

# Neuroendocrine mechanisms related with migratory preparation and consumption of sunflower in red-winged blackbirds



Alexis Trester<sup>1</sup>, Page Klug<sup>2</sup>, Jeffrey Kittilson<sup>1</sup>, Timothy Greives<sup>1</sup>

<sup>1</sup>Department of Biological Sciences, North Dakota State University, Fargo, ND  
<sup>2</sup>USDA-APHIS-Wildlife Services, National Wildlife Research Center, Fargo, ND



### Background

- One **key component** of long-distance bird migration is **pre migratory hyperphagia** (a drastic increase in feeding behavior), allowing birds to **build an extensive lipid storage to fuel flight**. However, the mechanisms driving this change in foraging behavior remain unknown
- Premigratory red-winged blackbirds (RWB)** and **RWB on stopover from Canada** will often **feed on oilseed sunflowers** to build this lipid storage, causing **damage to sunflower fields**
- Hunger-inducing (orexigenic) and hunger-suppressing (anorexigenic) signals in the hypothalamus** are well-established in rodents and poultry
- We explored the expression of two hunger-inducing, neuroendocrine genes: **NPY** and **ghrelin receptor (GHS-R)**; and two hunger-suppressing, neuroendocrine genes: **CART** and **leptin receptor (LEP-R)** to see if they played a role in sunflower depredation




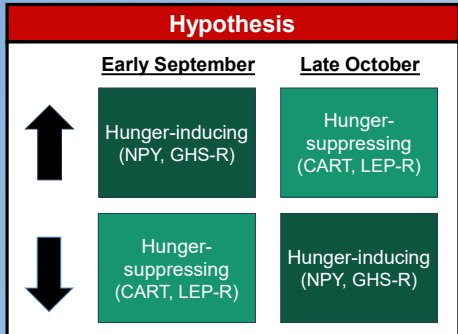
Photo by Jessica O'Connell

### Results

#### Orexigenic (hunger-inducing) Factors

#### NPY expression decreased over sampling period.

#### Ghrelin receptor (GHS-R) expression increased over sampling period.



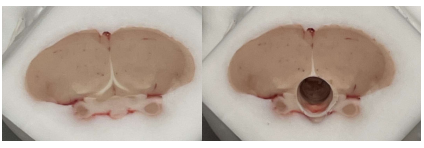
#### Anorexigenic (hunger-suppressing) Factors

#### Leptin receptor (LEP-R) expression peaked during middle of sampling period.

#### CART expression did not significantly vary over the sampling period.

### Methods

- We collected brains from red-winged blackbirds taken under a depredation order in North Dakota from September to late October
- We collected hypothalamic tissue punches from brain samples (see pictures below)
- We extracted RNA and quantified expression of NPY, GHS-R, CART, and LEP-R using qPCR



### Summary and Discussion

- The increase in ghrelin receptors indicates that blackbirds became more sensitive to ghrelin over the sampling period, potentially influencing hyperphagia
- Opposite our hypothesis, NPY decreased, potentially indicating that lower thresholds of expression signal sufficient lipid storage and ability to migrate
- The increased sensitivity to leptin (LEP-R peaked mid sampling period) may lead to greater signaling in the anorexigenic pathway, inducing upregulation of CART (CART displayed a similar, nonsignificant pattern)
- The peak in anorexigenic expression in the middle may signal resident breeders to depart as migrants arrive for stopover.
- Identifying birds as migrant or resident breeders using stable hydrogen isotopes ( $\delta H$ ) of claws and feathers will indicate if the bird has started migration or is stopping over



**Acknowledgements:** This work was funded by NSF and USDA-APHIS-WS, National Wildlife Research Center. Special thanks to Dwight Rasmussen and Ross Renner of the USDA Wildlife Services for carcass collection. We thank Jessica Duttonhfefer and Dr. George Linz for assistance and feedback on data.