Japan Geoscience Union Meeting 2015
(May 24th - 28th at Makuhari, Chiba, Japan)

U01-07 会場:国際会議室 時間:5 月 26 日 16:15-16:35

環境変動とサンゴ礁ー気候変動、土地利用変化との関わりと保全策
Coral reefs in a changing world: climate change and land-based pollution issues and conservation strategies

山野 博哉 [1*]
YAMANO, Hiroya[1*]

[1] 国立環境研究所
[1]National Institute for Environmental Studies

Tropical and subtropical islands are associated with coral reefs, which provide ecosystem services, including fisheries, tourism and coastal protection. This is especially true to reef islands that are composed fully of reef-derived materials. Both global-scale (climate change) and local-scale (land-based pollution) have been causing significant change on coral reefs.

Japan provides an ideal setting to examine these changes, because it covers a wide latitudinal range, stretching from subtropical to temperate areas, and latitudinal limits of coral reefs and coral distributions are observed around the Japanese islands. Seas around Japan showed significant sea surface temperature (SST) rises in winter, which is critical for corals to survive at the latitudinal limits of their distribution. In addition, some islands have significant amount of sediment discharge through rivers as a result of extensive land development. So land-based pollution issues can be examined.

In the southern part of Japan, mass coral bleaching occurred in 1998, 2001 and 2007. These events were driven by anomalously high SSTs in summer, which suggests that rising SSTs would cause higher frequency of bleaching. On the other hand, range expansion of corals was observed around the mainland Japan. We collected records of coral species occurrence from eight temperate regions of Japan along a latitudinal gradient since the 1930s, and detected four species showed range expansions, with speeds of up to 14km/year.

Future projection of coral reef status would require consideration of another important issue, ocean acidification, caused by dissolved CO_2 in seawater. Higher concentration of dissolved CO_2 cause reduction in aragonite (one of the forms of $CaCO_3$ that construct coral skeletons) saturation state (Ωarag). We used climate model outputs for SST and Ωarag and present-day their threshold values for coral distribution to project future coral habitats. Without consideration of coral adaptation and/or acclimation, in high CO_2 emission (SRES 2A) scenario, coral habitats will be lost in the 2070s because of higher SST in the south and lowered Ωarag in the north. On the other hand, lowered CO_2 emission (SRES 1B) scenario, coral could survive in the southern part even in the 2090s. This strongly suggests the importance of reducing CO_2 emission for conservation of corals.

Extensive land development and modification caused significant increase in sediment discharge, which is called ”red-soil discharge (RSD).” A 15-year monitoring results showed no recovery of corals at sites affected by RSD, while a site without RSD showed recovery of coral cover. This means that reducing other stressors such as land-based pollution would be an effective way to enhance resilience of corals to bleaching, in addition to reducing CO_2 emission. Because sediments are derived from farmlands, integrated framework to consider land-sea connections and regional economy, i.e., setting biodiversity conservation targets, identifying sediment source areas by monitoring and modeling, and estimating costs for preventing sediment discharge from farmlands, is needed, in order to prioritize the farmlands to conserve river and coastal ecosystems.

Marine protected areas (MPAs) are an effective tool for conserving coastal ecosystems. Identifying the candidate areas based on rigorous scientific knowledge is required. Generating large-scale databases for species distribution and physical environments would contribute to set up new MPAs for conserving biodiversity. Further, because distributional ranges are shifting/expanding, marine protected areas that incorporate these shifts/expansions are required. Integration of climate model outputs and spatial planning would help identify the areas. A data-based, spatially-explicit, transdisciplinary approach is required for future conservation of coral reefs in a changing world.

キーワード: 環境変動, サンゴ礁, 気候変動, 土地利用, 生態系保全
Keywords: environmental change, coral reef, climate change, land use, ecosystem conservation