

Basin-scale Relations between Marine Ecosystem Indices and Physical Environment in North Pacific

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To understand how marine ecosystem varies and how that variability is related to physical climate conditions, it is useful to conduct a multivariate analysis using large number (several tens) of marine ecosystem indices (e.g., Hare and Mantua 2000) and this type of analysis is referred to as large multivariate analysis (LMA). In this study we conduct an LMA for the marine ecosystem for whole North Pacific, for the first time to the author's knowledge, using the marine ecosystem indicators both in the eastern and western side of the basin. The main analysis method is Empirical Orthogonal Function (EOF) of marine ecosystem indicators and the relation of the marine ecosystem EOFs and physical climate condition is examined. The EOFs are calculated for marine ecosystem indicators in the western and eastern basin separately or combined. The results indicate that the first EOF mode is characterized by a long-term trend, irrespective of the EOF domain. The second mode varies on multi-decadal timescale in the eastern North Pacific, and on somewhat shorter timescale in the western North Pacific. It appears that the first mode is related to the overall warming over the North Pacific, but the second modes are closely related to decadal climate modes, i.e., the Pacific (inter-)Decadal Oscillation and North Pacific Gyre Circulation modes. The implications of the present results for marine ecosystem predictability will be discussed.

Keywords: Marine ecosystem indices, Decadal variability, Physical environment, Climate changes, Basin-scale fisheries, North Pacific