Bednekoff, Peter A., and Alasdair I. Houston. 1994. “Avian Daily Foraging Patterns: Effects of Digestive Constraints and Variability.” *Evolutionary Ecology* 8 (1): 36–52. <https://doi.org/10.1007/BF01237664>.

Study of small passerines

Birds show a pattern of feeding most heavily in the morning and then a secondary feeding in the afternoon, less around mid day – most considerable in the passerines.

Their feeding patterns are built to minimize starvation and predation.

Patterns are less pronounced in winter but still bimodal.

Magnitude of daily weight cycle is related to overnight energetic requirements.

Birds can add weight incredibly fast throughout the day, and lose it very fast.

Effect of the midday lull depends on temperature and insulation.

For insectivorous species it is different – it is dependant on prey abundance timing.

Fat reserves have a better energy ratio than food in the gut for weight, small birds with a small crop and gut may be better off with more consistent feeding to keep energy throughout the day as fat reserves, not as undigested food.

Given a predictable food supply, foraging should be delayed until the end of the day. This is not what we saw in Ontario.

Morton, Martin L. 1967. “Diurnal Feeding Patterns in White-Crowned Sparrows, Zonotrichia Leucophrys Gambelii.” *The Condor* 69 (5): 491–512. <https://doi.org/10.2307/1366149>.

Small birds feeding often has a morning and evening maxima

Different feeding patterns for different types of birds

Temp, social status, food availability, wind, photoperiod may all have an impact on feeding patterns

Feeding patterns can be seasonal, esp in migratory spp.

Bimodal feeding patterns are more extreme on cold days.

Kantak, Gail E. 1981. “Temporal Feeding Patterns of Some Tropical Frugivores.” *The Condor* 83 (2): 185–87. <https://doi.org/10.2307/1367429>.

Bonter, David N., Benjamin Zuckerberg, Carolyn W. Sedgwick, and Wesley M. Hochachka. 2013. “Daily Foraging Patterns in Free-Living Birds: Exploring the Predation–Starvation Trade-Off.” *Proceedings of the Royal Society B: Biological Sciences* 280 (1760): 20123087. <https://doi.org/10.1098/rspb.2012.3087>.

Theoretically foraging should be done when the risk of starvation outweighs the risk of predation – i.e. following dawn and approaching dusk

Found that species that visited feeders started before sunrise, tapered off throughout the day – appears that energy reserves were met before dusk.

Carrying too much fat can be maladaptive.

Early morning foraging replenishes fat reserves lost overnight.

If there is minimal predation pressure or fat reserves don’t affect flight much, then it would be in the birds best interest to feed throughout the day.

There have been mixed results in studies on bird weight gain throughout the day.

Did not see an expected bimodal feeding pattern.

There is a bimodal feeding pattern in birds that don’t have predation risks.

Birds may reach a satiation threshold which limits evening feeding.

McNamara, John M., Alasdair I. Houston, and Steven L. Lima. 1994. “Foraging Routines of Small Birds in Winter: A Theoretical Investigation.” *Journal of Avian Biology* 25 (4): 287–302. <https://doi.org/10.2307/3677276>.

Are there less birds of prey in a city (near the feeder)? Which could alter their feeding habits??

Because we split time into periods vs continuously throughout the day we used an ANOVA model with period as a categorical variable, instead of an ANCOVA or regression analysis