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Quantitative Studies on the Macroplankton off Coral Reef of Palao Port [1, 2]

By

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During the sojourn at the Palao Tropical Biological Station I had the opportunity of studying the macroplankton through the financial and moral support of the South Sea Bureau. The present study is concerned with the quantitative measuring of the macroplankton of the outer sea, four miles off the coral reef of Palao Port during the period from October to December, 1936. Here I wish to express my hearty thanks to the South Sea Bureau for the financial aid and to Mr. Y. SHIRAISHI of the Fishery Experimental Station in Palao for affording me the facilities I required during the investigation and also to thank Mr. K. NAKAZONO for help in carrying out the field work. In closing, I am much obliged to the Japan Society for the Promotion of Scientific Research, to Dr. S. HATAI, the director of the Palao Tropical Biological Station and to Dr. S. KOKUBO for giving me this opportunity.

To measure the number of macroplankton, viz. mostly zooplankton, collections were made every ten days by vertical hauls with a net of Müller gauze No. 3 (mouth area 266 cm^2, gauze area 2380 cm^2, ratio of both areas 8.67), but after the fourth collection the net was replaced by another coarse cotton net (mouth area, the same, gauze area 5278 cm^2, ratio of both areas 19.7) for the previous net had been torn.

The first six collections were made by vertical hauls from 300 metres, 150 metres, and 50 metres, while in the seventh and eighth the step collections were made i. e. in the layer between 300 metres–150 metres, 150 metres–50 metres, and 50 metres–surface by using Nansen's apparatus. These nets were rather small, inevitable for the use of the tiny boat.

The results given in the table show that there were 0.8–0.1 individuals of macroplankton per 10 liters in the layer from 300 metres to 150 metres, 2.2–0.4 per 10 liters in the layer from 150 metres to 50 metres, and 5.3–1.1 per 10 liters in the layer from 50 metres to the surface. In so far as the data of the present study are concerned it may be impossible to go further than expressing the results in above way. However, in valuing and criticizing the productivity

1) Nanyôsuisanjôhô, Vol. 1, No. 2, 1937 in Japanese.

2) Palao, Parao, Palau, Pelew in South Sea.

of the tropical seas the obove values may have some significance.

RUSSELL (1934) studied the number of plankton in tropical seas. According to him the average catch of zooplankton in a year, by vertical hauls with No. 3 silk net (diameter 50 cm) from 32 m depth (28 m from mouth part of net), in the Great Barrier Reef Lagoon was 5684. Among this copepods occupied 71 % (the number of copepods was 4037). The above value are considerably larger than in the present result (50 m–surface), probably because of the reason that Russell made a shallower haul and in a lagoon. The fact that the volume of plankton in an outer sea is usually less than in a lagoon was already assured by KRÄMER (1897), RUSSELL (1934) and EDMONDSON (1937). This fact may suggest the importance of the coral lagoon, in barren tropical seas, in affording a nursery ground for neritic animals. EDMONDSON (1937) reported the average number of copepods to vary 720–361 per 11 liters on the surface of a shallow reef of the Kanoehe Bay in Hawaii, and 737–947 per 11 liters at the north reef of that bay. In both of these places the laxuriant growth of corals has been observed. KRÄMER (1897) estimated the number of plankton as 17000–1650 per 1 cbm as collected by the net of Müller gauze No. 12 in the layer between 10 metres and the surface at Samoa. Their results are remarkably larger than that in my case.

In the present study the percentage of copepods in all the zooplankton was 65.5–95.7 % in the layer between 50 m- surface, showing close approximation to the result of RUSSELL (1934). KRÄMER (1897) reported 5–75 % for the copepods in New Zealand and 70–90 % in Samoa (he collected by a net of Müller gauze No. 12). The size of the copepods found in this investigation was as in RUSSELL's case, usually small excepting *Calanus vulgaris* and *C. robstior* which are frequently found.

The vertical distribution of macroplankton decreased with depth as shown in the table. The coral growth of the outer side of the reef seems to be the most vigorous (it is said that the formation and development of a lagoon during the subsidence of an island is caused by the difference of growth of coral in and out), and it is generally considered that reef corals can not thrive in considerable depth below nearly 50 metres. So it may be surmised that the food supply[1] for the vigorous flowering of reef corals is sufficient with about 5.3–1.1 plankton per 10 liters of water in the outer side of reef, though in still lagoon water more may be required. However, the minute zooplankton which should constitute some of food of corals would pass the mesh of the Müller gauze No. 3 and be missed from estimation.

1) Reef corals are only fed by zooplankton (YONGE, C. M. 1930; Great Barrier Reef Exp. Sci. Rep. Vol. 1, No. 2, VAUGHAN, T. W. 1930; Contr. Mar. Biol. Stanf. Univ. Press, etc. ...)

Table showing the number of plankton in
of No. 3 Müller gauze at

	No.	1	2			3			4		
	Date	Oct. 11 1936	Oct. 21, 1936			Nov. 1, 1936			Nov. 11, 1936		
	Weather	Cloudy	Bright			Bright			Bright		
	Net	No. 3 silk	No. 3 silk			No. 3 silk			Coarse cotton		
	Hauling layer (m)	300–0	50–0	150–0	300–0	50–0	150–0	300–0	50–0	150–0	300–0
Number of Plankton	Hydromedusa	18	3	4	8	1			3	4	6
	Chaetognatha	64	17	28	23	17	27	24	3	13	8
	Polychaeta larva	2	5	2	1	4	2	4	7	8	28
	Copepoda, Gymnoplea	312	70	160	198	73	228	216	49	172	137
	Copepoda, Podoplea		31	72	63	60	62	137	79	120	160
	Copepodid	102	57	91	138	59	75	4	533	704	856
	Copepoda nauplius	43	2		3			8	17	8	64
	Cirripedia nauplius		9	6	11	1	11	16			
	Ostracoda	10		3	24		4	12			49
	Schizopoda	8									
	Amphipoda							1		2	1
	Decapoda, Lucifer	1	1	1	1			1			
	Decapoda larva	44	23	26	63	22	45	41	2	16	49
	Mollusca	47	11	18	4	3	17	10			4
	Tunicata	15	2	5	7	40	20	28	14	40	61
	Echinodermata larva	11	7	8	4			12			
	Fish egg		4	8	2		2	4	1	12	8
	Fish larva	3		2	2			4	1		
	Others	3	1	11	4	2				4	24
	Water layer (m)	300–0	50–0	150–50	300–150	50–0	150–50	300–150	50–0	150–50	300–150
	Filtrated water (l)	7980	1330	2660	3990	1330	2660	3990	1300	2660	3990
	Total plankton	681	244	191	121	283	210	320	708	395	252
	Plankton per 10 liters	0.87	1.86	0.73	0.4	2.13	0.79	0.8	5.32	1.48	0.63
	Total of Copepoda (including yong and nauplius)	457	160	163	79	192	173	0	678	326	213
	Copepoda percentage	67.2	65.5	84.0	65.3	67.8	82.4		95.7	82.5	84.5

specimens collected vertically with a net 4 miles off Palao Port.

5			6			7			8		
Nov. 21, 1936			Dec. 1, 1936			Dec. 11, 1936			Dec. 21, 1936		
Bright			Bright			Bright			Bright		
Coarse cotton			Coarse Cotton			Coarse cotton			Coarse cotton		
50–0	150–0	300–0	50–0	150–0	300–0	50–0	150–50	300–150	50–0	150–50	300–150
8	12	8	4	13	6	4			1		
8	32	16	10	25	29	4	3	3		2	
4	4	4		2	4			1			
236	276	336	78	156	444	79	57	12	57	13	14
220	252	252	54	131	564	36	78	12	22	39	11
764	944	1028	173	467	828	27	72	14	58	32	12
28	24	36	25	42	140	3	1	1	13	4	5
							1				
4	20	24	1	17	32		20			3	15
12	8			7	20	1	1		1		1
	4		3	1		1	1	1			
									6	3	
52	36	28	21	47	96	1	6	1			
24	4	24	20	33	64	3	7		8	1	
56	72	68	21	42	104	1	1		8		
		4	6								
8	4	12	5	1	16	1				1	
		4							3	4	
	8	16	4	15	44	6		1			
50–0	150–50	300–150	50–0	150–50	300–150	50–0	150–50	300–150	50–0	150–50	300–150
1330	2660	3990	1330	2660	3990	1330	2660	3990	1330	2660	3990
1442	304	164	425	574	1354	169	265	46	177	106	58
1.06	1.14	0.41	3.19	2.16	0.34	1.27	1.0	0.12	1.33	0.4	0.15
1244	248	160	330	466	1172	145	208	39	150	88	42
88.1	81.6	97.6	77.6	81.2	86.6	85.8	78.5	84.8	84.8	83.0	72.4

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摘　　要

パラオ港外珊瑚礁沖に於けるマクロプランクトンの定量的研究

南洋群島パラオ港外珊瑚礁沖に於て、昭和十一年十月より同十二月に至る期間十日毎にミューラーガーゼ三號のネットにて垂直採集を行ひマクロプランクトンの量を計數したる結果は次の如し。

水　　深	300–150 米	150–50 米	50–0 米
海水10立中に含まれるマクロプランクトン數	0.8–0.1	2.2–0.4	5.3–1.1

珊瑚礁の外洋側斜面は現生珊瑚の發育最も良好なるものなれば、珊瑚蟲群体の旺盛なる發育に要するプランクトン數は以上の結果により 5.3–1.1/10 立を以て十分なりと考へ得べし。但し礁内の靜穩なる海水中に於ては尙多量を要するものと想像せらる。