# A Comparison of Euphausiid Shrimp Collections Made with a Micronekton Net and a One-Meter Plankton Net[1]

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IN AN EVALUATION of variable factors affecting the apparent geographic range and estimated abundances of euphausiids, Brinton (1962) compared euphausiid catching ability of a 1-m diameter net, made principally of 0.65 mm mesh, with a 45-cm diameter net made of 0.33 mm mesh. He found that adult and juvenile euphausiids were taken by the larger net in numbers as great or greater than were obtained with the 45-cm net, but that only about half as many larvae were taken with the coarser meshed meter net as with the 45-cm net. Collections with the 45-cm net contained almost as many species as the collections with the 1-m net, which filtered a volume of water 5 times as great (Brinton, 1962).

On Scripps Tuna Oceanography Research cruises 64-1 and 64-2 (off southern Baja California) an attempt was made to sample consecutively to the same depth with a micronekton net and a 1-m diameter plankton net, in order to compare euphausiid catches between the two nets. This paper is an evaluation of the euphausiid catching ability of the two nets.

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## METHODS

A description and figures of the micronekton net are found in Blackburn and associates (1962); the net with a 2.3 $m^2$ mouth opening is made of nylon netting of uniform mesh (apertures measuring about 5.5 mm by 2.5 mm) throughout and has a detachable cod end of #56 XXX grit gauze (mesh aperture 0.31 mm). The micronekton net was towed in oblique hauls, from an average depth of 131 m to the surface at 5 knots for an average period of 50 minutes; depth of haul was determined by a bathythermograph attached to the upper edge of the square mouth opening (1.5 m by 1.5 m). A flow meter was not used with the micronekton net, and volume of water filtered was estimated from size of mouth opening, ship speed, duration of tow, and a filtration coefficient of 0.757 which had been determined by Blackburn (MS). Estimated volume of water filtered per tow with the micronekton net ranged from 14,000 to 16,000 $m^3$.

The 1-m net (Ahlstrom, 1948) has a mouth opening of 0.785 $m^2$ and is made of #30 XXX grit gauze (mesh 0.65 mm) in the forward section of the net, with #56 XXX grit gauze (mesh 0.31 mm) in the rear section and cod end. It was towed in oblique hauls, from an average depth of 133 m to the surface at 1–2 knots for an average period of 14 minutes. Maximum depth of haul of the 1-m net was estimated from the amount of wire out and the wire angle; a calibrated flow meter placed at the center of the mouth opening was used to estimate volume of water filtered, which ranged from 385 to 468 $m^3$. On the average, the micronekton net filtered 34.4 times as much water as the meter net at each station.

Euphausiids were picked from the entire collection of each tow at 10 stations. "Wet" displacement volume of each entire euphausiid sample was determined according to the method of Ahlstrom and Thrailkill (1963). All euphausiids in these plankton samples were counted, with the exception of those in cruise 64-2 collections at stations 41 and 56; from these two collections, aliquots of ½ and ¼, respectively,

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were counted. Because the samples taken with the micronekton net were very large, it was necessary to use aliquots in all cases; these aliquots ranged from 2.75% to 50% depending upon the size of the sample. A Folsom plankton splitter (McEwen, Johnson, and Folsom, 1954) was used for fractionating the samples, with the exception of the micronekton sample at station 41. For this sample the animals in a gallon jar were kept in suspension by agitation, and a portion of animals and fluid was poured out; "wet" displacement volume of the animals was determined, and subsequently the euphausiids were measured and counted.

After the actual catch of euphausiids was estimated, the numbers were standardized for each size category to numbers per 500 $m^3$ of water (Table 1). Blackburn (MS) estimates that the amount of water actually filtered by the micronekton net at a speed of 5 knots, using the above mentioned filtration coefficient, is 1000 $m^3$ per 3.69 minutes. In this study micronekton standardized volumes, or numbers, per 500 $m^3$ were calculated by the following formula:

$$\text{ml or number}/500\ m^3 = \frac{\text{actual vol. or number}}{\text{number of minutes}} \times 1.85$$

Brinton (1962) has denoted as plentiful species those which occur in concentrations greater than about 25 specimens per 1000 $m^3$ of water. Of the euphausiid species which mature at $\geqslant$ 9 mm, only one, *Euphausia eximia,* was plentiful in the 64-1 and 64-2 collections, and this species was the predominant euphausiid in the samples. For each collection, in the portion of the sample counted, the length of each *E. eximia* was measured to the nearest mm, from the tip of the rostrum to the tip of the telson. In addition to other station data, the percentage of each sample which was counted and measured is noted in Table 1. Excluding station 41, the remainder of each sample was scanned under the microscope for rare species.

## DISCUSSION AND SUMMARY

Wilcoxon's signed-rank test (Tate and Clelland, 1957), a nonparametric statistical method, was employed to test for differences in euphausiid catching ability between the two nets. The data in Table 1 indicate that there is no significant difference between the nets with respect to estimated volume of total euphausiids per 500 $m^3$. However, it is clear that the nets differ with regard to ability to catch different species and ontogenetic stages. It is evident that the micronekton net does not quantitatively sample larval or juvenile *Euphausia eximia,* and that those animals which are less than 13 mm long escape readily through the larger mesh. In the size range 13–21 mm there appears to be no significant difference in number of *E. eximia* per 500 $m^3$, but there may be such a difference in the 22–28 mm size range; the micronekton net appears to catch more euphausiids in this size range than does the 1-m net. This difference in the 22–28 mm category may be interpreted as evidence of avoidance of the 1-m net by the larger euphausiids. However, when all adults (13–28 mm) are grouped together there is no significant difference between the nets with regard to the estimated density of *E. eximia.* Evidence of avoidance of towed nets by zooplankton has been presented by Fleminger and Clutter (1965).

In terms of the number of euphausiid species found at a station, there was no significant difference between the two nets when adults alone were considered (Table 1). When larvae and juveniles, as well as adults, were used to determine the total number of species present at a station, there was a significant difference between the catches of the two nets. The 1-m net caught more euphausiid species than the micronekton net, because it retained more larvae and juveniles than the micronekton net (Table 1) and also retained more adults of the smaller species (adult at $<$9 mm in length, Table 2). Table 2 shows a comparison of the two nets with respect to presence or absence of adults of different euphausiid species at nine stations. For the larger species (adult at $\geqslant$ 9 mm) the micronekton net as a sampling device is as good as or better than the 1-m net with regard to presence or absence of species (Table 2). Of the smaller species, with the exception of *E. distinguenda* (Table 2), presence of adults was observed more often in the 1-m net than in the micronekton net. Thus, for qualitative euphausiid studies, the 1-m net provides almost as much or more information for one-third of the ship time.

TABLE 1

EUPHAUSIID CATCHING ABILITY OF A MICRONEKTON NET COMPARED WITH A ONE-METER NET

| CRUISE AND STA. | POSITION LAT. N. | POSITION LONG. W. | DATE 1964 | NET | LOCAL TIME | DEPTH OF HAUL (M) | MEASURED TOTAL EUPHAUSIID DISPLACEMENT VOLUME, ML PER 500 $M^3$ | NUMBER OF SPECIES PRESENT AS LARVAE, JUVENILES, OR ADULTS | NUMBER OF SPECIES PRESENT AS ADULTS | ESTIMATED NUMBER OF *Euphausia eximia* PER 500 $M^3$ LARVAE 2-4mm | JUVENILES 5-12mm | ADULTS 13-21mm | ADULTS 22-28mm | ADULTS 13-28mm | PERCENT OF SAMPLE COUNTED AND MEASURED |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 64-1, 23 | 22° 55' | 112° 56' | 12 June | Meter | 2234-2247 | 129 | 4 | 11 | 7 | 4 | 203 | 32 | 6 | 38 | 100.00 |
| | | | | Micro-nekton | 2251-2350 | 134 | 2 | 10 | 9 | 0 | <1 | 11 | 14 | 25 | 25.00 |
| 64-1, 29 | 23° 02' | 111° 20' | 13 June | Meter | 2240-2254 | 131 | <1 | 8 | 5 | 8 | 20 | 4 | 0 | 4 | 100.00 |
| | | | | Micro-nekton | 2257-2357 | 135 | 4 | 6 | 5 | 0 | 1 | 26 | 26 | 52 | 25.00 |
| 64-2, 03 | 26° 58' | 115° 31' | 5 Aug | Meter | 2219-2233 | 134 | 6 | 13 | 6 | 47 | 19 | 7 | 4 | 11 | 100.00 |
| | | | | Micro-nekton | 2240-2334 | 145 | 5 | 5 | 5 | 0 | 0 | 10 | 29 | 39 | 12.50 |
| 64-2, 16 | 25° 33.8' | 113° 45' | 8 Aug | Meter | 2239-2253 | 139 | 4.5 | 9 | 6 | 31 | 23 | 2 | 15 | 17 | 100.00 |
| | | | | Micro-nekton | 2258-2352 | 125 | 2 | 5 | 5 | 0 | 0 | 6 | 11 | 17 | 50.00 |
| 64-2, 23 | 25° 01.7' | 113° 23.3' | 9 Aug | Meter | 2133-2147 | 134 | 3.5 | 9 | 6 | 130 | 1 | 18 | 20 | 38 | 100.00 |
| | | | | Micro-nekton | 2154-2246 | 140 | 6 | 4 | 4 | 0 | 0 | 10 | 56 | 66 | 12.50 |
| 64-2, 29 | 24° 29.4' | 113° 02.1' | 11 Aug | Meter | 0053-0108 | 131 | 3 | 8 | 4 | 15 | 26 | 30 | 8 | 38 | 100.00 |
| | | | | Micro-nekton | 0114-0210 | 130 | 5 | 4 | 4 | 0 | 0 | 15 | 33 | 48 | 12.50 |
| 64-2, 35 | 23° 50.7' | 112° 42.1' | 11 Aug | Meter | 2110-2124 | 136 | 3 | 6 | 4 | 0 | 17 | 10 | 13 | 23 | 100.00 |
| | | | | Micro-nekton | 2130-2224 | --- | 6 | 5 | 4 | 0 | <1 | 37 | 48 | 85 | 12.50 |
| 64-2, 41 | 23° 13.5' | 112° 18' | 13 Aug | Meter | 0056-0110 | 131 | 39 | - | - | 16 | 45 | 193 | 251 | 444 | 50.00 |
| | | | | Micro-nekton | 0116-0212 | 130 | 47 | - | - | 0 | 0 | 371 | 301 | 672 | 2.75 |
| 64-2, 56 | 22° 46.3' | 110° 22.4' | 16 Aug | Meter | 0105-0120 | 134 | 22.5 | 6 | 4 | 139 | 798 | 290 | 29 | 319 | 25.00 |
| | | | | Micro-nekton | 0121-0215 | 128 | 6 | 4 | 4 | 0 | 1 | 52 | 31 | 83 | 12.50 |
| 64-2, 58 | 23° 25' | 111° 12.5' | 16-17 Aug | Meter | 2309-2323 | 126 | 2 | 3 | 1 | 6 | 298 | 12 | 0 | 12 | 100.00 |
| | | | | Micro-nekton | 2326-0018 | --- | 3 | 5 | 5 | 0 | 1 | 36 | 14 | 50 | 25.00 |
| Wilcoxon's Signed-Rank Test (Tate and Clelland, 1957), T= | | | | | | | 20.5 | 4 | 6.5 | 0 | 0 | 22 | 3 | 11 | |
| | | | | | | | p > .20 | p<.05 | p >.20 | p<.01 | p<.01 | p>.20 | p=.01 | p>.20 | |

TABLE 2

COMPARISON OF THE MICRONEKTON NET AND ONE-METER NET WITH RESPECT TO PRESENCE OR ABSENCE OF ADULTS OF EUPHAUSIID SPECIES AT NINE STATIONS

| SPECIES | NUMBER OF STATIONS WHERE ADULTS WERE COLLECTED | | | |
|---|---|---|---|---|
| | IN METER NET ONLY | IN MICRONEKTON NET ONLY | IN BOTH NETS | IN NEITHER NET |
| Large species (adult at $\geqslant$ 9 mm) | | | | |
| *Euphausia eximia* | — | — | 9 | — |
| *Euphausia gibboides* | — | — | 5 | 4 |
| *Nematobrachion flexipes* | — | 5 | 3 | 1 |
| *Nematoscelis difficilis* | — | 4 | 4 | 1 |
| *Nematoscelis gracilis* | 1 | 3 | — | 5 |
| *Nyctiphanes simplex* | — | 2 | 2 | 5 |
| Small species (adult at $<$ 9 mm) | | | | |
| *Euphausia diomedeae* | 1 | — | — | 8 |
| *Euphausia distinguenda* | 1 | 3 | 1 | 4 |
| *Euphausia mutica* | 1 | — | 1 | 7 |
| *Euphausia recurva* | 1 | — | 1 | 7 |
| *Euphausia tenera* | 1 | — | 1 | 7 |
| *Stylocheiron affine* | 6 | — | 1 | 2 |
| *Stylocheiron longicorne* | 2 | — | — | 7 |
| *Thysanoessa gregaria* | 1 | — | — | 8 |

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