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The Biology of the Pelagic Amphipod, *Primno macropa* Guér., in the Western North Pacific. 2. Geographical Distribution and Vertical Distributional Pattern

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西部 北太平洋産 浮游性 端脚類, *Primno macropa*의 生物學的 硏究 2. 地理分布 및 垂直分布의 類型에 대하여

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摘 要

西部 北太平洋에 있어서의 本種에 대한 地理分布와 垂直分布 및 晝夜垂直移動에 관한 知見은 극히 限定된 海域과 深度에 있어서의 報告가 있을 뿐이다.

筆者는 北緯 20度에서 47度에 이르는 東經 150度 以西의 西部 北太平洋과 이의 附屬海에 걸친 광범위한 調査를 통하여 本種의 地理分布에 관한 새로운 知見을 얻었다. 그 結果로 東支那海의 表層을 제외한 68地點에서 本種이 出現함으로써 浮游性 端脚類中에서도 唯一하게 西部 北太平洋 全域에 걸쳐 一樣하게 分布하고 있으며 季節的인 消長이 없음이 究明되었다. 한편 垂直的으로는 0~1,500m 以深에 分布하고 있으며 最深採集記錄은 定點 229(34°44.3′N, 140°04.4′E)에서의 1,650~2,220m層에서 얻어졌다. 晝夜垂直移動의 類型을 보면 本種은 晝間에는 深層部에 分布하며 夜間에 表層部로 현저한 晝夜移動을 하고 있음을 밝혔다. 이 移動의 範圍는 100~200m에 달한다. 또한 黑潮域에서는 親潮域에 비하여 垂直分布의 深度가 얕으며 서로 垂直分布의 深度와 移動의 範圍가 다르다. 즉 黑潮域에서는 晝間 0~200m層에 夜間 100~300m層에 個體群의 中心이 分布하며 100m의 範圍로 垂直移動을 하는데 反하여 親潮域에서는 晝間 400~700m, 夜間 100~500m로 200m의 範圍로 移動한다. 이는 兩海域에 있어서의 個體群의 組成이 서로 다른데 起因되는 결과로 사료된다.

INTRODUCTION

In the western North Pacific the distribution of *Primno macropa* was first recorded from Sea of Japan, Okhotsk Sea, and Bering Sea by Behning (1939). Both Bogorov (1955) and Bulycheva (1955) reported on the distribution of a number of pelagic amphipods in this area, including a species of *P. macropa*. Vinogradov (1956) also reported on the distribution and vertical migrational pattern of

this species in western Bering Sea. In 1959 Irie reported on the brief distribution of a number of pelagic amphipods in the adjacent seas of Japan, including this species under the name of *Euprimno macropus*. Recently, its occurrence has been reported by the author (Yoo, 1971a), who provided a map showing its distribution in the western North Pacific.

On the vertical distribution of *P. macropa* several workers reported this species as typical migrants estimating from its collection depths (Mackintosh, 1934; Vinogradov, 1956; Irie, 1959; Brusca, 1967). But none of detail studies on this topic in the western North Pacific has been attempted.

Neverthless the importance of this species in this area only few works have been published dealing with the distribution of *P. macropa*. In present studies more detail survey for the geographical distribution and vertical distributional and migrational pattern of *P. macropa* in the western North Pacific has been carried out.

MATERIALS AND METHODS

Zooplankton was collected on different cruises of R/V Tansei-Maru and Hakuho-Maru of the Ocean Research Institute, University of Tokyo (Yoo, 1971b) and chart for the geographical distribution was provided dotting for 70 selected stations (Yoo, 1971a). Additional data was obtained and added to the previous chart (see Table 1).

The data for vertical distribution and migrational pattern was mainly obtained by horizontal tows with ORI-net in selected regions. The vertical distribution of animals was presented as biomass in wet weight per 1,000m^3 of water column, dividing into 7 layers; 0-100m, 100-200m, 200-300m, 300-400 m, 400-500m, 500-700m, and 700-1,000m and then it was calculated an average by each layer.

Table 1. Additional station list from which data of geographical distribution obtained

Cruise no.	Station no.	Type of net	Depth (m)
KH-67-3	H 5-1	ORI-100	0-670
KH-68-2	H30	ORI-C	surface
	H30-1	ORI-C	surface
	H34	ORI-C	surface
	H37-1	ORI-C	surface
	H43-1	ORI-C	surface
	H45-1	ORI-C	surface

RESULTS AND DISCUSSION

1. Geographical distribution of *Primno macropa*

Fig. 1. shows the geographical distribution of *P. macropa* in the western North Pacific and adjacent seas. This species has been found over all stations from the investigated area, not only in warm Kuroshio area (southern limit 20°N), but also in cold Oyashio area (northern limit 47°N). In Fig. 1 I have plotted the distribution of this species in the vicinity of Japan from Irie's data (1959). To these data I have also added some Korean stations reported by Hue (1967).

For the geographical distribution of *P. macropa* Irie (1959) has mentioned it as warm current indicator, characteristic to the Tusima Current, in lower latitude. In the other hand Vinogradov (1956) reported on the occurrence of the species from the mesopelagic layer of Okhotsk Sea and Kuril-Kamtsatka Trench, as pan-oceanic species.

In previous reports the distribution was based on the scattered records, because the data was collected in limited localities and

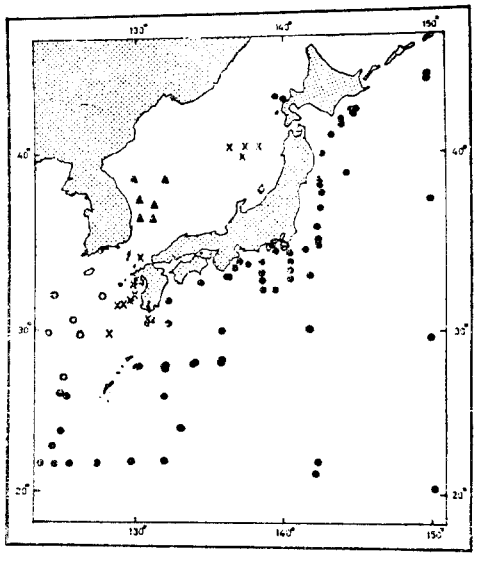

Fig. 1. Distribution of *Primno macropa* in the western North Pacific. Solid circles, positive stations; open circles, negative stations. x, positive stations reported by Irie(1959) and triangles, by Hue (1967).

depths. For the present studies *P. macropa* was distributed over all stations through all seasons and it is believed that this species is most common cosmopolitan species in the western North Pacific. But the negative stations in East China Sea during KH-68-2 cruise in June, 1968 give us evidence that this species do not swarm in surface layer of shallower water of the continental shelf, both day and night time,

2. Vertical distributional and migrational pattern of *Primno macropa*

Fig. 2 shows the vertical distribution of *P. macropa* in the selected area of the western North Pacific. Vertical distributional range indicates at depths from surface to more than 1,500m and most deeper record for the vertical occurrence of this species was obtained from depth of 1,650-2,220m in Station 229 (34°44.3'N, 140°04.4'E), off Nojima-Zaki, Central Japan.

Comparing with its vertical distributional pattern the northern station (42°20'N, 145°55'E) in Oyashio area and southern station (34°

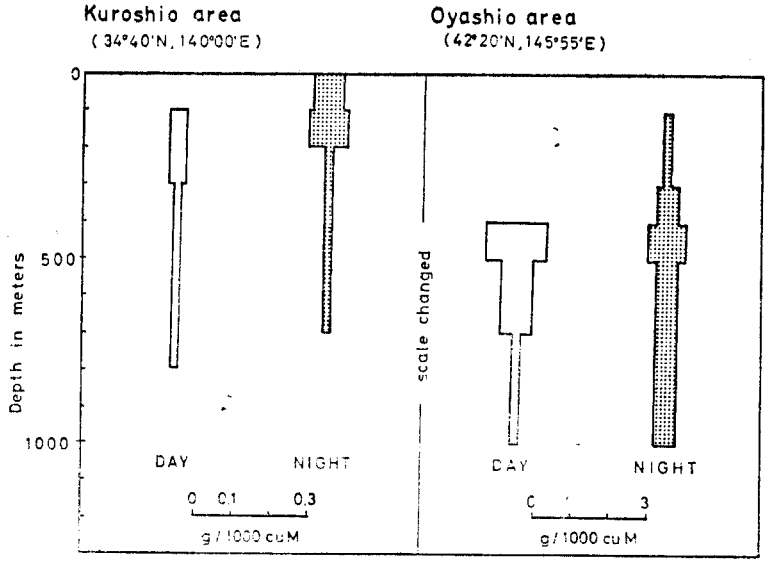

Fig. 2. Vertical distributional and migrational patterns of *Primno macropa* in the western North Pacific.

40'N, 140°E) in Kuroshio area have shown seperate type of mode. In Oyashio area it is obvious that *P. macropa* migrates diurnally 100m to 500m at night and from 400m to 700m at day. In contrast with previous pattern it migrates diurnally from surface to 200m at night and from 100m to 300m at day in Kuroshio area. It is suggested that there are two distinct population in the western North Pacific by their vertical migrational pattern.

For the vertical distribution and diurnal migration of *P. macropa* Vinogradov (1956) reported it as typical migrant at depths from 200-400m layers diurnally in western Bering Sea. Brusca (1967) gave evidence that this species shown a typical migratory activity toward the surface at night and retreated to deeper water during the daytime with his data which obtained from waters off southern California. The daytime depth range was from 80m to 650m. The deep, positive, night samples probably indicated a descent of part of the population during the dark hour. In contrary Mackintosh (1934) offered data which suggested that *P. macropa* migrated to the surface during the daylight hours and moved deeper at night in Antarctic Ocean.

In the present study the diurnal migration of *P. macropa* was distinct at depths from 100m to 500m at night and 400m to 700m at day in Oyashi population, and from surface to 200m at night and from 100m to 300m at day in Kuroshio population. And then their migratory activity was the range of 100-200m in both regions. In Kuroshio area, the population of *P. macropa* was distributed in somewhat shallower layers than in Oyashio area. In this instance it is suggested that the population is different in region and season according to their stages consisting the population.

SUMMARY

For the geographical distribution of *Primno macropa* it was distributed over all stations investigated, except surface tow in East China Sea, through all seasons. It is believed that this species is most cosmopolitan species in the western North Pacific.

Veritical distributional range of *P. macropa* indicates at depths from surface to more than 1,500m and most deeper recored for the vertical occurrence was obtained from depth of 1,650-2,220m in Station 229 (34°44.3'N, 140°04.4'E), off Nojima-Zaki, Central Japan. For the vertical distributional and migrational pattern it is a typical diurnal migrant in the western North Pacific; at depths from 100m to 500m at night and 400m to 700m at day in Oyashio population, and from surface to 200m at night and from 100m to 300m at day in Kuroshio population. In Kuroshio area, the population of *P. macropa* was distributed in somewhat shallower layers than in Oyashio area and it is suggested that the population is different in region and season according to their stages consisting the population.

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