INTERNATIONAL



SCOR-UNESCO ZOOPLANKTON INTERCALIBRATION TESTS

RESULTS OF 1st SERIES, R.S. VITYAZ AUGUST 2-9, 1962
AUSTRALIA

Ву

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When it was known that <u>Vityaz</u> would be made available by the Institute of Oceanology, <u>Moscow</u> for chemical intercalibration tests in Australian waters in August 1962, some of the zooplanktologists working in the Indian Ocean area suggested that the Indian Ocean Standard net be compared with others already in use.

On behalf of SCOR and UNESCO Mr Tranter was asked to take charge. This present report on biomass will be followed by one dealing with different taxonomic groups. SCOR and UNESCO are grateful to all the scientists and laboratories concerned for providing time and facilities for this international co-operative work.

(G.F. HUMPHREY)
President

Cseorge Humphrey

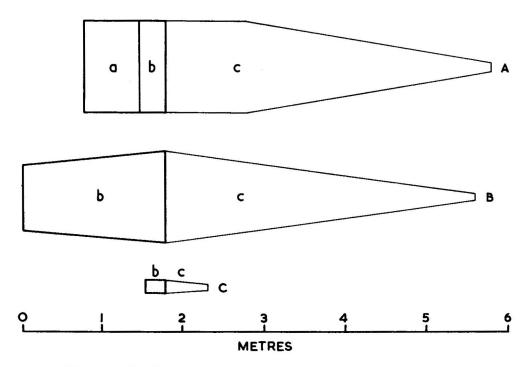


Fig. 1.- The zooplankton samplers. A. Indian Ocean Standard net. B. Soviet "Tropical" Juday net. C. Australian Clarke-Bumpus sampler.

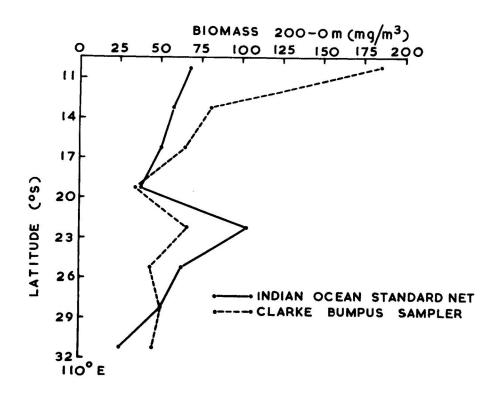


Fig. 2.- Mean (200-0 m) zooplankton abundance along meridian $110^{\circ}E$. as determined by Indian Ocean Standard net (northward run, August 20-27) and Clarke-Bumpus sampler (southward run, September 8-16). The values plotted (mg/m³) are the means of day (0800-1200) and night (2000-2400) observations at successive stations.

I. INTRODUCTION

The recent intensification of oceanographic research in the Indian Ocean has shown the need to compare the zooplankton sampling methods used by various workers. The Juday net (Bogorov and Vinogradov 1961), the Clarke-Bumpus (Tranter 1962) and the Indian Ocean Standard net (Currie 1962; Motoda 1962) are now in use in the area.

II. NETS AND THEIR OPERATION

The essential characteristics of the three nets are shown in Table 1, and their dimensions are compared in Figure 1.

TABLE 1
ZOOPLANKTON SAMPLERS

		1		SPECI	FICATION	1 S		
NET	SHAPE	Section	Material	Diameter cm	Length cm	Mesh Type	Meshes /cm	Mesh Aperture (mm)
Indian Ocean Standard	large non-truncate	8	French netting	113	70	coarse		ca : 2cm
А		b	terylene sail cloth	113	30		,	- 1
		С	nylon	113-10	400	medium coarse	21.5	0.33
Tropical Juday	l ar ge truncate	þ	canvas	80-113	175			
В		С	s i lk	113- approx.7	374	fine	38	0.17
Clarke- Bumpus	small truncate	b	stainless steel	12.3	23		i i	€. *
С	¥	С	nylon	12.3-6	56	medium	24.4	0.27

These nets were compared in August 1962 from the Soviet expedition ship Vityaz at SCOR-UNESCO Reference Station 1 in the south-east Indian Ocean (32°S., 111°50°E.). The experiment consisted of sampling the water column to 200 m with each net in quick succession. The work was carried out between 2100 hr (August 6) and 0700 hr (August 7) in which time nine successful hauls were made with each net.

Hauls with the Indian Ocean Standard net and Juday net were intended to be vertical, but in practice the drift of the ship led to considerable wire stray and at times the angle was as much as 50° from the vertical. The volume of water filtered was calculated by multiplying the mouth area of the net (Indian Ocean Standard: 1 m²; Juday: 0.5 m²) by the length of wire out, this having been adjusted in accordance with the wire angle to place the net at approximately 200 m. Hauls with the Clarke-Bumpus were oblique, the volume filtered being measured by a flowmeter previously calibrated in a flume tank in which the flow pattern simulates that under operational conditions (Tranter 1962).

Indian Ocean Standard net was recovered from 200 m at 1 m/sec, the Juday net at 0.6 - 0.8 m/sec, these being the recommended speeds of hauling. The Clarke-Bumpus was paid out and hauled in at a constant speed of 0.4 m/sec with the ship under way at 2 - 3 knots. This yielded a wire angle of 45 - 50° which was maintained by stopping and starting the ship's engines as required. The larger nets were washed down after each haul by dipping in the sea, and the washings were collected. The Clarke-Bumpus was washed down in a bucket.

III. HANDLING OF SAMPLES

Samples were later weighed in the laboratory by the method described in Tranter (1962). To facilitate removal of external interstitial water, weighing dishes with a large straining surface (25 cm²) were used for large samples. On only two occasions were disproportionately massive organisms found in a catch. On the first occasion (Juday net, 2330 hr) a single siphonophore increased the biomass of a sample by 86% and on the second (Clarke-Bumpus, 0241 hr) the inclusion of an eel larva led to a similar artefact (Table 1). In the statistical analysis of the results the weight of these organisms is not included.

IV. RESULTS

The results of the comparison are shown in Table **1**. It is remarkable that three nets, so different in size and construction, should give such similar values. The mean of nine determinations with the Indian Ocean Standard net was 40 mg/m³, with the Juday net 56 mg/m³, and with the Clarke-Bumpus 53 mg/m³. Further, both Indian Ocean Standard net and Clarke-Bumpus sampler gave surprisingly consistent results. The standard deviations of single hauls were 6.1 and 11.8 mg/m³ respectively (4.9 and 6.5 mg/m³ respectively when gross time effects due apparently to diurnal migration are excluded). Such variability is relatively small when one considers that biomass values in the eastern Indian Ocean vary from practically nil to over 100 mg/m³ (Tranter 1962). Results with these two nets are therefore comparable.

TABLE 2

RESULTS OF THE INTERCALIBRATION EXPERIMENT

(a) Biomass values for each net (mg/m³)

Indian Oc	ean Standard	J	uday	Clark	e-Bumpus
 Time	B i omass	Time	Biomass	Time	Biomass
2100	36	2055	18	2130	45
2210	43	2207	42	2230	42
0001	38	2330	72(134)	0120	42
0235	39	0035	60	0241	56(97)
0305	36	0240	44	0330	66
0355	31	0310	60	0420	76
0453	52	0410	73	0510	44
0550	39	0550	95	0607	48
0645	45	0642	38	0705	54

Where values are exclusive of single massive organisms, the gross biomass of the sample is given in brackets.

(b) Analysis of variance

Source of	Indian Ocean Standard				Juday			Clarke-Bumpus			
Variation	d.f.	S.S.	M.S. F.	d.f.	s.s.	M.S.	F.	d.f.	S.S.	M.S.	F.
Between blocks	2	153.56	76.78 3.21	2	918.22	459.11	n.s.	2	861.56	430.78	10.07*
Within blocks	6	143.33	23.89	6	3287.33	547.89		6	256,67	42.78	
Total	8	296.89	37.11	8	4205.56	525.69		8	1118.22	139.78	

^{*} Significant at 5% level

(c) Summary of results

	Indian Ocean Standard	Juday	Clarke-Bumpus
Mean	40	56	53
Ratio	1	1.4	1.3
S.D.	6.1 (4.9)*	22.9 (23.4)*	11.8 (6.5)*
S.D.: % of mean	15 (12)*	41 (42)*	22 (12)*

^{()*} Excluding variation due to time of sampling

V. DISCUSSION

More recent observations in the area support the thesis that results with the Indian Ocean Standard net and the Clarke-Bumpus sampler are comparable. On cruise G4/62 of H.M.A.S. Gascoyne along meridian 110°E., sampling was carried out on the way north with the Indian Ocean Standard net and on the way south (two weeks later) with the Clarke-Bumpus. The biomass distribution along the section is shown in Figure 2. There is a significant difference between observations with the two nets at the northern-most station, otherwise the profiles are essentially the same.

The lack of consistency of the Juday net in the comparison is difficult to explain. Of the three nets it was by far the finest mesh (38/cm) and was made of silk. Perhaps there could have been some degree of clogging or uneven washing. It might be significant that on one occasion when the washings were not collected, the catch was less than one third that immediately before or after. Nevertheless the variability (41% of the mean) was not excessive and, given a sufficient number of observations, results with this net are probably comparable with the other two.

It needs to be emphasized that, in this investigation, the catches were all handled by a standard method. Where a variety of methods is used for measuring the weight or volume of samples the resultant variability might be greater than that due to the nets themselves. It is also necessary to draw attention to the limited nature of the experiment, which consists of only nine samples with each net. A more extensive series of observations by day and night at more than one station might lead to some modification of the conclusions outlined above.

The samples taken during the intercalibration on <u>Vityaz</u> are being studied further in this Laboratory. Counts are being made of major taxa and some selected species and genera.

VI. ACKNOWLEDGMENTS

I wish to thank Dr M.E. Vinogradov of the Institute of Oceanology, U.S.S.R., for the incentive to carry out this investigation and Dr Sukhanova (U.S.S.R.), Dr Daniel (India) and Dr Kanagaratnam (Ceylon) for their generous assistance with the field work.

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The following tables give the densities of various taxonomic components of the plankton as determined by the three different nets.

These values form the basis of a more detailed report being prepared by Mr D.J. Tranter and Dr H. Barnes.

RESULTS OF THE INTERCALIBRATION OF ZOOPLANKTON SAMPLERS

Carried out on board Vityaz August 6-7, 1962

A. Counts (number/20 m^3) of selected taxonomic groups

Taxa	India	n Ocean Net	Std		Juday Net		Cla	arke-Bump Sampler	us
Hours	2100	2210	0001	2055	2207	2330	2130	2230	0120
Copepods	834	588	792	4059	8076	11,195	2407	1875	2361
Euphausiids: Larvae	56	57	158	17	99	172	169	146	100
: Adults		11	18	5	12	18	31	15	23
Decapods	4	2	2	5	4	6	6	10	5
Ostracods	56	49	62	56	109	92	167	125	127
Salps	5	20	33	5	23	42	13	19	14
Appendicularia	44	30	33	367	399	304	176	206	170
Chaetognaths	137	91	87	90	126	212	117	182	94
Polychaetes	7	6	7	7	31	32	14	26	18
Hours	0235	0305	0355	0035	0240	0310	0241	0330	0420
Copepods	693	974	796	9608	7589	10,269	2458	3121	2721
Euphausiids: Larvae	132	146	105	199	125	159	205	221	135
: Adults	200 100 100 100	26	15	22	15	17	25	34	20
Decapods	10	3	4	5	10	5	8	11	2
Ostracods	3 8	51	59	173	69	131	113	140	169
Salps	31	23	20	34	12	34	16	52	55
Appendicularia	63	37	40	529	146	565	300	284	669
Chaetognaths	108	109	91	198	152	238	138	152	154
Polychaetes	10	23	11	64	41	69	46	41	42
Hours	0453	0550	0645	0410	0550	0642	0510	0607	0705
Copepods	853	6 61	661	10,400	10,506	7346	2159	2559	2550
Euphausiids: Larvae	350	96	69	237	113	63	133	180	150
: Adults	18	23	11	32	13	11	25	34	16
Decapods	5	6	1	7	16	6	6	13	9
Ostracods	56	51	3 8	160	166	71	170	133	76
Salps	30	13	15	34	42	19	17	39	38
Appendicularia	49	6	52	704	582	120	450	242	110
Chaetognaths	119	104	93	232	256	168	83	160	150
Polychaetes	19	8	18	90	47	47	22	50	24

RESULTS OF THE INTERCALIBRATION OF ZOOPLANKTON SAMPLERS

Carried out on board Vityaz August 6-7, 1962

B. Counts (number/20 m^3) of euphausiid stages

Taxa	Indi	an Ocean Net	Std		Juday Net		Clarke-Bumpus Sampler		
Hours	2100	2210	0001	2055	2207	2330	2130	2230	0120
Euphausiid:									
nauplius	0	a 0	0		0	1	1	2	31
calyptopis	38	49	142	13	77	146	141	122	58
furcilia)	18	8	16	4	22	25	27	22	11
cyrtopia)				1			1		
Adult	9	11	18	5	12	18	31	15	23
Total	65	68	176	22	111	190	200	161	123
Hours	0235	0305	0355	0035	0240	0310	0241	0330	0420
Euphausiid: nauplius calyptopis furcilia cyrtopia Adult	0 107 25 31	0 123 23	0 79 26	3 170 26	0 99 25	10 128 21	5 174 26 25	18 198 33	13 88 34
									
Total	163	172	120	221	139	176	230	283	155
Hours	0453	0550	0645	0410	0550	0642	0510	0607	0705
Euphausiid: nauplius calyptopis furcilia cyrtopia Adult	1 69 42 18	0 77 19	0 49 20	12 167 58 32	0 30 83	1 45 17	33 77 23 25	28 116 36 34	21 89 40 16
Total	130	119	80	269	126	74	158	214	166

RESULTS OF THE INTERCALIBRATION OF ZOOPLANKTON SAMPLERS

Carried out on board <u>Vityaz</u> August 6-7, 1962

C. Counts (number/20 m^3) of selected copepod species and genera

Species	Indi	an Ocear Net	n Std		Juday Net		C1:	Clarke-Bumpus Sampler			
Hours	2100	2210	0001	2055	2207	2330	2130	2230	0120		
Euchaeta	00	16	1.77	9	10	28	10	10	44		
Haloptilus longicornis	22 3 0	16 23	17 12	3	10 11	28 11	28	29	28		
Pleuromamma abdominalis	24	23 17	31	8	21	33	14	25	4 5		
Pleuromamma piseki	114	82	90	46	76	138	122	23 88	45 85		
Oncaea	43	3 8	43	706	1050	1816	183	164	184		
Corycaeus	39	21	34	63	182	290	60	45	42		
Lucicutia flavicornis	98	41	71	72	73	153	193	96	118		
Candacia	6	9	7	13	5	23	18	9	10		
Eucalanus	26	22	38	16	17	74	30	45	46		
									· · · · · · · · · · · · · · · · · · ·		
Hours	0235	0305	0355	0035	0240	0310	0241	0330	0420		
Euchaeta	17	30	24	30	17	24	39	39	15		
Haloptilus longicornis	8	16	10	14	8	7	15	20	45		
Pleuromamma abdominalis	25	29	24	52	28	34	29	44	31		
Pleuromamma piseki	95	99	100	158	77	89	153	139	65		
Oncaea	36	52	32	2016	1496	2054	150	411	193		
Corycaeus	30	48	33	240	244	238	69	103	60		
Lucicutia flavicornis	58	74	68	198	72	118	78	113	72		
Candacia	6	14	15	14	11	12	16	21	13		
Eucalanus	28	50	50	61	35	47	35	63	40		
Hours	0453	0550	0645	0410	0550	0642	0510	0607	0705		
Euchaeta	16	23	13	16	30	14	27	45	24		
Haloptilus longicornis	10	14	18	12	37	10	33	37	28		
Pleuromamma abdominalis	38	25	20	28	46	13	32	35	7		
Pleuromamma piseki	87	54	53	127	128	50	73	119	58		
Oncaea	58	28	27	1685	1941	1448	196	186	232		
Corycaeus	45	40	40	369	233	390	72	107	136		
Luc icuti a fla vicorni s	73	71	56	89	236	126	79	141	115		
Candacia	10	11	11	14	19	10	12	30	21		
Eucalanus	44	45	33	56	63	37	45	72	54		