Abstract

Keith B. Rodgers
Emergent Trends in Northwest Pacific Biogeochemistry and Ecosystems

The Northwest Pacific is known to be an important region for marine ecosystems as well as for resource management and food security. Building on the work of observational ecologists and high-resolution process-focused modeling studies to evaluate the historical era, significant advances with Earth system models (ESMs) over the last two decades have facilitated a broad range of exploratory research into how future climate change may impact the region. In recent years work with ESMs has encompassed topics ranging from ecosystem stressors to fisheries, with climate impacts on phytoplankton populations playing a central role. The recent advent of Large Ensemble simulations with ESMs have provided new opportunities for deconvolving forced anthropogenic signals from natural variability, and thereby can aid in interpretation of not only the historical period, but also aid in estimating future emergence of forced trends.

In this presentation we will consider several applications of Large Ensembles in projections of future changes in marine ecosystems with particular attention devoted to the western North Pacific. For a given ESM, Large Ensembles comprise model simulations with identical external forcing but with differing initial conditions, and thereby they represent the evolution of equally likely trajectories of the Earth system. The topics considered will include forced (anthropogenic) changes in phytoplankton populations, changes in phytoplankton phenology, and changes in marine ecosystem stressors. The manner in which Large Ensembles can provide new mechanistic insight into future ecosystem changes will also be considered, along with the potential implications for fisheries and resource management. It is hoped that this presentation will stimulate further discussion between ecologists and modelers.

Sayaka Yasunaka
Data accumulation reveals changes in the ocean environment

Ocean temperatures are rising as a result of global warming. Since the ocean is warmed at the surface, it is warming faster and greater in the surface layer. When there is a strong warming at the surface, the surface and deeper layers of the ocean become more difficult to mix. Then, nutrients, which are more abundant in the deeper layers, are expected to be depleted in the surface layer. Actually, observational data show signs of this. Nutrients are essential for phytoplankton to carry out photosynthesis, so if they are depleted in the surface layer, it may affect the amount of photosynthesis and thus the ocean's CO_2 absorption. Continuous observations are desirable in order to understand the current state of the marine environment and to predict its future.

Kazuaki Tadokoro
Recent change of the plankton community of the important primary producer of the marine ecosystem in the western North Pacific Ocean

The unique and diverse waters forms around Japan because of there is subarctic waters of the Oyashio and subtropical waters of the Kuroshio exist in the narrow latitude band and the there is some marginal seas and Seto Inland Sea. The oceanographic environment forms the diverse marine ecosystems and it produces high productivity of fisheries resources. On the other hand the marine environment and ecosystem have change related to the climate change caused by natural and artificial factors. I will review the feature and recent change of the plankton ecosystems which is primary producer of the marine ecosystem around Japan in the western North Pacific Ocean.

Yuki Kanamori
Impacts of marine environments such as water temperature on fishery resources over almost half a century

Distribution and phenology of marine species, including fishery resources, have changed under climate change. The changes in distribution and phenology are important for thinking about sustainable fisheries, because the changes are expected to affect stock assessment and management, ways of fishing (e.g., fishing grounds and gears), and fisheries industry such as processing and marketing. However, little is known about the changes in distribution and phenology in western North Pacific in comparison with other regions such as the eastern North Pacific and the Atlantic.
Here, I show two case studies about the effect of marine environments on fishery resources in the western North Pacific over almost half a century: distributional change in chub mackerel and phenological change in North Pacific spiny dogfish.

Yu-Lin Chang
The application of ocean model simulation on Anguillid eel migration

Anguillid eels are widely distributed in the Indo-Pacific and North Atlantic regions with their juveniles living in estuarine and freshwater habitats and their reproduction and early life histories occurring in the open ocean. Their unusual catadromous life histories of spawning offshore over deep water with their larvae then using ocean currents to be transported towards their recruitment areas have contributed to a lack of understanding of what has caused the drastic declines in the northern hemisphere anguillid eel populations. With the spatial and temporal limitations in on-site observation, modeling simulations were introduced for further understanding of the eel ecology. The modeling simulation in eel shoreward migration, crossing Kuroshio, interaction with mesoscale eddies, and backward tracking for deriving spawning area, will be introduced. How the advanced ocean modeling and the potential benefit in eel or material simulation will also be discussed.

Michio Aoyama
Comparability and traceability of nutrients data in the world ocean

To better manage the global impacts of human activities on the world's oceans, it is necessary to have accurate observations of changes in carbon and dissolved nutrients in both upper and deep ocean waters. By establishing mechanisms for comparability of nutrient analyses, we will be able to detect changes in nutrient levels, then detect changes in the marine ecosystem related to the climate change caused by natural and artificial factors. Such changes could, either alter the supply of nutrients to the upper ocean directly or be from changes to ocean circulation.

Our nutrients community had been working towards comparability of global oceanic nutrient data for these 20 years. The laboratories that measure oceanic nutrients data participated 6 times inter-laboratory calibration exercise of CRM/RM of Nutrients and provided nutrient Certified Reference Materials, CRMs, for nutrient concentrations of Atlantic and Pacific waters in collaboration with JAMSTEC. Since their launch, the number of global users of these SCOR-JAMSTEC CRMs has been increasing greatly. The number of participants who use nutrient CRMs has increased very much during these last few years. This is really very good news. The primary goal is that nutrient data collected anywhere by one individual laboratory, and data collected over long time periods by one or more laboratories will be consistent and traceable with certified comparability. For future generations, it is unacceptable to produce historical data sets without the absolute consistency necessary to assess spatial and temporal trends.

Makio Honda
Ideal observation network for the study of the biological carbon pump

The biological carbon pump (BCP) is ocean's CO_2 uptake mechanism that, via the low trophic ecosystem activity, atmospheric CO_2 is absorbed and transported to the ocean interior. It has been reported that Northwestern Pacific is one of areas where the efficiency of the BCP is high. However, it is concerned that its efficiency would be lowered by the ongoing multiple stressors such as ocean warming, acidification and deoxygenation. Thus, the observation for the BCP this area should be continued and/or strengthened. In this talk, ideal observation network for the study of the BCP including not only traditional time-series sediment trap mooring observation, but also utilization of drifting buoy and unmanned surface vehicle (USV) with new sensors are discussed.

Xiaopei Lin
Pacific Decadal Climate Change and Fish Catches

The decadal climate change in the North Pacific is believed to be determined by the Pacific Decadal Oscillation (PDO), which was firstly found from the Salmon catches in the North Eastern Pacific Ocean. But our recent studies show that the Atlantic Multidecadal Oscillation (AMO) could regulate the decadal variability of the Kuroshio front and upper layer ocean temperature in the Northwestern Pacific Ocean. Then the fish catches near the Japan will also vary with the AMO rather than the PDO.

Hiroya Sugisaki
Recent poor catch problems in the rich fishery grounds

However, there are well known biological productive fishery grounds around Japan, serious problems on poor catch of fishery important species (e.g. saury, salmon, and more) is occurring. Not only the artificial effect (e. g. high fishing pressure) but the climate change effect is thought to be a reason of the poor catch. On the other hands, yields of some fishery important species were increasing. Ocean condition for fisheries seems to be changing recently.

Kaori Fujita
What Financial Institutions Which Make ESG Investments and Loans, Companies, and Consumers Expect from the Ocean

In recent years, ESG (Environmental, Social, and Governance) investment and financing has been gaining momentum, in which financial institutions make investments and loans in companies and organizations that are managing their businesses in a sustainable manner with ESG considerations in mind. The areas in which financial institutions are making ESG investments and loans have expanded beyond climate change to include biodiversity and natural capital. Within biodiversity and natural capital, "oceans" have also become an important issue. I will discuss what kinds of human activities related to the ocean financial institutions are interested in, how companies and consumers should engage with the ocean, and what kind of data and information they need to do so.