

UC SANTA BARBARA

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## **Both flexibility and persistence make some birds successful in human-made environments**

Across North America, grackles are virtuosos of adaptation. The small- to medium-sized New World blackbirds are particularly social and known for foraging skills that help them flourish in environments ranging from rural farms to urban parking lots.

They are often viewed as rather bold and somewhat amusing birds that pick up French fries and other fast food scraps — or, alternatively, as annoying pests that eat our grain crops.

UC Santa Barbara scientist Corina Logan, however, is fascinated by what goes on in their bird brains and how they manage to adapt to the growing footprint of human-made environments. In a pair of papers that appear in the *Peer Community Journal*, she and fellow authors investigate the role of behavioral flexibility in great-tailed grackles, a species related to cowbirds and meadowlarks that originated in Central America but has been rapidly expanding its range across the U.S.

“The big question was: Is behavioral flexibility how the great-tailed grackles are so rapidly expanding their geographic range?” said Logan, a research associate at UCSB’s Neuroscience Research Institute who also leads the Comparative Behavioral Ecology Group at the Max Planck Institute for Evolutionary Anthropology. “It is a long-held assumption that this must be the case, but researchers hadn’t yet

measured flexibility in populations across the range of a rapidly expanding species.” Their findings provide insight into what needs to be measured to predict how successful species might be in a new environment, which could be a useful tool for conservation managers.

### **A 'serendipitous study system'**

In their [first paper](#), Logan and co-authors define behavioral flexibility as “the ability to change behavior in the face of a changing environment by packaging information and making it available to other cognitive processes.” The cognitive trait is implicated in species range expansion, including early hominids, and also in the adaptations of people who move from one culture to another. However, it has been unclear whether this trait underlies behaviors related to animals’ successful adaptation to new environments, such as foraging, habitat use and sociability.

“The great-tailed grackles are a serendipitous study system about whether flexibility is involved in a rapid geographic range expansion because they happen to be expanding their range,” said Logan, [whose group in 2016 discovered](#) that the birds are also highly behaviorally flexible. “This allows us to ask questions like, ‘How does flexibility work? How does it relate to other abilities? Is it the main behavior involved in a range expansion?’”

To answer these questions, the researchers devised two experiments on two distinct populations of great-tailed grackles — one in Tempe, Arizona; the other in Woodland, California. One experiment involved reversal learning, in which the birds were presented with two different colored containers and steered into preferring one color by way of a food reward consistently placed in a container of that color. The food would then be placed in the other container. The speed with which the birds changed their color preference was the measure of flexibility. The researchers then trained one subset of the Arizona population to be more flexible by conducting this process repeatedly.

In the other test, the grackles accessed food through a box of four puzzles. Once the birds solved one puzzle, leading to a food reward, access to the food through that solution would be blocked, requiring the birds to attempt another puzzle. The speed with which they switched locations on the box was the indicator of flexibility. All the birds were then released and observed.

The researchers found that the grackles that had been trained to be more flexible became better at foraging. That is, they ate a wider variety of foods and used more foraging techniques, in effect packaging what they learned during the experiments and deploying it in their usual environments.

“We may laugh at the birds in parking lots eating the leftover French fries, but actually not all birds are able to change their behaviors to take advantage of these human-provided resources,” said Auburn University behavioral ecologist and co-author Kelsey McCune, who conducted the grackle research while she was at UCSB. “So, it’s interesting to find that this ability to eat many different foods is also related to the cognitive trait of behavioral flexibility.”

However, while flexibility underlies foraging behavior, the researchers found no

strong correlations between flexibility and sociability between the birds in both the Arizona (trained and untrained) and California (untrained) populations, or between flexibility and habitat use. They hypothesized that this may be because social and habitat use behaviors are “potentially formed early in life and individuals are less likely to change these behaviors when circumstances change.” Another explanation, they said, could be that while their sample sizes allowed them to detect larger effects and medium effects, they were not large enough to detect the weaker and smaller effects.

The [second](#) paper compared populations of great-tailed grackles and boat-tailed grackles — birds found along the Atlantic and Gulf coasts of the southeastern U.S., and the great-tailed’s closest relatives.

“Boat-tailed grackles are not rapidly expanding their range,” Logan said. As a result, the expectation was that the boat-tailed grackles would not do as well on the reversal learning test (switching between two different color containers with food) than the great-tailed grackles, or that they would also be less likely to switch between food types.

But when tested, the boat-tailed grackles' reversal learning speeds were within the range of their wider-ranging cousins, and there were no strong differences between the two populations in their ability to switch between food types. “These species are similar in many ways,” Logan said. “They eat the same kinds of foods, live in the same kinds of places, and they even look the same. That they are also similar in

their levels of flexibility was surprising, given differences in how fast they are expanding — or not — their ranges.”

The authors conclude that behavioral flexibility, while helpful in allowing birds to adapt to new food environments, factors into but is not the primary facilitator for geographic range expansion.

Rather, the success of the great-tailed grackle in the expansion of its range may be more attributable to persistence and variability in flexibility, as the researchers point out in [previous findings](#). “It is likely that, historically, both species needed flexibility to adapt to human-modified environments that encroached on their habitat,” Logan explained. “Perhaps they continue to rely on flexibility to interact in these human-modified environments, which is now their primary habitat.”

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