# General Discussion: Toward Elucidation and Prediction of Marine Ecosystem Change

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In recent years, as various phenomena that characterize the Anthropocene have become apparent, we have come to feel that the subsystems that make up the Earth system are directly or indirectly intertwined with the activities of human society and are driven as a single “Earth-human system”. Undoubtedly, the atmosphere-ocean interaction plays a vital role as one of the subsystem elements that make the Earth a planet of life. From the origins of life to the present, life and its interwoven ecosystems have repeatedly adapted and evolved in response to perturbations in the atmosphere and oceans on micro to macro scales, sometimes even affecting the habitability of the global environment, and have continued to inherit the ecosystems’ functioning to the present day. Our human activities have unconsciously become one of the significant subsystems impacting the whole Earth system. Our scientific knowledge is limited as to the temporal and spatial scales at which organisms and their ecosystems in the ocean will respond and adapt to rapidly advancing habitat changes in the near future. For example, seemingly sudden and nonlinear changes in ecosystems, such as changes in fish species, mass outbreaks, or mass mortality in a given area, can be captured from unknown precursors that are not captured by current observational data and may be viewed as rational phenomena derived from feedback mechanisms of ecosystem connectivity and adaptability. In order to explain the vulnerability and resilience of marine ecosystems, it will be essential to deepen our scientific understanding of the “flexibility” of life and ecosystems, or “evolutionary potential”, through interdisciplinary research in marine physics, ecology, geochemistry, mathematical and data science, and other fields. In this general discussion, we will discuss how to elucidate the mechanisms of marine ecosystem change, how to predict future ecosystem change with a high degree of certainty, and how the integration of scientific knowledge generated through these processes can contribute to the conservation and restoration of the marine and global environment and the development and sustainability of human society that receives the benefits of the marine ecosystem. We want to discuss these issues as much as time permits.

Keywords: Marine Ecosystem, Argo, eDNA, Earth System Model

 