUISE REPORT NO. 44

DIVISION OF FISHERIES AND OCEANOGRAPHY
COMMONWEALTH SCIENTIFIC AND INDUSTRIAL
RESEARCH ORGANIZATION, AUSTRALIA 1969

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CONTENTS

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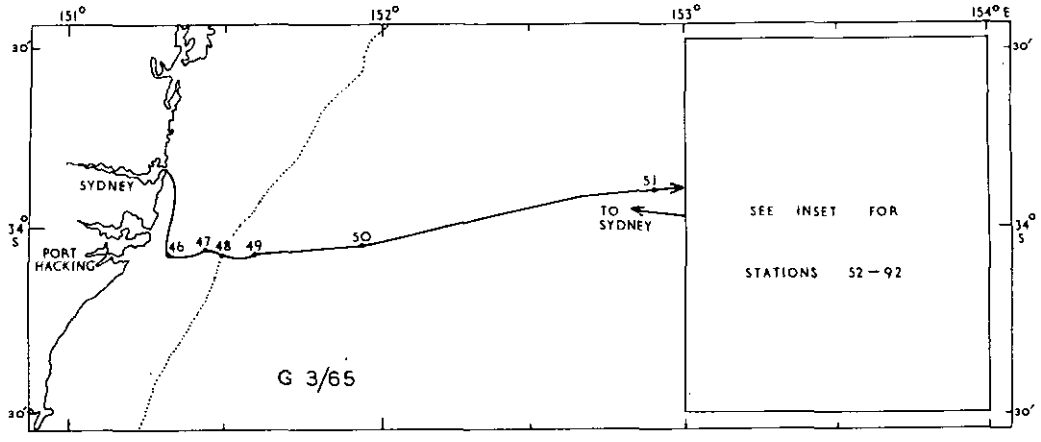

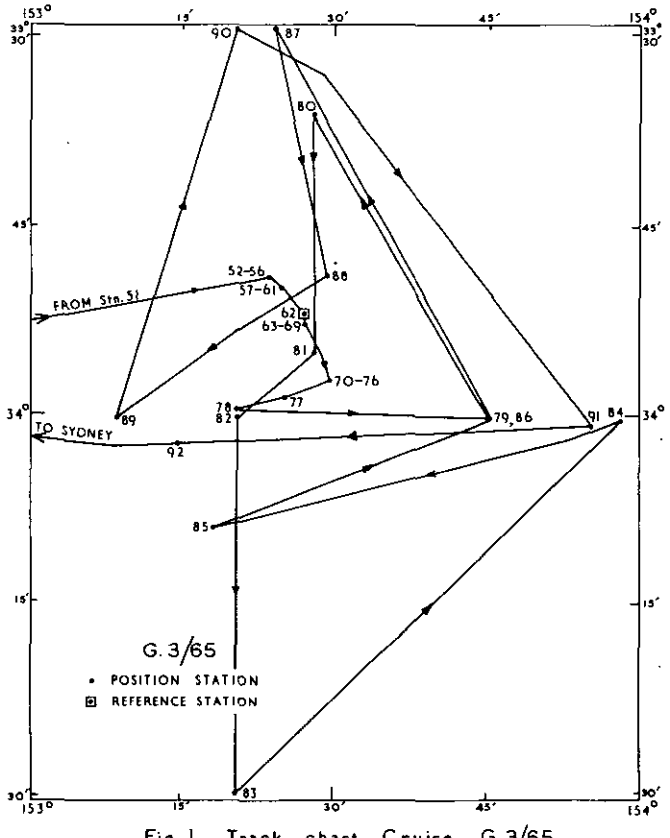

Fig. 1. Track chart Cruise G 3/65

OCEANOGRAPHICAL CRUISE REPORT

No. 44

Oceanographical Observations in the Pacific Ocean in 1965

H.M.A.S. Gascoyne

Cruise G3/65

February 22-28, 1965

I. INTRODUCTION

This report records the data collected during the third cruise in 1965 of H.M.A.S. Gascoyne, Royal Australian Navy oceanographical frigate.

Objectives

To compare zooplankton avoidance for nets of varying filtration coefficients.

To compare productivity methods and equipment.

To calibrate the sledge-dredge against the orange-peel grab in a known area.

Itinerary

The cruise left Sydney on February 22, proceeded to the Reference Station on the continental shelf off Port Hacking, occupied a series of stations in the vicinity of the Reference Station, and returned to Sydney on February 28 (Fig. 1).

Scientific Personnel

D. Tranter (Cruise Leader)
F. Davies
A. Heron
B. Scott
K.B. Tan
C. Walker

Salinity, oxygen, inorganic phosphate, and total phosphorus determinations were made in the ship's laboratory by J. Klye. Nitrate analyses were done at Cronulla by J. Klye and C. Walker. The primary production samples were taken and incubated aboard by N. Dyson, and the counts were made at Cronulla by B. Scott. The zooplankton samples were weighed at Cronulla by D. Tranter.

The data were processed under the direction of W. Hedge, using computer programmes designed by A.D. Crooks. The track chart was prepared for publication by R. Breach.

II. WORK ACCOMPLISHED

Forty-seven stations were worked (G3/46/65-G3/92/65). Surface hydrology samples were collected at 5 stations, subsurface hydrology samples at 6 stations, primary production samples at 11 stations, and zooplankton samples at 30 stations. At station G3/46/65, the double-sided sledge-dredge was calibrated against the orange-peel grab.

TABLE 1

WORK DONE AT EACH STATION

Stn No.	BT	Hydrology 1	Hydrology 2	Prim. Prod.	Zoo-plankton	Stn No.	BT	Hydrology 1	Hydrology 2	Prim. Prod.	Zoo-plankton
46	+			+		70					+
47	+					71					+
48	+					72					+
49	+	+	300			73					+
50	+	+	1500			74					+
51				+		75					+
52					+	76			4500	+	
53					+	77				+	
54				+		78	+		4500		
55					+	79	+				+
56					+	80	+				+
57	+	+	4500			81	+			+	
58					+	82	+				+
59					+	83	+			+	+
60					+	84	+				
61					+	85	+				
62	+	+	4500	+		86	+				+
63					+	87	+				+
64					+	88				+	
65					+	89	+				+
66					+	90	+			+	+
67				+		91	+				+
68					+	92	+				+
69					+						

BT Bathythermograms
Prim. Prod. Primary Production
Hydrology 1 Surface Samples
2 Subsurface Samples

III. METHOD OF COLLECTION AND ANALYSIS OF SAMPLES

1. Physics

Temperature.—Water temperatures were taken with deep-sea reversing thermometers: protected thermometers with a range of -2° to 30°C, and unprotected thermometers with a range of either -2° to 30°C or -4° to 60°C. Temperatures are considered accurate to ±0.03 degC.

Bathythermograms.—A 900-ft bathythermograph was used. Slides were digitized according to the method of the U.S. National Oceanographic Data Center (1964) and the results transferred to punched cards.

Thermometric Depth.—Depth calculations were made by the method described by Pollak (1950), and are considered accurate to ±15 m at depths greater than 1000 m, and to 1% at depths less than 1000 m.

Sigma-t.—Sigma-t values were computed from temperature and salinity values using the equations of Knudsen (La Fond 1951).

2. Chemistry

Salinity.—Salinity was measured on board with an inductive salinometer (Brown and Hamon 1961).

Dissolved Oxygen.—The standard Winkler method was used (Jacobsen, Robinson, and Thompson 1950) with potassium iodate as the iodometric standard. Saturation values were computed using the simpler of the equations given by Richards and Corwin (1956).

$$O_2\ (\%\ \text{Satn.}) = \frac{O_2\ (\text{ml/l}) \times (33.5 + T^\circ C) \times 100}{332.4 - (1.854 \times S‰)}\ .$$

Inorganic Phosphate.—The method of Atkins (1923) was used with 1 ml molybdate reagent (300 ml 10% w/v ammonium molybdate and 100 ml 50% v/v sulphuric acid) and 0.1 ml 1% w/v stannous chloride diluted afresh from a 40% stock solution in hydrochloric acid, which was kept under paraffin. The reagents were dispensed automatically by a piston dispenser.

Standard phosphate solutions were made up in distilled water. At air temperatures less than 25°C analyses were carried out in batches of 10; readings were begun within 10 min of adding reagents, and completed within 10 min. At air temperatures greater

than 25°C batches of 6 were analysed; readings were begun within 5 min of adding reagents and completed within 7 min. Each batch was compared with a distilled water blank and a 0.65 µg-atom/l standard in a Hilger Spekker absorptiometer using 4 cm cells and Ilford 608 filters. Each day a complete calibration was made using standards up to 3.25 µg-atom/l. Results are given as µg-atom/l with no correction for salt error and are precise to ±10% for values less than 0.5 µg-atom/l, and ±5% for higher values. To correct for salt effects the results given should be multiplied by 1.15.

Total Phosphorus.—100 ml samples were drawn from Nansen bottles into 150 ml Pyrex conical flasks, 0.2 ml of 72% v/v perchloric acid was added, and digestion at 200°-250°C carried out immediately on a sand tray. After evaporation of water, heating was continued until fuming of the salt residue commenced. The samples were then allowed to cool and 100 ml of distilled water and 2 drops of 2% w/v phenolpthalein were added. If alkaline, perchloric acid was added until a slight acidity persisted. The flasks were allowed to stand for about 24 hr to allow the salts to dissolve. Phosphate was then determined as described above for inorganic phosphate. Results are given as µg-atom/l with no correction for salt error. To correct for salt effects, the results given should be multiplied by 1.15.

Nitrate.—After collection, water samples were stored in 50 ml plastic bottles and preserved with 0.5 ml of saturated $HgCl_2$. Nitrate was determined at Cronulla by the strychnidine method (Rochford 1947). The reagent was prepared by adding 0.64 g strychnidine to a litre of nitrate-free sulphuric acid. Five ml of this reagent were added, without agitation, to 5 ml sea-water or standard nitrate solution previously cooled to approx. 5°C. The standards were made up in artificial sea-water preserved with 10 ml/l of saturated $HgCl_2$. The standards and samples were allowed to stand undisturbed for 18 hr to develop the colour. The solutions were read in a Unicam SP 600 spectrophotometer at a wavelength of 530 nm using a 5 mm cell. Solutions with an absorbance greater than that of the standard corresponding to 7.1 µg-atom/l were diluted with a mixture of equal volumes of artificial sea-water and sulphuric acid before reading. Results are given in µg-atom/l.

3. Primary Production

Water samples were taken twice daily between 0600-0800 h and between 1200-1400 h from 0, 25, or 50 m with a twin 6-litre

plastic sampler. To compare the results obtained with three different types of equipment, aliquots of the samples were incubated in 5 perspex-lined Jitts sampler bottles at 1000 ft-c, and in 5 glass and 5 perspex Doty bottles at 850 ft-c, using the ^{14}C techniques described by Dyson et al. (1965). No significant difference was obtained in the results of the three different techniques.

4. Zooplankton

Studies were carried out, in conjunction with laboratory experiments, to investigate the interaction between the water column and a towed plankton net. The results of these tests have been published by Tranter and Heron (1967).

5. Benthos

The double-sided sledge-dredge which had been used off Cronulla in a detailed study of the crab Lyreidus tridentatus was calibrated against the Hayward orange-peel grab. Both these instruments were operated on the same day at Station 46. The orange-peel grab was used on H.M.A.S. Gascoyne, and on M.V. Saga a double-sided, toothed sledge-dredge, the standard sampler in the crab study, was towed over the bottom. Samples from the orange-peel grab were washed through sieves of 1/5 inch opening and all samples of the crab Lyreidus were collected, counted, and measured. The samples from the sledge-dredge contained all crab sizes. The Lyreidus specimens were counted and measured, and the meter-wheels on the dredge were read to estimate the distance and area of bottom traversed.

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IV. DATA

Hydrology data were processed in a C.D.C. 3600 Computer. An explanation of the headings used is given at the beginning of the surface hydrology listing.

DATA

PART 1

HYDROLOGY

SURFACE SAMPLES

EXPLANATION OF HEADINGS

Parts 1 and 2	Hydrology
STATION	Gives the station identification. For example, G3/49/65 signifies the 49th station worked by Gascoyne in 1965, on her 3rd cruise for that year
DATE	Given as day/month/year
TIME	Given in Zone Time, and is the time at the beginning of the first cast. The code letter for the time zone follows the time. Zone Time throughout the cruise was Eastern Australian Standard Time, G.M.T. +10 hr, Code K
LATITUDE LONGITUDE	Given in degrees and minutes
SONIC DEPTH	Given in metres, measured at standard sound velocity of 800 fm (1463 m) per second
AIR TEMP. WET DRY	Air temperatures recorded from wet and dry bulb thermometers in °C
WIND DIR. SP.	Wind direction and speed are coded using Tables 8 and 9 in U.S. Navy Hydrogr. Office (1955)
ANEM. HEIGHT	Average height of the anemometer above sea level, given in metres
CLOUD TYPE AMT.	Cloud type and amount are coded using Tables 2 and 3 in U.S. Navy Hydrogr. Office (1955)
VIS.	Visibility is coded using Table 4 in U.S. Navy Hydrogr. Office (1955)
SEA DIR. AMT.	Sea direction and amount are coded using Tables 5 and 8 in U.S. Navy Hydrogr. Office (1955)
SWELL DIR. AMT.	Sea swell direction and amount are coded using Tables 6 and 8 in U.S. Navy Hydrogr. Office (1955)

BAROM. or ATMOS. PRESSURE	Atmospheric pressure given in millibars
WIRE ANGLES CAST1 CAST2 CAST3	Wire angles are measured at the surface and expressed in degrees for each cast
CAST	Gives the cast number
DEPTH	Sampling depth given in metres
TEMP	Sea temperatures recorded in °C
SALINITY	Given in parts per thousand
SIGMA-T	Sigma-t to 2 decimal places
OXYGEN	Given in ml/l
OXYGEN % SAT.	Oxygen percentage saturation
INORG. P	Inorganic phosphorus given in µg-atom P/l
TOTAL P	Total phosphorus given in µg-atom P/l
NITRATE	Given in µg-atom N/l

* or *** indicate no data available

CRUISE	STATION NUMBER	YR.	MTH.	DAY	TIME	LATITUDE	LONGITUDE	TEMP.	SALINITY	WIND DN.	WIND AMT.	SEA DN.	SEA AMT.	SWELL DN.	SWELL AMT.	VIS.	BAROM.
3	49	65	2	22	1920	K 34 05 S	151 35 E	22.8	35.76	15	2	15	2	10	1	2	1000.9
3	50	65	2	22	2315	K 34 03 S	151 56 E	23.0	35.71	24	2	23	2	02	1	5	1000.9
3	57	65	2	23	1535	K 33 50 S	153 25 E	22.3	35.69	18	3	17	2	04	1	2	1000.7
3	62	65	2	24	0600	K 33 32 S	153 27 E	21.7	35.71	17	2	17	2	20	1	7	1001.1
3	76	65	2	25	0900	K 33 33 S	153 29 E	21.6	35.74	14	3	14	2	08	1	8	1001.5

DATA

PART 2

HYDROLOGY

DEEP STATIONS

STATION	DATE	TIME	LATITUDE	LONGITUDE
G 3/ 49/65	22/ 2/65	1920 K	34 05 S	151 35 E

SONIC DEPTH	AIR TEMP. WET	AIR TEMP. DRY	WIND DIR.	WIND SP.	ANEM. HEIGHT	CLOUD TYPE	CLOUD AMT.	VIS.	SEA DIR.	SEA AMT.	SWELL DIR.	SWELL AMT.	ATMOS. PRESSURE	WIRE ANGLES CAST1	CAST2	CAST3
327	17.2	23,3	15	2	35	*	8	2	15	2	10	1	1000,9	5	5	5

CAST	DEPTH	TEMP.	SALINITY	SIGMA-T	OXYGEN	OXYGEN % SAT.	INORG. P	TOTAL P	NITRATE
1	0	22,79	35,764	24,59	4,97	101	0,14	0,29	***
1	25	21,80	35,738	24,85	5,03	101	0,11	0,29	***
1	50	20,34	35,605	25,19	4,86	95	0,19	0,41	***
1	75	19,44	35,614	25,39	4,65	89	0,30	0,40	***
1	100	19,10	35,619	25,49	4,75	90	0,30	0,71	***
2	150	18,44	35,590	25,63	4,51	85	0,38	0,49	***
3	200	17,02	35,512	25,92	4,29	78	0,53	0,62	***
3	250	15,65	35,440	26,18	4,47	79	0,56	0,73	***
3	300	15,09	35,405	26,28	4,67	82	0,60	0,73	***

STATION	DATE	TIME	LATITUDE	LONGITUDE
G 3/ 50/65	22/ 2/65	2315 K	34 03 S	151 56 E

SONIC DEPTH	AIR TEMP. WET	AIR TEMP. DRY	WIND DIR.	WIND SP.	ANEM. HEIGHT	CLOUD TYPE	CLOUD AMT.	VIS.	SEA DIR.	SEA AMT.	SWELL DIR.	SWELL AMT.	ATMOS. PRESSURE	WIRE ANGLES CAST1	CAST2	CAST3
1810	18,3	23,3	24	2	35	6	8	5	23	2	02	1	1000,9	7	5	*

CAST	DEPTH	TEMP.	SALINITY	SIGMA-T	OXYGEN	OXYGEN % SAT.	INORG. P	TOTAL P	NITRATE
2	0	23,01	35,711	24,49	4,91	101	0,10	***	***
2	25	22,73	35,702	24,56	4,97	101	0,09	***	***
2	50	21,04	35,710	25,04	5,11	101	0,09	***	***
2	75	19,04	35,614	25,50	4,80	91	0,24	***	***
2	100	18,46	35,610	25,64	4,71	88	0,29	***	***
2	150	15,86	35,339	26,06	5,28	94	0,25	***	***
2	200	14,68	35,399	26,37	4,90	85	0,52	***	***
2	300	12,53	35,197	26,66	4,86	81	0,71	***	***
1	490	9,33	34,760	26,90	4,65	72	1,15	***	***
1	686	6,78	34,513	27,09	4,33	63	1,55	***	***
1	882	5,38	34,470	27,23	4,16	59	1,77	***	***
1	1078	4,18	34,501	27,39	3,82	52	1,99	***	***
1	1274	3,39	34,557	27,52	3,53	48	2,09	***	***
1	1470	2,82	34,606	27,61	3,53	47	2,08	***	***

STATION	DATE	TIME	LATITUDE	LONGITUDE
G 3/ 57/65	23/ 2/65	1535 K	33 50 S	153 25 E

SONIC DEPTH	AIR TEMP. WET	AIR TEMP. DRY	WIND DIR.	WIND SP.	ANEM. HEIGHT	CLOUD TYPE	CLOUD AMT.	VIS.	SEA DIR.	SEA AMT.	SWELL DIR.	SWELL AMT.	ATMOS. PRESSURE	WIRE ANGLES CAST1	CAST2	CAST3
4682	17.2	23.9	18	3	35	4	8	2	17	2	04	1	1000.7	5	5	*

CAST	DEPTH	TEMP.	SALINITY	SIGMA-T	OXYGEN	OXYGEN % SAT.	INORG. P	TOTAL P	NITRATE
2	0	22.32	35.691	24.67	5.06	102	0.09	0.26	0.0
2	25	20.50	35.662	25.15	5.22	102	0.08	***	0.0
2	50	20.24	35.663	25.22	5.21	101	0.08	0.23	0.0
2	75	18.83	35.581	25.53	5.20	98	0.10	***	0.0
2	100	16.14	35.438	26.07	4.51	81	0.47	0.60	6.9
2	150	13.82	35.288	26.47	4.49	77	0.68	***	10.3
2	200	11.83	35.093	26.71	4.58	75	0.83	0.95	13.2
2	300	10.19	34.890	26.85	4.54	71	1.03	1.11	17.1
2	400	9.07	34.749	26.93	4.66	72	1.16	***	19.4
2	500	7.89	34.603	27.00	4.37	65	1.36	1.48	22.8
2	700	5.84	34.473	27.18	4.18	60	1.66	1.75	26.3
2	900	4.80	34.476	27.30	4.00	56	1.80	1.87	29.5
2	1100	3.88	34.522	27.44	3.72	51	2.00	1.94	30.9
1	1297	3.18	34.571	27.55	3.53	47	2.08	2.20	33.2
1	1497	2.76	34.613	27.62	3.55	47	2.05	2.14	32.8
1	1995	2.24	34.695	27.73	3.94	52	1.97	2.10	31.8
1	2494	1.83	34.769	27.82	4.18	54	1.89	1.96	31.8
1	2993	1.51	34.732	27.82	4.32	56	1.89	1.94	30.5
1	3492	1.25	34.726	27.83	4.43	57	1.88	1.99	30.3
1	3990	1.17	34.723	27.83	4.47	57	1.89	2.02	31.0
1	4489	1.16	34.721	27.83	4.51	58	1.93	2.04	31.0

STATION	DATE	TIME	LATITUDE	LONGITUDE
G 3/ 62/65	24/ 2/65	0600 K	33 52 S	153 27 E

SONIC DEPTH	AIR TEMP. WET	AIR TEMP. DRY	WIND DIR.	WIND SP.	ANEM. HEIGHT	CLOUD TYPE	CLOUD AMT.	VIS.	SEA DIR.	SEA AMT.	SWELL DIR.	SWELL AMT.	ATMOS. PRESSURE	WIRE ANGLES CAST1	CAST2	CAST3
4708	15,0	21,1	17	2	35	8	2	7	17	2	20	1	1001,1	5	5	*

CAST	DEPTH	TEMP.	SALINITY	SIGMA-T	OXYGEN	OXYGEN % SAT.	INORG. P	TOTAL P	NITRATE
2	0	21,71	35.712	24,86	5,06	101	0,10	0,29	0,0
2	25	21,03	35,696	25,03	5,14	101	0,08	***	0,0
2	50	19,78	35.632	25,32	5.27	101	0,10	0,30	0,0
2	75	16,97	35,468	25,90	4,69	85	0,34	***	4,0
2	100	15,09	35,375	26,26	4,46	78	0,56	0,69	8,5
2	150	13,15	35,236	26,56	4,54	76	0,73	***	11,0
2	200	11,88	35,085	26,70	4,52	74	0,85	0,90	13,5
2	300	10,46	34,916	26,83	4,58	73	1,00	1,07	16,1
2	400	9,04	34,748	26,93	4,63	71	1,21	***	19,1
2	500	7,73	34,585	27,01	4,39	65	1,43	1,43	22,9
2	700	6,08	34,479	27,15	4,26	61	1,68	1,68	26,9
2	900	4,67	34,479	27,32	3,98	55	1,88	1,92	28,9
2	1100	3,85	34,522	27,44	3,70	50	1,99	1,97	29,8
1	1296	3,25	34,566	27,54	3,52	47	2,02	2,11	31,5
1	1495	2,75	34,616	27,62	3,54	47	2,06	2,19	32,1
1	1993	2,24	34,695	27,73	3,94	52	1,98	2,10	30,8
1	2591	1,81	34,735	27,80	4,18	54	1,91	1,94	30,2
1	3089	1,41	34,733	27,82	4,36	56	1,91	1,96	30,8
1	3587	1,19	34,722	27,83	4,43	57	1,91	2,01	30,2
1	4085	1,16	34,721	27,83	4,49	57	1,91	2,02	29,5
1	4583	1,17	34,721	27,83	4,51	58	1,96	3,64	29,5

STATION	DATE	TIME	LATITUDE	LONGITUDE
G 3/ 76/65	25/ 2/65	0700 K	33 53 S	153 29 E

SONIC DEPTH	AIR TEMP. WET	AIR TEMP. DRY	WIND DIR.	WIND SP.	ANEM. HEIGHT	CLOUD TYPE	CLOUD AMT.	VIS.	SEA DIR.	SEA AMT.	SWELL DIR.	SWELL AMT.	ATMOS. PRESSURE	WIRE ANGLES CAST1	CAST2	CAST3
4700	15.6	22.2	14	3	35	*	1	8	14	2	08	1	1001.5	5	5	5

CAST	DEPTH	TEMP.	SALINITY	SIGMA-T	OXYGEN	OXYGEN % SAT.	INORG. P	TOTAL P	NITRATE
2	0	21.59	35.737	24.91	5.04	100	0.08	0.30	0.1
2	25	20.68	35.671	25.11	5.18	101	0.07	***	0.0
2	50	20.18	35.652	25.23	5.18	100	0.08	0.28	0.0
2	75	17.83	35.513	25.72	4.86	90	0.25	***	1.2
2	100	15.46	35.392	26.19	4.52	80	0.53	0.67	7.2
3	150	13.78	35.276	26.46	4.45	76	0.73	***	10.3
3	200	12.00	35.087	26.68	4.42	72	0.87	0.97	13.4
3	300	9.99	34.862	26.87	4.58	72	1.06	1.21	16.9
3	400	8.82	34.714	26.94	4.55	69	1.24	***	19.7
3	500	7.79	34.593	27.01	4.37	65	1.43	1.54	22.5
3	700	5.86	34.472	27.17	4.20	60	1.69	1.77	26.4
3	900	4.72	34.474	27.31	3.98	55	1.89	1.93	29.5
3	1100	3.90	34.515	27.43	3.69	50	1.98	2.04	30.2
1	1294	3.25	34.572	27.54	3.54	48	2.06	2.16	30.5
1	1493	2.81	34.607	27.61	3.49	46	2.08	2.19	32.1
1	1991	2.25	34.694	27.73	3.90	51	1.97	2.03	29.5
1	2488	1.87	34.734	27.79	4.14	54	1.90	1.99	29.5
1	2986	1.51	34.738	27.82	4.33	56	1.91	2.01	***
1	3484	1.20	34.725	27.83	4.40	56	1.91	2.12	29.2
1	3981	1.16	34.722	27.83	4.48	57	1.90	2.02	29.5
1	4479	1.16	34.722	27.83	4.48	57	1.88	2.09	29.7

STATION	DATE	TIME	LATITUDE	LONGITUDE
G 3/ 78/65	25/ 2/65	1609 K	33 59 S	153 20 E

SONIC DEPTH	AIR TEMP. WET	AIR TEMP. DRY	WIND DIR.	WIND SP.	ANEM. HEIGHT	CLOUD TYPE	CLOUD AMT.	VIS.	SEA DIR.	SEA AMT.	SWELL DIR.	SWELL AMT.	ATMOS. PRESSURE	WIRE ANGLES CAST1	CAST2	CAST3
4709	16.1	22.8	09	2	35	4	3	8	09	2	18	1	1001.4	5	*	*

CAST	DEPTH	TEMP.	SALINITY	SIGMA-T	OXYGEN	OXYGEN % SAT.	INORG. P	TOTAL P	NITRATE
1	1066	3.72	34.537	27.47	3.63	49	2.01	***	30.2
1	1261	3.23	34.568	27.54	3.49	47	2.05	***	30.8
1	1457	2.78	34.609	27.61	3.52	47	2.06	***	31.0
1	1948	2.22	34.695	27.73	3.92	51	1.96	***	30.2
1	2440	1.89	34.731	27.79	4.12	54	1.89	***	29.8
1	2935	1.52	34.739	27.82	4.32	56	1.91	***	29.5
1	3431	1.20	34.729	27.84	4.40	56	1.90	***	29.2
1	3927	1.14	34.725	27.84	4.49	57	1.90	***	29.5
1	4434	1.16	34.721	27.83	4.48	57	1.95	***	30.5

DATA

PART 3

BENTHOS

LYREIDUS SAMPLING WITH 1/4 sq m ORANGE-PEEL GRAB

VESSEL	STATION	DATE
GASCOYNE	46	22/2/65

SAMPLE NUMBER	DEPTH (m)	JUVENILES	ADULTS	TOTAL
1	82	4	0	4
2	71	0	0	0
3	71	0	0	0
4	71	0	1	1
5	82	0	1	1
6	82	0	0	0
7	82	1	0	1
8	82	3	0	3
9	82	0	0	0
10	82	0	1	1
11	82	2	0	2
12	72	0	0	0
13	82	2	0	2
14	82	0	0	0
15	82	0	0	0
16	82	0	0	0
17	82	0	0	0
18	82	1	0	1
19	82	0	0	0
20	82	0	0	0
21	82	1	0	1
22	82	0	1	1
23	82	0	0	0
24	82	1	0	1
25	82	1	0	1
26	82	0	1	0
27	82	0	0	0
28	82	0	0	0
29	82	0	0	0
30	82	2	0	2
31	81	4	0	4
32	81	0	0	0
33	81	2	0	2
34	81	0	1	1
35	81	2	0	2
36	81	2	1	3
37	81	2	0	2
38	81	1	0	1
39	81	1	0	1

LYREIDUS SAMPLING WITH 1/4 sq m ORANGE-PEEL GRAB

VESSEL	STATION	DATE
GASCOYNE	46	22/2/65

SAMPLE NUMBER	DEPTH (m)	JUVENILES	ADULTS	TOTAL
40	81	0	0	0
41	81	1	0	1
42	79	0	1	0
43	*	*	*	*
44	79	2	0	2
45	79	0	0	0
46	79	3	0	3
47	79	1	0	1
48	79	1	0	1
49	79	1	0	1
50	79	0	0	0
51	79	1	0	1
52	81	1	0	1
53	81	0	0	0
54	81	1	0	1
55	81	2	0	2
56	81	1	0	1
57	81	2	0	2
58	81	5	0	5
59	81	2	1	3
60	81	3	0	3
61	81	0	0	0
62	81	0	1	1
63	81	1	0	1
64	82	3	0	3
65	82	2	0	2
66	82	2	0	2
67	82	0	0	0
68	82	0	0	0
69	82	0	1	1
70	82	0	0	0
71	82	1	0	1
72	73	0	0	0
73	73	1	1	2
74	73	0	0	0
75	73	1	0	1
76	73	0	0	0
77	73	1	0	1
78	73	1	0	1

LYREIDUS SAMPLING WITH 1/4 sq m ORANGE-PEEL GRAB

VESSEL	STATION	DATE
GASCOYNE	46	22/2/65

SAMPLE NUMBER	DEPTH (m)	JUVENILES	ADULTS	TOTAL
79	73	0	2	0
80	73	0	0	0
81	73	1	0	1
82	73	2	0	2
83	73	4	0	4
84	73	1	0	1
85	73	0	0	0
86	73	1	0	1
87	73	1	0	1
88	73	1	1	2
89	73	0	1	1
90	73	1	0	1

OCEANOGRAPHICAL CRUISE REPORTS

1. Oceanographical observations in the Indian Ocean in 1959. H.M.A.S. *Diamantina* Cruises Dm1/59 and Dm2/59.
2. Oceanographical observations in the Indian Ocean in 1960. H.M.A.S. *Diamantina* Cruise Dm1/60.
3. Oceanographical observations in the Indian Ocean in 1960. H.M.A.S. *Diamantina* Cruise Dm2/60.
4. Oceanographical observations in the Indian Ocean in 1960. H.M.A.S. *Diamantina* Cruise Dm3/60.
5. Oceanographical observations in the Pacific Ocean in 1960. H.M.A.S. *Gascoyne* Cruises G1/60 and G2/60.
6. Oceanographical observations in the Pacific Ocean in 1960. H.M.A.S. *Gascoyne* Cruise G3/60.
7. Oceanographical observations in the Indian Ocean in 1961. H.M.A.S. *Diamantina* Cruise Dm1/61.
8. Oceanographical observations in the Pacific Ocean in 1961. H.M.A.S. *Gascoyne* Cruise G1/61.
9. Oceanographical observations in the Indian Ocean in 1961. H.M.A.S. *Diamantina* Cruise Dm2/61.
10. Oceanographical observations in the Indian and Pacific Oceans in 1961. H.M.A.S. *Gascoyne* Cruise G2/61.
11. Oceanographical observations in the Indian Ocean in 1961. H.M.A.S. *Diamantina* Cruise Dm3/61.
12. Oceanographical observations in the Pacific Ocean in 1961. H.M.A.S. *Gascoyne* Cruise G3/61.
13. Oceanographical observations in the Pacific Ocean in 1962. H.M.A.S. *Gascoyne* Cruise G1/62.
14. Oceanographical observations in the Indian Ocean in 1962. H.M.A.S. *Diamantina* Cruise Dm1/62.
15. Oceanographical observations in the Indian Ocean in 1962. H.M.A.S. *Diamantina* Cruise Dm2/62.
16. Oceanographical observations in the Pacific and Indian Oceans in 1962. H.M.A.S. *Gascoyne* Cruises G2/62 and G3/62.
17. Oceanographical observations in the Indian Ocean in 1962. H.M.A.S. *Gascoyne* Cruise G4/62.
18. Oceanographical observations in the Indian Ocean in 1962. H.M.A.S. *Diamantina* Cruise Dm3/62.
19. Oceanographical observations in the Pacific Ocean in 1962. H.M.A.S. *Gascoyne* Cruise G5/62.
20. Oceanographical observations in the Indian Ocean in 1962. H.M.A.S. *Diamantina* Cruise Dm4/62.
21. Oceanographical observations in the Indian Ocean in 1963. H.M.A.S. *Gascoyne* Cruise G1/63.
22. Oceanographical observations in the Indian Ocean in 1963. H.M.A.S. *Gascoyne* Cruise G2/63.
23. Oceanographical observations in the Indian Ocean in 1963. H.M.A.S. *Diamantina* Cruise Dm1/63.
24. Oceanographical observations in the Indian Ocean in 1963. H.M.A.S. *Diamantina* Cruise Dm2/63.
25. Oceanographical observations in the Indian Ocean in 1963. H.M.A.S. *Diamantina* Cruise Dm3/63.
26. Oceanographical observations in the Pacific Ocean in 1963. H.M.A.S. *Gascoyne* Cruise G3/63.
29. Oceanographical observations in the Pacific Ocean in 1963. H.M.A.S. *Gascoyne* Cruise G4/63.

OCEANOGRAPHICAL CRUISE REPORTS

(Continued)

31. Oceanographical observations in the Pacific Ocean in 1963. H.M.A.S. *Gascoyne* Cruise G5/63.
32. Oceanographical observations in the Pacific Ocean in 1964. H.M.A.S. *Gascoyne* Cruise G1/64.
33. Oceanographical observations in the Indian Ocean in 1964. H.M.A.S. *Diamantina* Cruise Dm1/64.
34. Oceanographical observations in the Indian Ocean in 1964. H.M.A.S. *Gascoyne* Cruise G2/64.
35. Oceanographical observations in the Indian and Pacific Oceans in 1964. H.M.A.S. *Gascoyne* Cruise G3/64.
36. Oceanographical observations in the Indian Ocean in 1964. H.M.A.S. *Diamantina* Cruise Dm2/64.
38. Oceanographical observations in the Indian Ocean in 1964. H.M.A.S. *Diamantina* Cruise Dm4/64.
39. Oceanographical observations in the Pacific Ocean in 1964. H.M.A.S. *Gascoyne* Cruise G4/64.
40. Oceanographical observations in the Indian Ocean in 1964. H.M.A.S. *Diamantina* Cruise Dm5/64.
41. Oceanographical observations in the Indian Ocean in 1964. H.M.A.S. *Gascoyne* Cruise G5/64.
42. Oceanographical observations in the Pacific Ocean in 1964. H.M.A.S. *Gascoyne* Cruise G6/64.
43. Oceanographical observations in the Indian Ocean in 1965. H.M.A.S. *Gascoyne* Cruise G2/65.
44. Oceanographical observations in the Pacific Ocean in 1965. H.M.A.S. *Gascoyne* Cruise G3/65.
45. Oceanographical observations in the Pasific Ocean in 1965. H.M.A.S. *Gascoyne* Cruise G4/65.
46. Oceanographical observations in the Indian Ocean in 1965. H.M.A.S. *Gascoyne* Cruise G5/65.
49. Oceanographical observations in the Indian Ocean in 1965. H.M.A.S. *Diamantina* Cruise Dm2/65.
54. Oceanographical observations in the Indian Ocean in 1966. H.M.A.S. *Diamantina* Cruise Dm2/66.