Nitrogen and phosphorus are crucial nutrients in aquatic ecosystems as most organisms at the base of the food chain rely on them. Considering that the recycling of nutrients is directly influenced by fishes, an American team of scientists has recently investigated the impacts of fish extinction on nutrients recycling processes. Their results highlight the complexity of predicting the consequences of extinctions from species-rich animal communities. Nevertheless, the importance of exploited fish species in nutrient recycling suggests that overfishing could have particularly detrimental effects on ecosystem functioning.

In a recent study, an American team of scientists has investigated the impacts of nutrient recycling in random and non-random extinction scenarios on tropical ecosystems using computer simulations and field data from Lake Tanganyika (bordering Tanzania, Zaire, Zambia and Burundi) and from the Rio Las Marias (a Venezuelan river). Their main results are as follows:

- Following extinctions, surviving species may be able to compensate for lost species by increasing their roles in nutrient recycling. In simulations of both ecosystems, when surviving species successfully picked up the slack in nutrient recycling left by extinct species, N and P were maintained at 80% of their starting values until over half of the species were lost.

- Non-random extinction scenarios (which are generally closer to real world extinction patterns) produce markedly different outcomes than random ones. In non-random scenarios, losses of rare species have the weakest impacts. If extinctions are modelled on their order in the food chain, intermediate effects are observed which are comparable to random extinction scenarios, where surviving species do not compensate for loss of other species. This observation is mostly explained by the relatively small population densities of top predators.

- Considering that fishermen target species whose population density and body size give them relatively high biomass, fishing can rapidly decrease fish biomass and reduce the role of fish in nutrient recycling. Overfishing is also predicted to decrease N/P ratios as small fish typically recycle less N relative to P than larger species. This could have important impacts on primary producers by changing the identity of the limiting nutrient.

- The variation among species in contribution to nutrient cycling is related to both the relative biomass within the community and species-specific differences in excretion rates. In some ecosystems, single species may account for up to 50% of recycled nutrients. However, species that heavily recycle N are not always the same ones that recycle the most phosphorus, thus making it difficult for conservation programmes to prioritise which species to protect.

The authors conclude that the consequences of declining fish diversities will depend upon the order of extinction and the compensatory responses from surviving species. Patterns of species composition and species-specific functional traits can give rise to important differences in the impacts of extinctions. Nevertheless, eroding aquatic diversity is likely to have detrimental effects on ecosystem functioning by altering nutrient recycling. As fish play an important role in the rapid recycling of nutrients in tropical aquatic ecosystems, fish extinction can have serious implications for ecosystem productivity and could therefore jeopardise freshwater tropical fisheries.


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