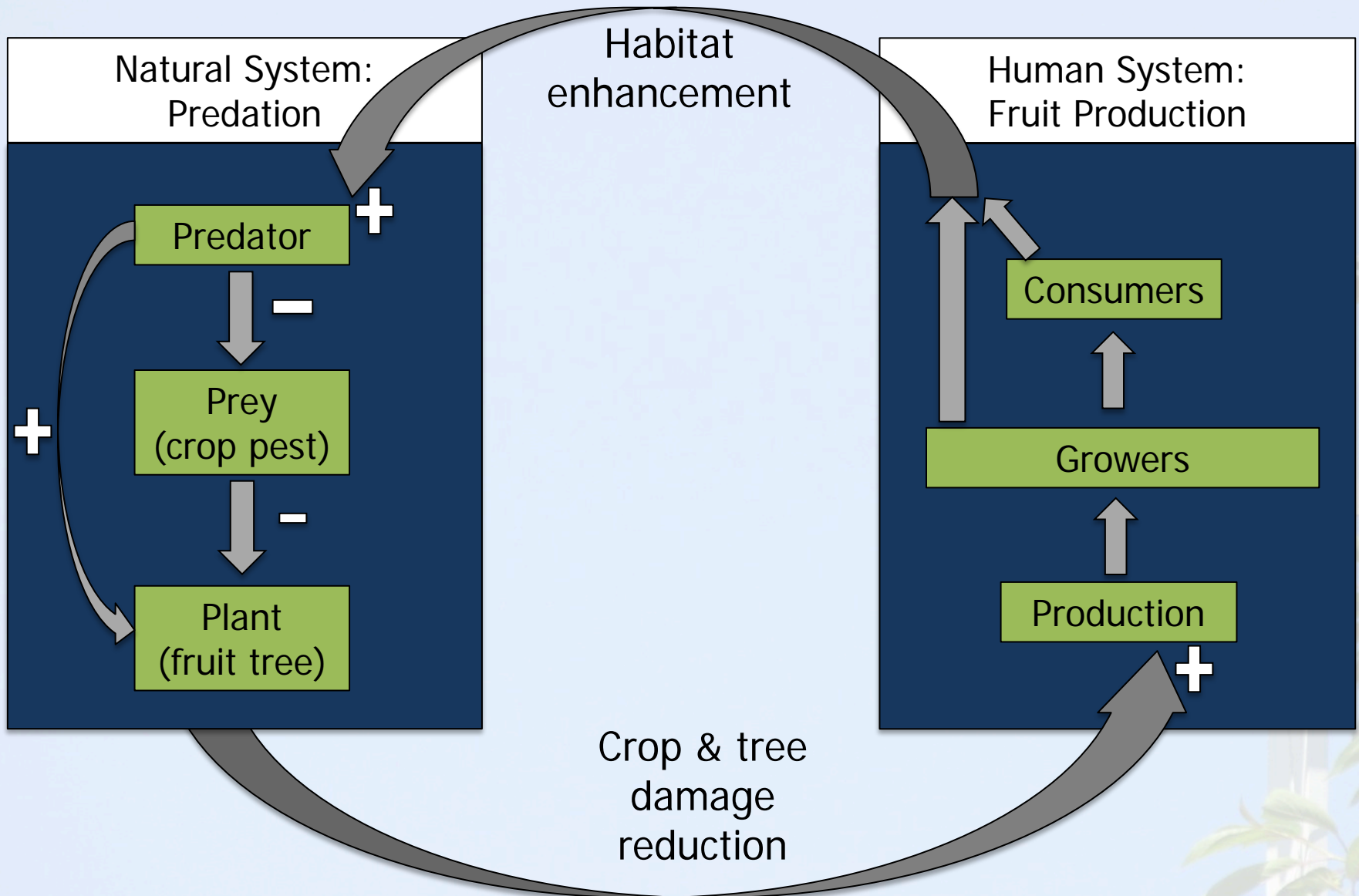


Evaluating the Conservation and Agricultural Applications of American Kestrel Nest Boxes in a Fruit-growing Region

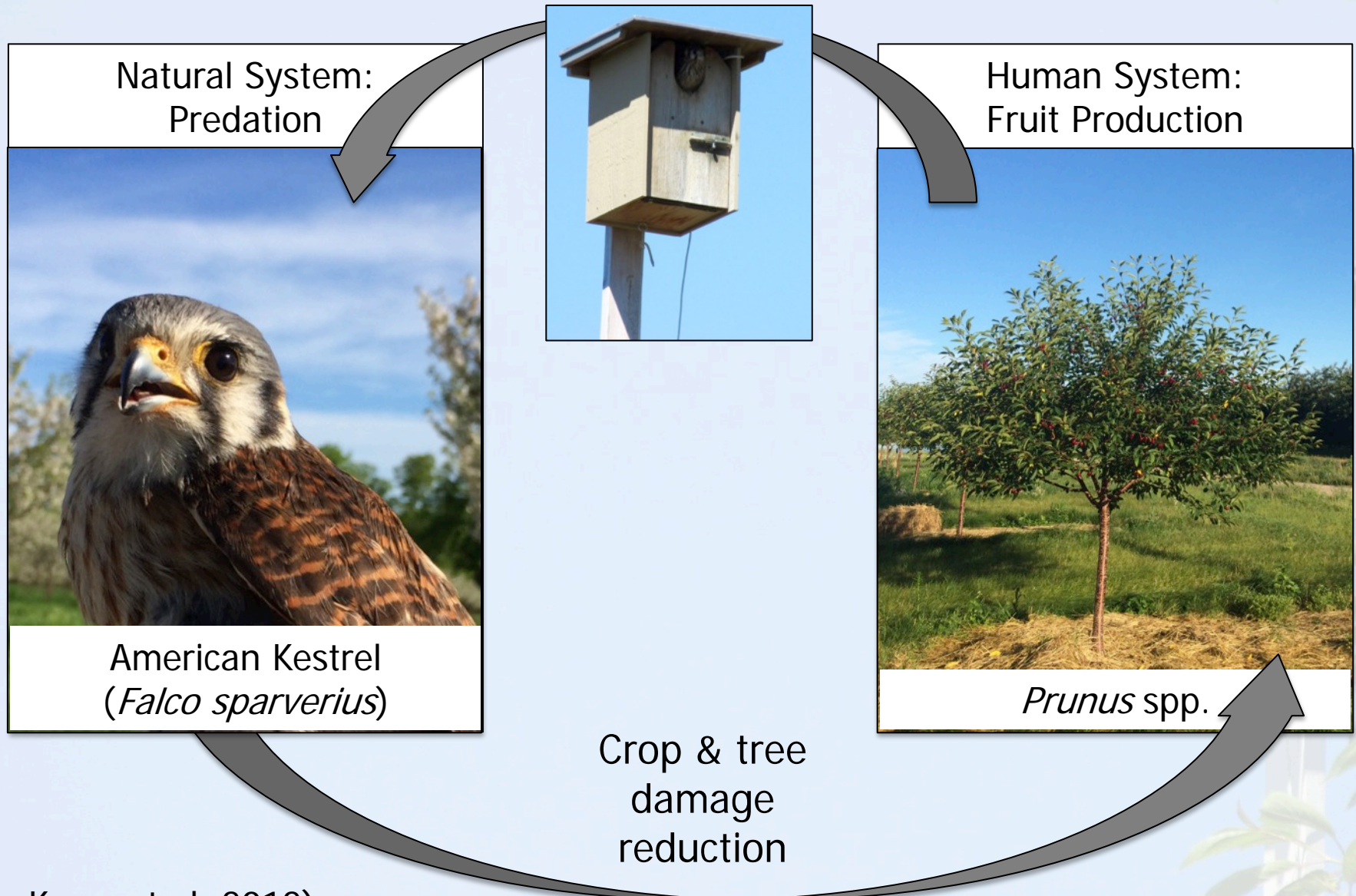
Megan Shave ♦ Catherine Lindell
Michigan State University



Coupled Human and Natural System Overview



Coupled Human and Natural System Overview



(e.g. Kross et al. 2012)

Cherry Orchard Nest Boxes in Michigan



Leelanau Peninsula



Project Overview

Part 1: Conservation

- Reproductive rates
- Kestrel presence in region

Part 2: Agriculture

- Quantifying prey removal
- Effects on prey abundances



Conservation: Reproductive rates of kestrels using orchard nest boxes



Monitoring Nest Boxes



Kestrels Show High Reproductive Rates

Table 1. Nesting attempts, apparent nesting success, and mean productivity (number of fledglings per box with nesting attempts) for new nest boxes in Michigan cherry orchards in 2013–2015.

YEAR	BOXES AVAILABLE	% BOXES WITH NESTING ATTEMPTS	NESTING ATTEMPTS INITIATED	% NESTING SUCCESS	MEAN PRODUCTIVITY
2013	8	100	8	100	4.25
2014	18	83	16	88	3.87
2015	18	100	19	89	3.56
Total	44	93	43	91	3.80

Table 2. Reproductive rates of kestrels using new nest boxes in Michigan cherry orchards, 2013–2015.

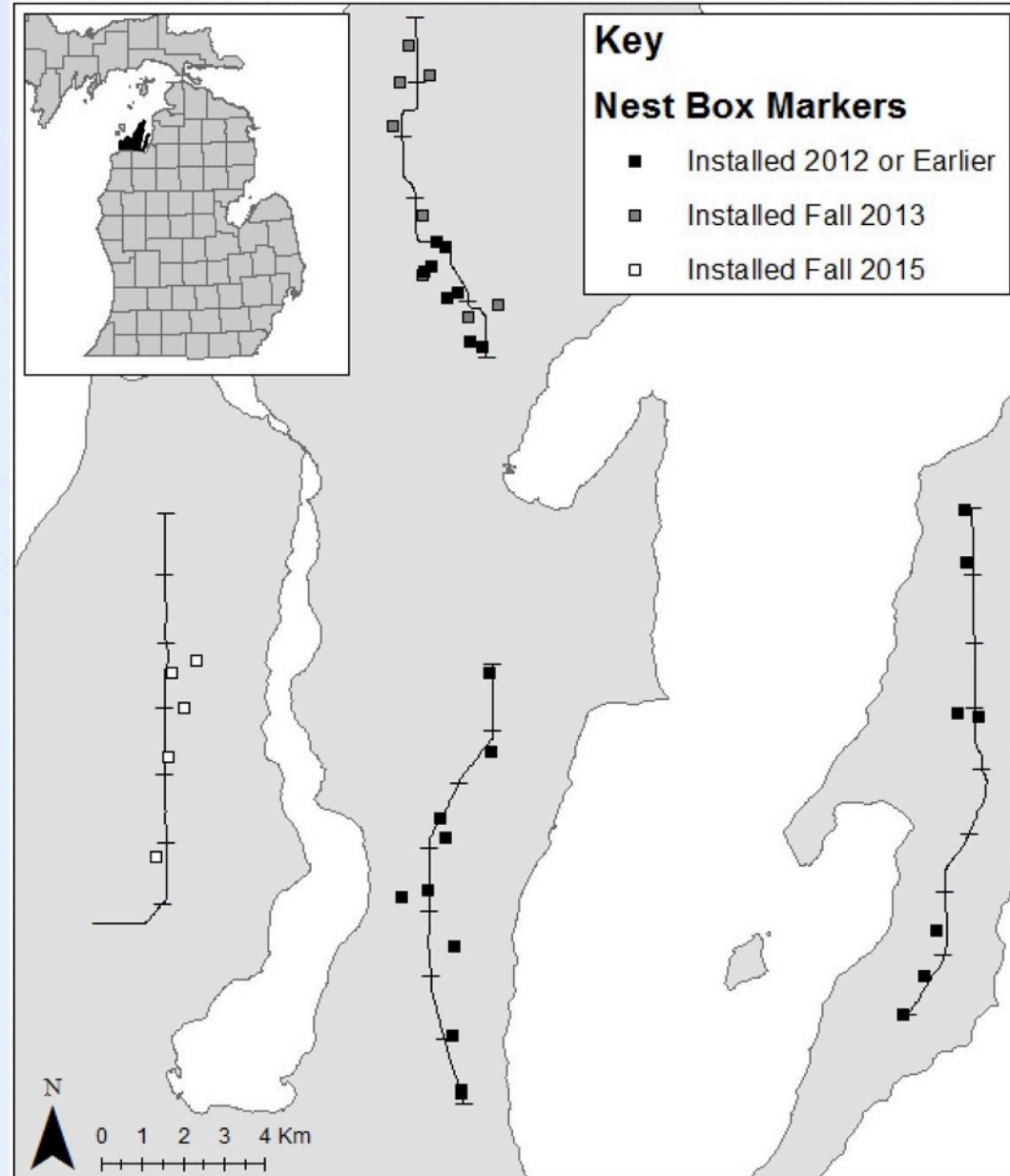
YEAR	MEAN CLUTCH SIZE \pm SE	MEAN HATCHLINGS \pm SE	% HATCHED	MEAN FLEDGLINGS \pm SE	% HATCHLINGS FLEDGED
2013	4.88 \pm 0.12	4.75 \pm 0.16	97	4.25 \pm 0.25	89
2014	4.93 \pm 0.071	4.43 \pm 0.23	90	4.14 \pm 0.31	94
2015	4.65 \pm 0.15	4.24 \pm 0.22	91	3.76 \pm 0.30	89
Total	4.82 \pm 0.075	4.47 \pm 0.13	93	4.05 \pm 0.18	91

(Shave & Lindell 2017, *Journal of Raptor Research*)

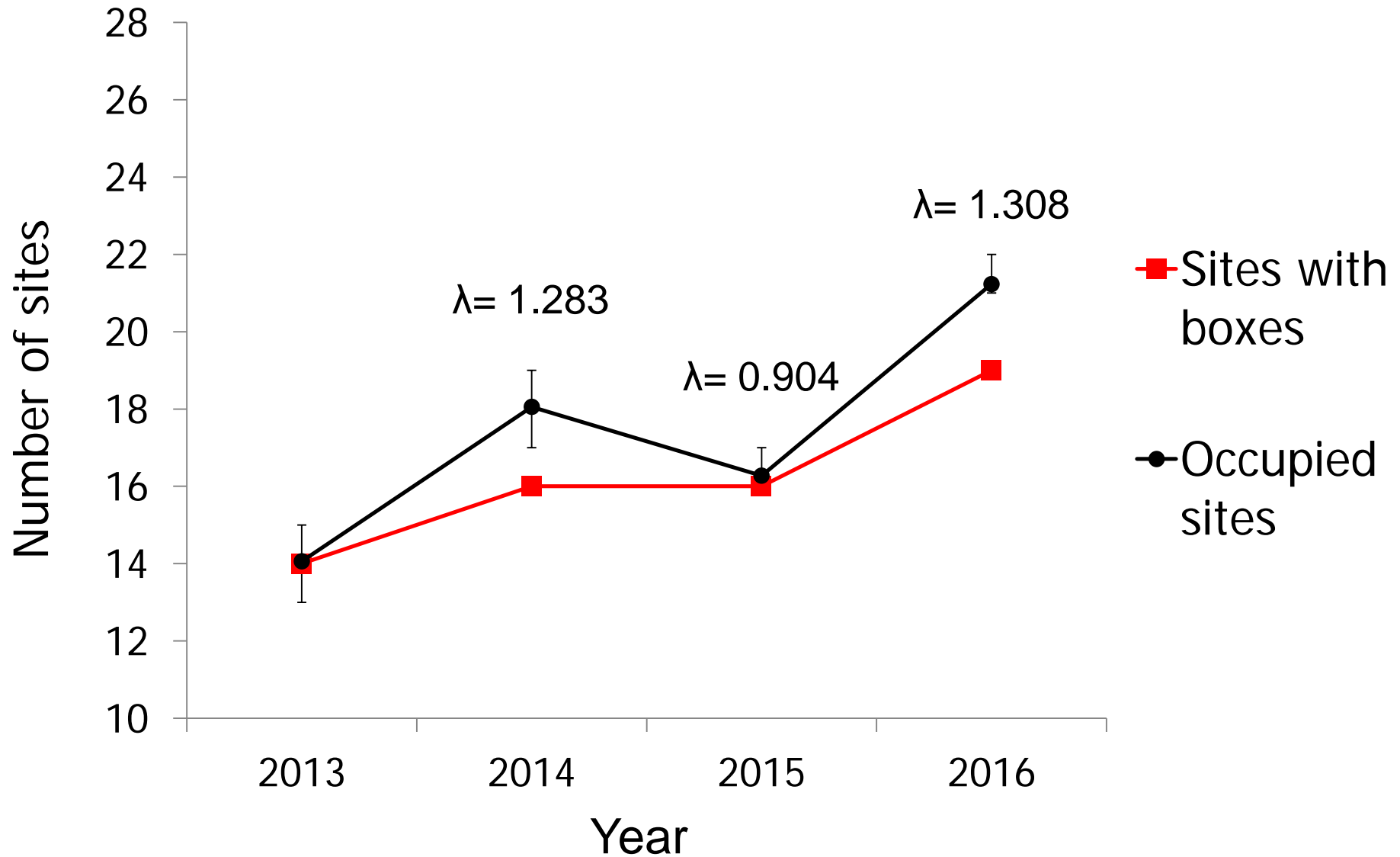
Conservation: Effects of nest boxes on kestrel presence in fruit-growing region



Transect Surveys of Kestrel Presence



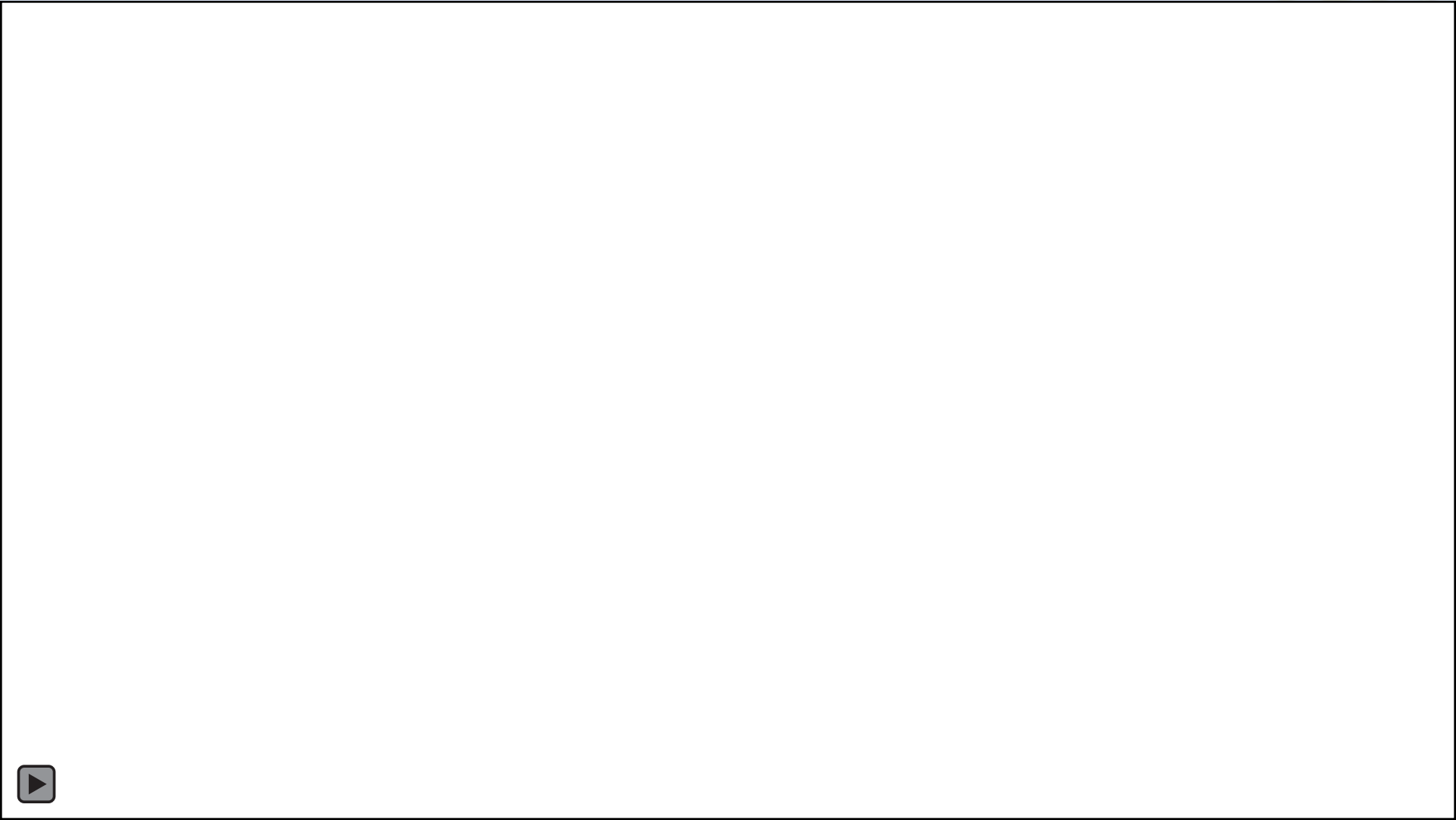
Kestrel Presence Increased With Boxes



Agriculture: Quantifying prey removal by kestrels using orchard nest boxes



Recording Prey Deliveries



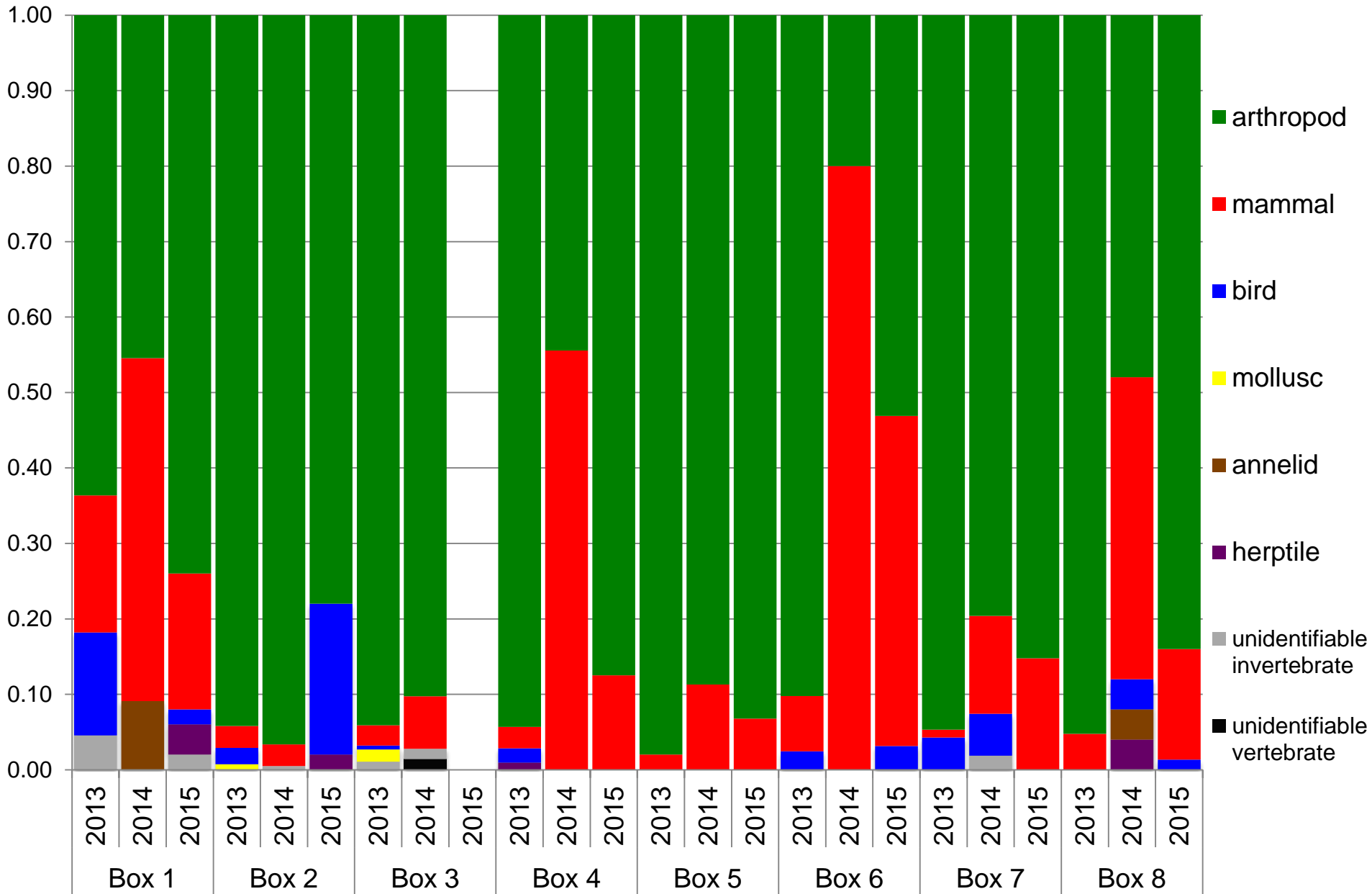
Male Delivering Vole



Kestrels Consume Orchard Pests



Variation in Types of Prey Delivered



Variation in Types of Prey Delivered



Agriculture: Effects of nest boxes on fruit-eating bird abundances in orchards



Hypothesis

Kestrels reduce fruit-eating bird abundances by:

- Consuming birds (direct effect)



Hypothesis

Kestrels reduce fruit-eating bird abundances by:

- Acting as a cue of predation risk (indirect effect)



Prediction

Orchards with active kestrel boxes will have lower fruit-eating bird abundances than those without



Mixed Effects Modeling of Orchard Transect Counts

Small
fruit-eating birds



Random effects: orchard/transect + year

	df	LRT	<i>P</i>	
box	1	32.90	<0.0001	***
crop	1	6.74	0.009	**
perch	1	0.01	0.91	
harvest	1	0.85	0.36	
harvest^2	1	6.76	0.009	**
edge	1	2.33	0.127	

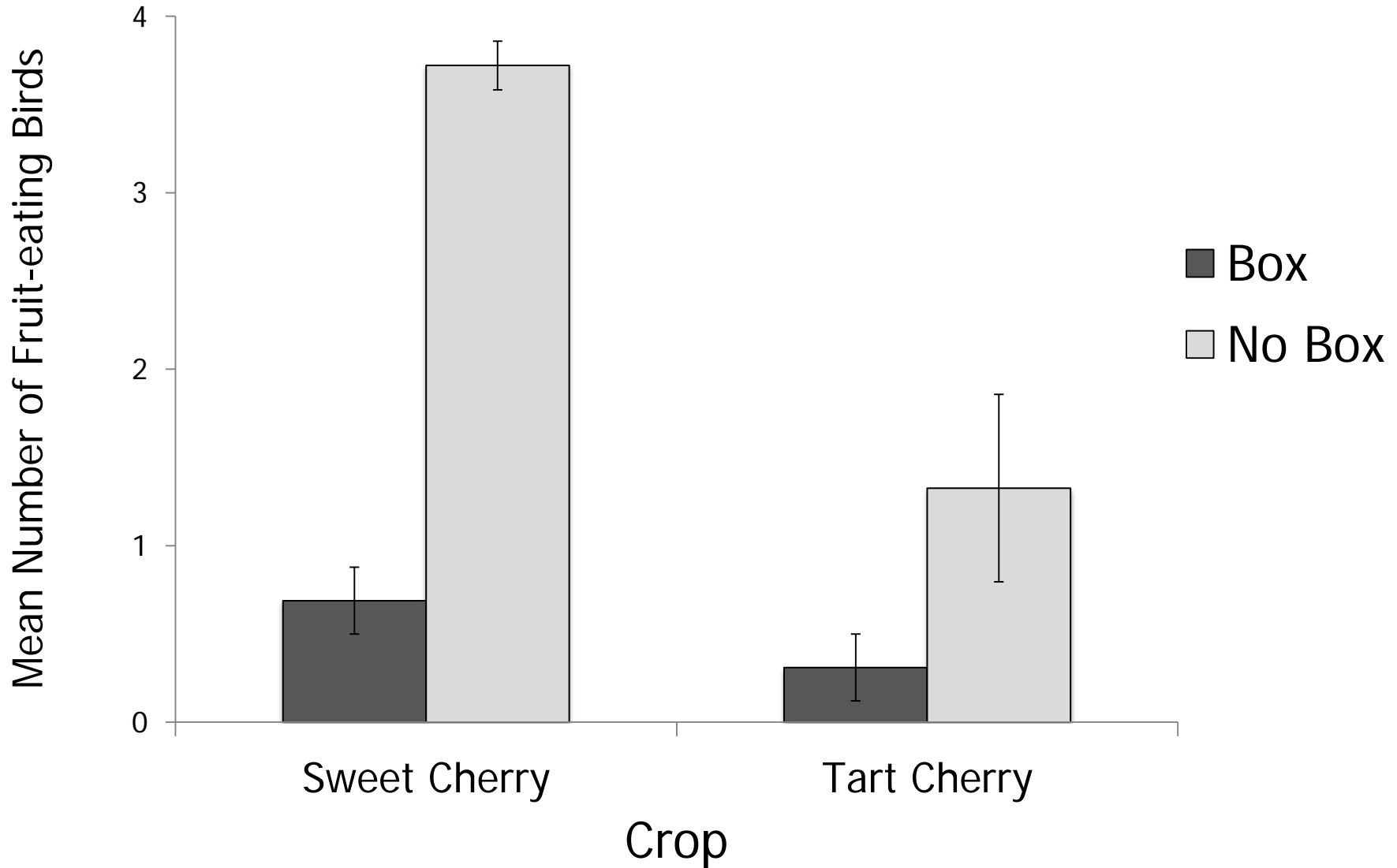
Medium
fruit-eating birds



Random effects: orchard/transect + year

	df	LRT	<i>P</i>	
box	1	13.35	0.001	**
crop	1	3.70	0.054	.
perch	1	0.00	0.988	
harvest	1	1.77	0.183	
harvest^2	1	2.37	0.124	
edge	1	0.38	0.538	

Fruit-eating Bird Abundances Lower at Sites with Kestrel Boxes



Take Home Messages

High reproductive rates and tolerance of monitoring

Increased kestrel presence in region

Kestrels consume orchard pests at varying rates

Fruit-eating bird abundances lower at orchards with active nest boxes



Ongoing & Future Work

Modeling kestrel predation of rodents

Measuring rodent activity in orchards

Estimating value of orchard nest boxes using regional economic modeling

New nest boxes in blueberry fields in southwestern Michigan



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Kate Howard

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Literature Cited

KROSS, S.M., J.M. TYLIANAKIS, AND X.J. NELSON. 2012. Effects of introducing threatened falcons into vineyards on abundance of passeriformes and bird damage to grapes. *Conservation Biology* 26:142-149.

SHAVE, M.E. AND C.A. LINDELL. 2017. American Kestrels occupying nest boxes in Michigan cherry orchards show high reproductive rates and tolerance of monitoring. *Journal of Raptor Research* 51:1-11.

