

A Three Species Predator-Prey Model Incorporating Trophic Transfer of Polychlorinated Biphenyls (PCBs) in the Great Lakes System

Annchen Knodt

Cara Montgomery

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Abstract

We considered the effects of two invasive species, the zebra mussel and the round goby on the ecology of the Great Lakes Region. These species, transported by ballast water released from ships arriving from Europe, first appeared in the Great Lakes in 1988. They have since thrived and grown to exceptionally large proportions, significantly impacting the Great Lakes ecology in many ways. Since round gobies consume zebra mussels as a primary food source, and smallmouth bass (a species native to the Great Lakes) in turn consume round gobies, we decided to examine this food chain. We created and compared two three-species predator-prey mathematical models. This food chain is of particular interest because it facilitates the trophic transfer of polychlorinated biphenyls (PCBs), harmful organic pollutants found in the Great Lakes environment. We made attempts with our model to track the transfer of these PCBs through the food chain in order to predict their effects on higher level predators and potentially humans, as well as discuss possible control measures.