

Investigation of the relationship between salinity and stable oxygen isotope of surface seawater based on high resolution $\delta^{18}\text{O}$ mapping in Tsushima warm current area and the Sea of Japan

*Toyoho Ishimura¹, Satoshi Kitajima², Tsuneo Goto³, Haruyuki Morimoto³, Taketoshi Kodama³, Nobuaki Nanjo⁴, Shuichi Tanaka⁵, Kouji Koide¹, Kozue Nishida¹, Motomitsu Takahashi²

1. National Institute of Technology, Ibaraki College, 2. Seikai National Fisheries Research Institute, Japan Fisheries Research and Education Agency, 3. Japan Sea National Fisheries Research Institute, Japan Fisheries Research and Education Agency, 4. Fish. Res. Inst. Toyama Prefect., 5. Tottori Prefectural Fisheries Experimental Station

Stable oxygen isotope of seawater ($\delta^{18}\text{O}_{\text{sw}}$) correlates with salinity, because $\delta^{18}\text{O}_{\text{sw}}$ varies by the effects of evaporation, influx of fresh water, etc. Besides, this correlation is also changed by regional and seasonal characteristics of those effects. Recently Horikawa et al. (2015) and Kodaira et al. (2016) reported the relationship between $\delta^{18}\text{O}_{\text{sw}}$ and salinity in the Tsushima warm current area, from the East China Sea to the Sea of Japan. On the other hand, the details of seasonal and yearly fluctuations of $\delta^{18}\text{O}_{\text{sw}}$ for each area are not well understood. In this study, we conducted sampling of the surface seawater in the Sea of Japan and the East China Sea in a wider area to detect the variations of relationship of $\delta^{18}\text{O}_{\text{sw}}$ and salinity. Then, we verify the consistency with previous studies and calculate $\delta^{18}\text{O}_{\text{sw}}$ -salinity relation formula for each area.

Seawater samples used for the study were sampled at more than 100 stations by using a bucket or a pump on the ship, from 2015 to 2017, in the East China Sea and the Sea of Japan (30 - 43 degrees north latitude: 124 - 140 degrees east longitude).

For the analysis, $\delta^{18}\text{O}_{\text{sw}}$ and $\delta\text{D}_{\text{sw}}$ were determined by using a cavity ring-down spectroscopy stable isotope ratio analyzer (CRDS: Picarro L2130-i) and a customized continuous-flow stable isotope ratio analytical system (Headspace CO2 equilibrium method: MICAL3c + IsoPrime). Salinity was measured using a sensor calibrated with Autosal or Autosal.

The relation of $\delta^{18}\text{O}_{\text{sw}}$ -salinity obtained in this study was roughly in agreement with the previous studies on the Tsushima warm current area. The slope of the relational expression was slightly different between the East China Sea and the Tsushima Strait. Furthermore, as a result of detailed comparison in the eastern part of Tsushima Strait, intercepts of relational expression were different between the middle of the Sea of Japan, Tsushima Strait and Toyama Bay. These results indicate that there will be the possibility that the $\delta^{18}\text{O}_{\text{sw}}$ -salinity relationship differs among each sea areas. In this study, we will also discuss the $\delta^{18}\text{O}_{\text{sw}}$ data of seawater sampled after the autumn of 2017 for each area.

Hereafter, we plan to proceed with seawater sampling for $\delta^{18}\text{O}_{\text{sw}}$ with high temporal-spatial resolution (e.g. vertical sampling in water column and seasonal sampling) in the East China Sea - the Sea of Japan to detect the characteristics of $\delta^{18}\text{O}_{\text{sw}}$ variations. The findings obtained are expected to bring us important information to discuss related studies, for example, elucidation of migration history of fish based on $\delta^{18}\text{O}_{\text{sw}}$ analysis of fish otoliths, and formation process of Japan Sea proper water.

Keywords: the Sea of Japan, seawater, stable oxygen isotope, salinity, Tsushima warm current