



Effects of corticosteroids on vocal babbling in an extremely altricial bird

Rory Eggleston

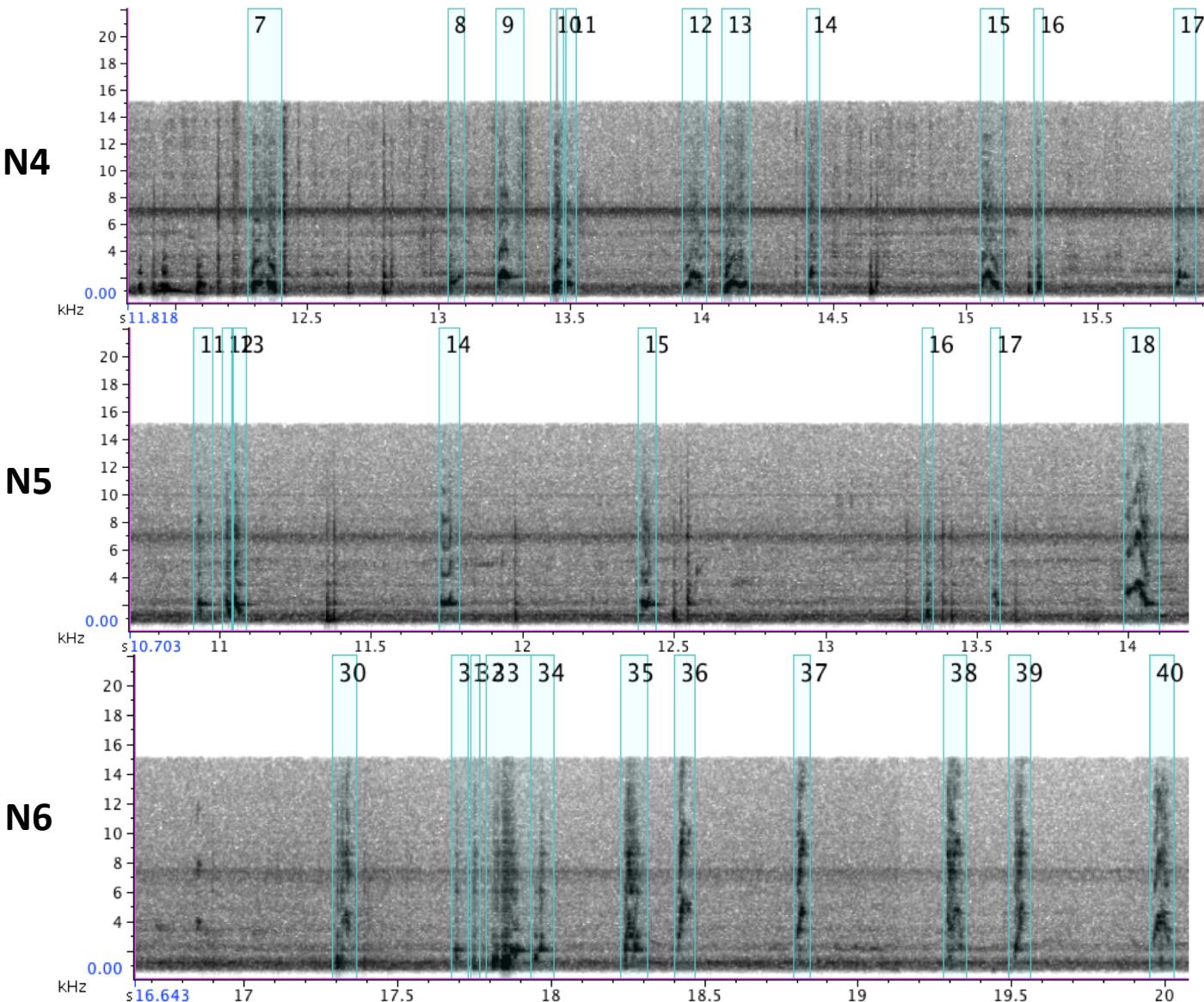
Vocal learning

- The ability to modulate acoustic signals based on environmental stimuli
 - Differs from innate vocalizations
- Vocal learners occur in diverse range of taxa
 - All are behaviorally complex
 - But similar developmental stages
- Sensory phase
 - Listening and memorization
- Sensorimotor phase
 - Neuromuscular connections, auditory feedback, and production



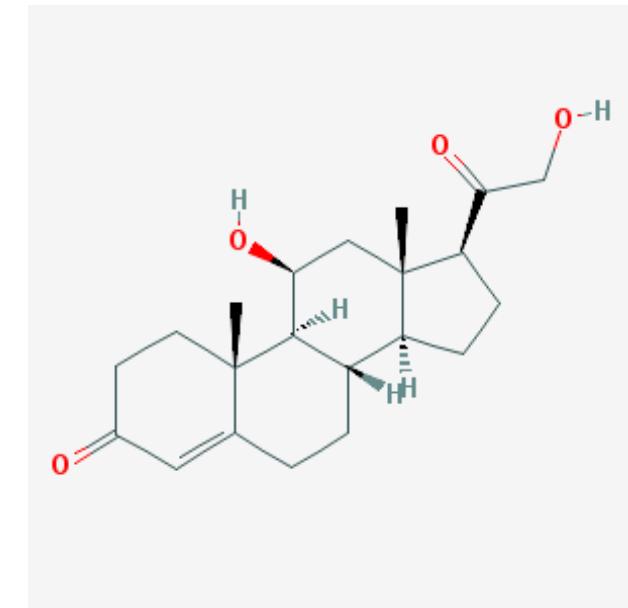
Vocal babbling

- Documented in a number of vocal learning taxa
- Overproduction of sounds out of context, generally in a continuous stream
- In parrotlets, involves the incorporation of both innate and learned vocalizations
- Likely a learned behavior in parrotlets (Berg et al. 2011)



Stress and corticosterone (cort)

- Glucocorticoid steroid hormone found in all vertebrates
- Binds to specific glucocorticoid receptors found in most cells
- Acute:
 - Positively influences spatial memory and survivability during development (Crino et al. 2014, Kitaysky et al. 2003)
- Chronic:
 - Can depress growth and feather development (Spencer & Verhulst 2007)
- Few studies of the effect of cort on the development of vocal learning in the wild



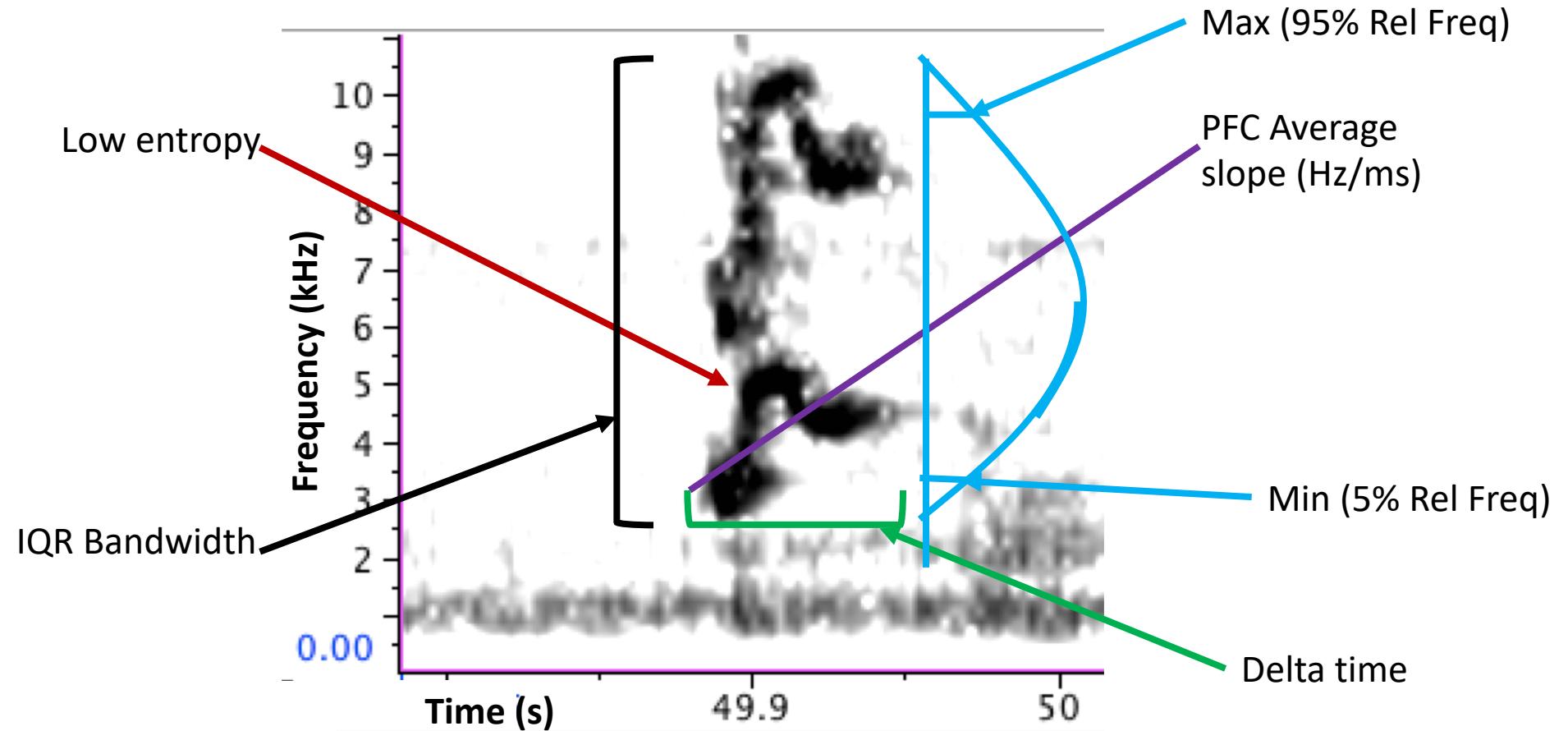
Objectives and hypotheses

- **Objective**
 - Determine if elevated cort levels affect the output, onset, richness, and diversity of vocal babbling in Green-rumped Parrotlets
- **Hypothesis:** Cort plays a significant role in babbling
 - Supplementing baseline cort could:
 - Have an effect on these factors in babbling
 - Have no effect on these factors in babbling
 - Have a combination of effects

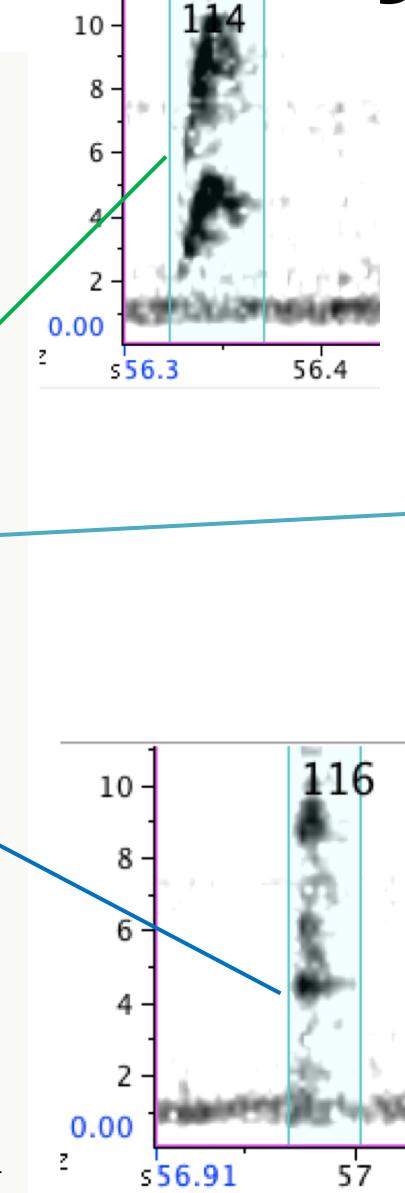
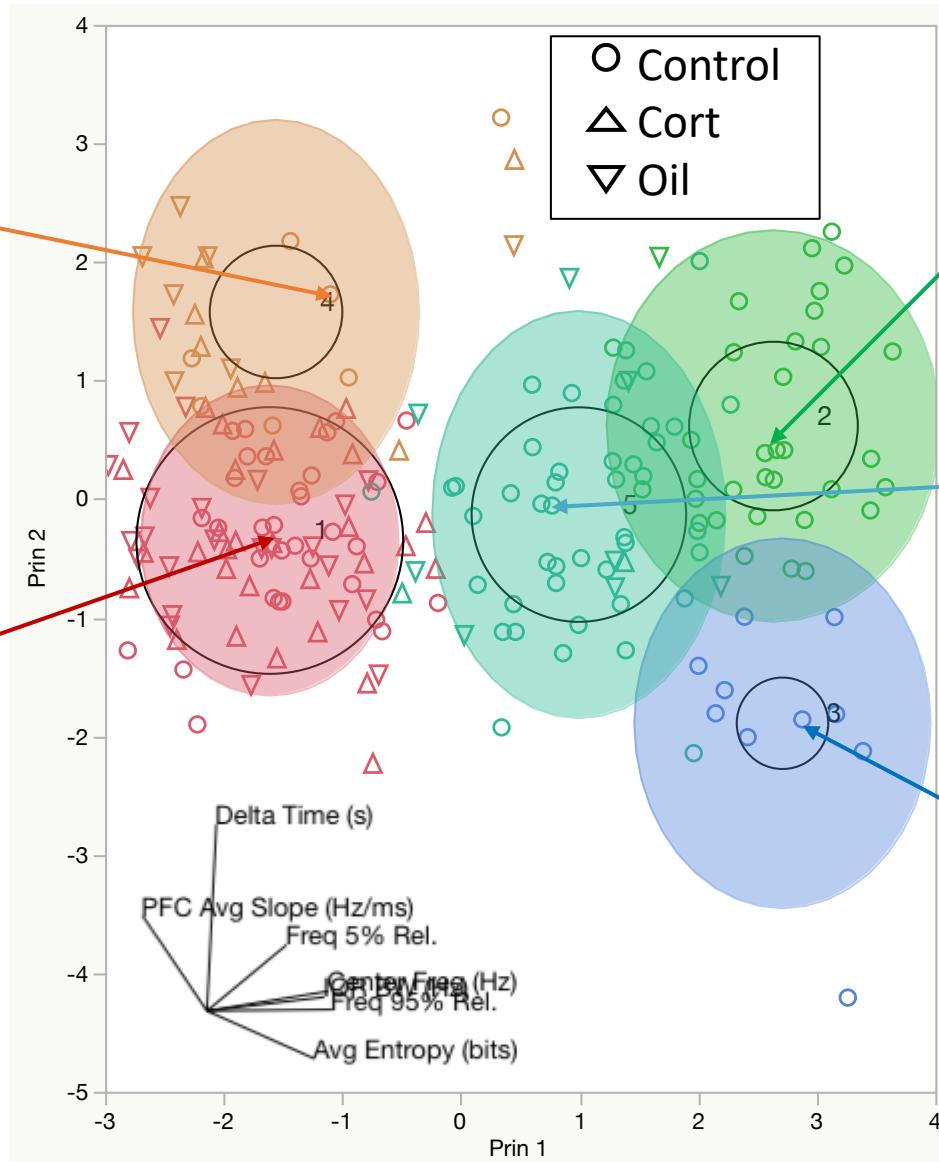
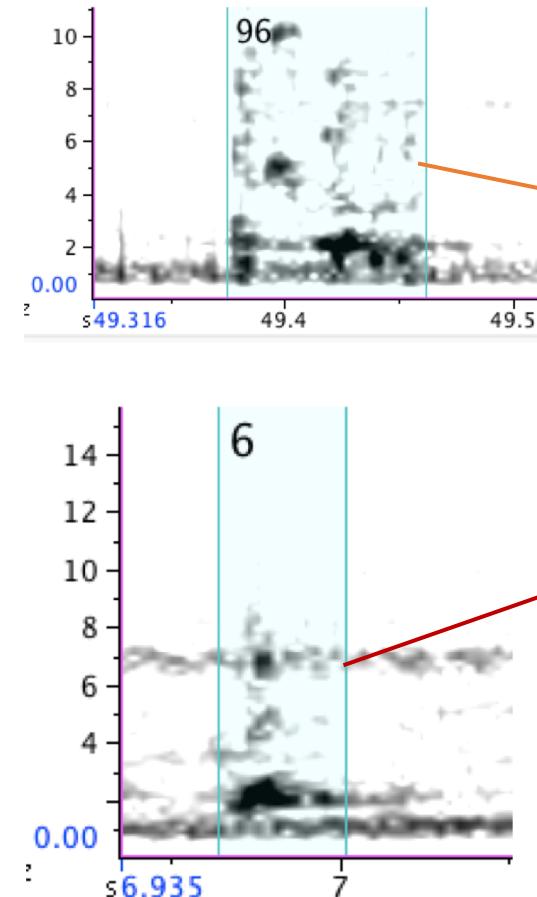
Methods—Statistical analysis

- ***K*-means clustering analysis**
 - Determine discrete call types
 - Quantify signal diversity and richness in individuals
- Generalized Linear Mixed Model (GLMM)
 - Differences in onset, diversity, richness, and output between treatment and controls
 - Useful in distinguishing between main and fixed effects and for data with repeated measurements in each individual

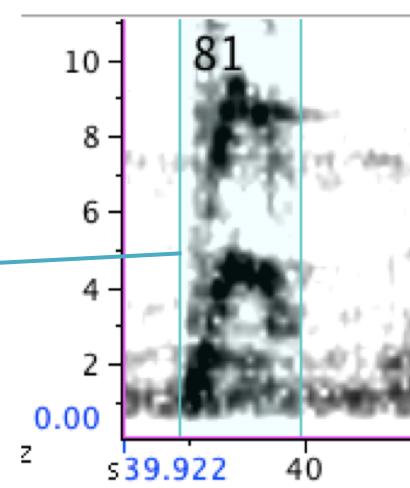
Preliminary results—Spectrographic measurements



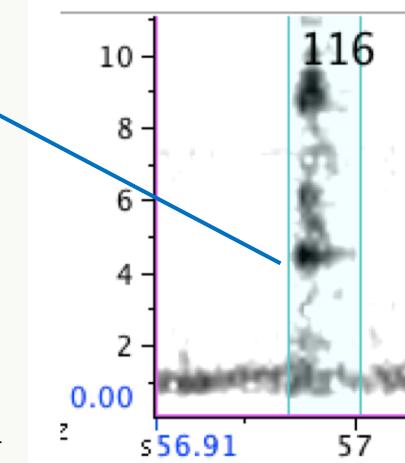
Preliminary results—K-means clustering analysis



	δ -W index
OIL (4 call types)	1.02
CORT (3 call types)	0.67
CONTROL (5 call types)	1.43



	Eigenvalues
PC1	3.6199
PC2	1.1518



Literature Cited

- Berg, K.S., Delgado, S., Cortopassi, K.A., Beissinger, S.R., & Bradbury, J.W. 2011. Vertical transmission of learned signatures in a wild parrot. *Proceedings of the Royal Society B*, 279:1728, 585-591.
- Crino, O.L., Driscoll, S.C., Ton, R., & Breuner, C.W. 2014. Corticosterone exposure during development improves performance on a novel foraging task in zebra finches. *Animal Behaviour*, 91, 27-32.
- Kitaysky, A.S., Kitaiskaia, E.V., Piatt, J.F., & Wingfield, J.C. 2003. Benefits and costs of increased levels of corticosterone in seabird chicks. *Hormones and Behavior*, 43:1, 140-149.
- Spencer, K.A. & Verhulst, S. 2007. Delayed behavioral effects of postnatal exposure to corticosterone in the zebra finch (*Taeniopygia guttata*). *Hormones and Behavior*, 51:2, 273-280.