Study of the influence of long-term ocean acidification on underwater sound wave propagation

*Shinpei Gotoh[1,2], Takao Sawa[2], Yoshihiro Fujiwara[2]

1. Tokyo University of Marine Science and Technology, 2. Japan Agency for Marine-Earth Science and Technology

Absorption loss (α) is a key factor in sound wave propagation through seawater. It is known that α decreases with rising seawater temperature and decreasing pH, but the full implications of recent global changes in marine environments have yet to be explored. Current reports show that both seawater temperatures and anthropogenic atmospheric CO_2 levels are increasing rapidly. Dissolved atmospheric CO_2 causes a decrease in seawater pH (marine acidification). Here, we present a study of long-term changes in the value of α, using observational temperature and pH data from the Pacific Ocean off the Japanese coast. We find that α decreased steadily over the past 30 years, with the most rapid decrease seen at high latitudes. In addition, we produce predicted values of α for 2100, based on two ocean acidification model scenarios. We also calculate the impact of decreasing values of α on submarine noise levels from long-term off-shore installations. We find that predicted noise levels increased by a factor of up to 1.44 between 2014 and 2100, a level of increase that could have a significant impact on marine mammals and sonar technologies. Our results highlight the importance of considering noise reduction techniques for future long-term off-shore installations.

Keywords: underwater sound wave propagation, absorption loss (α) , pH, underwater noise level, long-term change

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