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## NET FOR SAMPLING MICRO AND MACRO ZOOPLANKTON IN A SINGLE HAUL

C. T. ACHUTHANKUTTY AND R. ALFRED SELVAKUMAR

*National Institute of Oceanography, Dona Paula, Goa*

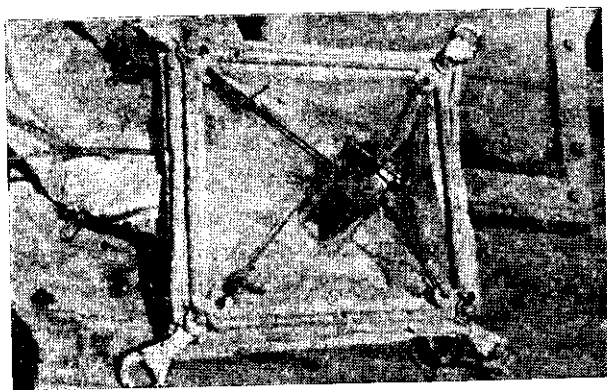
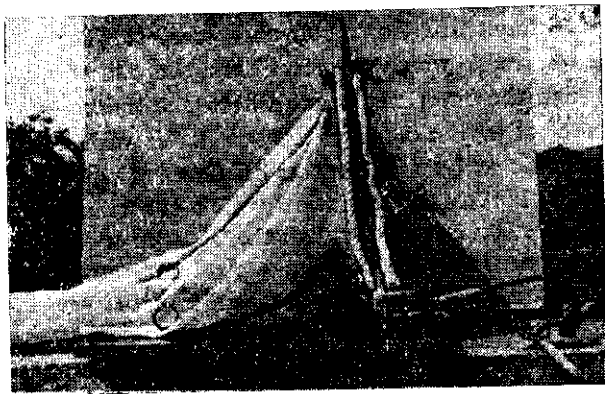
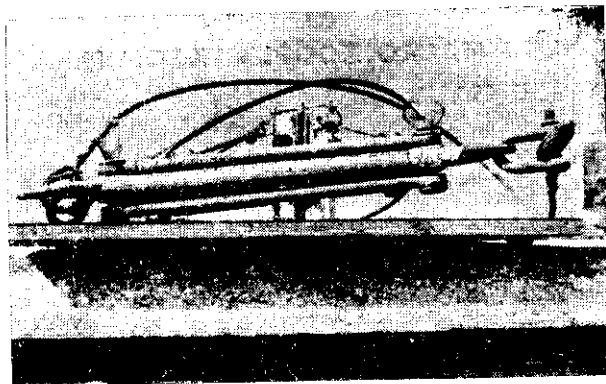
### ABSTRACT

A new gear designed for sampling macro and micro-zooplankton from a particular body of water is described. The mouth area of the frame is  $1/16 \text{ m}^2$  with provision for the attachment of flowmeter and bridles. The net is made of nylon cloth of  $300 \mu\text{m}$  mesh width which filters the macro-zooplankton ( $300 \mu\text{m}$  and above) and the outer net which filters the micro-zooplankton ( $50\text{--}300 \mu\text{m}$ ) is made of nylon cloth of  $50 \mu\text{m}$  mesh width. Trial collections made from the oceanic and coastal waters off Goa indicated that a sizeable amount of micro-zooplanktonic population which contribute a major share in the secondary production escape through the  $300 \mu\text{m}$  mesh net. It is found that by restricting the time of hauling depending on the productivity of the water, the net can be efficiently operated in estuaries and coastal waters also.

The present method of plankton sampling provides no single gear to collect plankton of all sizes. Thus it becomes impossible to sample animals ranging from  $20 \mu\text{m}$  to more than  $1 \text{ cm}$  in size by one net because of the problems of clogging, avoidance, escape through the mesh, etc. Keeping these drawbacks in mind, an attempt was made to collect at least macro (above  $300 \mu\text{m}$  size) and micro-zooplankton ( $50\text{--}300 \mu\text{m}$  size) together in two different nets from a particular body of water in a single haul. A new gear with two nets of different mesh sizes was, therefore, designed in order to estimate the

contribution of micro and macro-zooplankton to the secondary production.

The plankton sampler has a square frame made of  $1/2''$  thick iron rod with an area of  $1/16 \text{ m}^2$ . The outer corners of the frame are provided with large rings for attaching the bridles for towing. The inner corners have small rings for fixing the flow meter (Fig. 3). Two frame guards — one upper and one lower — having the same area as the main frame, are attached to it with nuts and bolts. The upper frame has wing nuts and the lower one has blunt nuts (Fig. 1). The macro-zooplankton net which forms the



Figs. 1, 2, 3. (top to bottom).

1. Frame.
2. Attachment of net.
3. Attachment of flowmeter and bridles.

inner portion is made of nylon cloth of 300  $\mu\text{m}$  mesh width and is fitted between the upper frame guard and the main frame with wing nuts at the corners. The net is 1 m long and the deges of the mouth are thickened to avoid sliding while in operation and the corners are provided with gaps for the insertion of the nuts. The net has a cylindrical upper portion, 35 cm long and a lower conical portion, 65 cm long. The cod end of the net is provided with a detachable transparent plankton bucket, 12.5 cm long and 5.5 cm in diameter with a window covered by the same material as the net. The net for micro-zooplankton is mounted outside. It is attached in between the lower frame guard and the main frame by blunt nuts at the corners. The blunt nuts are for avoiding any damage to the net while in operation. The edges and the corners of the mouth are similar to those of the inner net. The outer net is 1.5 m long, made of nylon cloth of 50  $\mu\text{m}$  mesh width. The cylindrical upper portion is 50 cm long and the conical lower portion is 100 cm long. A throttling band of terylene cloth, 10 cm broad with copper rings is provided in the cylindrical portion. This is 30 cm below the opening and is used for closing the net by a tripping mechanism during vertical hauls. The window of the plankton bucket is covered with 50  $\mu\text{m}$  mesh cloth. Attachment of the nets to the frame is shown in Fig. 2. Since there is no gap between the main frame and the frame-guards, water can enter only through the mouth opening of the inner net and the macro-zooplankton (300  $\mu\text{m}$  and above in size) gets filtered in this net and the outer



4. Net in vertical position to remove the sample and for washing.

net filters the micro-zooplankton (50-300  $\mu\text{m}$  in size). The net after hauling is hanged vertically with the help of two hooks (Fig. 4) for removing the collected plankton from the buckets. After collecting the micro-zooplankton from the outer bucket, the outer net should be removed for collecting macro-zooplankton from the inner bucket. For subsequent collections, the outer net can be attached to the frame.

Trial collections have been made from 11 different stations in the oceanic and coastal waters off Goa. At all the 11 stations horizontal hauls were made for 5 minutes maintaining the speed of the boat at 3 km per hour and the flow meter readings were noted. The plankton collected in the two buckets were preserved in 5% formalin. The total volume of water filtered through the net during each haul was 10-12  $\text{m}^3$ . Mean displacement volume and mean abundance of each group collected in the two nets are given in Table 1.

TABLE 1

*Mean displacement volume and mean abundance of macro and micro-zooplankton in 11 stations (nos/10  $\text{m}^3$ ) (range in parenthesis).*

Zooplanktonic organisms	Macro-zooplankton	Micro-zooplankton
	Dis. volume	
Tintinnids	0.90 ml	10.27 ml
Medusae	—	7,800 (166-59,760)
Siphonophores	3 (0-22)	1,848 (0-9,960)
Pelecypod (larvae)	5 (0-29)	—
Gastropod (larvae)	15 (0-83)	1,290 (0-5,395)
	2	358

(TABLE 1. Continued)

Zooplanktonic organisms	Macro-zooplankton	Micro-zooplankton
	(0-22)	(0-1,660)
Cirriped nauplii	110	6,187
	(0-509)	(0-17,430)
Cypris stage of cirriped	4	1,094
	(0-27)	(0-3,320)
Copepod nauplii and copepodites	59	629,479
	(0-353)	(45,235-1,718,100)
Copepod (adults)	944	1,522,582
	(51-3,424)	(38,014-4,439,670)
<i>Lucifer</i> sp. (adults)	73	—
	(0-662)	
<i>Lncifer</i> sp. (larvae)	12	452
	(0-48)	(0-2,490)
<i>Alima</i> larva of squilla	91	—
	(0-613)	
<i>Megalopa</i> of crab	1	—
	(0-3)	
Other decapod larvae	623	2,999
	(45-2,916)	(0-26,560)
Decapod nauplii	—	3,768
		(373-12,450)
Cladocerans	1,243	1,993
	(0-6,662)	(0-13,280)
	1	—
	(0-3)	—
Amphipods	4	5,644
Polychaete (larvae and adults)	(0-25)	(0-27,390)
	129	22
Fish eggs	(0-788)	(0-249)
	12	11
Fish larvae	(0-32)	(0-124)
	104	645
Chaetognaths	(0-509)	(0-2,490)
	44	9873
Appendicularians	(0-218)	(0-24,900)

At all the stations, it was found that the displacement volume of micro-zooplankton was 3-9 times greater than that of macro-zooplankton. King (1950) estimated that 2 to 50% of the minute organisms including copepods escape through the net having 173 mesh per inch and Banse (1962) found that 15 to 30 times plankton of the total biomass pass through the No. 2 or No. 3 nets. Micro-zooplanktonic organisms like tintinnids, decapod nauplii, etc. were not collected in the inner net and macro-zooplankton such as siphonophores, lucifer, alima larva of *Squilla*, amphipods, etc. were not collected in the outer net. This clearly shows that the organisms which were collected in the outer net have escaped through the 300  $\mu$ m mesh net and thus a sizeable amount of micro-zooplanktonic population passes unnoticed in the zooplankton studies. Micro-zooplankton constituted by copepods, copepod nauplii, copepodites, appendicularians, cirriped nauplii, cladocerans, pelecypod and gastropod larvae, etc., which play a major role in the secondary production, normally escape through the 300  $\mu$ m mesh net (No. 3 net) (see Table 1). Banse (1962) is of the opinion that a major portion of the zooplankton biomass cannot be assessed at all by the routine methods employed in zooplankton counting since most of the metazoans escape through the meshes of No. 3 net. Lohman (1908), in his investigations off Kiel found that small metazoans like

Rotatoria, copepod-eggs and copepod nauplii, *Oithona similis* and lamelli-branch larvae are mostly lost by a No. 2 or No. 3 nets but are retained by the No. 20 net.

The difficulty always faced with an encased net is clogging. This drawback, in the opinion of Vannucci (1968), Tranter and Smith (1968) can be remedied by reducing the mouth aperture or speed of the tow and increasing the filtering area. As the filtration efficiency of micro-zooplankton net is comparatively lower than macro-zooplankton net, escape of some of the fast swimming organisms is unavoidable.

It is found that the net can be operated more efficiently in oceanic waters than in estuaries or coastal waters where turbidity is rather high. Even then, if the time of hauling is restricted to 5 minutes in a productive area and 2 minutes in a very rich area, this net can be efficiently operated even in coastal waters and estuaries.

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