

Ecological studies on growth-phase Anguillid eels: Focusing on the connectivity of aquatic and terrestrial ecosystems

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Anguillid eels are catadromous fish species that spawn in the open ocean and grow in continental waters. Eels have long been commercially and culturally important species, providing a variety of ecosystem services to our society. However, stocks of some anguillid eels have experienced remarkable declines in recent decades, making their conservation an urgent issue. To contribute to the conservation and sustainable use of eels, we aimed to elucidate the ecology of growth-phase Anguillid eels (the Japanese eel *Anguilla japonica*, and the giant mottled eel *A. marmorata*) with a special focus on the effects of habitat loss and degradation on eels. While studying eel ecologies, we found that a collapse of the connectivity between land, river, and marine ecosystems related to habitat modifications can negatively affect eels, as well as riverine biodiversity.

By focusing on the unique ecology of Japanese and giant mottled eels, we demonstrated that eels can act as indicator, umbrella, and flagship species, and serve as a comprehensive surrogate for conservation of freshwater biodiversity¹. Using data obtained from 78 sites across six rivers in Japan, we showed that: (1) eels are the highest-order predators with a broader distribution in rivers than other species, making them effective umbrella species that indirectly protect a wide range of other organisms; (2) since dams and weirs reduce the biodiversity of rivers by impeding upstream migration of eels and other migratory species, eels can act as an indicator of river-ocean connectivity; and (3) eels have the potential to stimulate public interest and support for conservation as flagship species. Thus, restoring and maintaining river-ocean connectivity would conserve eels as well as biodiversity in freshwater ecosystems more broadly.

Based on three years of monthly sampling surveys in the Tone River system, we found that (1) the terrestrial earthworm subsidy driven by rainfall contributed the most to the diets of Japanese eels inhabiting lower reaches of a large river, where the effects of subsidies have been thought to be low²; (2) shoreline revetments may block one of the important linkages between terrestrial and riverine ecosystems, which is the supply of earthworms from land to rivers³; (3) abundances, food consumption, and condition factors of eels inhabiting the revetment areas of the river were significantly lower than those of eels inhabiting the natural shore areas consisting of soil and vegetation, in part due to the collapse of terrestrial-river connectivity caused by revetments³. These results highlight the importance of restoring and maintaining terrestrial-river connectivity in riverine environment restoration.

References

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