

1 8. Seasonal variation in microbial community and physicochemical properties of deep sea water in Korea.

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1. Introduction

Until recently, research on marine microbial communities has mainly been conducted on surface water (SSW) and marine sediments. Additionally, it is difficult to find literature on seasonal variation in mineral components (Mg^{2+} , K^+ , and Ca^{2+}) and major nutrients (PO_4^{3-} , NO_2^- , NH_4^+) of SSW and DSW and their relationship with microbial communities. In this study, we investigated the relations between the microbial community and environmental factors in seawater from three Deep sea water(DSW) pumping stations (Goseong: GS, Sokcho:SC, and Ullueungdo: UL) and SSW in Korea.

2. Material and method

DSW and SSW samples from three pumping stations were collected aseptically and through the four seasons. Environmental factors, mineral components, and nutrients were measured by appropriate equipment, and the microbial (16S RNA) community was analyzed using molecular genetic methods.

3. Result and Discussion

The results showed that the microbial diversity (Shannon index) of DSW was higher than that of SSW, as in previous studies. Additionally, it was confirmed that seasonal microbial diversity was lowest in spring and gradually increased until fall through the three regions. The number of viable microorganisms in seawater in

each region was significantly lower in deep water than in surface water. The lowest number of viable microorganisms was found in GSDSW in February. Inter-regional environmental data showed that GSDSW had higher nitrate (GSDSW average: 226.9 ug/l) and phosphate (GSDSW average: 19.8 ug/l) compare to other DSW and SSW. Seasonal changes found in water temperature, and minerals (Mg^{2+} , K^+ , Ca^{2+} and NH_4), with the highest changes occurring in August. The ratio average of Mg^{2+} , K^+ , and Ca^{2+} in seawater was 4:2:1, and it was different in season, region, and water depth. As a result of principle coordination analysis (PCA) by combining the microbial communities and environmental factors of each region, GSDSW showed a high correlation with NO_2^- and PO_4^{3-} regardless of seasonal changes, and *Firmicute sp.* (May) and *Verrucomicrobia sp.* (August).

The results showed that the DSW of Korea had a low number of viable microorganisms and nutrients were higher than SSW, while physicochemical values were changing seasonally. It is suggested that natural conditions such as typhoons in summer, seafloor topography, vertical mixing, and coastal upwelling were related to environmental factors. Through continuous environmental monitoring, it is necessary to understand the relations between environmental factors and microbial communities over several years.