A Review on the Copepods in the South Sea of Korea

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Ecological and taxonomical studies on the copepods were reviewed in order to make
data bases on the species composition, abundance, distributional pattern, and seasonal
variations of copepods in the South Sea of Korea. Total 179 species have been reported
in this area. The dominant species in the coastal waters and embayments, such as Acartia
clausi, Paracalanus parvus, Oithona similis, and Oithona nana, were different from those
reported in the offshore waters around Cheju Island. Indicator species of the South Sea
were also discussed in this paper. Copepod abundances were higher in the coastal waters,
up to more than 390,000 individuals/m³ (collected with a 150 μm mesh net), than in the
offshore waters. There were two types of temporal variations in copepod abundances in
the coastal waters, i.e., bimodal abundance peaks in spring and fall, and unimodal peak
during summer to early fall.

Introduction

Copepods are the most important metazoan zooplankton in coastal waters because of their numerical
dominance and trophic importance. They were reported as a dominant group in the coastal waters
around Korea (Park, 1956; Lee, 1972; Park, 1973; Park et al., 1973; Shim and Ro, 1982; Shim and
Park, 1982; Ro, 1982; Shim and Lee, 1983; Kim, 1984; Kwak, 1990; Yoo, 1991). They play an important
role in the marine food web, serving as a primary food source for many small carnivores and as
grazers on phytoplankton.

Studies on the species composition, abundance, and distributional pattern of copepods in the coastal
waters around Korea have been actively conducted, and lots of data have been accumulated in the Yellow
Sea (Ro, 1982; Shim and Park, 1982; Cho et al., 1983; Kim and Huh, 1983; Shim and Lee, 1983;
Huh et al., 1987; Kim, 1987; Sim et al., 1988; Park, 1989; Kwak, 1990; Shim and Yoon, 1990; Park et al.,
1991; Shin, 1991; Suh et al., 1991; Yoo, 1991; Park et al., 1992), in the South Sea (Lee, 1972; Park
and Lee, 1982; Shim and Ro, 1982; Kim, 1984; KO-
Lee, 1989; Park et al., 1990), and in the East Sea
(Hue, 1967; Shim and Lee, 1986, Kang, 1989; Choi,
1991; Park et al., 1991). As seen in the numbers of references above, the information on the cope-
pods in the South Sea is relatively limited compared with that of the Yellow Sea.

The South Sea of Korea is shallow, with the depth of less than 200m. The surface temperature is over 30°C
during the summer season, and warmer (around 10°C) than the Yellow Sea and the East Sea
during the winter season due to the effect of the Tsushima Current (KORDI,1989), which is a branch of the Kuroshio Current. The South Sea is an economically important area for fisheries and aquaculture. Therefore, it would be valuable to re-
view the information on the copepods which are principal food sources for fishes.

The purposes of this study were to make a list of the copepod species reported in the previous
studies in the South Sea of Korea, and to describe spatial and temporal variations in abundances and
distributional pattern of copepods in order to supply data bases for future studies in this area.

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Materials and Methods

This review study was performed based on the previous studies about taxonomy and ecology of copepods in the South Sea. The South Sea was defined as the waters around the southern part of the Korean Peninsula, i.e., the western boundary is the line between Chindo and Chagwido, the southern boundary is between Udo and Osesaki in Japan, and the eastern boundary is between Ulgi and Kawajirimizaki in Japan (Fish. Res. Dev. Agency, 1979; see Fig. 1). Copepods were classified into three groups such as calanoid copepods, cyclopoid copepods, and harpacticoid copepods, and the species previously reported in the South Sea are listed in Table 1 with the references. Table 1 also shows the seasons when copepods occurred and locations where they were collected.

Results and Discussion

Species composition

Total 179 species of copepods have been reported in the South Sea. More species were reported in the South Sea than in the Yellow Sea, where 148 species were identified (Yoo, 1991). The dominant species were *Oithona similis*, *Paracalanus parvus*, and *Calanus helgolandicus* in the Korea Strait (Park, 1956), *Oithona nana*, *P. parvus*, *Acartia clausi*, and *Temora turbinata* in Jinhae Bay (KORDI, 1982), *O. similis*, *P. parvus*, *Corycaeus affinis*, *C. helgolandicus*, and *Centropages abdominalis* in Jinhae Bay (=Chinhae Bay) and adjacent waters (Lee, 1982), *P. parvus*, *O. nana*, *O. similis*, *C. affinis*, and *Tortanus forcipatus* in the embayments near Yeosu (=Yosu) (Shim and Ro, 1982), *P. parvus*, *O. similis*, *A. clausi*, and *C. affinis* in Kwangyang Bay (Kim, 19 84), *Acartia pacifica*, *Calanus sinicus*, *Oncoea media*, and *Oncoea venusta* around Cheju Island (KORDI, 1989), *Oithona daviseae*, *O. similis*, and *P. parvus* in Masan Bay (Lee, 1989), and *A. clausi* and *A. abdominalis* in the southern coastal waters (Park et al., 1990). In general, dominant species in the coastal waters and embayments of the South Sea, as described above, were different from those in the offshore waters (see Kang, 1992 for the oceanic calanoid copepods).

Most of the dominant species reported in the South Sea were also found in the Yellow Sea (see Table 1 in Yoo, 1991). Some species, such as *Eurytemora pacifica*, *Paracalanus crassirostris*, *Pontella latifurca* and *Tortanus spinicaudatus*, were reported as the characteristic species in the Yellow Sea (Yoo, 1991). However, *E. pacifica* and *P. crassirostris* were also reported in the South Sea (Kim, 1985; Lee, 1989).

Some of the dominant species, such as *Acartia clausi*, *Paracalanus parvus*, and *Calanus helgolandicus* had been in taxonomical argument. For example, *A. clausi*, one of the dominant species reported in the South Sea of Korea, was renamed as *Acartia omori* by Bradford (1976) in Tokyo Bay, and Ueda (1986) distinguished *A. clausi* into two species such as *A. omori* and *Acartia hudsonica* from Japanese waters. Since then, taxonomical studies on the copepods belonging to the genus *Acartia* have been actively conducted in the Korean waters (Kang and Lee, 1990; Yoo et al., 1991). Kang and Lee (1990) reported the morphological differences between *A. omori* and *A. hudsonica*, and Yoo (1991) reported that *A. omori* was a dominant species in the Yellow Sea. This species was also found in the South Sea (Lee, 1989).

*Paracalanus parvus*, reported as a dominant species in the Yellow Sea (Shim et al., 1988), was not in the zooplankton list in another study (Yoo, 1991) conducted in the same waters, which reported *Paracalanus indicus* as a dominant species. Therefore, further taxonomical studies on the species belonging to genus *Paracalanus* should be needed. *Calanus helgolandicus* and *Calanus finmarchicus*, which had been reported, were known as *Calanus sinicus* in Sagami Bay, Japan (Kitachi, 1979 cited in Kim, 1985). Lee (1986) compared the characteristics of a copepod, belonging to genus *Calanus*, collected in the southern coastal waters of Korea with those of *C. sinicus*, *C. finmarchicus*, *C. helgolandicus* and *Calanus pacificus* reported in the previous studies (references are therein) in detail, and concluded that this species was *C. sinicus*. However, he suggested that further studies would be necessary.