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## Variation in the macrofaunal community over large temporal and spatial scales in the southern Yellow Sea

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**Abstract** To detect large, temporal- and spatial-scale variations in the macrofaunal community in the southern Yellow Sea, data collected along the western, middle and eastern regions of the southern Yellow Sea from 1958 to 2014 were organized and analyzed. Statistical methods such as cluster analysis, non-metric multidimensional scaling ordination (nMDS), permutational multivariate analysis of variance (PERMANOVA), redundancy analysis (RDA) and canonical correspondence analysis (CCA) were applied. The abundance of polychaetes increased in the western region but decreased in the eastern region from 1958 to 2014, whereas the abundance of echinoderms showed an opposite trend. For the entire macrofaunal community, Margalef's richness ( $d$ ), the Shannon-Wiener index ( $H'$ ) and Pielou's evenness ( $J'$ ) were significantly lower in the eastern region when compared with the other two regions. No significant temporal differences were found for  $d$  and  $H'$ , but there were significantly lower values of  $J'$  in 2014. Considerable variation in the macrofaunal community structure over the past several decades and among the geographical regions at the species, genus and family levels were observed. The species, genera and families that contributed to the temporal variation in each region were also identified. The most conspicuous pattern was the increase in the species *Ophiura sarsii vadicola* in the eastern region. In the western region, five polychaetes (*Ninoe palmata*, *Notomastus latericeus*, *Paralacydonia paradoxa*, *Paraprionospio pinnata* and *Sternaspis scutata*) increased consistently from 1958 to 2014. The dominance curves showed that both the species diversity and the dominance patterns were relatively stable in the western and middle regions. Environmental parameters such as depth, temperature and salinity could only partially explain the observed biological variation in the southern Yellow Sea. Anthropogenic activities such as demersal fishing and other unmeasured environmental variables may be more responsible for the long-term changes in the macrofaunal community.

Keywords: Benthos; Diversity; Community structure; Environmental factor; The southern Yellow Sea

### 1. Introduction

The southern Yellow Sea is a marginal sea in the northwestern Pacific Ocean, semi-enclosed by China and the peninsula of Korea (Fig. 1). It has an area of approximately  $30.9 \times 10^4$  km<sup>2</sup> and an average depth of 45.3 m, with a maximum depth of 144 m to the north of Cheju Island. Several large rivers flow into the southern Yellow Sea, including the Xinyi River, Huaihe River, Sheyang River and Yangtze River from China and the Han River and Geum River from Korea. Among them, the Yangtze River has the largest freshwater flow. As a consequence of the large quantities of sediment carried by these rivers, the sediment types characterizing the southern Yellow Sea are mainly fine sand-silt in the coastal areas and mud in the central areas (Liu et al., 1986). The hydrographic regime is characterized by the Yellow Sea Coastal Current in the western area, by the Korean Coastal Current in the eastern

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