Distribution of Zooplankton in Asan Bay, Korea with Comments on Vertical Migration

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아산만 동물플랑크톤 분포와 수직이동

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Seasonal distributions of zooplankton were investigated in Asan Bay, Korea. Labidocera euchaeta, Sagitta crassa, Calanus sinicus, Acartia omori were dominant taxa throughout the year with seasonally varying percent compositions. Bivalve veliger larva (fall), Decapoda larva (spring and summer), and Paracalanus parvus, Eudone tergestina (summer) were also dominated during certain period. The patterns of time dependent vertical distributions of one major taxon, A. omori, showed seasonal differences, i.e., it showed the trends of normal vertical migration in winter and reversed vertical migration in spring. At surface layer day time abundances were equal or less than night time abundances in general.

Introduction

Many previous studies on zooplankton distribution in the coastal areas and bays of Korea showed seasonal fluctuations in species composition and abundances(Choe, 1972; Lee, 1972; Shim and Ro, 1982; Kim and Huh, 1983; Kang, 1986; Choi et al., 1988; Shim and Yun, 1990). But no study has been done in Asan Bay. The only zooplankton study in this bay was on the sampling scheme by Park(1990). Along with the day-night difference in catches, he showed that some major species of zooplankton migrated vertically even in this shallow area of strong tidal mixing.

Present study was initiated to use to long term data of zooplankton distribution for the monitoring purpose in Asan Bay, where construction of many industrial complexes and reclamation was under way so that monitoring the possible environmental changes was to be needed. As a first step, we report the seasonal variation in species composition and abundance of zooplankton in this bay. Also, we examined whether the vertical distribution patterns shown in Park(1990) was invariant with season. However, the causes of the distributional patterns shown in this study are not discussed. It is because multidisciplinary approach that includes the studies on physical oceanography and phytoplankton, which

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is under way, is essential for that.

Materials and Methods

Zooplankton samples were collected at about 3 km east of Ilpado (37°06'N and 126°34'E) located in Asan Bay for one day and night in each season. Fall, winter, spring, and summer samples were collected during November 11~12, 1989, February 27~28, May 26~27, and August 5~6, 1990, respectively.

An open/closing "Bongo" net (mouth diameter 60 cm) fitted with 0.333 and 0.505 mm mesh size nets on each side was used. The net was towed obliquely at depths of 0~5 and 5~10 m during day and night (water depth, about 15 m). The time lag between the day sampling and night sampling was kept to be about 12.5 hours to make the tidal phase be as equal as possible so that the distance between the centers of the moving water parcels sampled during the day and night was minimized. It was not only because the day-night difference, if any, could be interpreted in terms of locality unless the same water mass was sampled, but also because it was practically difficult to deploy a marker buoy in this bay of shallow and strong tidal mixing. The effort for the sampling of same water mass was shown to be effective in this area (Park, 1990). The period around dusk was avoided to minimize variation due to the vertical migration if any.

Tow speed and duration were about 1 m/sec and 7~8 minutes, respectively. The volume filtered during towing was calculated with the flow meter attached to the net. Three replicate samples were intended for each time and depth interval. Samples were fixed with buffered formalin.

A Folsom Plankton Splitter was used to split the samples into subsamples of countable size. Each subsample containing about 500~1,000 individuals by subsampling was counted under a dissecting microscope with identification to lowest practical taxon.

The differences in abundances with regard to sampled layers and sampling time were examined by partitioning the variances into sampling time effect, sampled layer effect, and interaction of these two effects. That is, analysis of variance (ANOVA) with the same model in Park (1990) was done with abundance data. In this ANOVA, significance of the interaction was major concern since significant interaction could be interpreted as minimum requirement for the indication of the presence of vertical migration as explained by Park (1990). When interaction was not significant, this term was deleted from the model for the test of significant difference between the sampling time and/or sampled layer.

Results

From the total of 94 samples (49 from 0.333 mm mesh net and 45 from 0.505 mm mesh net), 56 taxa were identified. Noctiluca scintillans was not included not only because of its large variation in abundances caused by the clogging effect of the net but also because of its controversial taxonomic position, Dinoflagellate. The list and seasonal average abundances, weighted mean of the two layer sampled and two sampling time, were given in Appendix I.

The numbers of taxa appeared in each season were given in Table 1 with the number of replicate samples in parentheses by sampling time and sampled layer. Total number of taxa appeared was the greatest in fall, sharply reduced during winter, and then gradually increased with seasonal warming. However, total abundance (individuals/m³) was the smallest in fall and the greatest in summer. This relation was shown in Figure 1.

The numbers of taxa appeared at different time or at different depth range did not show noticeable seasonal patterns. In addition, mesh size of the net did not seem to affect significantly on the numbers of the taxa appeared though samples from the smaller mesh net usually yielded a few more taxonomic groups. But, the rank orders of abundances were usually not in good agreement between the samples from the two different mesh size nets. As expected, and as shown in Table 2, the abundance of the larger animals showed higher ranks in the net of large mesh.