ETHOGRAM OF THE COMMON BEHAVIOR OF Quiscalus mexicanus (PASSERIFORMES: ICTERIDAE) IN THE REPUBLIC OF PANAMA

TECNOCIENCIA

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Abstract: In this study, the behavior of *Q. mexicanus* was recorded through observations from July to October 2020. The observations period was from 7:00 to 10:00 a.m. and from 2:00 a.m. at 5:00 p.m. Eastern Time (ET). During this study we were able to describe 29 specific behaviors that are grouped into nine main functional categories. These categories will be used to construct an ethogram that we hope will be useful to improve our knowledge about the behavior of *Q. mexicanus*, a bird that practically coexists with humans in the Republic of Panama.

Keywords: Kleptoparasitism, tolerance, ecological relationships, social behavior.

Resumen: En este estudio se registró el comportamiento de *Q. mexicanus* a través de observaciones de julio a octubre de 2020. El período de estudio fue de 7:00 a 10:00 a.m. y de 2:00 a.m. a 5:00 p.m. hora del este (ET). Durante este estudio pudimos observar y describir 29 comportamientos específicos que se agruparon en nueve categorías funcionales principales. Estas categorías se utilizaron para construir un etograma que esperamos sea útil para mejorar nuestro conocimiento sobre la conducta de *Q. mexicanus*, ave que prácticamente convive con los humanos en la República de Panamá.

Palabras clave: Cleptoparasitismo, tolerancia, relaciones ecológicas, comportamiento social.

INTRODUCTION

Quiscalus mexicanus, known in Panama as “changos”, are birds of the family Icteridae, a species of strongly anthropogenic birds, with a high efficiency to track food in urban landscapes (Christensen 2000). They are sexually dimorphic, males are bluish-black, and females are brown, with long tails (Wehtje 2003). This species is native to Central America and northern South America; however, it is distributed throughout the American continent from Canada to Peru and in some Caribbean islands, its affinity for human communities has led it to be a tolerant and adaptable organism (American Ornithologists' Union 1998, Christensen 2000, Wehtje, 2003, Gurrola-Hidalgo et al. 2009).

Many organisms have a social structure with different hierarchical levels that are very well defined which frequently have conflicts between them, but that can contribute to the well-being of the population, so it is interesting to understand the social structure and the ethological characteristics of the different members of the colony (Kubitza et al. 2015). Previous studies on different aspects of the social behavior of Q. mexicanus have been of the interest of many researchers, such as vocal behavior (Kok 1971), physiological changes caused by rainfall (Yorzinski 2020), feeding behaviors (Grabrucker & Grabrucker 2010, Martínez et al. 2021) and behaviors exhibited in habitat use (King 2012).

Understanding how a species interacts with conspecific, heterospecific, humans, and the environment is necessary to implement effective conservation strategies both in situ and ex situ (Lichtenberg & Hallager 2008, Gokula 2011). Understanding animal behaviors helps us to better understand why animals need to survive and what behavior plays an important role in animal survival.

The purpose of this study was to propose an ethogram of the behaviors observed in Q. mexicanus as a tool for collecting data to help study their behavior in a systematic and standardized way so that it can be used to analyze quantitative data and prevent bias in observations.

MATERIALS AND METHODS

Study area

The study was conducted in La Locería, Betania, Panama City, (O 8.9848644, E 79.5331006) from July to October 2020.

A total of 13 individuals were observed for this study. The flock consisted of three males, three chicks and seven females. The birds were observed in their natural environment. Observations were sampled during an interval of 20 minutes per hour for six hours, three times a week (Total = 120 men hours). The study period was from 7:00 to 10:00 a. M. and from 2:00 a.m. to 5:00 p.m. M., Eastern Time (ET). The average distances at which the birds were observed in their habitat was five meters from the observer to the areas where the birds carried out their activities. A table was prepared to illustrate (Table 1.) the types of behaviors were observed (Smith & Wassmer 2016).

Observations were recorded in a field notebook throughout the study, capturing a greater variety of daytime behaviors. To perform the ethogram, the Smith & Wassmer (2016) methodology was used with some modifications.

RESULTS

TABLE 1.
Descriptions of behaviors exhibited by Quiscalus mexicanus

Functional behavior category	Behavior	Description
Sexual behavior	Courtship	Males with bright feathers seem to be more attractive to the opposite sex. During the breeding season, the alpha male defends his harem of females from other males and performs almost 90% of the mating. Females can mate with lower-ranking males when eating outside of their harem. The vocalization most frequently heard in the breeding season is the male's solicitation call, which indicates his interest and willingness to mate.
Parental behavior	Fight between members	The alpha female is very authoritative and tries to choose which chicks eat and which do not. Females fight each other to protect their young from other females and males of the same species, stealing food from each other for their young.
	Maternal care	The females are responsible for feeding the juveniles, each female is responsible for her offspring. They teach them to hunt, defend and groom themselves. Females feed their young with any type of available food.
	Show grief	When a gardener pruned a tree where there was nestlings the female was in distress, singing over the pile of pruned branches, looking everywhere, singing a desperate song and jumping all over the rubble looking despaired and in pain.
Antagonistic behavior	Threat screen	They are very territorial organisms, before any intruder the males raise their feathers completely, the females sing incessantly marking territory and move their wings to simulate an attack. Males and females were observed showing signs of threat.

	Attack flight	The bird flies directly towards another bird in a fast, straight flight, causing the other bird to fly away without a fight. Both sexes were observed to displace other birds.
	Struggle	Birds make physical contact by hitting their beaks and pecking each other on the head and neck. The fights happen on power lines and end on the ground. Both genders were observed to participate in fights.
	Withdrawal	Some lower-ranking birds tend to retreat when attacked.
	Hierarchical relief	Two young adult males were observed confronting the alpha male by pecking and jumping after getting off the power line, onto the street, while the other members perched on the wire and emitted a "HAHH HAHH HAHH" sound. One of the males eventually faced off with the alpha male, until victory was achieved, at which point the alpha male threw away the food from his beak and withdrew.
	Meeting	The alpha female makes a "tiaaah tiaaah" sound of call and all members of the flock arrive.
	Sharing	Some members of the flock share food, puddles to bathe and objects to clean their beaks.
Grooming	Maintenance	The bird cleans its beak using different objects, mainly the power line, its own wings, throat and area around the legs. The neck and abdomen are groomed by bending the neck back and approaching from above. The chest is fixed by tilting the head down. The upper part of the wing is smoothed and cleaned by spreading the wing, bending the head sideways and approaching from above. The lower part of the wing is fixed by lifting the wing and approaching from below.
	Bathrooms	The birds flutter over puddles, sink their heads flapping their wings to spread the water all over their bodies, they do the

		same when the rain falls on power lines
	Scratch	Birds use indirect scratching letting one wing drops and the foot on the same side is passed over the shoulder to scratch the head.
	Extension of body parts	A bird fans its tail and extends one leg and wing contralaterally and then extends the opposite wing and leg after retracting the first. A variation occurs when the bird gathers its wings along the back.
	Body Lint Removal / Feather Settling	Feathers are smoothed down quickly.
Ingestion/ egestion	Foraging	Birds forage for food on the ground or search inside containers (Craig 1989). When searching for food on the ground, the bird walks, jumps, runs or stands on the ground to find prey. Sometimes they carry the prey to the landing site (Fitzpatrick 1980). Birds move quickly with jumps or short flights as they perch in search of food.
	Eating	The food is caught with the beak, the head is raised and the food is consumed. The fruits are consumed right in the place where they are suspended.
	Drinking	The bird lowers its beak into the water and tilts its head up to swallow. The pattern repeats several times. Birds can also drink rainwater accumulated on objects in the open.
	Cleaning the beak	The bird rubs both sides of its beak on the power line or on they are standing after eating.
	Defecation	Vent feathers and undertail coverts inflate and the body leans forward as stool passes.
Movement	Flight	The bird uses short or quick wing movements to go through the air from one place to another.
	Jump	The bird moves from one place to another by propelling itself with its legs.
Vocalization	Singing	Occurs primarily in response to other individuals flying around, begins as soon as

s		birds begin to move from roosting, and is commonly heard early in the morning when flocks disperse for the day, or late afternoon when they return to their roosts.
	Onomatopoeia	At least nine different sounds were perceived during this study: Threat alert: "Gra Gra" Chicks asking for food: "Hahh, Hahh, Hahh" Arrival of a member: "Gri Gri Gri" Chicks playing: "Ihc Ihc Ihc" Flying together: "Ihg Igh Igh" Intraspecific fighting for food: "Iah Iah Iah" Interspecific fighting for food: "Jiah Jiah" Imminent danger (Predator): "Mtat Mtat Mtat" Marking territory: "Ah Ah Ah" with the beak open and the chest up.
Resting	Perching	The birds perch together for periods of around 5 minutes to rest after bathing or grooming. Birds hide their heads under their wings, close their eyes, and perch on one leg.
	Settling	The bird rests on the power line with its chest feathers erect but remains alert with its eyes open.
Interspecific interactions	Tolerance	Compete for nesting sites with other birds. It nests in the same trees with other species and there are frequent agonistic interactions. It alights with other species. It is frequently found in close association with humans, particularly in urban and suburban areas. Scavenge for food in human leftovers at garbage dumps and outdoor restaurants, perches and nests in courtyards and parks in densely populated areas. https://birdsoftheworld.org/ Forages in flocks, often with other icteridae, or other families of birds. In Panama they coexist peacefully with Psitácidae of the species *Brotogeris jugularis* (Müller, 1776). They were observed sharing food and hábitat with a

	flock of 26 *B. jugularis* that consisted of 10 couples and six singles.
Kleptoparasitism	They have been observed stealing or snatching food from other birds or members of their own species.
Predation	Although they are social, they sometimes attack other members of its species and other species of birds. Their attacks are by biting, pecking, scratching, and flying towards them. They eat the eggs and chicks of other birds, and sometimes kill and eat other adult birds. The breeding pair defend the territory around their nest by stalking, chasing, or throwing themselves to possible predators including humans.

As a result of this study, 29 observed behaviors (second column of Table 1) could be divided into nine main functional categories that correspond to the first column of Table 1. As in other studies, greater activity of males and females were observed in open areas, power lines, parking lots and garbage disposal areas during the day and are more evident and boisterous at sunrise and sunset. We describe and discuss here only those behaviors related to reproduction, feeding, parental care and grooming.

Q. mexicanus are sexually dimorphic and dichromatic. Males are up to 43 cm in length (with a tail almost if its body), weigh 230 g, and are black with an iridescent luster. Females are smaller; they measure up to 33 cm in length, weigh 125 g, and are brown. Males with bright feathers are more attractive to the opposite sex. During the breeding season, the alpha longer tail male defends his harem from other males and performs most of the mattings. Females can mate with lower- ranking males when eating outside of their harem. Main sounds produced by Q. mexicanus are song, request for mating, alarm, and whistles. The most frequently heard vocalization in the breeding season is the requesting call of the male, which indicates his interest and willingness to mate. In this study we could discriminate at least 10 different vocalizations. Ten additional sounds were perceived during our observations and are described and interpreted in Table 1.

Q. mexicanus are territorial birds, males and females show various behaviors of threat and physical attack described in the Table 1 and generally the birds of lower hierarchy tend to withdraw when they are attacked so they can be displaced from the group. In some exceptional cases there is displacement of birds with a higher hierarchical rank such as an alpha male (Ficken 1963).

Despite the extreme territoriality, some members of the flock share food and objects to clean their beaks, in turn they also share the puddles to bathe. Grooming behavior is extensive and elaborate in these birds and has been described in the Table.

Females were observed taking care of their progeny and involved in collecting food for juvenile feeding. No males participated in these activities. As social birds, Q. mexicanus exhibits a varied repertoire of agonistic behaviors and a dominance-subordinance response.

Grooming to keep their feathers in the best condition consumes an important part of the Q. mexicanus time of the day. While preening, birds remove dust, dirt, and parasites from their feathers and align each feather in the optimum position Most of them preens several times a day to keep themselves healthy.

The most elaborated behavior of Q. mexicanus are those related to foraging and drinking water. We described only three major behaviors (Table 1) that require a more extensive consideration.

DISCUSSION

During courtship males exhibit intimidating poses using their tails, and stretching out their necks backwards, flying up at each other and striking (Townsend 1927). We observed that size of males is an important cause for their success during courtship, but it is also likely that their calls are key to attract females and repel potentially competitive males (Townsend 1927, Kok 1971). Their extreme sexual dimorphism is partially a result of the sexually competitive environment (Bjorklund 1991). Sexual and individual recognition play an important role in relationships and social interactions between members of a colony. Recognition among the Q. mexicanus appears to be primarily through visual or auditory cues (Kok 1971).

The main vocalizations were song, request for mating, alarm, and whistles. Song is produced mostly by males to claim territory (Cok 1971). The vocalization that is heard most frequently in the breeding season is the requesting call of the male, which indicates his interest and willingness to mate. (Cok 1971, Johnson et al. 2000). The alarm sounds are repetitive in times of extreme danger. It occurs in response to strong disturbances in nesting colonies and perches. It is usually caused by the presence of humans and other potential predators, and by panic or due to hostility from other members of the group. The call is often given in flight when the bird flees from a source of danger (Kok 1971). The whistle is given mainly in response to other individuals flying around, it starts as soon as the birds begin to move from the roost and is commonly heard early in the morning when the flocks disperse for the day, or at the end of the day when they head back to.

The uniparental care observed in Q. mexicanus correlates with their social polygyny (Gregory 2019). The females are responsible for feeding the juveniles, teaching them to hunt, defend and groom themselves.

Agonistic behaviors consist of both aggressive and submissive actions within the context of a social interaction (Wilson 1975). Agonistic encounters are observed more frequently when relationships are unclear, such as the arrival of new individuals. Subordinate individuals in general, respond to aggressive behaviors performed by higher- ranking individuals with appeasement or submissive signals or just getting away.

Since there is a dominance relationship among members of Q. mexicanus flocks then predictable dominance-subordinance responses must occur between members and the occurrence of competitive conflicts between members of a social group should decrease. Submissive postures allow avoidance of combat (Seibert 2006).

Grooming is a common behavior in most birds, and we observed it frequently during our study period, especially after bathing. The Q. mexicanus regularly groomed other members of the group, female or

male, and during courtship. We frequently observe them grooming themselves, bathing in shallow water, and scratching. As in other

species of birds, sunbathing appears to be important in thermoregulation and care of feathers (Kennedy 1969, Perera & Kotagama 2013).

Five categories of feeding behavior were observed in which females are those that carry out the greatest activity. Birds forage for food on the ground or search inside containers (Craig 1989). When searching for food on the ground, the bird walks, jumps, runs, or stands on the ground to find prey. Sometimes they carry the prey to the landing site (Fitzpatrick 1980). We were able to determine that the main diet of this species is essentially based on human food leftovers that they extract from the garbage dumps of the surrounding buildings. Additionally, they consume seeds and insects found in the substrate. Even when there is no scientific evidence yet Q. mexicanus can be behaviorally flexible when looking for food. They can innovate when accessing food that requires the creation of a new behavior, usually involving the manipulation of a tool to drink such as bottle caps that can lift and steepening for drinking rainwater (Gregory 2019).

Although it has not been reported in the literature, we observed some

Q. mexicanus submerging food in water before consuming it, such as rice, crackers, and pieces of bread. According to Morand-Ferron (2005) this action is carried out to facilitate the ingestion of hard food such as peanuts or certain insects, which suggests that the food found in these areas are not easy to ingest. Regarding the consumption of insects, previous works report these birds' removing insects from the license plates of vehicles, as if it were a kind of trap (Grabrucker & Grabrucker 2010), however, this behavior was not observed in this study.

Q. mexicanus appears to prefer urban habitats in contrast to forested habitats (Rappole et al. 1989). It competes for nesting sites with other birds, they nest in the same trees, and there are frequent agonistic interactions. It is frequently found in close association with humans, particularly in urban and suburban areas (Gregory 2019).

Regarding their interspecific behavior, they have been observed searching for food in flocks, often with other Icteridae, or other families of birds. Sometimes coexistence can end in kleptoparasitism as they can steal or take food from other birds or members of their own

species. Although they are very sociable, Q. mexicanus sometimes attacks other Quiscalus and other species of birds, pecking and aggressively flying towards them. They eat the eggs and chicks of other birds, and sometimes kill and eat other adult birds. The breeding pair defends the nest by stalking, chasing, or throwing themselves at predators, including humans.

Q. mexicanus exhibits a wide range of smart behaviors including learning and good memories and communication. They even can solve problems and use tools, both activities indicate more than just basic instinct. We conclude that Q. mexicanus possess high levels of intelligence and have behaviors that indicate that they feel things like we humans do (Barber 1993).

The rapid geographical expansion of Q. mexicanus provides an opportunity to study how sexual selection, individual vocal repertoire, and geographic variation in song of this species vary from one place to another. Data on the ecological success and rapid expansion of the range of Q. mexicanus are very important in understanding the precise effect of habitat alteration by humans and what behavioral traits determine the success of bird species. During this study we were able to observe and describe 29 specific behaviors that were grouped into nine main functional categories used to construct an ethogram that we hope will be useful to improve our knowledge about the behavior of this species, a bird that practically coexists with human beings in the Republic of Panama.

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