Invited Abstract

NONINDIGINEOUS FISHES IN LAKE ERIE

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Lake Erie has a long history of colonisation by exotic organisms. Of the 143 fish species in the Lake Erie basin, 34 of these are nonindigenous species (NIS). Nineteen of these fishes have become established, while 15 others have been reported but failed to establish populations. NIS fishes now account for over 75% of the commercial harvest of fishes from Lake Erie. These fishes arrived through a variety of vectors including intentional release (stocking), unintentional release (aquaria and ornamental ponds, bait buckets and aquaculture), ballast water and canals. We describe the status of the dominant nonindigenous fishes, comment on their ecological impact, profile three candidate species likely to arrive in Lake Erie within the next few years, and review current policy designed to mitigate the introduction of nonindigenous fishes to Lake Erie.

Rainbow smelt (Osmerus mordax), alewife (Alosa pseudoharengus), white perch (Morone americana), sea lamprey (Petromyzon marinus) and non-native salmonids (Oncorhynchus spp.) are the dominant nonindigenous fishes which have become established in Lake Erie. Rainbow smelt entered Lake Erie in 1935, twenty-three years after their escape from Crystal Lake, Michigan. The salmonids became established as the result of stocking programs initiated in the late 1800s. The other species invaded through ship canals in the first half of the twentieth century. Each species has had a marked impact on the fish community of Lake Erie. Predation on the eggs and young, and / or competition for food with native fishes characterise the impacts of rainbow smelt, alewife, white perch and non-native salmonids. The sea lamprey parasitises many native and non-native fishes, costing millions of dollars annually in lost production and control measures throughout the Great Lakes. However, rainbow smelt and alewife comprise the dominant prey of most piscivores in Lake Erie, and smelt, white perch and non-native salmonids generate millions of dollars annually to sport and commercial fisheries. Round gobies (Neogobius melanostomus) are a relatively recent invader (1993) that arrived via ballast water from the Black and Caspian seas. Gobies prey on the eggs and young of native fishes and aggressively displace native benthivores. Adults consume large quantities of zebra mussels, moving energy back from benthic to pelagic food webs. Unfortunately, this foraging pathway may also serve as a vector for contaminant transfer to important sport and commercial species.

Eurasian ruffe (Gymnocephalus cernuus), blueback herring (Alosa aestivalis), and fourspine stickleback (Apeltes quadracus) are three fishes expected to invade Lake Erie within the next few years. All are now resident in the Great Lakes system: ruffe and fourspine stickleback arrived via ballast water, while blueback herring invaded Lake Ontario through the Erie barge canal.

Current policy regulating nonindigenous fishes is inadequate to protect the Lake Erie ecosystem. Federal, provincial and state policy lack a clear mandate, fail to provide standards for evaluating introductions, and have few provisions for interstate or bi-national coordination to establish consistent policies and legally effective rules. The province of Ontario and the four US states bordering Lake Erie each have some provision restricting the introduction of exotic fishes, although each is open to broad interpretation on the part of the enforcing agency. Ballast water legislation remains weak, as the main tool for regulation (open ocean exchange) remains voluntary in Canada, while the mandatory US program contains broad sweeping vessel safety exemptions that undermine the mandate of the policy. Unintentional introductions from aquaculture, bait fish, aquaria and ponds are recognised within each jurisdiction as potential sources for nonindigenous fishes, but little policy exists to actually prevent the introduction of exotic fishes from any of the means. Ballast water is the primary vector for introduction of nonindigenous invertebrates, and has served as a source for a number of fishes. While considerable dialogue has been generated on ballast water controls, lack of action, loop holes and difficulties in enforcement have enabled organisms to continue to arrive via this means.

Continued research is needed to identify potential invaders including an examination of donor and recipient habitats, assessment of vulnerability of recipient communities, evaluation of dispersal mechanisms, and description of international trade routes. Large-scale and long-term ecological studies and manipulation experiments are needed to accurately assess the impact of exotic species on the Great Lakes ecosystem.

Until suitable policy and regulation is developed and enforced, Lake Erie and the rest of the Great Lakes ecosystem will remain vulnerable to invasion by exotic species. The negative impacts of these nonindigenous species far outweigh any potential benefit, and will continue to impair the long-term sustainability of the Great Lakes resources.