

Effects of Vocalizations and Presence of Conspecifics on the Breeding Behavior of American Coots (*Fulica americana*)

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BACKGROUND

The American Coot (*Fulica americana*) is a species that, despite its commonality, is largely overlooked and understudied. After an initial meta analysis that included 100 pieces of literature on the species, it was found that 55% of the studies were conducted over two decades ago. These studies focused mainly on the physiology or ecology of coots, leaving gaps in knowledge surrounding coot behavioral ecology, especially regarding the effects of vocalizations on the establishment of breeding pairs and territory maintenance. This study aims to provide more data regarding the effects of vocalization of presence of conspecifics on the breeding behavior of American Coots.

Acoustic or vocal signaling is a common communication method used by most bird species (Nottebohm et al., 1975). This is most seen in Passerine species, of which many species have complex songs that are used as signals to conspecifics (Fu et al., 2021; Nottebohm et al., 1975). In non-Passerine species however, the use of vocalizations as signals is relatively understudied. This includes the Rallidae family, or rails, which consists of crakes, gallinule, and coots. The American Coot is one of the most widespread members of the Rallidae family and is often overlooked due to its status as a 'trash bird'. Unlike most other rails, it has a gregarious temperament and is not skittish. American Coots are often highly territorial however, especially during breeding season (Gullion, 1953; Ryan et al., 1979). Studies have shown that vocalizations between rails serve as signals which affect reproductive behavior and agonistic behavior (Fu et al., 2021; Jedlikowski et al., 2021). These vocal signals contribute to the outcome of interactions between conspecifics and interspecifics and therefore affect fitness.

Empirical Questions:

1. **Do vocalizations correlate to territory establishment and maintenance?**
2. **Does the presence of conspecifics within the established territory of a breeding pair correlate with increased vocalization?**
3. **Does the use of different types of vocalizations correlate with the presence conspecifics?**

Vocal signaling between breeding pairs may be important in territory establishment and maintenance. Furthermore, the reproductive success of American coots relies on territory establishment and yet factors such as disturbances, whether conspecific or interspecific, can impact nesting behavior and thereby reproductive success. Coots also face the threat of brood parasitism by conspecifics, who may locate nests using vocal cues (Shizuka & Lyon, 2010). Brood parasitism occurs at the detriment of host chicks, meaning that it is within the fitness interests of the host breeding pair to defend against brood parasites (Shizuka & Lyon, 2010). One defense mechanism that evolved in response to nest parasites are chick-recognition systems (Shizuka & Lyon, 2010). These systems allow

host coots to recognize parasitic chicks from their own by recognizing the earliest born chicks as reference templates and discriminating against parasitic chicks born later (Shizuka & Lyon, 2010). There is potential, however, for there to be other mechanisms used in preventing brood parasitism such as the moderation of pair signalling among breeding pairs to prevent conspecifics from parasitizing nests.

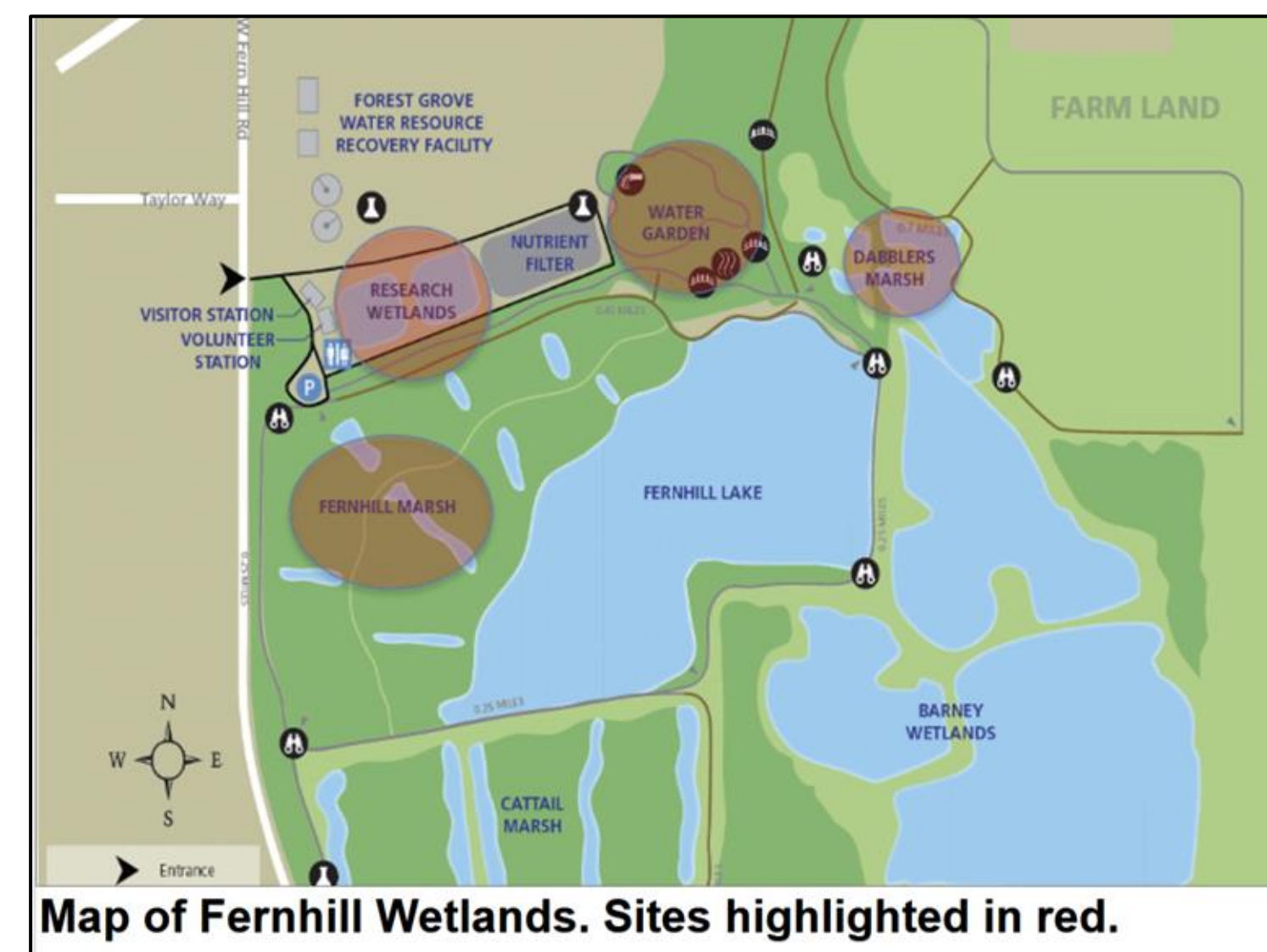


Adult American Coot Photo credit: Jay Cook

METHOD

Target Species:

The America coot (*Fulica americana*) is a duck-like, slate colored bird with a white bill containing a frontal plate. The reproductive season of American coots begins in early spring, with breeding pairs establishing nesting territories prior (Gullion, 1953). Ryan et al. (1979) characterized the breeding season in three phases: prelaying, laying-incubation, and brood-rearing periods. In each of these phases breeding pairs displayed different behavior, with individuals in prelaying and brood-rearing phases demonstrating high aggression and territorial defensiveness (Gullion, 1953; Ryan et al., 1979). Little is understood about variation in vocal signalling between pairs during breeding season nor how the presence of conspecifics impacts vocalizations.



Map of Fernhill Wetlands. Sites highlighted in red.

Design & Procedure:

This observational, longitudinal two phase field study employed naturalistic observation using mixed sampling via continuous event based recording. Two phases occurred during this study:

Phase one: Methodological revisions. Cackling geese were initially selected as a target species but were found to be an unreliable subject for behavioral observations leading to multiple revisions. Our target species was changed to American coots, due to their consistent presence at target site and their activity level. With this change, our empirical questions also shifted from how anthropogenic noise impacted waterfowl species, to the effects of vocalizations on breeding behavior of the American coot. Several adjustments were made to our behavioral ethogram and our sampling methods.

Phase two: Pilot data collection and target site. Observations of American coots were conducted utilizing mixed sampling techniques with continuous event-based recording every 20 seconds. Scan sampling of the flock occurred initially but was switched to focal sampling in the occurrence of a relevant behavioral event. Data collected included: number of conspecifics, conspecific distance, locomotion, patch displacement, relocated patch, vocalization, disturbance type, disturbance behavior type, flush, agonistic, grooming, and foraging behavior. Data collections occurred in 12 minute bouts with one observer keeping time and the other recording data on the ethogram. Observations were performed at Fernhill Wetlands in Forest Grove, Oregon. Four different sites were used for data collection.



Fernhill Wetlands

AMERICAN COOT (<i>Fulica americana</i>) ETHOGRAM																			
WELFARE VARIABLES				DISTURBANCE				VOCALIZATION				AGONISTIC				LOCOMOTION			
Sex	#	Meters	YN	CS	ISC	Antico	Flush	Grant	Cackle	Creek	Proton	Chase	Spain	Burn	Walk	Flight	YN	Dive	Nesting
0:00																			
0:20																			
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American coot (*Fulica americana*) Ethogram

Materials:

Materials used included printed ethogram, clipboard, Rite in the Rain pencil, stopwatch, Vortex 10x42 binoculars. During data analysis, SPSS ver 31.0 was used to code data.

RESULTS

Our focus being on did disturbance impact displacement. Based on our Chi-square test of independence results there was no significant relationship between disturbance presence and displacement, $\chi^2(3, N = 84) = 1.12, p = .289$. Our logistic regression did not give us many indications except when regarding whether disturbance impacted vocalization and nest identification. The Disturbance significantly increased the odds fo vocalizing, $B = -1.14, SE = 0.59, \text{Wald } \chi^2 = 5.33, p < .022$, as did identified nests, $B = -1.35, SE = 0.59, \text{Wald } \chi^2 = 5.22, p = .021$. Due to not enough data collection during this research period it is important to focus on the groundwork set up for the future.

Methodological Revisions

With the shift away from Cackling geese and anthropogenic noise caused a shift in the project. Table 1 helps us to see that out of the recorded behaviors that most occurred or did not occur for all observations. Since we did focal sampling it made it easier to focus on coot behavior rather than all that was going on in the area.

Pilot Data Collection

Having data be collected on a 20-sec interval allowed for as many behaviors as possible to be recorded in a short window giving little screenshots in the moment that will paint a bigger picture. Setbacks that occurred during this project included needing to change focal species and time set aside for data collection. **Table 1:** Descriptives of Behaviors Observed Once we had an edited ethogram we were able to create clearer data collection methods for future research.

Descriptive Statistics			
	N	Mean	Std. Deviation
Compression	428	0.00	0.048
Flush	429	0.01	0.118
Vocalize	415	0.10	0.295
Vocal_Grunt	429	0.05	0.226
Vocal_Croak	429	0.06	0.239
Vocal_Cackle	429	0.02	0.143
Posture	429	0.00	0.048
Splash	429	0.00	0.000
Chase	429	0.00	0.000
Fly	429	0.00	0.048
Stand	429	0.04	0.206
Swim	429	0.75	0.433
Dive	429	0.24	0.43
Walk	429	0.07	0.259
Preen	429	0.18	0.386
Dip	429	0.02	0.135
Flap	429	0.03	0.165
Nesting	429	0.09	0.284
Forage	429	0.86	0.345

CONCLUSIONS

We have conducted a research project that has much more that needs to be done to better understand these species. We started with three questions that we wanted to answer. First, does vocalization correlate to territory belonging to a breeding pair correlate to territory establishment and maintenance? Second, does the presence of conspecifics within territory belonging to a breeding pair correlate with vocalization occurrence? Finally, does the use of different vocalization types correlate with the presence of conspecifics within an established territory of a breeding pair?

Based on our predictions:

- (1) during establishment and maintenance of territory, vocalizations among breeding pairs will increase
- (2) the presence of conspecifics will result in increased vocalization
- (3) vocalization types will vary with the presence or absence of conspecifics in the territory of a breeding pair.

Based on our results from the data we aren't able to draw conclusions to these questions but can use this to create a better research program moving forward.

Broader Implications

Analyzing the data that we have so far allows for a deeper understanding of the implications it can have for monitoring conservation efforts and behaviors of species. With the lack of empirical literature surrounding American coot behavioral ecology, there are grounds for the continuation of research into this topic. Currently, there is not enough collected data to support or reject the predictions proposed in this study, however, a serviceable method that will aid in future data collection was developed during pilot data collection. Data collection will continue into the summer, fall, and winter seasons providing a full year of data regarding the effects of vocalizations on breeding behavior. This data will inform future studies and work to fill the gap in literature on the behavior of this underrepresented species.

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