

## Long-term dynamics of sardine and anchovy populations during the last 2800 years inferred from Beppu Bay sediments

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Paleorecords of pelagic fish abundance could better define the nature of fishery productivity dynamics and help understand of pelagic fish stocks to long-term climate changes. We report high-resolution record of sardine and anchovy scale deposition rates (SDRs) from Beppu Bay, southwest Japan, showing multidecadal and centennial variability in the abundance of Japanese sardine and Japanese anchovy during the last 2850 years. Variations in the sardine SDR showed periodicities at ~50, ~100, and ~300 yr, while variations in the anchovy SDR showed periodicities at ~30 and ~260 yr. Comparisons between and correlation analyses of the time series of the sardine and anchovy SDRs demonstrate that there is not a consistent out-of-phase relationship during the last 2850 years. This indicates that the multidecadal alternations in the sardine and anchovy populations commonly seen in the 20th century did not necessarily occur during earlier periods. The Japanese sardine SDR record shows a long-term decreasing trend in the amplitudes of the multidecadal to centennial fluctuations. This decreasing trend may have resulted from an increasing trend in the winter sea surface temperature in the western North Pacific. The multicentennial variability in sardine abundance during the last millennium is consistent with the variabilities in the abnormal snow index in East Asia and the American tree ring-based Pacific Decadal Oscillation index, suggesting a basin-wide or regional climate–marine ecosystem linkage.

Keywords: Beppu Bay sediments, sedimentary scales, sardine and anchovy, species replacement, basin-scale linkage between climate and marine ecosystem