Abstract

[Project Information]

Project Title :	Proposal for a New Management Technique Using Top-down Controls of Tidal Flat Ecosystem: Balancing Fisheries and Biodiversity Conservation
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[Abstract]

This study focused on apex predators (primarily sharks and rays), a largely overlooked group. We aimed to elucdate the food-web network structures based on comprehensive and empirical data covering all trophic levels and to propose new management measures that utilize ecosystem functions through top-down control based on apex predator management and conservation. Based on thorough field surveys, this study comprehensively clarified the species composition, distribution, biomass, feeding habits, and ecological properties of the Ariake Bay ecosystem, including all trophic levels from apex predators to small fish and benthic organisms. Based on these results, an ecosystem model was constructed using Ecopath with Ecosim based on functional groups, and a food-web network diagram was obtained. We identified apex predators including keystone and structuring species. Based on observational data collected during the sampling of top predators, we constructed species-specific TS diagrams and integrated them with a physical environment model (water temperature and salinity) to predict changes in top predators from the past to the future in response to environmental changes. The results showed that increased water temperature did not cause significant changes in the top predators or functional groups of the ecosystem. However, changes in salinity had a significant impact on the entire ecosystem through fluctuations in keystone species.

Ecosystem model simulations demonstrated that reducing fishing pressure on apex predators and enhancing their abundance can activate top-down control, indirectly promoting the stability of shellfish populations via food-web interactions. Furthermore, this study suggests that appropriate

apex predator and keystone species management could help maintain biodiversity and simultaneously ensure biological productivity. Using stable isotopic ratio analysis as an indicator, we developed a method to estimate the feeding damage caused by eagle rays on bivalves, to determine whether there is a scientific basis for eagle ray population control. Based on the findings of this study, we propose a shift to new management strategies that utilize ecosystem functions through top-down control, emphasizing the need to conserve or appropriately manage predators to protect ecosystems, including fishery resources.

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