Anolis carolinensis response to avian calls, predatory vs non-predatory

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Anolis carolinensis

Also known as the Green Anole

Native to the Southeastern United States (Tollis and Boissinot. 2013)

Can change coloration between brown and green

Introduction

Avian predation has an important selective pressure on anoles (Bloomberg and Shine. 2000)

In turn, location can play an important role on avian predation on green anoles. Some avian predators, such as the pearly-eyed thrasher, are only found to eat anoles and other vertebrates when in moist habitats (McLaughlin and Roughgarden, 1989).

Introduction

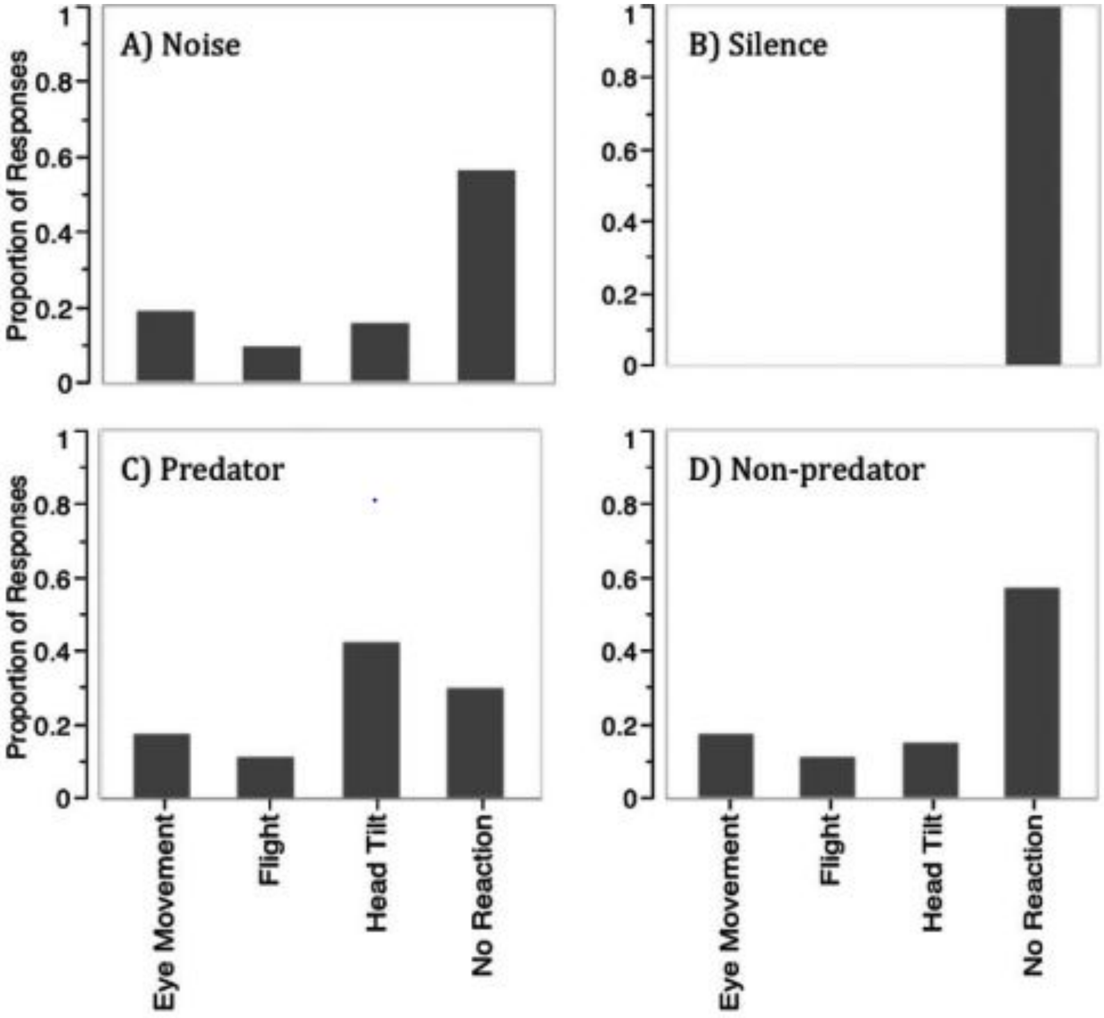
Exposure to a predator can lead to high stress in anoles, and they can respond in many different ways.

Some of the anole's more common responses are running, hiding, and looking around by tilting the head and shifting the eyes (Leal and Robles, 1995; Cantwell and Forrest, 2013).

Introduction

Birds are frequent predators of anoles with some of the most common in America being the red-tailed hawk and the American kestrel (Poulin et. al, 2001).

Close relatives of the green anole have increased response to these predator calls compared to non-predator calls (Cantwell and Forrest, 2013).



Cantwell and Forrest, 2013.

Objective:

The objective of this study is to see how American green anoles respond to the calls of different kinds of birds

Hypothesis:

Green anoles will respond to combined auditory and visual cues from predatory birds and react differently and more than they would to non-predatory birds

Methods

Seven female anoles were housed in two tanks: one containing four individuals and another containing three.

Three birds were chosen to compare anole responses to their auditory and visual cues. Two predatory (red tailed hawk and kestrel) and one non-predatory (pigeon). One control group was utilized as well (Jonah’s face).



Methods

A printed picture of each bird and the control was placed beside the tank individually while simultaneously playing a recording of the pictured bird’s call.

Once the picture was placed the recording was played for 30 seconds and the anoles’ responses were observed for one minute. A resting period of ten minutes was allotted to reduce stress levels.

For the control a picture of Jonah was placed and he made his own personalized predatory call.

Three trials were done for each bird.

Methods

The anoles were monitored for five direct responses to the bird call and picture: looking, hiding, running, grouping behavior, and unresponsive behavior.

Sign tests and a binomial test were used to analyze the data. Each anole was monitored individually, and each response and nonresponse of the anole was charted.

If the individual's responses were greater than its nonresponses, than a positive was allotted. If the individual's responses were less than its nonresponses, than a negative was allotted.

Non-predatory cues

Table 1. The comparison of anole behavior with no response when subjected to a pigeon auditory and visual cue. This comparison was done using the sign test, and it was found that anoles would respond to the cues in some way significantly more than they would not with a P-value of 0.008.

Pigeon call behavior vs no behavior			
Anole	Behavior	No behavior	Difference
1	3	0	+
2	2	1	+
3	2	1	+
4	3	0	+
5	3	0	+
6	3	0	+
7	3	0	+

Predatory cues

Table 2. The comparison of anole behavior with no response when subjected to a red-tailed hawk auditory and visual cue. This comparison was done using the sign test, and it was found that the anoles would respond to the cues in some way significantly more than they would not with a P-value of -.008.

Hawk call behavior vs no behavior			
Anole	Behavior	No behavior	Difference
1	3	0	+
2	3	0	+
3	3	0	+
4	3	0	+
5	3	0	+
6	3	0	+
7	3	0	+

Predatory cues

Table 3. The comparison of anole behavior with no response when subjected to a kestrel auditory and visual cue. This comparison was done using the sign test, and it was found that anoles would respond to the cues in some way significantly more than they would not with a P-value of 0.008.

Kestrel call behavior vs no behavior			
Anole	Behavior	No behavior	Difference
1	3	0	+
2	3	0	+
3	3	0	+
4	3	0	+
5	3	0	+
6	3	0	+
7	3	0	+

Specific behaviors

Table 4. The comparison of anole looking behavior with no behavior at all when subjected to a pigeon auditory and visual cue. This comparison was done using the sign test, and it was found that anoles would look around significantly more than doing in response to the cues with a P-value of 0.062.

Pigeon call looking behavior vs no behavior			
Anole	Looking	No behavior	Difference
1	3	0	+
2	0	1	-
3	2	1	+
4	3	0	+
5	1	0	+
6	1	0	+
7	2	0	+

Specific behaviors

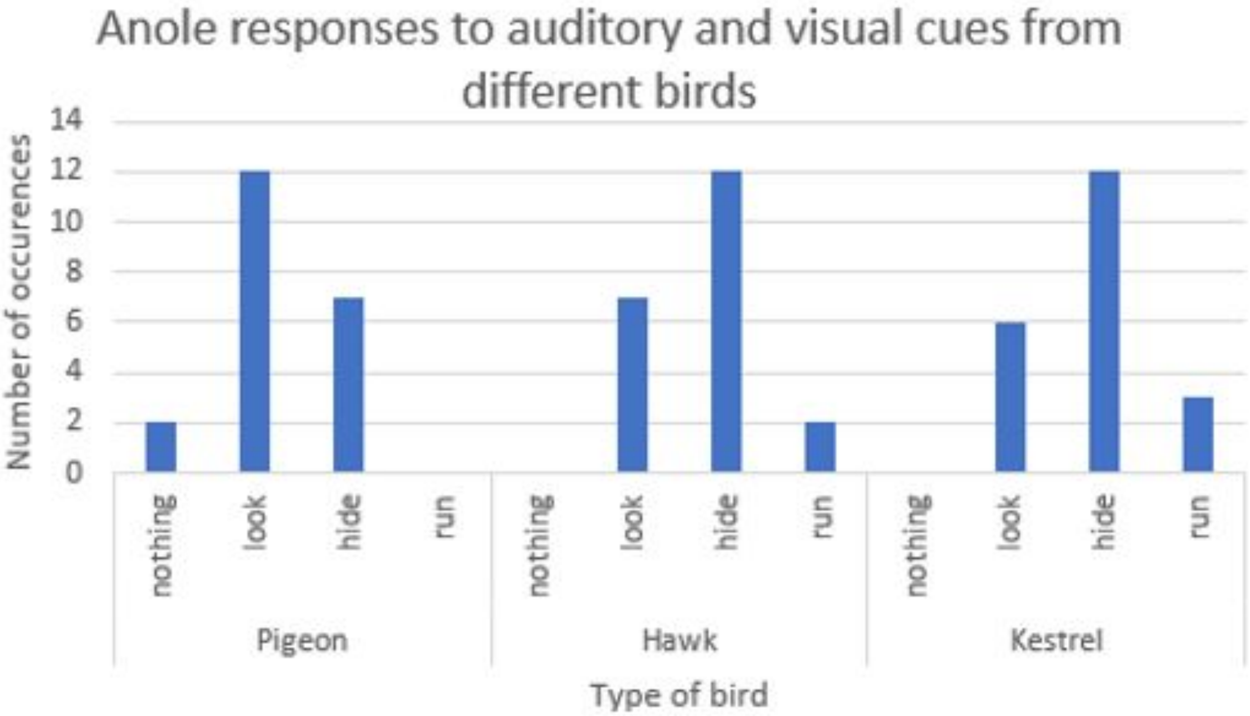


Figure 1. The different responses by the anoles when subjected to visual and auditory cues from birds. This shows the comparison between the anoles' responses when subjected to cues from different types of birds.

Grouping behavior

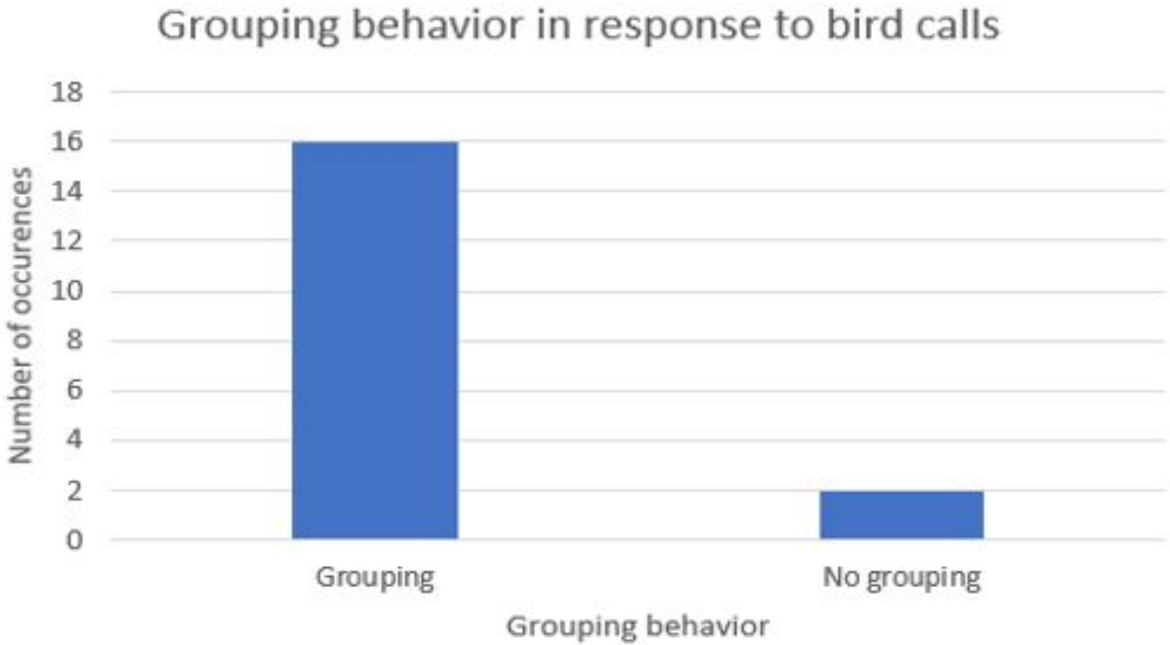


Figure 2. The grouping behavior of anoles when subjected to visual and auditory cues of birds. This is a comparison of how many times the anoles grouped together with how many times they did not while responding to a cue. This was analyzed with a binomial test which found that anoles were significantly more likely to group together than to not when in response to a cue with a P-value of 0.001.

Human control

Table 5. The comparison of anole behavior with no response when subjected to a human auditory and visual cue. This comparison was done using the sign test, and it was found that the anoles would not respond to the cue significantly more than they would with a P-value of 0.062.

Human call behavior vs no behavior			
Anole	Behavior	No behavior	Difference
1	1	2	-
2	0	3	-
3	0	3	-
4	0	3	-
5	0	3	-
6	0	3	-
7	3	0	+

Discussion/Conclusion

Statistically the data collected was not significant

There were however visual differences in response to predatory vs non predatory avian calls

(Stuart-Fox et. al,2006) - Anti-predator response to birds

(Ito,2013) - A response in color change and other protective behaviors to avian predators

Limitations

- Photo quality
- Distance between tanks
- Amount of time between tests
- Number of anoles (sample size)

Was the hypothesis supported?

Statistically No, the anoles responded to the auditory and visual cues of both predatory and non-predatory birds.

It may be that the anoles evolved to fear bird calls from birth, but learned which calls were those of predators. Since the anoles were born in captivity, they cannot tell the difference.

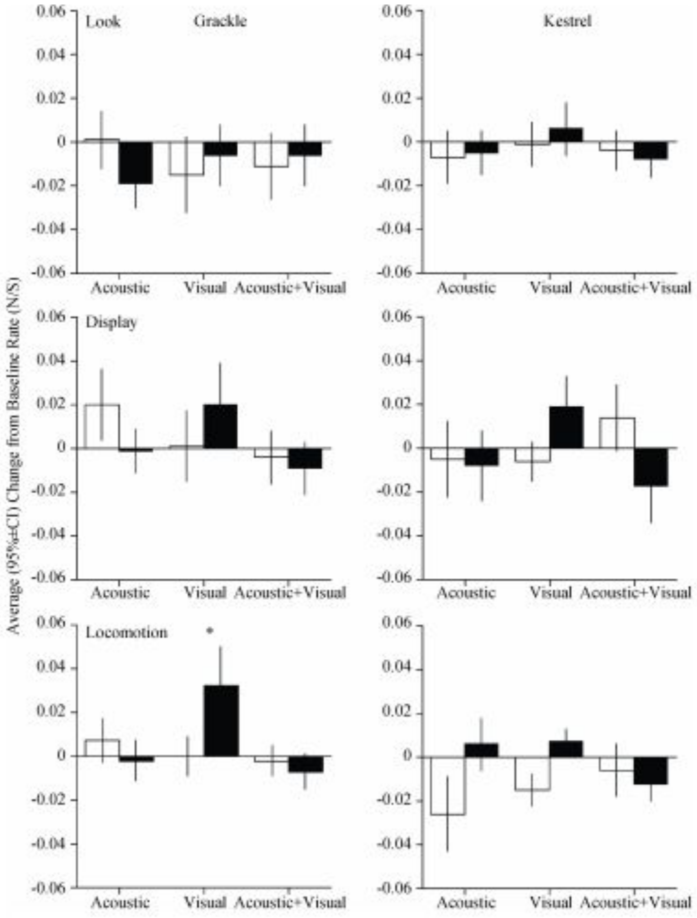


Fig. 1 Average (± 95% CI) Change from Baseline Rate (N/S) of looking, displaying, and locomotion for brown anoles in response to grackle and kestrels vocalizations, models, and the combination of model and vocalization

An anole's anti-predator response can be both proximate and ultimate.

While anoles can recognize the sounds of potential predators at birth, they learn which specific calls to fear through experience (Elmasri et. al, 2012).

Future directions

These tests require more trials and a higher sample size to allow for more consistent data

It has also been previously found that green anoles will change escape behavior depending on their environment (Irschick et. al, 2005).

Future tests should use a mixture of male and female anoles because they react to predatory cues differently based off sex (Vanhooydonck et. al, 2007).

Table 2

Results from the two-way MANOVA with ecomorph and sex as factors, and approach, flight, and final distance as dependent variables. Shown are the results for each dependent separately. Significant *P*-values are shown in bold

Factor	Dependent	df	*F*	*P*
Ecomorph	Approach distance	4, 14	18.25	**<0.0001**
	Flight distance	4, 14	6.51	**0.004**
	Final distance	4, 14	7.96	**0.001**
Sex	Approach distance	1, 14	11.47	**0.004**
	Flight distance	1, 14	2.33	0.149
	Final distance	1, 14	5.47	**0.035**
Ecomorph x sex	Approach distance	4, 14	3.64	**0.031**
	Flight distance	4, 14	0.31	0.864
	Final distance	4, 14	0.85	0.518

Future Directions

The grouping behavior of the anoles should be looked at to see if this would occur among anoles that are not familiar with each other.

One of the few studies that have looked at convergence in lizards as an antipredatory adaptation found no correlation between the two (Downes and Hoefer, 2003).

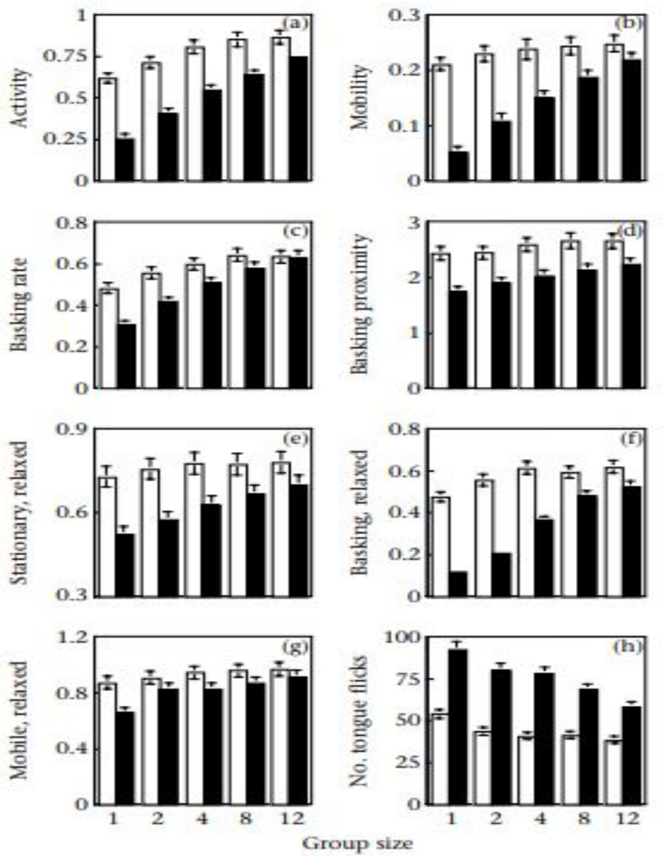


Figure 1. Mean ± SE scores for all lizard behaviours during trials with 1, 2, 4, 8 or 12 group members and low predation risk (□) or high predation risk (■). (a) Activity, (b) mobility, (c) basking rate, (d) basking proximity, (e) stationary and relaxed, (f) basking and relaxed, (g) mobile and relaxed and (h) number of tongue flicks. See text for definitions of behaviours and calculations of scores.

Downes contrasting information suggests that green anoles have a unique convergence strategy when it comes to lizards

This finding could be the beginning of a better understanding of social and anti-predatory behaviors in green anoles

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