Urbanization and its Implications for Avian Aggression: A Case Study of Urban Black Kites (*Milvus migrans*) along Sagami Bay in Japan

KEIO Environmental Innovators

Dana Galbreath and Tomohiro Ichinose, *Keio University* danamgalbreath@gmail.com

Introduction

Habitat fragmentation and degradation are major concerns for wildlife conservation. Biodiversity, community structures, life history traits, behavioral syndromes, and survival rates are all impacted by human activities. As communities change, they also bring about unprecedented shifts in behavior and species interactions; in this case, the black kite, *Milvus migrans*, has demonstrated elevated instances of aggression towards humans in Japan to the point where warning signs have been placed in several cities along Sagami Bay. Previous research has implied that urbanization causes a dramatic change in the abundance of aggressive individuals of a given species; however, the effect of land-use type upon bird aggression remains unclear. Thus, in this research project, those studies were furthered by determining what connection, if any, exists between urban green land-use types and the prevalence of aggression in urban black kites.

Research Goals

G1: Through this research, I hoped to determine how land use, as a factor of urbanization, affects Black Kite aggressive tendencies.

G2: I hoped to use this data as an incentive for city planners to conserve and promote urban green space as a tool for human-animal conflict mitigation.

Methods

This research was conducted in two stages: field observations and GIS green space analysis. Five locations were chosen along Sagami Bay in order to provide an urbanization gradient: in order from lowest to highest percentages of foraging zone green space, these locations were Enoshima, Fujisawa (a); Kamakura Beach, Kamakura (b); Zushi Beach, Zushi (c); Oiso Beach, Oiso (d); and Iwa Beach, Manazuru (e).

Figure 1: Research locations a-e.

Figure 2: Black kite warning sign.

Field observations:

Field observations were conducted for a period of six hours on each trial day from 10:00 am to 4:00 pm. During each trial, the amount of intra- and interspecific attacks, the times at which they occurred, the number of humans present, the total number of black kites present, the weather conditions, and the number of aggressive birds (which engaged in aggressive activity at any point during the observation period) were recorded.

GIS analysis:

The observation points were plotted on a vector map of Japan, and then buffers with two-kilometer radii were placed around each point to repesent the foraging zone of each population. All land-use types were tabulated within the buffer zones, and the area of each type in square kilometers was determined. The two groups of data were then compared using IBM SPSS.

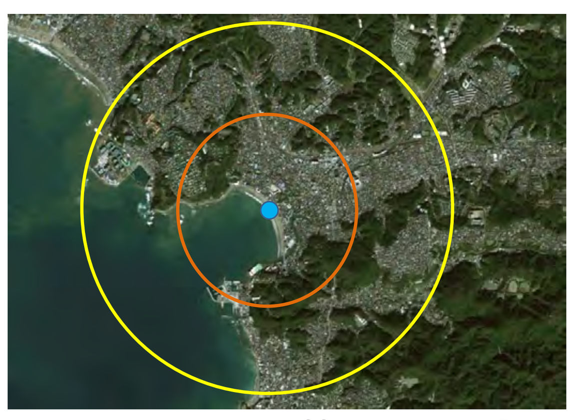

Figure 3: Buffer example.

Aggression Index:

$$AI = \frac{\sum_{j=1}^{n} B_j \times N_j \times P_a}{T},$$

where n=number of behavior types, j=type of behavior, Bj=score for attack type, Nj=number of that attack type, Pa=number of aggressive birds, and T=total birds.

Bj scores are: Attacks (Other Birds)=1, Attacks (Black Kites)=2, and Attacks (Human)=3. These are based upon each action' s associated level of aggression and risk-taking.

Results

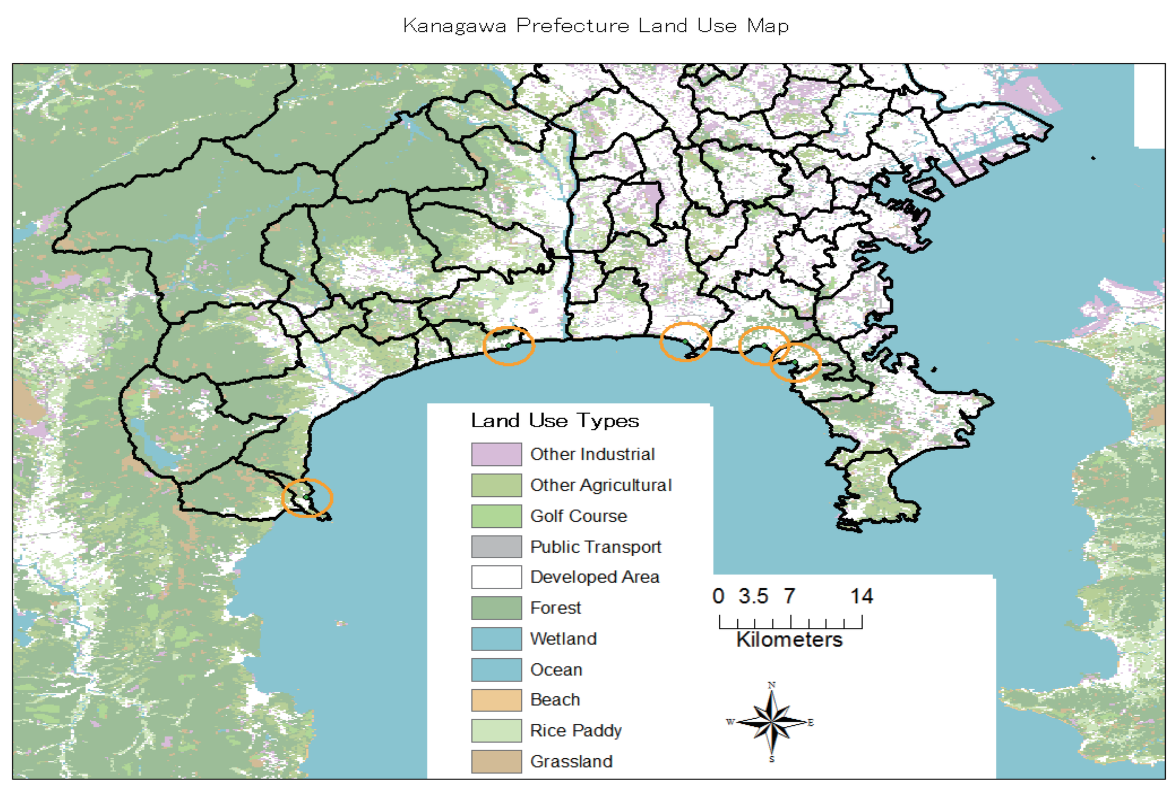

Figure 4: Land use map of Kanagawa Prefecture.

Table 1: Amount of land-use type in each zone.

Location	forest area (km^2)	grassland area (km^2)	paddy area (km^2)	wetland area (km^2)	other agriculture area (km^2)	beach area (km^2)	total green space area (km^2)
Enoshima	0.471	0.0631	0	0.184	0.0368	0.179	0.934
Kamakura	2.36	0.0631	0	0.0385	0	0.105	2.57
Zushi	2.94	0.252	0.0260	0.0361	0.0701	0.0481	3.37
Oiso	2.56	0	0.112	0.0788	0.314	0.343	3.40
Manazuru	1.37	0.543	0	0	2.87	0.0949	4.88

Table 2: Results of stepwise multiple regression and univariate ANOVA.

Parameter Estimates

Dependent Variable: AI (log)

Parameter	B	Std. Error	t	Sig.	95% Confidence Interval		Partial Eta Squared	Noncent. Parameter	Observed Power[b]
					Lower Bound	Upper Bound			
Intercept	1.466	.117	12.570	.000	1.230	1.701	.794	12.570	1.000
forest per kite	-2.208	.292	-7.553	.000	-2.799	-1.618	.582	7.553	1.000
oa per kite	-9.284	1.365	-6.803	.000	-12.040	-6.528	.530	6.803	1.000
[Season= Fall]	-.037	.287	-.130	.897	-.616	.542	.000	.130	.052
[Season= Spring]	.384	.136	2.824	.007	.109	.658	.163	2.824	.787
[Season= Summer]	0[a]								

a. This parameter is set to zero because it is redundant.

b. Computed using alpha = .05

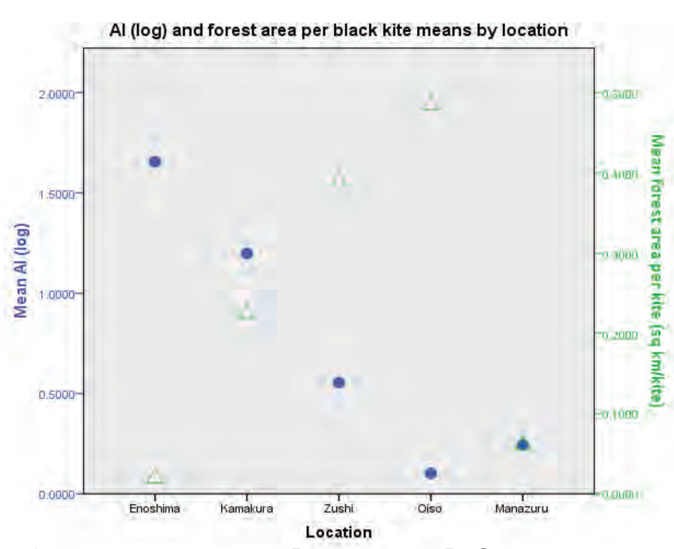

Figure 5: AI (log) and forest area/kite by location.

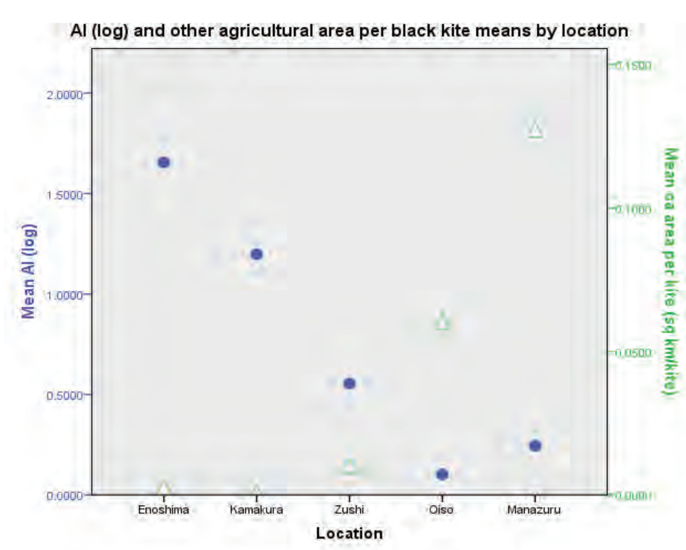

Figure 6: AI (log) and other agricultural area/kite by location.

Final mixed model equation:

$$AI(log) = 1.466 - 2.208\left(\frac{\text{Forest area}}{\text{Total black kites}}\right) - 9.284\left(\frac{\text{Other agricultural area}}{\text{Total black kites}}\right) + 0.384(\text{Spring}).$$

Conclusion

Through this study, urban habitat reduction has been shown to have a significant impact upon black kite aggression. Forests and agricultural areas are particularly important for mitigating these aggressive tendencies, and steps should be taken to properly conserve and manage them. Although the amount of habitat space alone cannot account for all of the behavioral differences witnessed, nesting habitat and preferred foraging habitats are clearly of some importance to black kites, as evidenced from each population' s differences in behavior. Thus, in order to prevent further novel, harmful behaviors from developing amongst urban animals, cities should attempt to determine which types of green space are of vital importance to resident wildlife and consider them accordingly when planning future urban landscapes.