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Invaders that did no harm? The Panama Canal as a natural biological invasion experiment.

Invasive species may cause severe economic losses. Thus the hot debate regarding the ecological mechanisms determining the outcome of biological invasions is of equal interest to scientific and business communities. Do invaders bump residents out by competing with them for scarce resources, or do they merely move in without causing harm to their neighbors?

In one of the first environmental impact studies ever, the Smithsonian Institution's 1910 Panama Biological Survey provided baseline data for Panama Canal construction, a project creating the largest man-made lake in existence at the time. The Canal, completed in 1914, rerouted the Chagres River on Panama's Atlantic slope into the Pacific Ocean—connecting watersheds across the continental divide. Since then, fish from the Atlantic and Pacific sides of Panama have intermingled, but the mix has not resulted in extinction of fish in tributaries on either slope according to new research published in the Proceedings of the Royal Society of London (online) by Scott Smith and Graham Bell of Canada's McGill University and Eldredge Bermingham, Staff Scientist at the Smithsonian Tropical Research Institute in Panama.

At the beginning of the 20th Century, concern about human-induced environmental change was already on the agenda. Faced with the immanent flooding of 500 square kilometers of lowland tropical forest in Panama, the Panamanian government authorized the Smithsonian Institution to conduct the Panama Biological Survey (1910-1912), an extensive biological census of the region to be covered by Lake Gatun, the Panama Canal waterway.

The U.S. Bureau of Fisheries assigned Seth E. Meek from the Chicago Field Museum of Natural History and Samuel F. Hildebrand, his assistant, to census the fish fauna of the Canal area. They made lists of fish in the Chagres River on the Atlantic slope and in the Rio Grande, on the Pacific slope, rivers that would become part of the Canal waterway, a new freshwater corridor between two oceans.

It did not take long for fish to move from Atlantic to Pacific slopes and vice versa. When Hildebrand returned to Panama in the 1930's many species had already moved into streams on the opposite slope.

In 2002, the authors of the new report returned to the Chagres and the Rio Grande to collect fish. In total, they found that three fish species had colonized the Chagres Riverand five had colonized the Rio Grande. Both sides of the Isthmus became more species rich as a result of the Canal connection. All of the original species found in each stream in Meek and Hildebrand's initial, 1916 survey, are still there.

This is a significant contribution to our understanding of biological invasion because it shows that dispersal played a more significant role than local ecological interactions in the structure of the fish communities in these two rivers, even after many generations in this great natural experiment.

Smith, S., Bell, G., and Bermingham, E. 2004. Cross-cordillera exchange mediated by the Panama Canal increased the species richness of local freshwater fish assemblages. Proceedings of the Royal Society of London B. online. See: www.journals.royalsoc.ac.uk

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