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COMMONWEALTH OF AUSTRALIA



Commonwealth Scientific and Industrial Research Organization

Division of Fisheries and Oceanography

REPORT 25

Scientific Reports of Cruises on

H.M.A.S. "WARREGO"

W1/57 - May 21 - 28, 1957

W1/58 - April 18 - 26, 1958

Marine Biological Laboratory  
Cronulla, Sydney  
1959

H.M.A.S. "WARREGO"

On two occasions the Department of the Navy gave permission for scientists of this Laboratory to accompany H.M.A.S. "Warrego" when she was on routine cruises. On the first occasion, May 21-28, 1957, a line of hydrology stations was worked between Sydney and Mackay, on the second occasion hydrology stations, surface sampling stations, and phytoplankton stations were worked between Coff's Harbour and Darwin from April 18 to 26, 1958.

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When citing this report abbreviate as follows:  
C.S.I.R.O. Aust. Div. Fish. Oceanogr. Rep. No. 25

H.M.A.S. "WARREGO"

SCIENTIFIC REPORT OF CRUISE WL/57

May 21-28, 1957

SCIENTIFIC PERSONNEL

D.J. Rochford (in charge)  
C. Walker

ITINERARY

Figure 1 shows the positions of all stations worked during a cruise to Mackay and the positions from which surface samples were taken during the period May 21-28, 1957. Later in the year - August, September 1957 - when the ship was again in the area ship's officers repeated two stations (WL/21,25/57).

SCIENTIFIC REPORT

HYDROLOGY - D.J. ROCHFORD

Water samples were collected for chlorinity, dissolved oxygen, and total phosphorus at 0, 25, 50, 75, 100, 150, 200, 300, and 500 m. Unprotected thermometers were used at depths below 200 m.

Regional Water Masses

Table 1 lists the regional water masses; the chlorinity-temperature relationships and the principal regional water masses are shown in Figure 2.

TABLE 1

Regional Water Masses

No.	Water Mass	Chlorinity ‰	Temp. °C	Total P. µg/l
1	South Equatorial	19.55	24.2	9
2	Coral Sea	19.68	21.2	12
3	Central Tasman	19.69	18.5	13

At the southern end of the region there was a very sharp boundary (50°C in 60 miles) between the South Equatorial and the Central Tasman water masses. In the central portion, the South Equatorial was displaced offshore and the Coral Sea water mass predominated. The stations repeated in August-September (Fig. 1) show that the amount of the Coral Sea water mass had increased north of Brisbane between May and September (Fig. 2).

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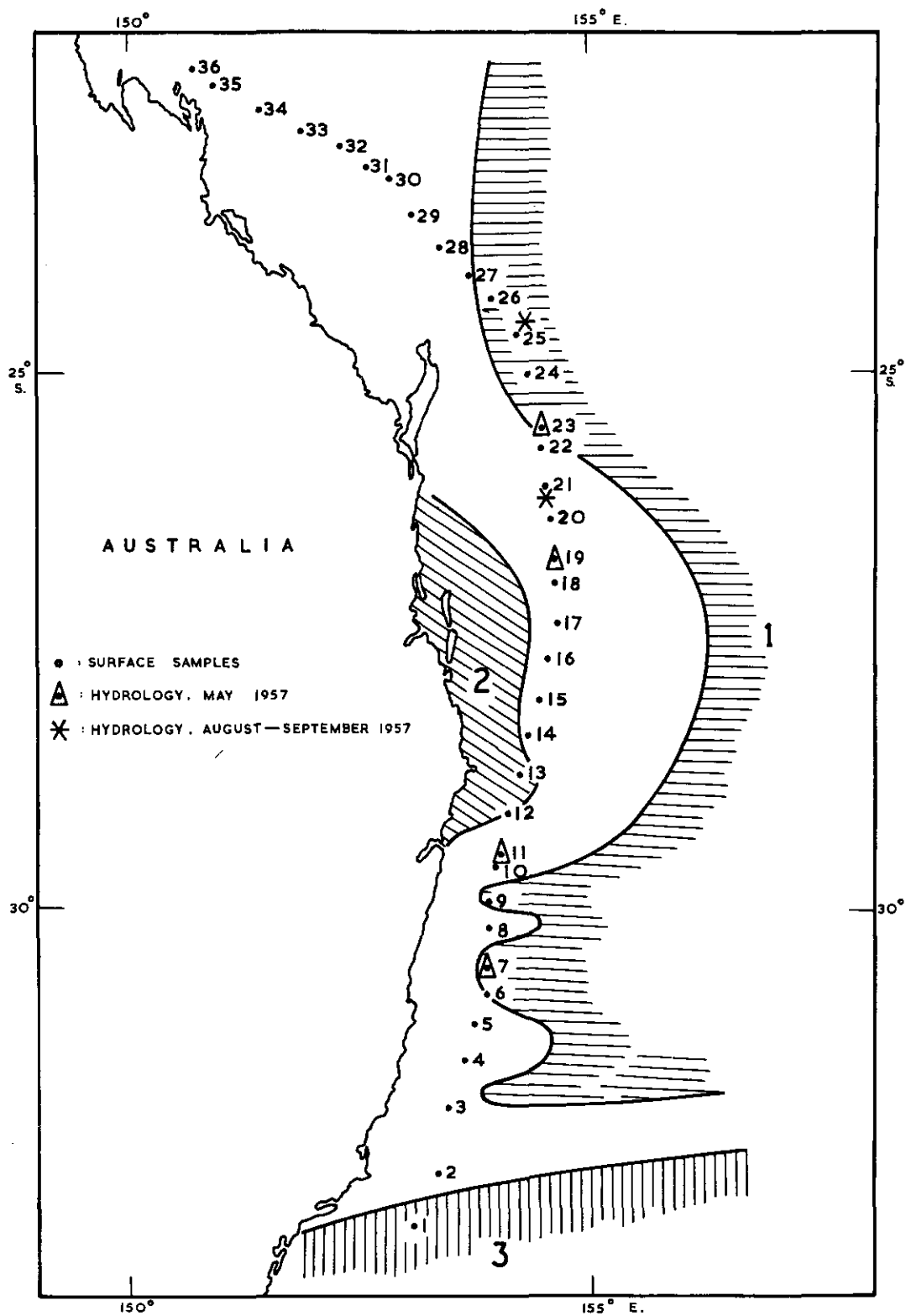


Fig. 1.- Cruise W1/57. Track chart and boundaries of regional water masses.

1. South Equatorial 2. Coral Sea 3. Central Tasman

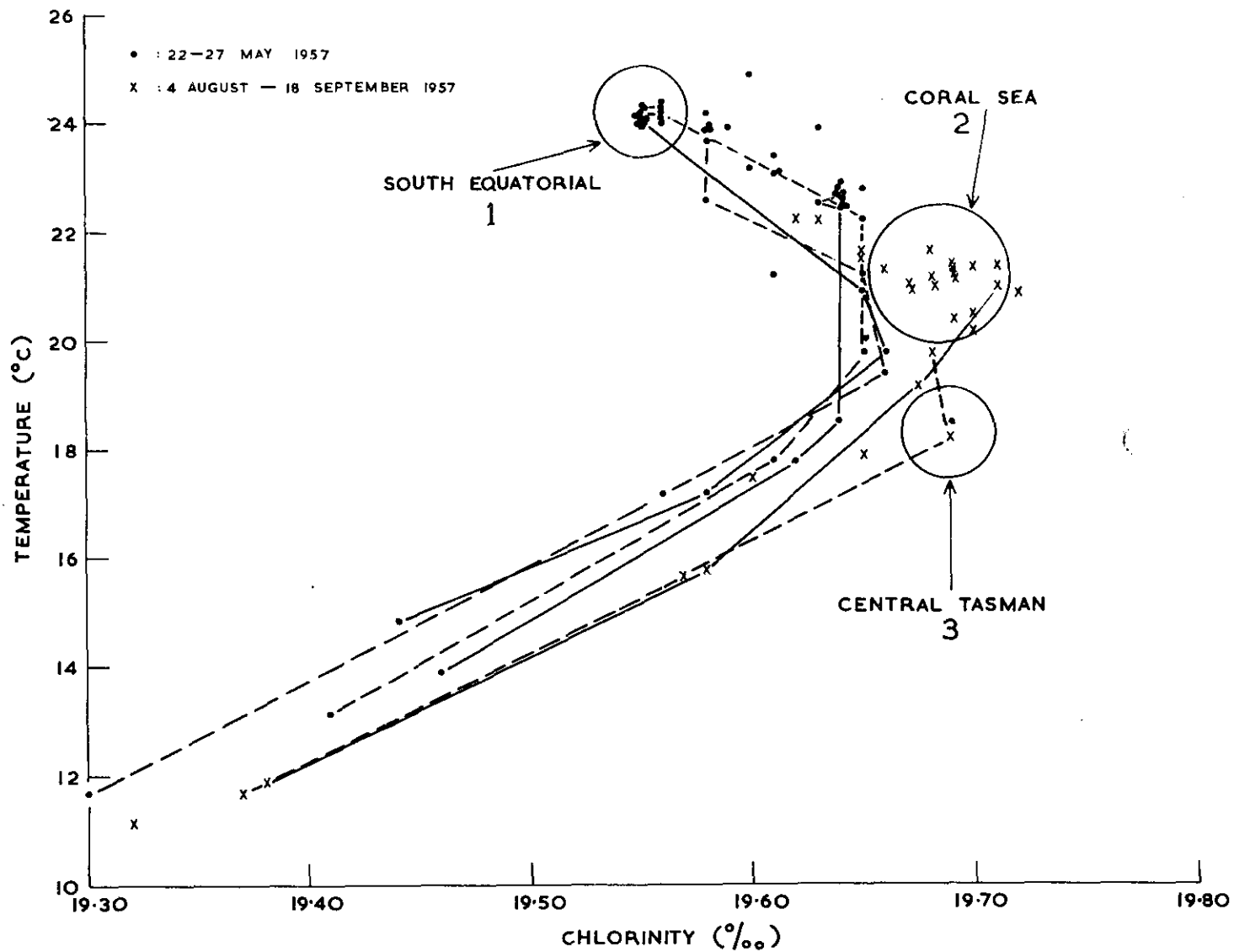


Fig. 2.- Chlorinity-temperature relationships of three regional water masses.

H.M.A.S. "WARREGO"

SCIENTIFIC REPORT OF CRUISE W1/58

April 18-26, 1958

SCIENTIFIC PERSONNEL

C. Walker (in charge)  
L. Crosby

ITINERARY

Figure 1 shows the positions of hydrology stations, and of surface water sampling stations.

SCIENTIFIC REPORTS

(a) HYDROLOGY - D.J. ROCHFORD

The hydrology stations W1/15, 17, 19, 21, 23/58 were worked to about 500 m, but those between Cairns and Darwin were worked only to depths of about 50 m. At the first series, samples were collected at 0, 25, 50, 75, 100, 150, 200, 300, 400, and 500 m for chlorinity \*(Hamon 1957), dissolved oxygen \*(C.S.I.R.O. 1951) and for total phosphorus \*(Rochford 1951). Unprotected thermometers were used at all depths below 100 m. Surface samples for chlorinity and temperature were collected every four hours on passage.

\*Hamon, B.V. (1956).- A portable temperature-chlorinity bridge for estuarine investigations and sea water analysis. J. Sci. Instr. 33: 329-333.

C.S.I.R.O. Aust. (1951).- Hydrological and planktological observations by F.R.V. "Warreen" in south-eastern Australian waters 1940-42. C.S.I.R.O. Aust. Oceanogr. Sta. List 2.

Rochford, D.J. (1951).- Studies in Australian estuarine hydrology. I. Introductory and comparative features. Aust. J. Mar. Freshw. Res. 2: 1-116.

Regional Water Masses

Figure 2 shows the chlorinity temperature relationships of the regional water masses (Table 1), of water in the Gulf of Carpentaria and inside the Barrier Reef, and of North New South Wales coastal waters.

TABLE 1

Regional Water Masses

No.	Water Mass	Chlorinity ‰	Temp. °C	Total P. µg/l
2	Arafura	18.95	29.0	12
4	South Equatorial	19.57	26.6	10
5	Coral Sea	19.73	21.4	16

The positions of the water masses are indicated in Figure 3. The Coral Sea water mass had a higher mean total phosphorus (Table 1) than previously defined \*(Rochford 1957), this was apparently due to bottom sediment effects at Stations WL/19-23/58 (Fig. 1). This water mass (5 in Figs. 2 & 3) was not found at the surface, so its position can be fixed only approximately by using the data from the distribution of its mixtures with other water masses. Likewise it cannot be established whether the waters in the Gulf of Carpentaria and inside the Barrier Reef (1 in Figs. 2 & 3) are one water mass, nor that the coastal waters of northern New South Wales (3 in Figs. 2 & 3) are one, or a series of locally formed water masses.

\*Rochford, D.J. (1957).-- The identification and nomenclature of the surface water masses in the Tasman Sea. Aust. J. Mar. Freshw. Res. 8: 369-413.

(b) PHYTOPLANKTON - E.J.F. WOOD

The qualitative distribution of phytoplankton organisms taken in the collections at 32 stations (Fig. 4, Table 2) between Coff's Harbour and Darwin in April 1958 is shown in Tables 3 and 4. These lists show that at the time of sampling there were few dinoflagellates in the waters south of Station WL/P10/58. Diatoms were present but not numerous in



the same region. At this point the ship turned west and on the run into Cairns diatoms were almost absent but dinoflagellates were more numerous, the indicator species being Amphisolenia bidentata and Ceratocorys horrida.

The waters from Cairns to Station W1/10/58 (137°39'E, 10°54'S, off Wessel I.) were very rich in diatoms, the number of species and individual cells being of the same order as rich catches from the Antarctic, but with different representative species. A total of 67 species appeared for the first time in the catches at, or north-west of Cairns, and most of them occurred as the ship travelled west. Dinophysis miles, which is frequent in the New Guinea region, appeared at Station W1/9/58 and Ceratium dens at Station W1/P17/58. C. dens is a dinoflagellate characteristic of this region, but it has appeared off the east coast of Australia\* (Wood 1954). At Station W1/9/58 a number of species of Chaetoceros occurred which did not appear in catches from other stations. Stations W1/6/58 and W1/P18/58 contain an unknown species of Biddulphia; it would seem safe to assume that the waters from Darwin east to Cairns have a related flora and that the flora of the Arafura Sea is contributing to that of the Torres Strait - Cairns waters. The water from Darwin to Wessel Island may be enriched east of the latter by water from rivers of the south-west coast of New Guinea. Table 5 gives the number of phytoplankton organisms per litre. On this cruise the phytoplankton was concentrated in the upper 20 m and was usually slightly more numerous at 20 m than at the surface.

\*Wood, E.J.F. (1954).- Dinoflagellates in the Australian region. Aust. J. Mar. Freshw. Res. 5 (2): 171-351.

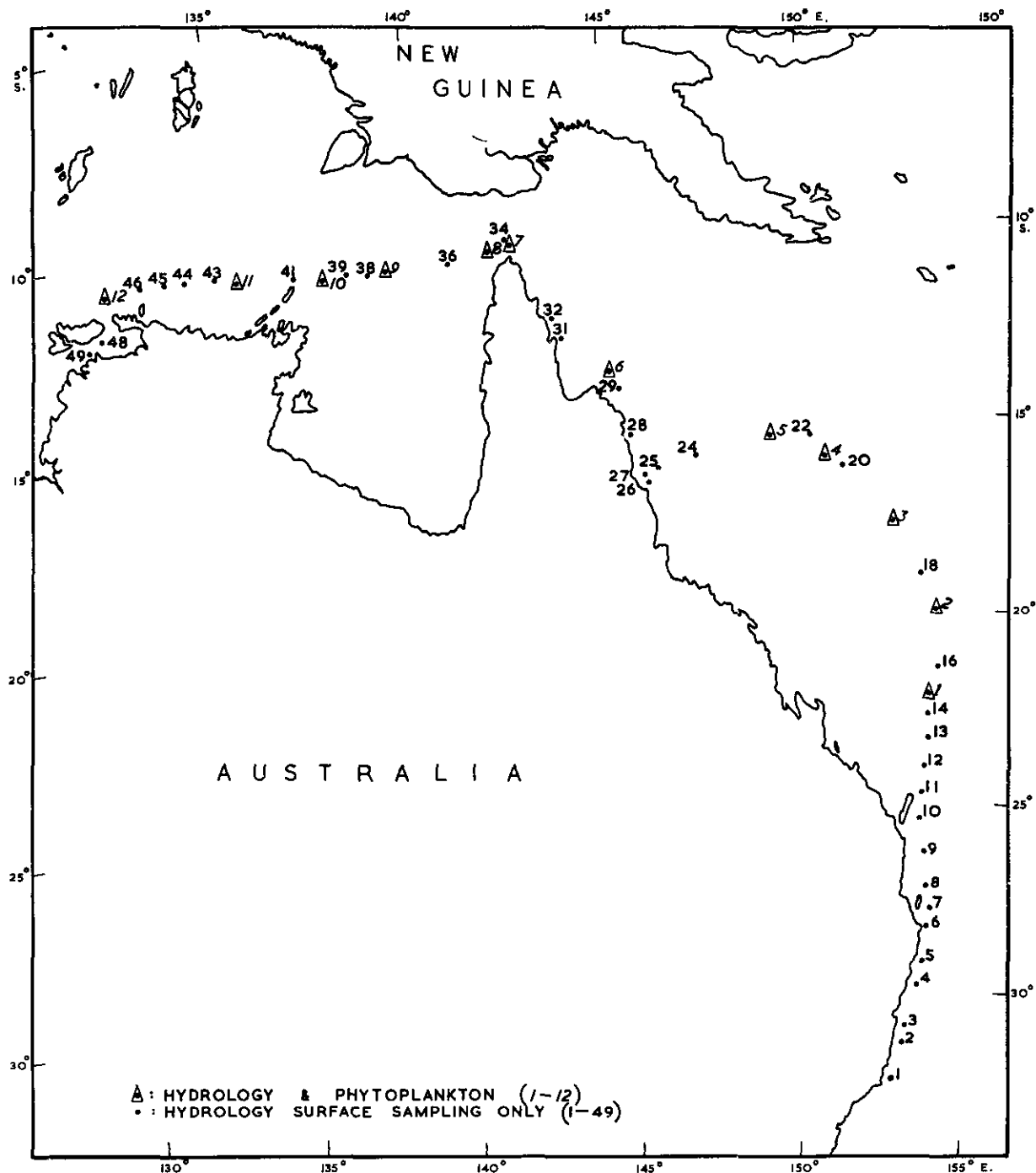


Fig. 1.- Cruise W1/58. Track chart showing main stations W1/1/58 - W1/12/58 at which hydrology samples (including surface samples) and phytoplankton samples were taken and hydrology surface sampling stations 1-49.

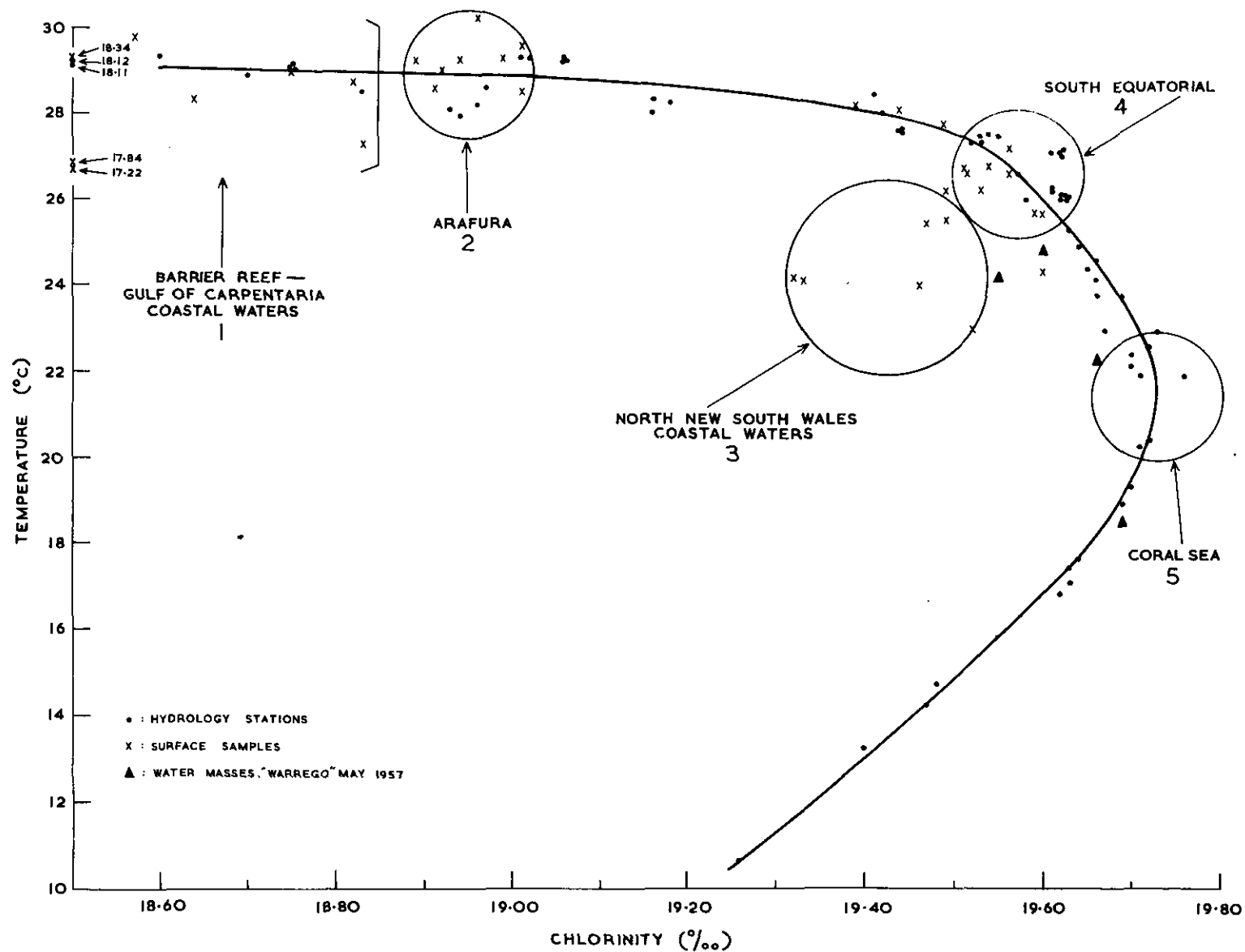


Fig. 2.- Chlorinity temperature relationships of water at vertical and surface stations. 1. Gulf of Carpentaria and Barrier Reef Coastal. 2. Arafura. 3. North New South Wales Coastal. 4. South Equatorial. 5. Coral Sea (not at surface).

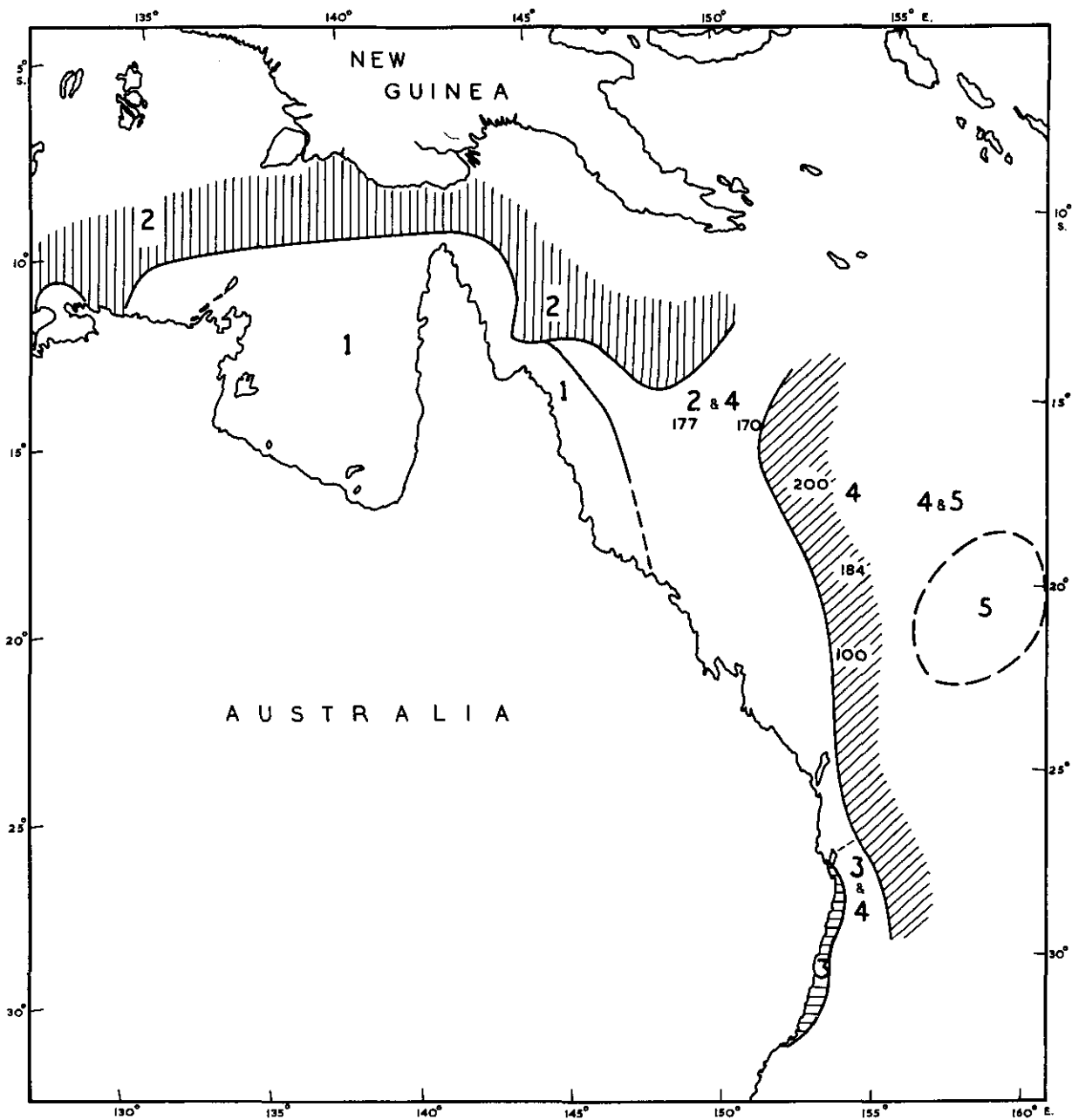


Fig. 3.- Distribution of water masses.  
 1. Gulf of Carpentaria and Barrier Reef Coastal.  
 2. Arafura. 3. North New South Wales Coastal.  
 4. South Equatorial. 5. Coral Sea (not at surface).  
 Small numerals indicate depth of occurrence of Coral Sea  
 water mass.

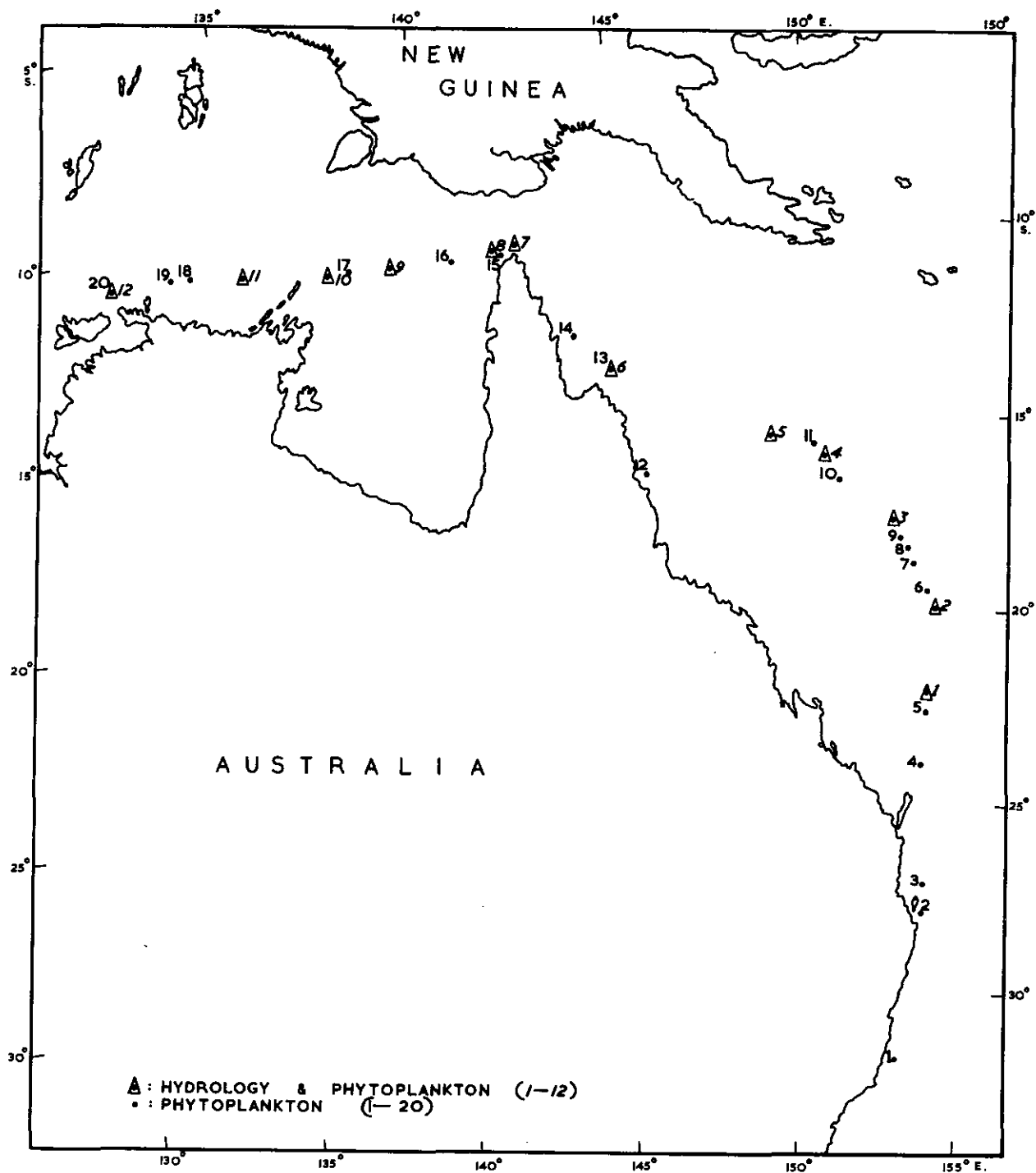


Fig. 4.- Track chart showing main stations W1/1-12/58 and extra phytoplankton stations W1/P1-20/58.

TABLE 2

## H.M.A.S. "WARREGO"

SYDNEY - DARWIN CRUISE, APRIL 15-27, 1958

Numbers and Positions of Stations at which  
Phytoplankton Hauls were made

Column No. in Tables 3 & 4	Number	Position	Date Sampled
1	WL/P1/58	153°05'E 31°17'S	16/4/58
2	WL/P2/58	153°46'E 27°52'S	17/4/58
3	WL/P3/58	153°52'E 27°02'S	17/4/58
4	WL/P4/58	153°43'E 24°00'S	18/4/58
5	WL/P5/58	153°54'E 22°35'S	
6	WL/1/58	153°54'E 22°04'S	18/4/58
7	WL/2/58	154°00'E 19°55'S	19/4/58
8	WL/P6/58	153°30'E 19°30'S	
9	WL/P7/58	153°20'E 18°45'S	
10	WL/P8/58	153°10'E 18°25'S	
11	WL/P9/58	152°50'E 18°10'S	
12	WL/3/58	152°49'E 17°30'S	19/4/58
13	WL/P10/58	151°13'E 16°35'S	20/4/58
14	WL/4/58	150°55'E 16°00'S	
15	WL/P11/58	150°30'E 15°45'S	
16	WL/5/58	149°12'E 15°30'S	20/4/58
17	WL/P12/58	145°39'E 16°30'S	22/4/58
18	WL/P13/58	144°59'E 13°47'S	23/4/58
19	WL/P14/58	144°00'E 12°50'S	
20	WL/6/58	144°59'E 13°47'S	23/4/58
21	WL/7/58	142°30'E 10°32'S	24/4/58
22	WL/8/58	141°55'E 10°36'S	
23	WL/P15/58	142°51'E 10°50'S	
24	WL/P16/58	140°56'E 10°49'S	24/4/58
25	WL/9/58	139°12'E 10°55'S	25/4/58
26	WL/P17/58	138°05'E 10°55'S	
27	WL/10/58	137°39'E 10°54'S	25/4/58
28	WL/11/58	135°11'E 10°45'S	26/4/58
29	WL/P18/58	133°59'E 10°42'S	
30	WL/P19/58	133°24'E 10°42'S	
31	WL/12/58	131°58'E 10°43'S	
32	WL/P20/58	131°58'E 10°43'S	

TABLE 3

H.M.A.S. "WARREGO"  
 SYDNEY - DARWIN CRUISE, APRIL 15-27, 1958  
 OCCURRENCE OF DIATOMS (INDICATED BY +)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32				
<i>Melosira crenula</i>	+	+	+	+			+	+				+		+		+			+	+			+	+												
<i>M. sulcata</i>																								+	+											
<i>Hyalodiscus stelliger</i>																								+												
<i>Pyxidicula cruciata</i>																	+																			
<i>Skeletonema costatum</i>										+														+			+									
<i>Asteromphalus flabellatus</i>																			+																	
<i>Lauderia annulata</i>																				+		+			+	+	+									
<i>Thalassiosira subtilis</i>	+															+																				
<i>T. decipiens</i>	+															+																				
<i>Stephanopyxis turris</i>																																				
<i>S. palmeriana</i>																		+																		
<i>Coscinodiscus gazellae</i>																	+							+												
<i>C. oculus-iridis</i>									+	+						+	+					+	+	+	+	+	+	+	+	+	+	+	+	+	+	
<i>C. centralis</i>										+																										
<i>C. lineatus</i>																																				
<i>C. concinnus</i>											+																									
<i>C. granii</i>											+																									
<i>C. gigas</i>																+																				
<i>Chaetoceros decipiens</i>								+		+																										
<i>Ch. eibenii</i>							+																													
<i>Ch. lorenzianum</i>																+	+																			
<i>Ch. laeve</i>																+	+																			
<i>Ch. diversum</i>																+	+																			
<i>Ch. peruvianum</i>																+	+																			
<i>Ch. vanheurckii</i>																+	+																			
<i>Ch. cinctum</i>																+	+																			
<i>Ch. coarctatum</i>																+	+																			
<i>Ch. affine</i>																+	+																			
<i>Ch. secundum</i>										+	+					+	+																			
<i>Ch. concavicornis</i>										+	+					+	+																			
<i>Ch. teres</i>																+	+																			
<i>Ch. danicum</i>																																				
<i>Ch. difficilis</i>																																				
<i>Ch. similis</i>																																				
<i>Ch. lacinosum</i>																																				





TABLE 3 (CONTD.)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
Actinoptychus senarius																	+					+			+	+						
Bacteriastrum varians																	+															
B. hyalinum																	+	+			+	+										+
B. delicatulum																	+		+				+			+						
Dactyliosolen mediterraneum																	+							+								
Corethron criophilum																		+			+						+					
Cerataulina pelagica																	+				+		+				+				+	
Lithodesmium undulatum																											+					
Triceratium bicuadratum																							+									
Climacodium bicneavum																	+															
Asterionella japonica											+	+		+																		
Thalassiothrix nitzschioides	+				+	+	+										+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
T. frauenfeldii				+	+	+	+										+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
T. longissima																	+	+		+	+	+	+	+	+	+	+	+	+	+	+	+
Mastogloia rostrata						+	+																									
Synedra frauenfeldii																							+									
Campylodiscus biangulatus																							+									
Nitzschia sigma					+																											
N. seriata				+		+				+	+		+	+			+	+			+	+		+	+	+	+					
N. longissima												+	+					+	+													
N. hungarica																						+						+				
N. closterium																						+						+				
Bacillaria paxillifer																	+	+			+	+						+				+
Amphora hyalina																	+															
Pleurosigma angulatum																			+	+		+								+		
P. balticum																						+										
P. naviculaceum																						+	+					+			+	
P. fasciola																						+	+									
Navicula subcarinata														+											+		+					
Schroederella delicatula										+							+									+		+				

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TABLE 4

H.M.A.S. "WARREGO"

SYDNEY - DARWIN CRUISE, APRIL 15-27, 1958

OCCURRENCE OF DINOFLAGELLATES (INDICATED BY +)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32						
Noctiluca miliaris	+																					+																
Ceratium furca	+																																					
C. fusus																+						+		+														
C. tripos	+				+										+																							
C. concilians	+						+								+																							
C. massiliense	+			+						+						+					+																	
C. carriense							+			+		+																										
C. contrarium			+				+								+																							
C. trichoceros																																						
C. setaceum					+										+																							
C. pentagonum																																						
C. buceros										+																												
C. falcatifforme										+																												
C. schroeteri (new rec.)										+																												
C. hexacanthum								+																														
C. vultur								+				+			+																							
C. gallicum												+			+																							
C. extensum												+																										
C. breve																+																						
C. dens																																						
C. belone								+																														
Peridinium grande																+	+																					

TABLE 4 (CONTD.)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32			
<i>P. oblongum</i>																										+									
<i>P. divergens</i>																																	+		
<i>P. steinii</i>																+	+						+												
<i>P. oceanicum</i>																					+														
<i>P. elegans</i>																							+										+		
<i>Prorocentrum micans</i>																						+													
<i>Diplopsalis lenticula</i>																							+												
<i>Dinophysis caudata</i>																+																			
<i>D. miles</i>																																			
<i>D. ovum</i>																																			
<i>Oxytoxum scolopax</i>																																			
<i>Pyrocystis pseudonociluca</i>												+																							
<i>P. hamulus</i>												+																							
<i>Pyrophacus horologicum</i>												+																							
<i>Ceratocorys horrida</i>								+		+	+	+																							
<i>Ornithocercus magnificus</i>																																			
<i>O. quadratus</i>																																			
<i>O. steinii</i>																																			
<i>Amphisolenia bidentata</i>																																			
<i>A. curvata</i>																																			
<i>A. tridentata</i>																																			

TABLE 5

H.M.A.S. "WARREGO"

SYDNEY - DARWIN CRUISE, APRIL 15-27, 1958

NUMBER OF PHYTOPLANKTON (FIGURES ARE LOG. NUMBER PER LITRE)

Station	0m		20m		50m		Dominant Species
	>30 $\mu$	<30 $\mu$	>30 $\mu$	<30 $\mu$	>30 $\mu$	<30 $\mu$	
WL/1/58	3.35	5.81	3.50	5.78	2.44	*	<u>Skeletonema costatum</u>
WL/2/58	3.01	5.17	3.09	5.54	2.11	*	<u>Nitzschia seriata;</u> <u>emiaulus hauckii</u>
WL/3/58	3.31	5.87	8.33	6.15	1.48	5.40	<u>Nitzschia seriata;</u> <u>Rhizosolenia alata;</u> <u>R. robusta</u>
WL/4/58	3.18	6.13	8.48	6.20	0.90	*	<u>Chaetoceros secundum</u>
WL/5/58	1.46	*	1.67	*	0.95	*	<u>Nitzschia seriata</u>
WL/6/58	1.52	5.00	1.15	4.69	*	*	
WL/7/58	3.11	5.40	3.02	5.54	*	*	<u>Chaetoceros decipiens;</u> <u>Bacteriastrium delicatulum</u>
WL/8/58	3.56	6.37	*	*	*	*	<u>Bacteriastrium delicatulum</u>
WL/9/58	6.23	6.06	6.39	*	*	*	<u>Nitzschia seriata</u>
WL/10/58	4.75	6.37	3.76	6.30	*	*	<u>Nitzschia seriata</u>
WL/11/58	3.53	5.92	3.79	6.38	*	*	<u>Nitzschia seriata</u>
WL/12/58	3.50	6.08	3.60	6.09	*	*	<u>Nitzschia seriata</u>

\*Numbers too few to count

(c) BIOCHEMISTRY - G.F. HUMPHREY

Two samples were taken on April 26 at Station W1/12/58, 0 and 20 m for pigment determination by a modification of the Richards with Thompson \*(1952) method.

The samples were analysed 40 hours after collection. Table 6 gives the results.

TABLE 6

H.M.A.S. "WARREGO"

SYDNEY - DARWIN CRUISE, APRIL 15-27, 1958

CHLOROPHYLL DETERMINATIONS

Date		Chlorophyll a	Chlorophyll b	Chlorophyll c	Astacin	Non-Astacin Pigments
26.4.58	0 m	0.30 mg/m <sup>3</sup>	0.04 mg/m <sup>3</sup>	0.26 MSPU/m <sup>3</sup>	0.08 MSPU/m <sup>3</sup>	0.12 MSPU/m <sup>3</sup>
W1/12/58	20 m	0.19 mg/m <sup>3</sup>	0.04 mg/m <sup>3</sup>	0.37 MSPU/m <sup>3</sup>	0.12 MSPU/m <sup>3</sup>	0.01 MSPU/m <sup>3</sup>

\*Richards, F.A., with Thompson, T.G. (1952).- The estimation and characterization of plankton populations by pigment analyses. II. A spectrophotometric method for the estimation of plankton pigments. J. Mar. Res. 11: 156-172.

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