



Relationships between Social Competence and Acoustic Density in North American Red Squirrels

Stavi R. Tennenbaum¹ and Dr. Ben Dantzer²

¹University of California, Berkeley, Rausser College of Natural Resources Honors Program, Berkeley, CA and ²University of Michigan, Department of Psychology, Ann Arbor, MI



BACKGROUND

■ Social competence, the ability of an organism to regulate its behavior to optimize social relationships, can mediate adaptive responses to fluctuating environments (1). In North American red squirrels (*T. hudsonicus*), increased population densities have a substantial effect on both physiological and behavioral responses to stress (2) and offspring growth rates (3), yet these responses are highly variable.

■ The population of red squirrels used in this study has been monitored by the Klauene Red Squirrel Project (KRSP) in the southwest Yukon for the last 32 years. Red squirrels are a territorial, asocial species whose behavior is influenced by their social environment (4).

OBJECTIVE

Determine whether female red squirrels exhibit variation in social behavior based on social competence—defined as differences in their attentiveness to acoustic cues of increased density. Assess the impact of maternal behavioral variation on offspring growth.

METHODS

■ **Playback experiment** – Population density was experimentally increased on two treatment grids using speakers playing unique squirrel rattles at 7 min intervals during daylight hours throughout the breeding season. Two control grids, one with a sham treatment playing chickadee calls and one with no deployed speakers, were used.

■ **Behavioral trials** – Breeding females (n = 14) were live trapped and placed in an enclosure with a clear plexiglass lid in the field. No pregnant females were used in trials. Squirrels were filmed from overhead actively exploring the novel environment of the box for 7.5 min. (OF trial), and then exposed to their own mirror image within the box for another 5 min (MIS trial).

■ **Offspring growth rates** – Natal nests were located and accessed using radio telemetry. Pups were weighed at ~0-2 and 25 days after birth. Differences between the two weights (g) were used and averaged across each litter.

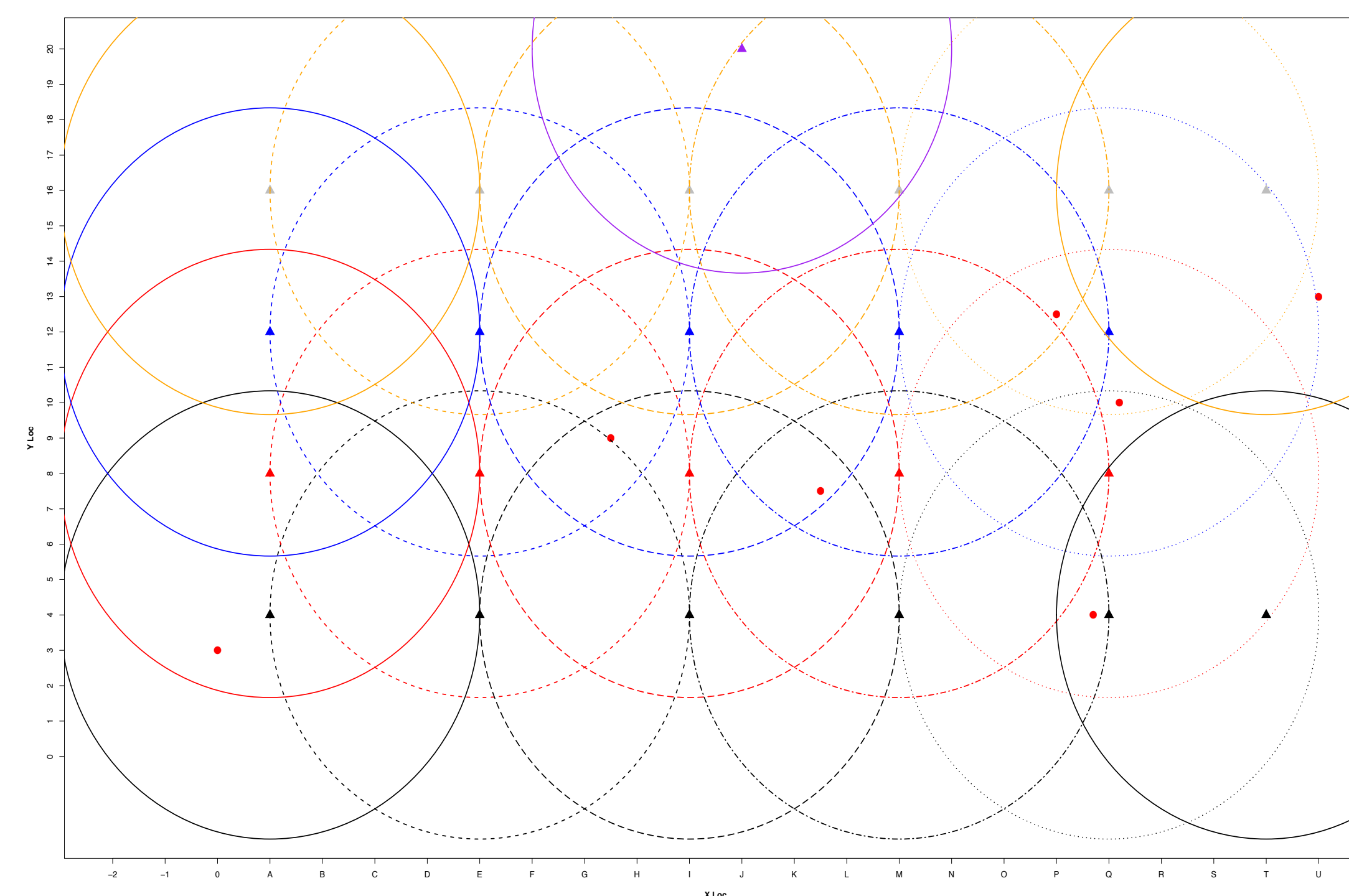
METHODS

■ **Acoustic density** – Squirrel populations on all grids were censused in August and October 2019. Census data reflecting the number of neighboring squirrels heard within a 130 m radius was used to measure acoustic density.

■ **Video analysis** – Videos were scored by SRT using the BORIS software and an ethogram used for KRSP personality trials since 2007 (5).

■ **Statistical analysis** – Behavioral data from OF and MIS trials was condensed to avoid redundancy using a principal component analysis. All further statistics used PC1 scores as metrics of activity and conspecific sociability.

Figure 1: Acoustic density map of speaker set on experimental grids



RESULTS

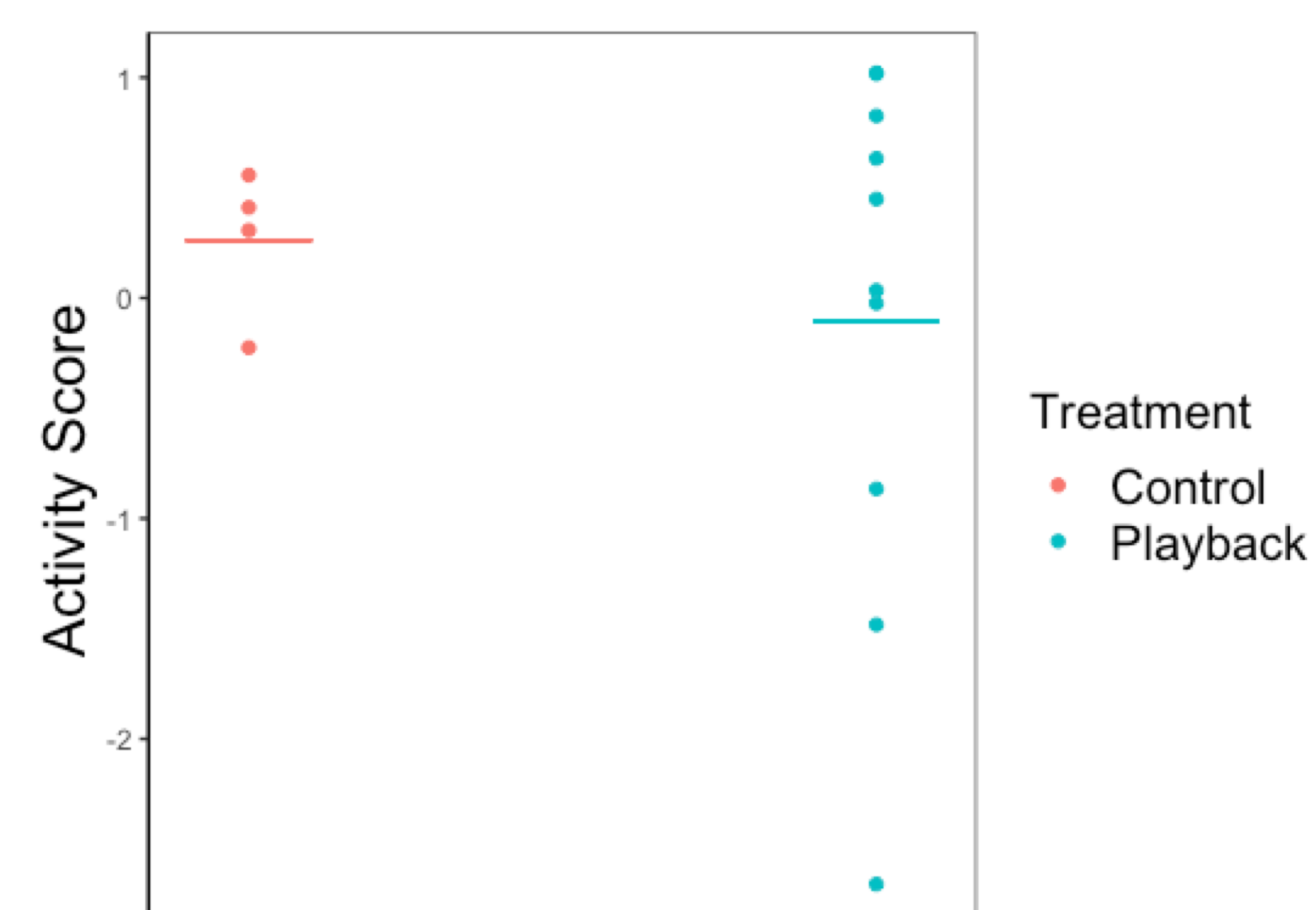


Figure 2: Effect of the playback experiment on activity

PC1 scores measuring activity level within the OF trial. High PC1 scores corresponded with a more active squirrel. PC1 represented 75% of the variation in the dataset. There was no difference in activity levels by treatment grid (Mann-Whitney U, w=19, p=0.945).

RESULTS

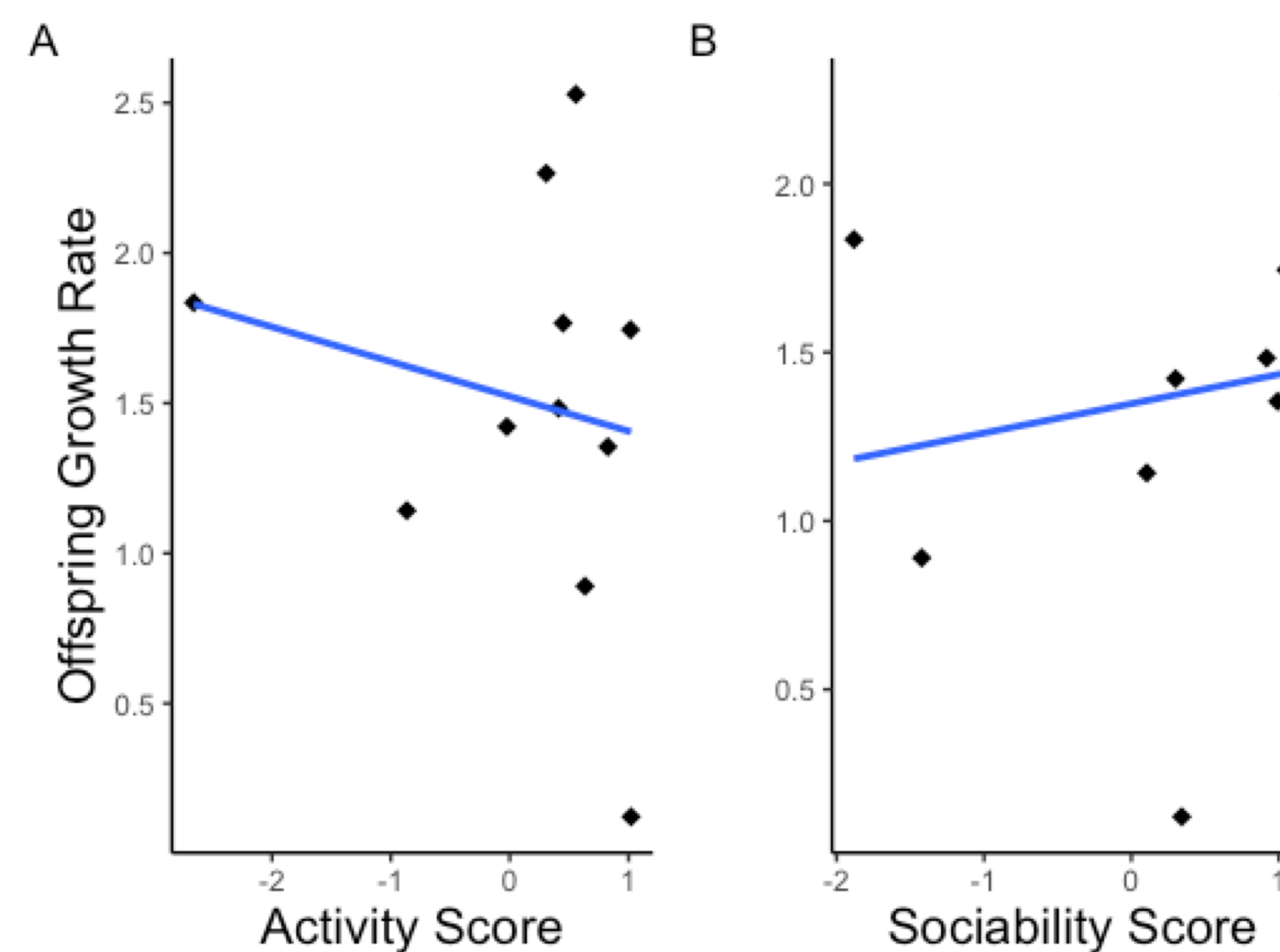


Figure 3: Correlation between maternal behavior and offspring growth rate

(A) PC1 scores from the OF component of the field trial compared to averaged offspring growth rates of juveniles. There was no association between activity and offspring growth rates (Spearman rank, (p)=-0.3, p=0.299). (B) PC1 scores from the MIS component of the field trial. High PC1 scores reflected a bolder, more aggressive squirrel. PC1 represented 61% of the variation in the dataset. There was no association between sociability and offspring growth rates (Spearman rank, (p)=-0.4, p=0.336).

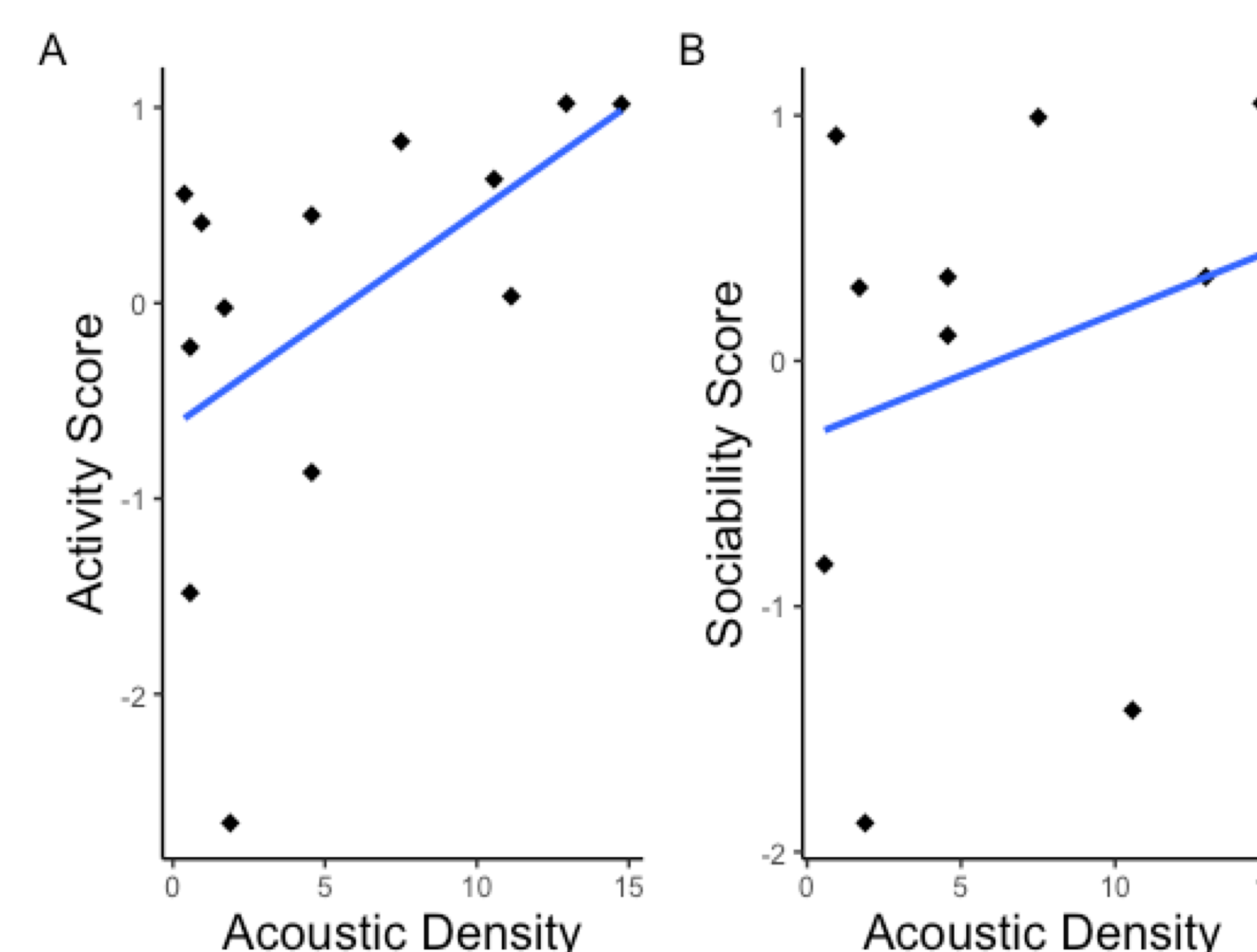


Figure 4: Correlation between local acoustic density and maternal behavior

(A) Estimated acoustic density compared to activity levels. Greater local acoustic density was significantly associated with an increase in squirrel activity (Spearman rank, (p)=0.6, p=0.037). (B) Estimated acoustic density compared to sociability. There was no association between acoustic density and sociability (Spearman rank, (p)=0.4, p=0.286).



CONCLUSIONS

■ Squirrels exposed to experimentally increased acoustic densities were more active, but showed no significant increase in sociability in response to a perceived conspecific.

■ No relationship was found between maternal social behavior or activity level and offspring growth rates.

■ These findings illuminate the role of animal personality as an unlikely driver of variable behavioral responses to changing social environments within a free-living, asocial species. However, a larger, multi-year sample size is needed to affirm these findings.

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