

Fig. A1. Location of the Common Nighthawk migration count conducted annually from 2008-2022 in Duluth, MN. Duluth is located at the southwestern terminus of Lake Superior, a region that is well-known for concentrating migrating birds. The count location is designated with a star and putative tracks of migratory nighthawks are shown with arrows.



Fig. A2. Cumulative daily counts of Common Nighthawks on 1,221 eBird checklists on which at least one Common Nighthawk was detected in St. Louis County, Minnesota, USA during August and September. Checklist submission years ranged from 1956 – 2022, but only 28 checklists (2%) were submitted prior to 2008. The dashed horizontal line represents the minimum daily “high-count” threshold used in this manuscript. Even taken cumulatively across all years, no dates outside of the monitoring period described in this study reached this level. Any eBird checklists that contained counts made during this study were removed prior to analysis.

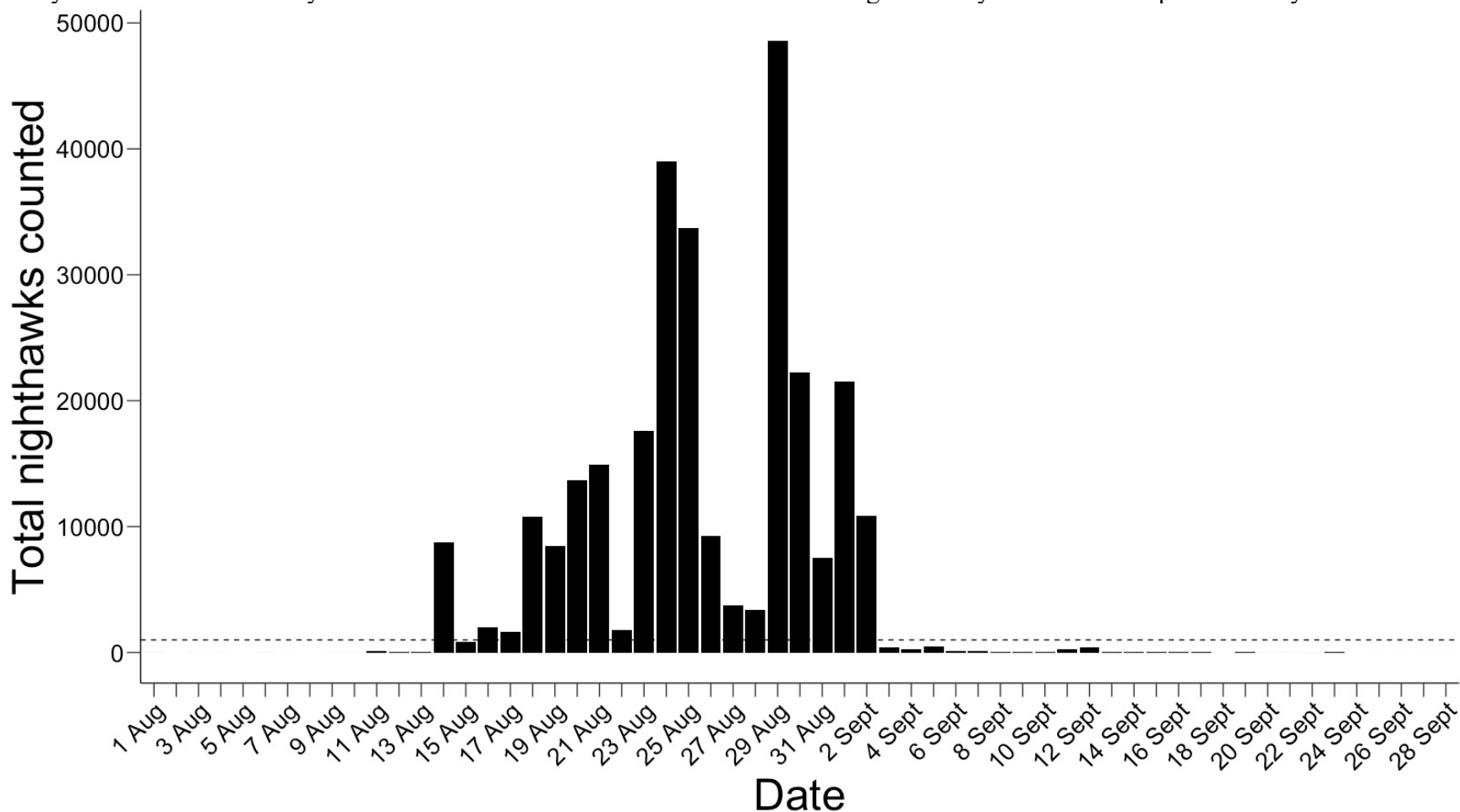


Fig. A3. Study design and data analysis schematic describing data sources (A), and the analytical processes undertaken to describing the intensity of nighthawk migratory movements (B) and trend analysis (C).

A. Data sources

Raw data sources	Description
Historical Count Surveys (1985 – 2007)	Historical Common Nighthawk migration counts (Hendrickson and Eckert 1991)
Systematic Count Surveys (2008 – 2022)	Standardized Common Nighthawk migration counts described in this paper
Weather Variables (1985 – 2022)	NOAA Daily Weather Summaries for Duluth International Airport

B. Migration intensity

Response Variables	Source	Description	Modeling approach
Daily Count Totals	Systematic Counts	Log-transformed counts of Common Nighthawk	GLMMs
“Large Flight Days”	Systematic and Historical Counts	Binary flight day/not a flight day	Logistic Regression
Model covariates (Fixed effects)		Model covariates (Random effects)	
Latitudinal (east-west) wind direction		Year	
Longitudinal (north-south) wind direction			
Wind speed (km/hr)			
Temperature (°C)			
Barometric pressure			
Ordinal date and Ordinal date ²			

C. Trend Analysis

Response Variables	Source	Modeling Approach
Daily Count Totals	Systematic Counts	Arithmetic mean Geometric mean passage rate index

Table A1. Top models from logistic and generalized linear mixed model selection evaluating the effects of weather on Common Nighthawk migration in Duluth, Minnesota from 2008-2022. Logistic models were used to model the effects of weather on days during which $\geq 1,000$ nighthawks were counted. Generalized linear mixed models were used to model the effects of weather on daily nighthawk counts. Model coefficients and standard errors are listed. All models include ordinal date and the square of ordinal date as fixed effects and year as a random effect. Models with $\Delta AICc$ values ≤ 2 are listed. Lat = latitudinal wind direction, Long = longitudinal wind direction, WS = wind speed, P = atmospheric pressure, and T = temperature.

Model	Lat	Long	Lat*Long	WS	Lat*WS	Long*WS	P	T
GLMM	-0.75±0.10***	0.00±0.11	-0.36±0.20	-0.26±0.07***	-0.15±0.10	0.13±0.10	-0.06±0.06	0.32±0.07***
GLMM	-0.71±0.09***			-0.29±0.07***	-0.20±0.09*		-0.04±0.06	0.28±0.07***
GLMM	-0.71±0.09***			-0.28±0.07***	-0.20±0.09*			0.28±0.07***
Logistic	-1.56±0.37***	-0.19±0.36	-1.28±0.66	-0.69±0.19***				0.67±0.20***
Logistic	-1.35±0.29***			-0.66±0.18***				0.57±0.19**

*** $P \leq 0.001$, ** $P \leq 0.01$, * $P \leq 0.05$