Study on Carbon Transfer in a Seagrass Ecosystem

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Abstract

Carbon-14 released from spent nuclear fuel reprocessing plants, migrates not only in the terrestrial environment but also in the marine environment. Although the role of ^{14}C in the open sea is of less importance than that in the terrestrial environment from the viewpoint of radiation dose assessment around nuclear facilities, its probable long-term accumulation in neighboring areas, including coastal areas, is a matter of concern for the radiation protection of the general public.

The Closed Hydrosphere Experiment Facility (CHEF) was developed as a part of the Closed Ecology Experiment Facilities (CEEF) to study circulation and accumulation of radionuclides in the hydrosphere ecosystem. A mathematical model to analyze carbon transfer in a seagrass ecosystem was developed, being described as a network consisting of 4 sub-models: Sea water and sediment model, Seagrass model, Sea urchin model, and Sea cucumber model. Based on the data obtained by the experiments in CHEF where an artificial seagrass ecosystem had been constructed, model parameters in each sub-model were determined. The accumulation rate of carbon in sea sediment was estimated as about 1.3% per day of the total carbon amount of the seagrass community of the unit area in the real marine environment. The estimate was within the range of observational data reported so far, which implies the model has applicability and effectiveness for describing the natural environment.

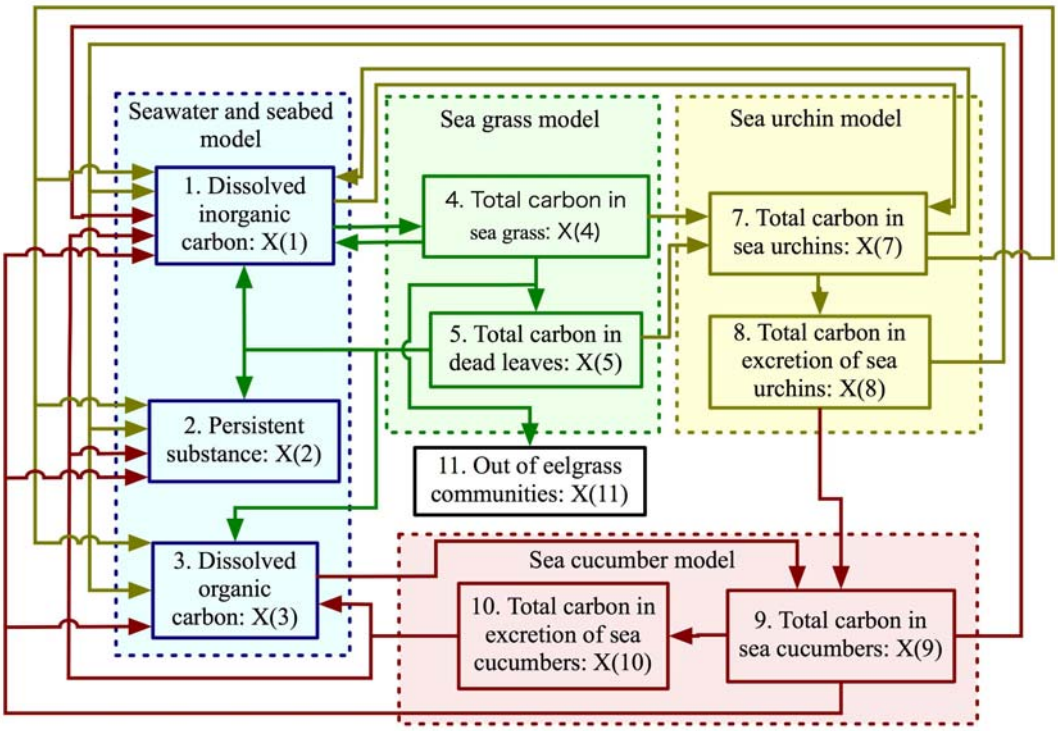

Fig. 1 Schematic of the carbon cycle model in sea grass ecosystem.

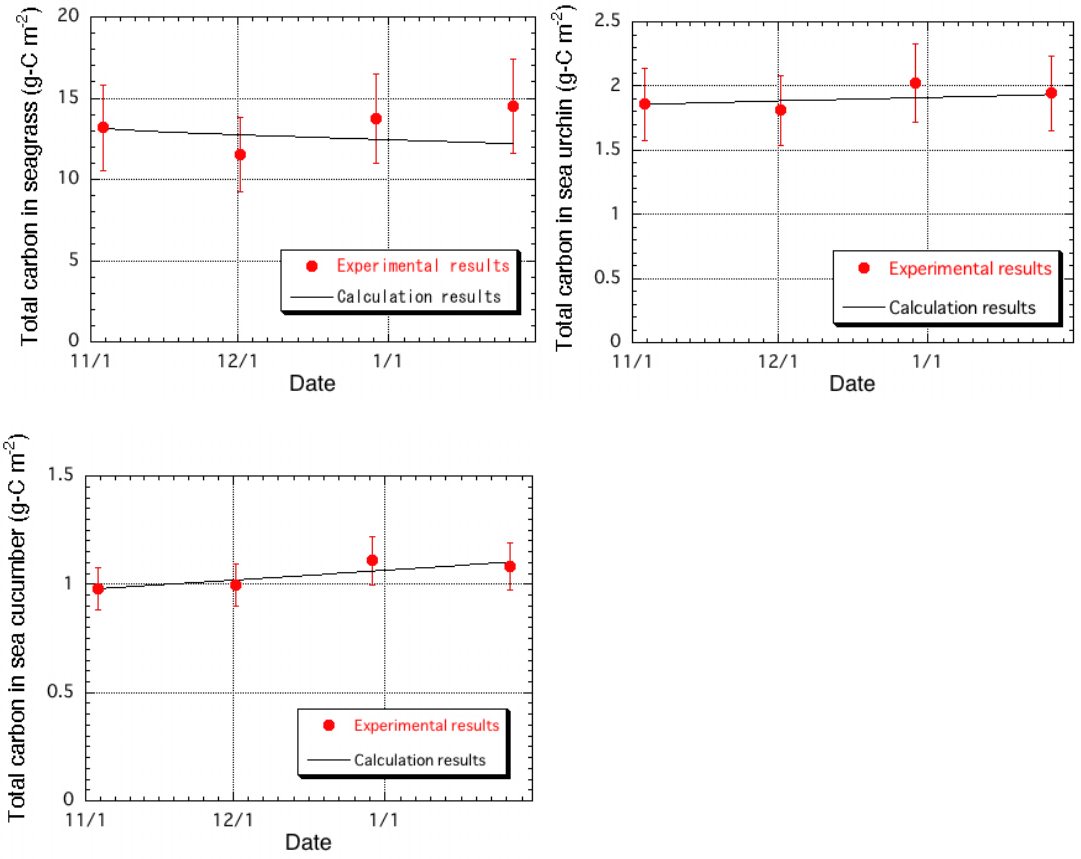

Fig. 2 Temporal variation in the amount of carbon in sea grass, sea urchin and sea cucumber.