information paper

MAY 1968

intergovernmental oceanographic commission

UNESCO/NS/IOC/INF - 137

As was announced in the final issue of the IIOE Information Paper, No. 18, interesting information in regard to IIOE will from now on take this new form.

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1. APPRAISAL OF THE IIOE LARVAL FISH COLLECTION AT IOBC, COCHIN, INDIA, by Elbert H. Ahlstrom, U.S. Bureau of Commercial Fisheries, La Jolla, California.

From January 24 to February 9, 1967, I was at the Indian Ocean Biological Centre (IOBC) at Cochin, India, to advise on the potential of the larval fish collection, and to furnish background in the identification of the larvae to the family level (or below).

My approach was to study a number of representative collections of fish larvae, selected to contain material from each of the research vessels participating in the International Indian Ocean Expedition while maintaining a comprehensive coverage of the IIOE area. I selected 50 samples to treat in some detail, as these should give insights into the problems of working up the IIOE collections.

For the purposes of this report, I have grouped the study material into three ecological assemblages:

1) The Oceanic Zone --dominated by larvae of bathypelagic fishes, especially myctophids and gonostomatids.

2) The Coastal Zone --containing larvae of coastal species only.

3) The Intermediate Zone --containing a mixture of larvae of bathypelagic and coastal species.

Ecological Assemblage	No. of collections examined	Av. nos. of larvae per collection	Range in nos. per collection	No. of families represented	Av. no. of families per collection	Range in no. of families per collection
Oceanic Zone	19	36.1	3-221	23	4.9	1- 9
Intermediate Zone	27	72.0	4-216	43	7.9	3-17
Coastal Zone	4	74.8	17-129	14	6.5	3-10
All Zones	50	58.6	3-221	47	6.7	1-17

I am including a summary table (table 1) that lists the number of occurrences and number of larvae obtained of each family from each of the three ecological zones and from the collections as a whole. A total of 46 families and one order (Anguilliformes - eels) are included. Some of the larvae were in too poor condition to be identified, others were unknown to me. These are combined under "Dis. and Unident." (i.e. disintegrating and unidentified larvae).

The Oceanic Zone:

This area was dominated by larvae of deep sea fishes: myctophids, gonostomatids, stomiatids, paralepedids, scopelarchids, etc. Two families were especially abundant--Myctophidae (47.6% of larvae) and Gonostomatidae (30.5%). The families present in the oceanic zone can be determined from table 1.

It is possible to identify most of the myctophid and gonostomatid material to genus. The genera of these two families represented in the 50 collections are summarized in table 2. The genus, Diaphus, (as delimited by Fraser-Brunner) was the dominant genus in the collections as a whole, followed by the gonostomatid lantern fish, Vinciguerria. However, Diaphus

Table 1. Occurrence and abundance of fish larvae, by family, in 50 selected collections from the International Indian Ocean Expedition, grouped by ecological assemblages

	Ecological Assemblages							
	Oceanic		Intermediate		Coastal		Total-all areas	
	Occ.	Number obtained	Occ.	Number obtained	Occ.	Number obtained	Occ.	Number obtained
Myctophidae	19	326	25	712	1	1	45	1,039
Gonostomatidae	17	209	21	236	0	0	38	445
Sternoptychidae	2	5	3	6	0	0	5	11
Bathylagidae	3	4	2	20	0	0	5	24
Paralepididae	9	18	9	28	0	0	18	46
Scopelarchidae	4	6	2	4	0	0	6	10
Chauliodontidae	5	7	6	27	0	0	11	34
Stomiatidae	2	2	3	13	0	0	5	15
Melanostomiatidae	2	3	3	5	0	0	5	8
Astronesthidae	2	2	4	8	0	0	6	10
Idiacanthidae	0	0	1	1	0	0	1	1
Clupeidae	0	0	1	1	0	0	1	1
Engraulidae	0	0	5	244	2	39	7	283
Synodidae	0	0	6	47	2	59	8	106
Anguilliformes	5	5	7	7	0	0	12	12
Bregmacerotidae	4	6	14	138	1	1	19	145
Gadidae	0	0	2	3	0	0	2	3
Hemirhamphidae	0	0	1	1	0	0	1	1
Melamphaidae	1	1	3	3	0	0	4	4
Bothidae:Paralichthinae	0	0	0	0	1	22	1	22
Bothidae:Bothinae	0	0	8	8	2	4	10	12
Cynoglossidae	0	0	3	3	1	1	4	4
Apogonidae	0	0	1	1	0	0	1	1
Thunnidae	5	10	3	10	0	0	8	20
Gempylidae	3	3	6	9	0	0	9	12
Scomberomoridae	0	0	5	28	0	0	5	28
Carangidae	0	0	8	25	3	8	11	33

Table 1. -- Continued. Occurrence and abundance of fish larvae, by family, in 50 selected collections from the IIOE, grouped by ecological assemblages

	Ecological Assemblages							
	Oceanic		Intermediate		Coastal		Total-all areas	
	Occ.	Number obtained	Occ.	Number obtained	Occ.	Number obtained	Occ.	Number obtained
Coryphaenidae	1	1	1	2	0	0	2	3
Nomeidae	1	2	10	35	0	0	11	37
Mullidae	0	0	2	3	0	0	2	3
Serranidae	1	3	4	10	3	9	8	22
Sciaenidae	0	0	1	2	0	0	1	2
Bramidae	0	0	1	1	0	0	1	1
Pomacentridae	0	0	1	1	0	0	1	1
Labridae	2	2	12	32	0	0	14	34
Gobiidae	2	3	16	50	3	20	21	73
Sphyraenidae	0	0	1	1	0	0	1	1
Scorpaenidae	1	1	6	105	2	65	9	171
Triglidae	0	0	1	1	2	16	3	17
Carapidae	0	0	1	1	1	1	2	2
Ophidiidae	0	0	1	4	0	0	1	4
Monocanthidae	0	0	0	0	2	6	2	6
Tetraodontidae	0	0	3	3	0	0	3	3
Diodontidae	0	0	2	2	0	0	2	2
Molidae	1	1	0	0	0	0	1	1
Lophiidae	0	0	1	1	0	0	1	1
Ogcocephalidae	1	1	0	0	0	0	1	1
Antennariidae	0	0	1	1	0	0	1	1
Disintegrated and unidentified	10	64	16	102	4	47	30	213
Total	(19)	685	(27)	1,945	(4)	299	(50)	2,929

Table 2. Genera represented in collections of larvae of Myctophidae and Gonostomatidae (based on 50 selected International Indian Ocean Expedition samples)

	Ecological Assemblage							
	Oceanic		Intermediate		Coastal		Total-all areas	
Myctophidae	Occ.	Number obtained	Occ.	Number obtained	Occ.	Number obtained	Occ.	Number obtained
Diaphus	15	102	21	379	0	0	36	481
Lampanyctus	14	43	13	57	1	1	28	101
Diogenichthys	8	21	13	48	0	0	21	69
Symbolophorus	9	27	10	30	0	0	19	57
Myctophum	2	3	7	26	0	0	9	29
Notolychnus	7	14	8	25	0	0	15	39
Hygophum-Benthosema	10	43	9	44	0	0	19	87
Centrobranchus	4	16	3	15	0	0	7	31
Electrona	3	3	3	5	0	0	6	8
Ceratoscopelus	4	7	4	7	0	0	8	14
Notoscopelus	2	6	1	3	0	0	3	9
Lampadena	2	5	1	3	0	0	3	8
Scopelopsis	1	4	0	0	0	0	1	4
Undetermined	9	32	9	70	0	0	18	102
Total	(19)	326	(25)	712	(1)	1	(45)	1,039
Gonostomatidae								
Vinciguerria	13	157	18	205	0	0	31	362
Cyclothone	10	48	8	25	0	0	18	73
Other*	4	4	4	6	0	0	8	10
Total	(17)	209	(21)	236	(0)	0	(38)	445

* Contains larvae of Diplophos, Maurolicus, Gonostoma and perhaps one other genus. Records on hand not complete enough to tabulate them separately.

was exceeded in number in the Oceanic Zone by Vinciguerria; Diaphus averaged 5.4 larvae per haul, Vinciguerria 8.3.

Interestingly, a series was obtained of Scopelopsis while examining the IIOE collections. This myctophid has photophores all over the body and also has unusually high counts for the dorsal and anal fins.

In addition to 11 families of Clupeiformes and Myctophiformes, larvae were obtained in small numbers from 13 other families. Perhaps of most interest are the tuna larvae (family Thunnidae) present in 5 of the 19 collections. The majority of the families present are frequently represented as larvae in oceanic collections: Eel leptocephali, the gadoid Bregmaceros, Melamphaeidae, Thunnidae, Gempylidae, Nomeidae (Psenes and related genera), Molidae, etc. Interestingly, the presence of oceanic gobies was verified by otoliths from oceanic bottom mud samples obtained from Anton Bruun 9 by John Fitch, Director of the California Fish and Game's Terminal Island Laboratory. Deep water scorpaenids are not unusual. The larvae of Labridae (unmistakably so) and of Serranidae (less positive, here) are unusual oceanic forms.

The Intermediate Zone

The intermediate zone was the richest area in kinds of fish larvae. In addition to the typical oceanic families, many others were represented--43 in all. Actually, several of the families found in oceanic waters were

more abundant in this zone. This particularly applied to the Bregmacerotidae and the Nomeidae. Larvae of several families were collected only from this zone. Of interest, was the Scomberomoridae (related to tunas and mackerels). Also a number of families were common in this zone as well as in coastal waters; examples are Engraulidae, Synodontidae, and Carangidae.

It is interesting to note that the myctophid genus Diaphus was by all odds the most abundant kind of larvae in the intermediate zone; it averaged 14.0 larvae per haul. Anchovy larvae (Engraulidae) averaged 9.0 larvae per haul, Vinciguerria, 7.6 larvae, Bregmaceros, 5.1 larvae.

The Coastal Zone

Only 4 of the 50 collections are referred to the coastal zone. This number of collections is too few to give an adequate representation of the families that would occur in coastal collections. I would anticipate that the variety may be as great as in the intermediate zone. Also, identification of these larvae will pose more problems than those of the other two assemblages.

In the few collections studied, moderate to fairly large numbers of larvae were obtained of Engraulidae, Synodontidae, Bothidae-Paralichthinae, Scorpaenidae, Triglidae and Gobiidae.

Discussion

Larvae belonging to 46 families and one order (Anguilliformes) were identified from the 50 collections. This list is incomplete--more families will be encountered as more collections are identified. Only about 2 to 3% of the IIOE collections were examined during my stay in Ernakulam. I believe that these collections are representative, and that the list already contains most families that will make a significant contribution, in terms of numbers of larvae, to the IIOE material. These are summarized in table 3. About one-third of the families contribute between 90-95% of the larvae (exact percentage depends on proportion of "Dis. and Unident." that is referrable to these families).

It is gratifying to find tuna larvae in 8 of the 50 collections. Distribution and abundance of these larvae will be of considerable interest to a number of scientists. The abundance of anchovy larvae (Engraulidae) should also be noted. Nearly 10% of the larvae belonged to this family.

I am somewhat puzzled by the scarcity of clupeid larvae (only one specimen in the 50 collections) and of scombrid larvae. No material of Rastrelliger was observed in the 50 collections. However, several specimens of Rastrelliger, previously identified as such by Mr. Peters, were examined. They definitely are scombrid larvae, and undoubtedly are Rastrelliger larvae. From present evidence, the larvae of Rastrelliger are not common in the IIOE collections.

Table 3. Percentage contributions of more commonly occurring fish families in 50 selected IIOE collections, grouped by ecological assemblages

Family	Oceanic	Intermediate	Coastal	Total
Myctophidae	47.6%	36.6%	0.3%	35.5%
Gonostomatidae	30.5	12.1	0	15.2
Bathylagidae	0.6	1.0	0	0.8
Paralepididae	2.6	1.4	0	1.6
Chauliodontidae	1.0	1.4	0	1.2
Engraulidae	0	12.5	13.1	9.7
Synodidae	0	2.4	19.7	3.6
Bregmacerotidae	0.9	7.1	0.3	4.9
Bothidae	0	0.4	8.8	1.2
Thunnidae	1.5	0.5	0	0.7
Scomberomoridae	0	1.4	0	1.0
Carangidae	0	1.3	2.7	1.1
Nomeidae	0.3	1.8	0	1.3
Serranidae	0.4	0.5	3.0	0.8
Labridae	0.3	1.6	0	1.2
Gobiidae	0.4	2.6	6.7	2.5
Scorpaenidae	0.1	5.4	21.7	5.8
Other families	4.4	4.6	8.0	4.6
Disintegrated and unidentified	9.3	5.3	15.8	7.3
Total	99.9	99.9	100.1	100.0

Flatfish larvae were present in a number of collections, mostly in small numbers. The best material examined was a collection of Pseudorhombus (Bothidae - Paralichthinae). Larvae of Bothidae - Bothinae represent 4 or more kinds in the material examined.

Before the larval fish materials are parcelled out to specialists, the collections should be analyzed as a whole, in order to obtain information on the kinds, abundance, and distributions of the major groups of fishes. The importance of systematically-collected larval fish information for evaluating fishery resources has not been sufficiently appreciated. This use of the material could prove to be the most consequential, in terms of spin-off.

2. AN ASSESSMENT OF COPEPODS IN THE INTERNATIONAL COLLECTION AT IOBC, COCHIN, INDIA, by A. Fleminger, Scripps Institution of Oceanography, La Jolla, California.

Many years of study by a wide variety of specialists will be required to extract the potentially rich, faunal information contained within the International Collection of Indian Ocean zooplankton. Specialists will be attracted to the collection by its broad geographical and seasonal coverage, as well as by the fact that it is being systematically sorted into quantitatively representative subsamples of major taxonomic categories. The specialists in turn will expect that: (1) the original samples are representative of the contents of the stratum routinely sampled (200 meters to the surface), that (2) the subsampling and sorting have not disturbed this quality appreciably, and (3) that the specimens are in reasonably good condition.

With plankton gathering methods varying from institution to institution and attempts to calibrate different kinds of collecting gear and towing procedures only just beginning, interest in the International Collection may be enhanced by a preliminary estimate of the representativeness and reliability of sorted material.

At the conclusion of the 5th Consultative Committee meeting in March, 1967, I undertook a brief survey of sorted, free-living copepods, Category 46, to determine their composition, qualitatively and quantitatively, and their state of preservation. I planned to

judge the quality of the sorting on the basis of the proportion of non-Category 46 individuals present in the observed material and to judge the faunal representativeness of the material by comparing results with existing knowledge of the region.

One or more Category 46 sortings were chosen at random from the total number of samples obtained within a number of Marsden 10° squares. The Marsden squares were selected so as to provide a sequence of samples ranging the width and breadth of the Indian Ocean (Figure 1).

Twenty-three samples were examined (Table 1). Each was subsampled volumetrically with the aid of a Stempel-type piston pipette and analyses were carried out on one or more subsamples, each being 2.5% by volume. Identifications and counts were made with the aid of a stereomicroscope at 16x magnification. Every specimen in a subsample was identified and counted.

The results are shown in Table 2. On the left of Table 2 is a complete list of the recorded taxa. The values of abundance represent the number in a vertical tow made with the Indian Ocean Standard Net from 200 m to the surface. The species list contains 84 calanoid copepods identified to species and a smaller number identified to genus or to family. Twenty-seven families and 42 genera appear in the list. The most abundant categories, including the six most abundant species based on sexually mature individuals, are given in Table 3.

The list contains no surprises. It is rich in the so-called micro-copepods, i.e., < 2 mm in total length, which appear to dominate in most tropical and subtropical seas. The most abundant calanoid copepods in Table 2, identifiable in that both the generic and specific

parts of their name are cited, are less than 3 mm in total length when sexually mature; four are typically less than 2 mm. The cyclopoids, Oncaea spp., Corycaeus spp., and Oithona spp. are equally small in size.

The relative richness of the copepod fauna can be seen in the number of different species observed in a sample. The mean number of different species in 23 samples is 34 (range 10-59). This is a minimal estimate since cyclopoid and harpacticoid copepods were identified only to genus and, in addition, the total copepod sample was not scanned for less numerous species absent from the aliquot. The high number of Euchaeta spp., immature copepodites, may prove to be especially interesting in analyzing trophic dynamics within the copepods inasmuch as the genus consists of predacious species which may subsist primarily on smaller copepods. Although direct evidence is lacking, the same may apply to Oncaea spp. and Corycaeus spp.

Comments on the quality of the preservations have already been presented in letters to the Director, Office of Oceanography, dated 4 April 1967 and 28 September 1967. Suffice it to say that in general, the copepods seem to have undergone moderate to extensive degeneration of soft, internal tissues from as yet unknown causes. The external skeleton, usually was found in sufficiently good condition to permit routine identifications.

Quality of sorting

Persistent homogeneity of the sortings and a yield in faunal diversity approximating or exceeding the expected would substantiate faith in the high quality of the sorting program. One estimate of the quality of the sorting is the relative number and kind of improperly

assigned organisms appearing within a sorted category. My survey indicates an extremely high degree of homogeneity in the sorting of Category 46 and an absence of extensive, or moderate, systematic error.

The final six items appearing in Table 2 comprise the total number of observed taxa not belonging to copepod Category 46. Their cumulative records amount to nine instances, all but one being based upon one specimen. The 23 samples yielded an average of 34 different taxa per sample. Hence, among the cumulative total of 782 taxa tabulated in the 23 samples, there were nine improperly assigned kinds of organisms for an error of about 1%.

It can be argued that this estimate of 1% is somewhat on the high side. One of the plankton samples (R/V Kistna 194) yielded four of the nine cases, the remaining five being distributed among five different samples. All cases but one were based on the observation of only one specimen, indicating relatively low abundance and suggesting nonsystematic error. Two of the improperly sorted items, a radiolarian and a small annelid, often adhere to the appendages of larger crustaceans and are thereby sorted inadvertently with the specimen to which they are attached. Two other forms, Copilia and Sapphirina, are copepods sorted separately from Category 46; they also fall into the category of random errors. The last item, ostracod, may easily be mistaken for and sorted with copepods when sorting is carried out without the aid of visual magnification. It, alone, may represent a small but systematic source of error.

Comments on the Spp. List

Is the IIOE International Collection representative of the Indian Ocean copepod fauna? Although my brief examination cannot substitute for the array of data necessary to consider this question in depth, comparison of the present results with what is already known about the region may reveal the promise of the material. The collecting methods utilized during the IIOE, being restricted to the uppermost 200 m of depth, preclude adequate representation of species normally occurring below the epiplankton.

The present study yielded evidence of more than 84 species of calanoid copepods. The combined list of Indian Ocean Calanoida in three recent papers dealing with the epiplankton (Kasturirangan,1963[1]; Saraswathy, 1967[2], Tanaka 1960[3]) yields a total of 100 species, more than half of which also appear in Table 2. The most extensive list is to be found in the combined works of Sewell (1929-1947[4,5]), which yields about 400 species of Calanoida, the result of more than 35 years of study on various sectors of the Indian Ocean region. Roughly 210 of these species may be regarded as epiplanktonic and they include virtually all the calanoids listed in the references of Kasturirangan, Saraswathy, and Tanaka mentioned above.

Since the present study, utilizing small aliquots from about 1% of the total number of available samples in the International Collection, yielded almost half of Sewell's total list of epiplanktonic calanoids, there is no reason to doubt the qualitative representativeness of the IIOE International Collection. In fact, it can be anticipated that this

collection will yield a complete record of the epiplanktonic copepod fauna as well as the general features of its distribution in the Indian Ocean.

It is virtually futile to attempt to assess the quantitative representativeness of the Collection on the basis of my observations. I should mention, however, that in my experience with similar tropical and subtropical species that are numerous in the Western Hemisphere (e.g., Nannocalanus minor, Clausocalanus furcatus, Paracalanus denudatus, Lucicutia flavicornis) mean values of abundance are of the same order of magnitude and, in fact, tend to be similar to the values obtained from the present study.

Footnotes

1. Kasturirangan, L.R., 1963, Publ. No. 2, Indian Nat. Comm. Ocean Res.
2. Saraswathy, M., 1967, Proc. Symp. Crustacea, Pt. 1, pp. 74-106.
3. Tanaka, O., 1960, Biol. Res. Japanese Antarctic Res. Exped. 10.
4. Sewell R.B.S., 1929, 1931, Rec. Indian Mus. X.
5. Sewell R.B.S., 1947, John Murray Exped., Sci. Reports, VIII.

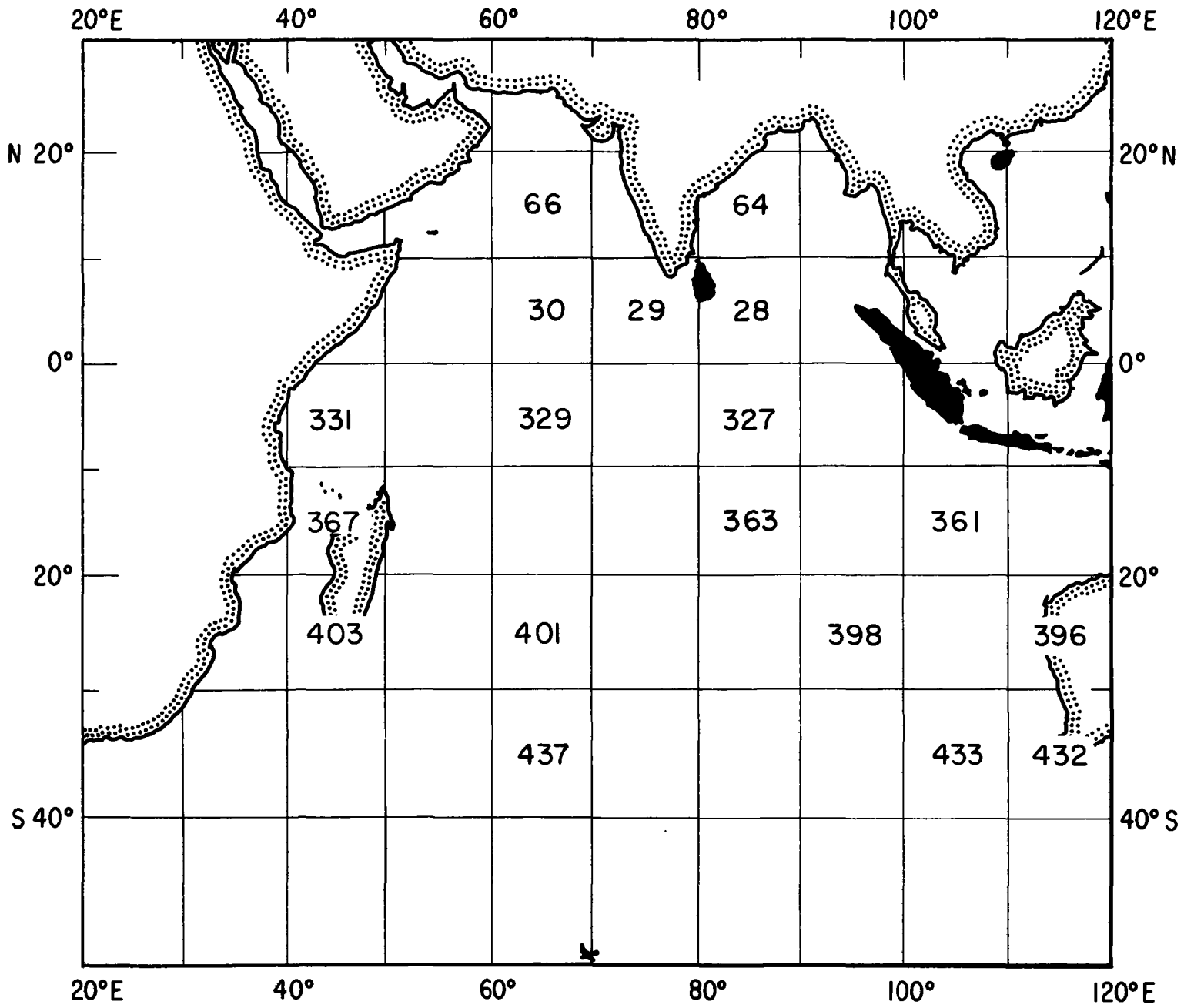
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Figure 1

Table 1 - Samples examined for this report

Ship	Sta. No.	Latitude	Longitude	Marsden Sq.
ARGO	94	03°02'N	89°01'E	028
VARUNA	2007	09°00'N	75°20'E	029
ARGO	62	04°51'N	79°04'E	029
ARGO	63	04°00'N	79°02'E	029
VITYAZ	5319	5°22'S	68°22'E	030
INS. KISTNA	194	14°15'N	86°00'E	064
A. BRUUN	8	15°35'N	60°00'E	066
A. BRUUN	191	23°57'N	60°58'E	102
ZULFIQUER	5	23°58'N	66°09'E	102
VITYAZ	5279	4°59'S	83°58'E	327
VITYAZ	5328	33°12'S	99°06'E	329
METEOR	152	2°19'S	43°43'E	331
UMITAKA MARU	6321	11°01'S	106°03'E	361
VITYAZ	5336	19°32'S	87°42'E	363
A. BRUUN	411	14°24'S	46°08'E	367
GASCOYNE	5	27°30'S	111°00'E	396
GASCOYNE	32	28°55'S	110°00'E	396
VITYAZ	5198	28°01'S	91°27'E	398
A. BRUUN	347	22°06'S	64°55'E	401
A. BRUUN	367	22°34'S	41°16'E	403
DIAMANTINA	53	32°00'S	110°00'E	432
DIAMANTINA	4	30°30'S	109°57'E	433
A. BRUUN	129	30°34'S	69°55'E	437

Marsden 10° sq. / Station	028 Argo 94	029 Var. 2007	029 Argo 62	029 Argo 63	030 Vita. 5319	064 Kist. 134	066 A. B. 8	102 A. B. 191	102 Zul. 5	327 Vita. 5279	329 Vita. 5328	331 Met. 152	361 UM 6321	363 Vita. 5336	367 A. B. 411	396 Gasc. 5	396 Gasc. 32	398 Vita. 5198	401 A. B. 347	403 A. B. 367	432 Dm. 53	433 Dm. 4	437 A. B. 129	Total
Centropages calaninus				20									160											180
elongatus										160														160
furcatus			160			40									100									300
gracilis	160																			100				260
orsinii								4,400																4,400
spp. juv.							133																	133
Clausocalanus arcuicornis	160				300				560				160	89	300	107	534	89		300	480	480	44	3,603
farrani	160	320		20	100	80	533	400	320				160		400		67							2,560
furcatus	160	160	80		100	400	1,066	400	1,760			160	1,120		1,300	320	133			200	160			7,519
jobei																				100		53		153
lividus																	67	44	44		320			475
mastigophorus	160	320			300	40	133			80			160	44	400			89		100		53		1,879
minor	480	160	80			200	133			240			400		100					100				1,893
parapergens							267						80		100	53	200			100	320	53		1,173
sp. d																					213			213
spp. juv.					100	80	133	400		80	44	40	720		300	320	200	44	44	100	1,173	160		3,938
Clytemnestra sp.																					53			53
Corycaeus spp.	320	800	880	180	1,100	360	1,466	400	640	800	44	200	720	577	400	53	534	44	622	400	906	426	89	11,961
Ctenocalanus vanus	160	160			100					160	89				200			44		200	213			1,326
Eumetideus acutus					100					160			80	222	100		67				53			782
giesbrechti			80																		53			133
sp.										80														80
spp. juv.		160			100								160				67			100				587
Eucalanus attenuatus		320	320	20	700	200	267			240		120	80	89		53	67			200				2,676
crassus			160	40								120												320
elongatus								400																400
hyalinus																	67			100				167
mucronatus				60				400	160											200				820
pileatus		160	80		100	40	133		320															833
subcrassus				20	100																			120
subtenuis					1,400					320		120		89		267	133			100				2,429
spp. juv.		160	160	120	300	120	1,066	2,000		800		760		44		53				100				5,683
Euchaeta concinna						40																		

Marsden 10° sq. / Station	028 Argo 94	029 Var. 2007	029 Argo 62	029 Argo 63	030 Vita. 5319	064 Kist. 134	066 A. B. 8	102 A. B. 191	102 Zul. 5	327 Vita. 5279	329 Vita. 5328	331 Met. 152	361 UM 6321	363 Vita. 5336	367 A. B. 411	396 Gasc. 5	396 Gasc. 32	398 Vita. 5198	401 A. B. 347	403 A. B. 367	432 Dm. 53	433 Dm. 4	437 A. B. 129	Total
erythraea								400																400
negligens	160	320	160		200	120	133			160	355			133	400	53	534	89		100	1,226	107		4,250
spp.									320			40					67							427
spp. juv.																						53		213
Acrocalanus andersoni										160														160
gracilis	640	160		440		80	400	4,400	480			80	240	44	300	107				100				7,471
longicornis	160					40	933	3,200	1,920	80		200		44			67							6,644
monachus	160		240	40		40	133													100				713
spp.			80				667					40	80		200									1,067
spp. juv.								400																400
Aetideid sp.																	133				53			186
spp. juv.	480				100	120														200	53	53		1,006
Augaptilus spp. juv.																	67							67
Calanid spp. juv.	640	160	80	140	400	560	1,066			80		520	640	311	500	160	200	133		400			311	6,301
Calanoid spp. juv.	800	1,120			1,300	480	133	800		640	44		480	444	800	426	133	178	533	200	693	426	133	9,763
Calanopia minuta	160	160																						320
sp.			320	20																				340
Calanus (N.) gracilis										240				311			67				107			725
(N.) minor	480	160	1,280	300	100	120	1,066	400	800	400	133	160	160	1,998	700	693	1,467	44	222		1,173	53	133	12,042
(N.) robustior										80				89		107	133							409
tenuicornis		480			400					320			160	311	900	160	67	89	311		853	107	266	4,424
Calocalanus pavo		320					133	400				40			100	107	200				107			1,407
plumulosus							133		160		22	40										53		408
styliremis																	67							67
sp.											22													22
Candacia aethiopica				80		40				80				44				89						333
bipinnata																	67							67
bispinosa										80				133		107	133							453
catula			80	20	100					80														280
longimana										80														80
simplex			80														133				53			266
truncata	160	160	80	20		40	133			80				44										717
spp.						40					22		80				67							209
spp. juv.	160	320	400	20	100	40				80				44			67		44	200	320			1,795
Canthocalanus pauper	640		80			40	133	400	160	80														1,533

spp.											80																		80
spp. juv.	160	1,120	1,200	60	500	440	1,733	800	1,120	240				560	133	900	213	267		44	600	213							10,303
Euchirella bella						80				80																			160
formosa																							53						53
venusta					100																								100
sp.			80																				53						133
spp. juv.			160					800																					960
Haloptilus longicornis		1,120			100	80	133	400		480	67		80	44	200	107	67	44		200	107								3,229
spp. juv.																	67												67
Heterorhabdus papilliger	160		160		100									44						100									564
spinifrons																							53						53
sp.						80											67				53								200
spp. juv.				20		40				160	44																		264
Heterostylites spp. juv.						40																							40
Labidocera acuta								2,400																					2,400
laevidentata				40																									40
spp. juv.					100		133																						233
Lubbockia sp.										80			80									107							267
Lucicutia clausi					100 ♂																								100
flavicornis	320	640	160		200	280			480	960		40		484	900	213	667	178	89			480	160	222					6,473
sp.	160		80			80				400		40	640				67		89										1,556
spp. juv.															200														200
Mecynocera clausi											67			89	100							53							309
Macrosetella sp.																	67												67
Miracia sp.						40																							40
Oithona spp.	160	1,280	240	20	300	480	933	1,200		720	155	120	560	222	900		400		44	400	800								8,934
Oncaea spp.	320	480	2,320	200	1,000	280	3,866	2,000	1,120	1,600			2,880		2,800	426	934		44	1,700	1,546	533	89							24,138
Paracalanus denudatus			320		1,200	80	267	4,000				240	320		400	53	67			600										7,547
sp.								400 ♂					80																480
spp. juv.			80				1,733	400					240				67				53								2,573
Phaenna spinifera														44															44
Phyllopus sp.										80																			80

Marsden 10° sq. / Station	029 Argo 94	029 Var. 2007	029 Argo 62	029 Argo 63	030 Vitz. 5319	064 Kist. 194	066 A. B. 8	102 A. B. 191	102 Zul. 5	327 Vitz. 5279	329 Vitz. 5328	331 Met. 152	361 UM 6321	363 Vitz. 5336	367 A. B. 411	396 Gasc. 5	396 Gasc. 32	398 Vitz. 5198	401 A. B. 347	403 A. B. 367	432 Dm. 53	433 Dm. 4	437 A. B. 129	Total
Pleuromamma abdominalis							133																	133
gracilis	160	160			300					160						267	133	178		100	373	320	44	2,195
indica	640					120		3,200	3,520					44		53						160		7,737
xiphias	160															53					53	53		319
sp.										160														160
spp. juv.					500	360	400	800	2,400	480	22		160	89	200	107	67	89		100	533	107	44	6,458
Pontellina plumata			80			40				80												53		253
Pseudodiaptomus sp.								400	160															560
Rhincalanus cornutus	480	320	80	140	500	120				800		800	80											3,320
spp. juv.							133																	133
Scaphocalanus curtus								1,200												100				1,300
spp.																					53			53
spp. juv.																				100				100
Scolecithricella ctenopus						40																		40
dentata										160											213	53		426
tenuiserrata							133	400		80							67				53	53		786
sp. 1			80 ♂		100 ♂	40			320								67							607
sp. 2						40																		40
spp. juv.				20								40												60
Scolecithricid sp. ♂							133						80	44										257
spp. juv.								400					80								107			587
Scolecithrix bradyi			160		100 ♂									89	300	107	133							889
danae	480		400		100	40	267			320	22	160	160		400	53	133			500	53			3,088
Temora discaudata		160	80	100		40						80				53								513
turbinata									160									44						204
Undeuchaeta major	160																							160
plumosa																	67				53			120
spp. juv.										240														240
Undinula vulgaris				80		80	400					40												600
darwini			80	100	800		133			80			320							300				1,813
vulgaris			80	60			133								500									773
sp.													80											80
spp. juv.			400	120								40	240											800
annelid						40																		40

Marsden 10° sq. / Station	029 Argo 94	029 Var. 2007	029 Argo 62	029 Argo 63	030 Vitz. 5319	064 Kist. 194	066 A. B. 8	102 A. B. 191	102 Zul. 5	327 Vitz. 5279	329 Vitz. 5328	331 Met. 152	361 UM 6321	363 Vitz. 5336	367 A. B. 411	396 Gasc. 5	396 Gasc. 32	398 Vitz. 5198	401 A. B. 347	403 A. B. 367	432 Dm. 53	433 Dm. 4	437 A. B. 129	Total
annelid						40																		40

Table 3 - Ten most abundant organisms

Taxon	Numbers in 23 samples	Mean/sample	No./100m^3
Oncaea spp.	24138	1049	525
Nannocalanus minor	12042	523	261
Corycaeus spp.	11961	520	260
Euchaeta spp. (immature copepodites)	10303	448	224
Oithona spp.	8934	388	194
Paracalanus denudatus	7490	326	163
Acrocalanus gracilis	7471	325	163
A. longicornis	6644	289	145
Clausocalanus furcatus	6519	283	141
Lucicutia flavicornis	6473	281	141