Is invasion success explained by enemy release?

The cover for *Journal of Applied Ecology* issue 57:06 shows a Cuban treefrog in Florida, USA. Discussing the research behind the image, Elizabeth Roznik explains how invasive species such as this can outcompete native frogs due to their large body sizes, fast growth rates, and tolerance of parasites.

Invasive species are among the leading threats to native wildlife. Understanding the mechanisms underlying invasions can help us manage invasive species and their impacts. The enemy release hypothesis suggests that invasive species have an advantage in their introduced range because they leave behind many of their predators and parasites from their native range. This allows them to shift resources from defence to growth, reproduction, and dispersal. Although many studies have shown that invasive species have fewer parasites than their native counterparts, few studies have tested whether the loss of natural enemies can be primary driver of the invasion process.

We used a manipulative field experiment to test whether parasite release in the Cuban treefrog (*Osteopilus septentrionalis*) contributes to its invasion success. The Cuban treefrog is native to several Caribbean island groups and has been introduced to Florida, USA, where it negatively impacts native frogs through competition and predation. We conducted a one-year mark-recapture study, in which we used an anthelmintic drug to remove parasitic gut worms from Cuban treefrogs and native treefrogs *(Hyla* spp.) at half of 12 wetlands. We expected that the drug would have a greater benefit to native than invasive hosts because they may be investing more in parasite defences.

We marked more than 4,000 frogs over one year, 78% of which were Cuban treefrogs. We recorded fewer species of parasitic worms in the Cuban treefrog's introduced than native range. However, growth and survival rates of invasive and native treefrogs responded similarly to the anthelmintic treatment. This suggests that the Cuban treefrog's release from parasitic worms does not appear to significantly contribute to its invasiveness in established areas. These findings indicate that any manipulation of parasites in invasive or native hosts would not be an effective method of controlling Cuban treefrogs, such as restoring missing parasites to Cuban treefrogs or treating native treefrogs for parasites.

Instead, other mechanisms may facilitate the invasion of Cuban treefrogs, such as the life-history traits that we observed. Cuban treefrogs have much faster growth rates than native treefrogs, with male Cuban treefrogs reaching sexual maturity in less than half the time required for males of native species to mature. Females have similar rates of maturation, but invasive females reach a body size that is at least twice that of native females, leading to much larger clutches of eggs. The rapid growth and maturation and high fecundity of Cuban treefrogs contribute to their invasion success by allowing them to rapidly colonize new areas and reach high densities.

We did not find strong support for parasite release as a primary driver of the invasion of the Cuban treefrog in an area where they have been established for 20 years. However, we cannot rule out an advantage of enemy release at the invasion front, where parasites could be lagging behind their hosts. Successful methods of controlling Cuban treefrogs on a landscape scale have not been identified, and our study suggests that parasite manipulation would not be a useful strategy. Cuban treefrogs often

spread by hitchhiking on vehicles, boats, and ornamental plants. Therefore, surveillance, early detection, and prompt removal of any individuals that appear in suitable areas outside of their current range are key to reducing their expansion.

To help manage invasive Cuban treefrogs and help researchers monitor their spread, you can report Cuban treefrog sightings in peninsular Florida and beyond, and learn how to manage Cuban treefrogs around your home.

Originally posted on The Applied Ecologist

Article: Roznik, EA, Surbaugh, KL, Cano, N, Rohr, JR. Elucidating mechanisms of invasion success: Effects of parasite removal on growth and survival rates of invasive and native frogs. *J Appl Ecol*. 2020; 57: 1078– 1088. https://doi.org/10.1111/1365-2664.13634