Marine ecosystem model of seaweed growth stimulated by aquaculture wastewater effect

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In recent years, the impact of human activities, such as agriculture and aquaculture, on marine ecosystems have been receiving heightened attention. For example, aquaculture has been observed to induce environment interactions through the release of organic substances from fish farms into the surrounding environment. Additionally, there have been cases where human activities, such as the cultivation of seaweed beds, have demonstrated positive effects on marine ecosystems. However, further studies are required to accurately quantify and forecast these effects.

In order to further examine these effects, we are developing ecosystem cycle forecasting technology to model and forecast changes in crucial components of marine ecosystems. Initially, we identify a target experimental area where the marine ecosystem has been undergoing transformations owing to interactions with human activities. Subsequently, we build a marine ecosystem model to track the cycling of materials within that area. Finally, we simulate quantitative changes in organisms and nutrients using the marine ecosystem model.

In this presentation, we introduce a marine ecosystem model focusing on seaweed (*Monostroma nitidum,* known as “Hitoegusa”) farms located adjacent to shrimp (*Marsupenaeus japonicus,* known as “Kuruma-Ebi”) aquaculture ponds on the island of Kumejima in Okinawa. In the aquaculture facility targeted in this study, wastewater from the shrimp aquaculture ponds is ejected into seaweed farms. This wastewater, containing leftover excess nutrients, may stimulate seaweed growth. To quantitatively estimate the amount of seaweed growth, we built a marine ecosystem model based on biochemical cycles and ocean flows. Using this model, we conduct a comparative evaluation of the simulated results and measured data.

In the near future, we plan to broaden the scope of our model to encompass other human activities, including agriculture and marine development. This expansion will allow us to forecast future responses of marine ecosystems to various human activities. We also aim to utilize this technology to identify human activities that could potentially have positive effects on marine ecosystems and to promote the conservation of marine biodiversity.

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