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

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28 July 2008

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, signifi-
cantly 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 poly-
chlorinated 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.