

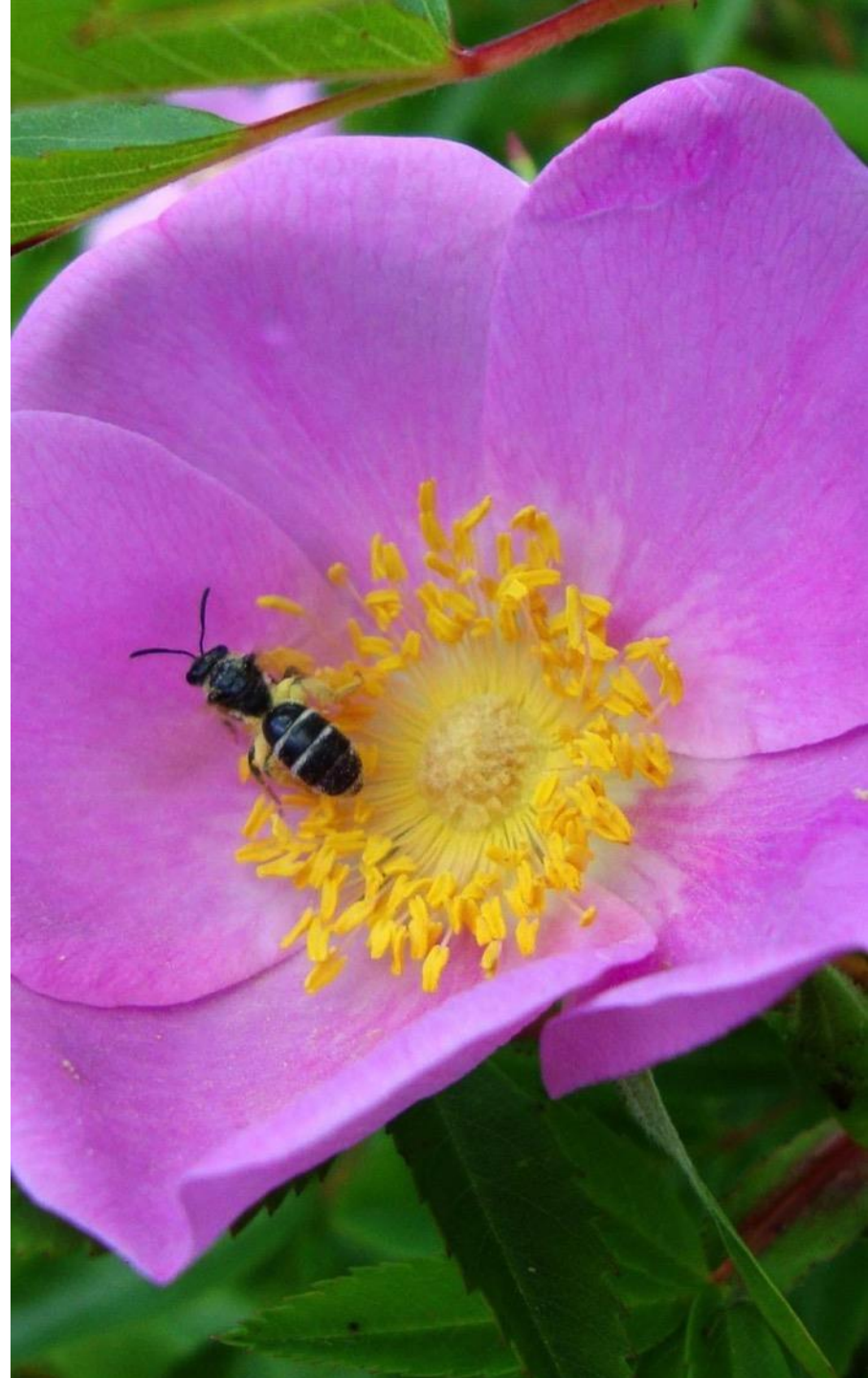
The Status of the Bees



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bee diversity

- Worldwide – 20,000 species
- U.S. – 2,500 species
- Florida, Arizona – 700 species
- New York – 450 species
- Massachusetts – 350-400
- **Maine – 275 species**



where do we stand...

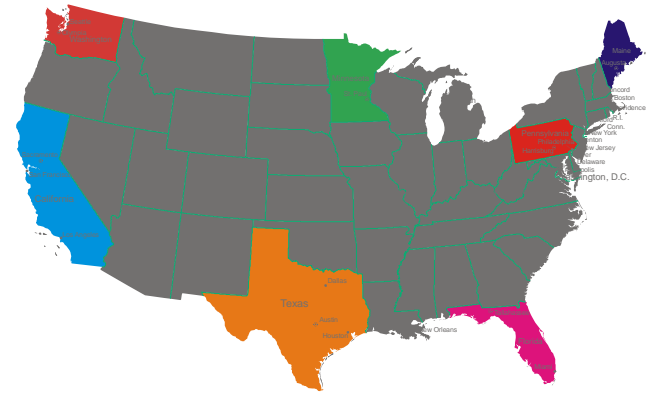
honeybees



Maine brings in almost 85,000 colonies per year just for wild blueberry!

Three Maine research projects on honeybees since 2009

1.



1. National stationary hive project (2009-2013)

2. Effect of fungicide propiconazole (2011-2013)

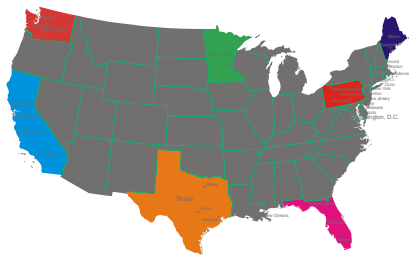
2.



3. Health of honeybee colonies on Maine blueberry barrens (2014-2015)

3.





spring 2009 – spring 2013 colony losses (all trials and all sites, n = 442 colonies)

• 2009 - 2013 colony loss

relative risk

Year*** $P = 0.0006$

Apiary site*** $P < 0.0001$

*Varroa**** $P < 0.0001$

Varroa x site*** $P = 0.0003$

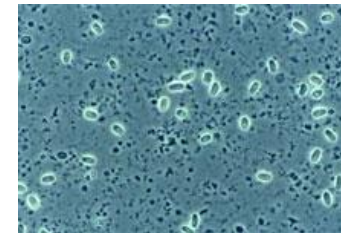
*Nosema*** $P < 0.007$

Nosema x site* $P = 0.021$

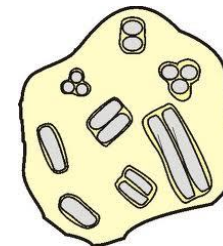
IAPV* $P = 0.054$



4.9

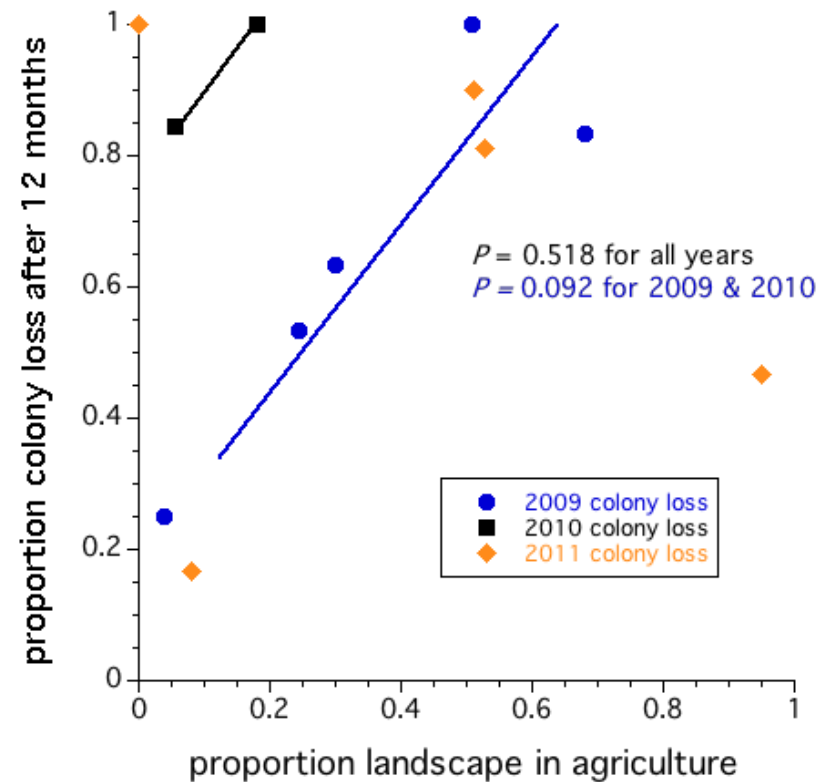
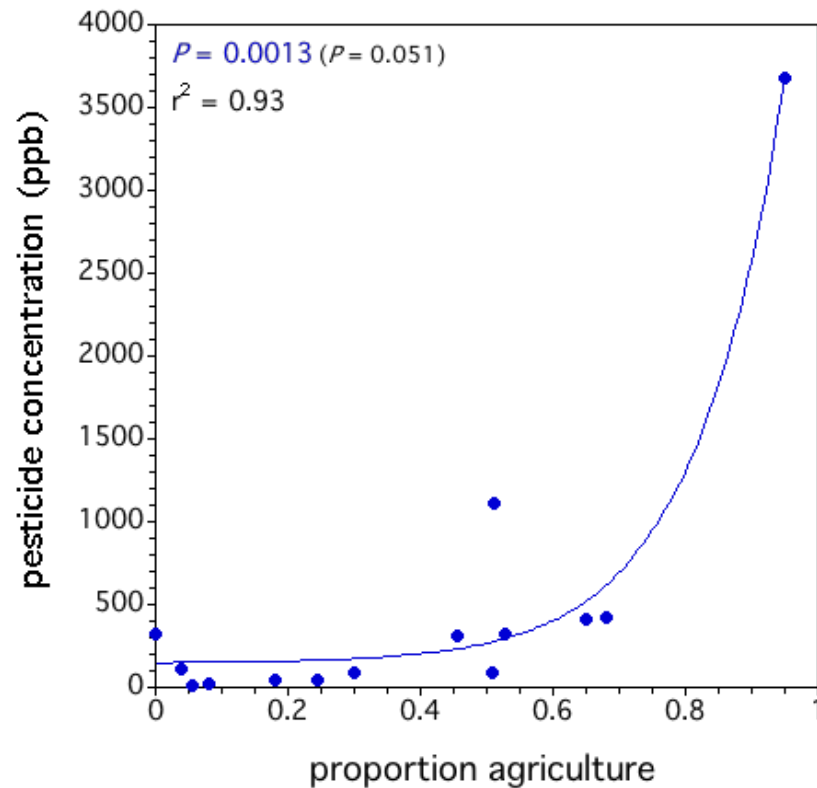


2.1



1.3

effect of intensive agriculture?



factors that affect colony losses

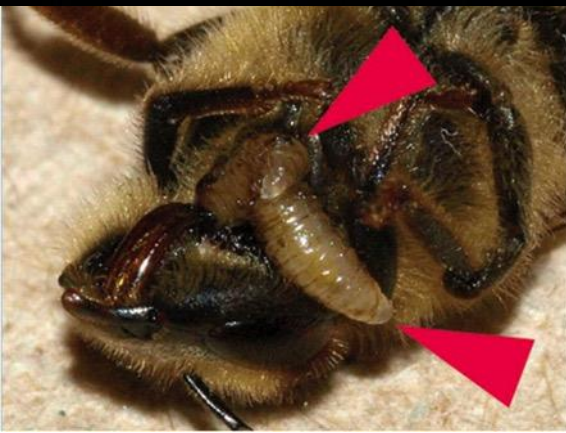
- *Varroa destructor* (1986)
- *Nosema ceranae* (1990)
- Viruses – new and old
- Overall geographic location (weather, forage)
- Pesticides – **acute**, but also subtle sublethal effects



what's new and emerging?



ZOMBIE BEES (2012)



how are the wild bees?

- species declines
- exotics ?
- species shifts
- species rebounds

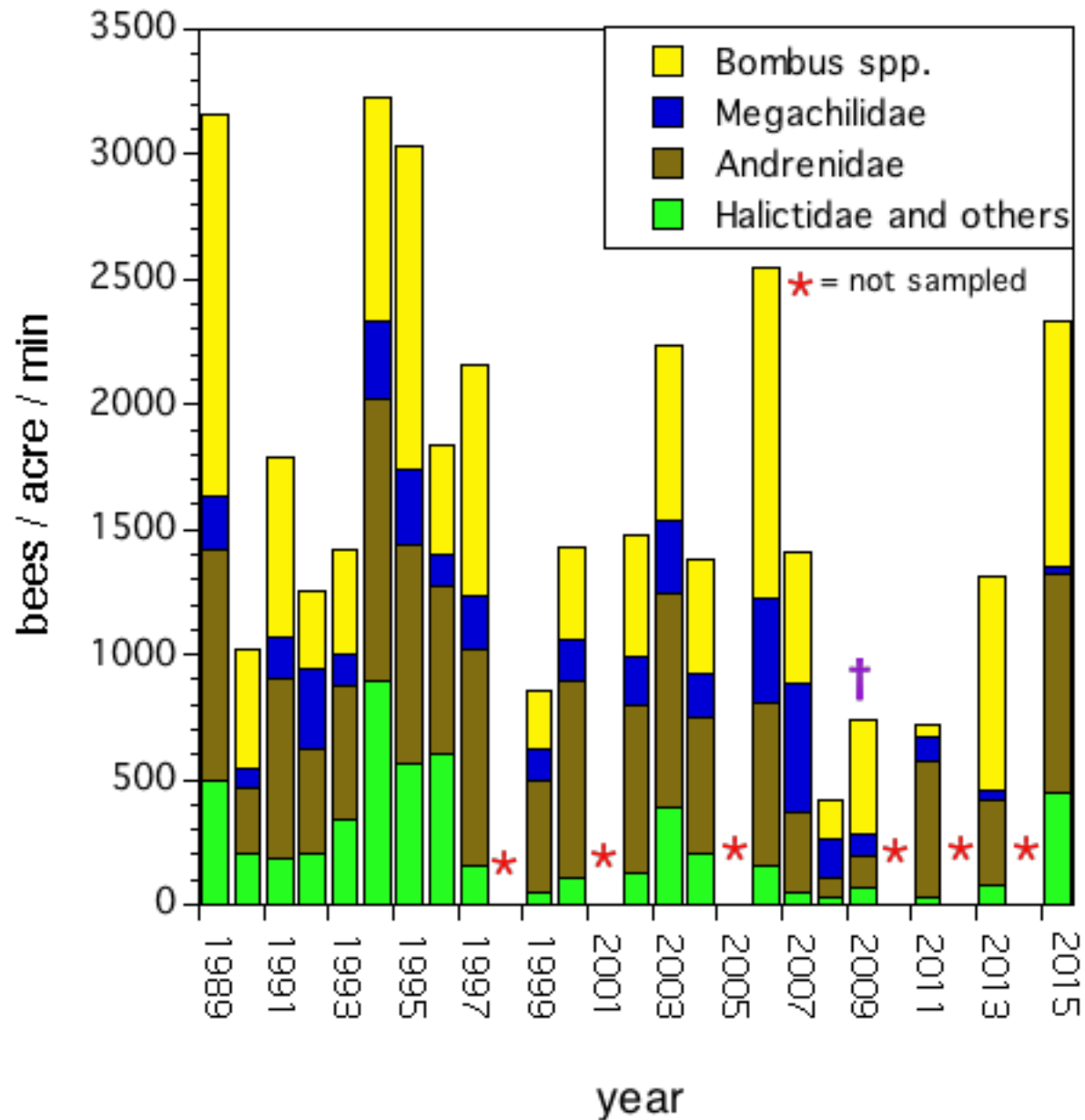


A. Dibble

very, very
difficult to
measure !



another factor that makes it difficult



declines HAVE been documented
around the globe



Declines in the Northeast...

Putting numbers to the pollination crisis

44% of bee
species are
stable

27% of bee
species are
increasing



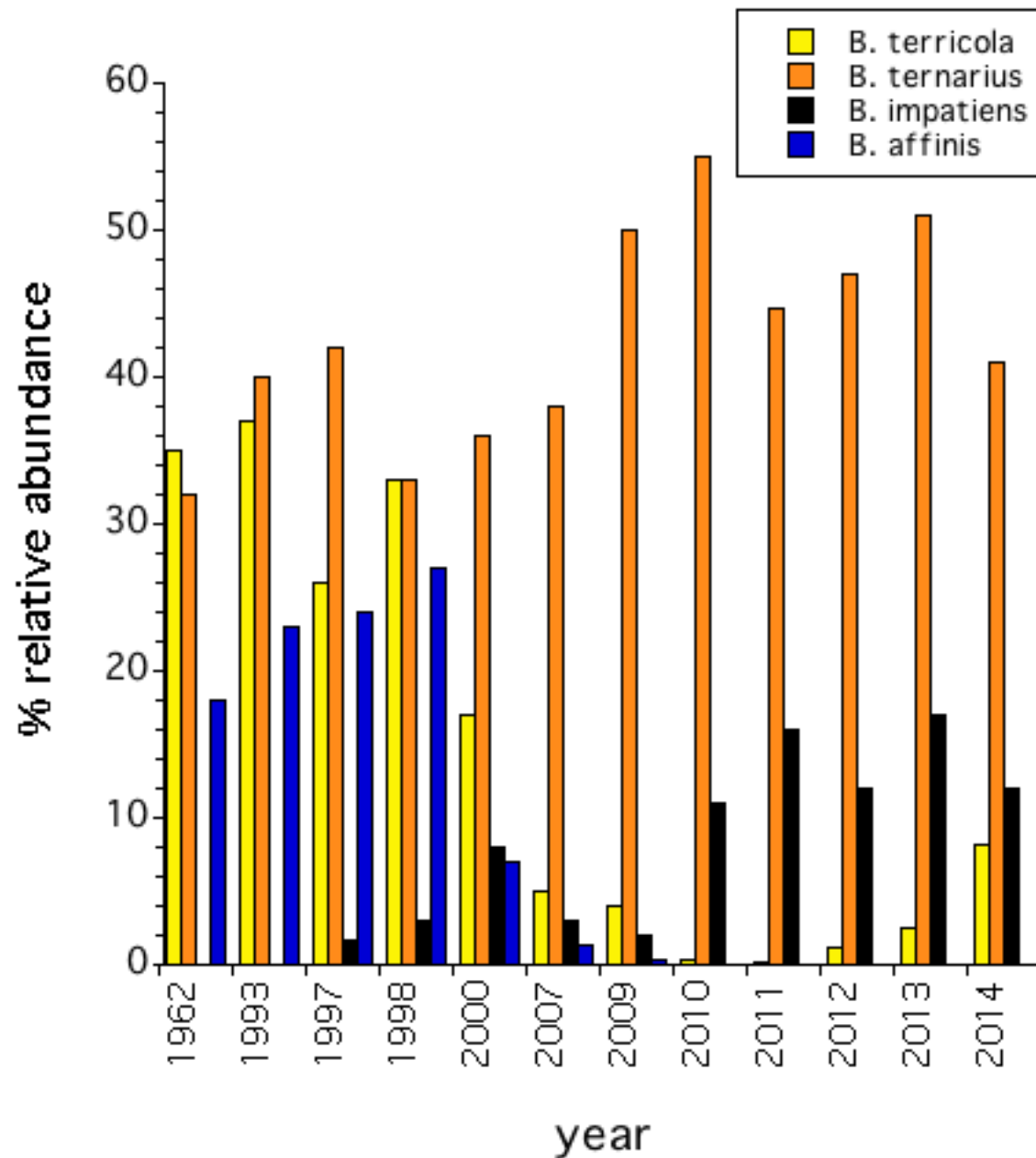
29% of bee
species are
declining

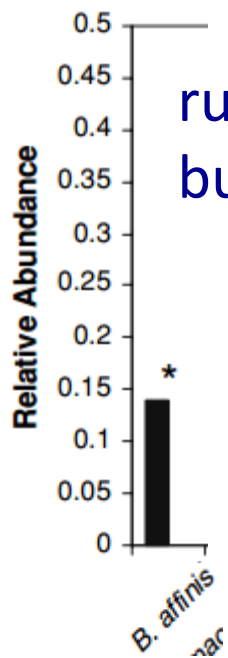
Only 4 out 187
species analyzed show
dramatic declines

Bartomeus et al 2013 PNAS, In press.

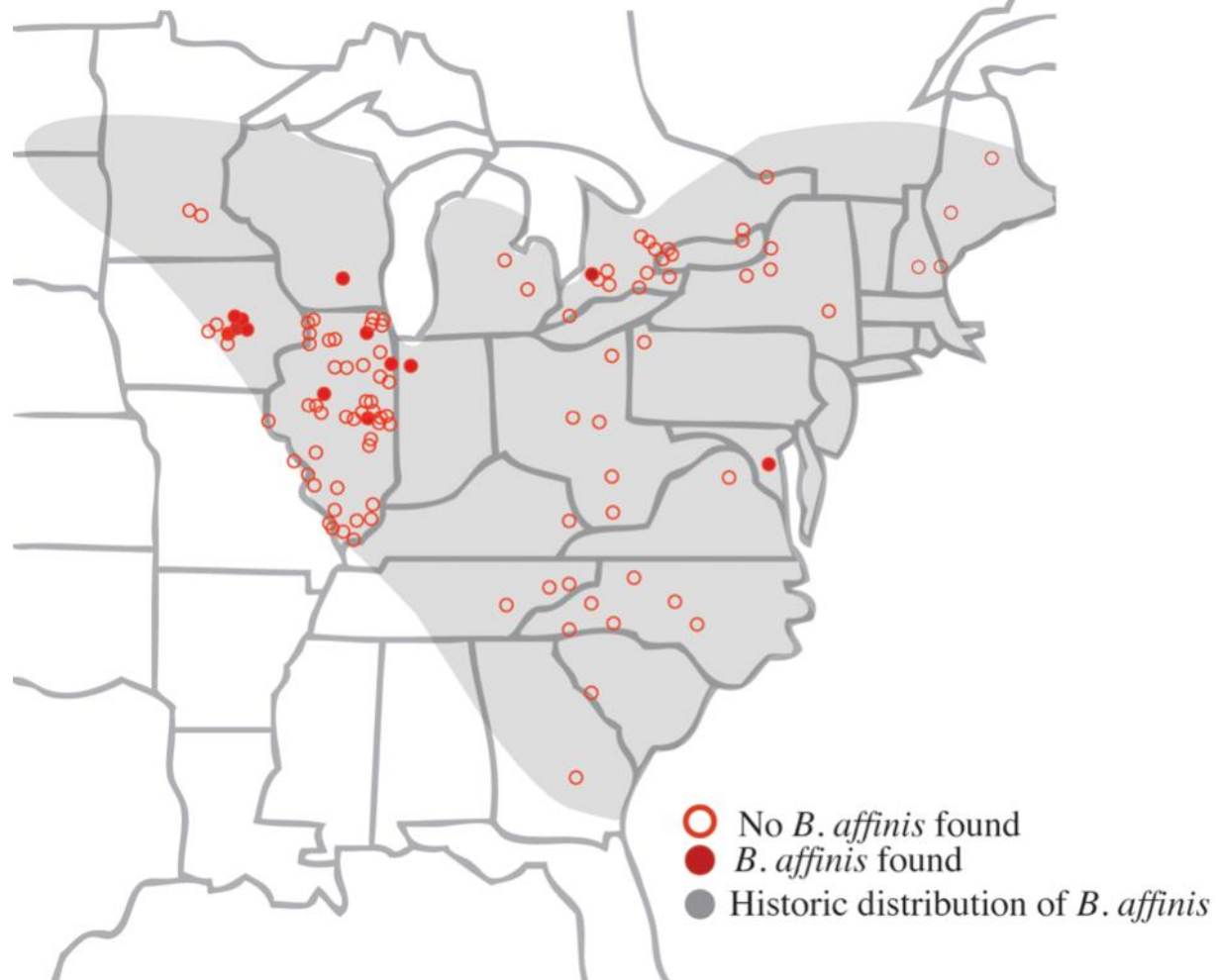
Data reflects relative abundance changes in the northeastern US along the last 100 years

Historical trends in Maine





rusty patch
bumble bee



Colla and Packer 2008, images:
Xerces Society, Sam Droege



the decline of the yellow banded bumble bee in Maine



WANTED

FOR POLLINATION OF CROPS AND WILDFLOWERS



Once common through most of Eastern North America, *Bombus terricola* numbers have steeply declined in recent years. To conserve *B. terricola*, the Xerces Society is documenting the former and current ranges of this bumble bee and they need your help. Any information leading to the conservation of this species will be duly rewarded with increased food security.

**YELLOW BANDED BUMBLE BEE
A.K.A. BOMBUS TERRICOLA**

**NOT TO BE CONFUSED WITH
BOMBUS PENSYLVANICUS OR BOMBUS AURICOMUS**

Bombus terricola workers have black on the last three abdominal segments with a fringe of brownish yellow hairs near the tip of the abdomen.

B. pensylvanicus and *B. auricomus* have black only on the last two abdominal segments. Also, *B. terricola* workers have lighter colored wings, shorter faces, and tend to be smaller than *B. pensylvanicus* and *B. auricomus* workers.



Bombus terricola



Bombus pensylvanicus



Bombus auricomus

**If you have seen *Bombus terricola* please contact info@xerces.org
For more information on bumble bees in decline please visit www.xerces.org/bumblebees**

2013 survey for the yellow banded bumble bee, *Bombus terricola*

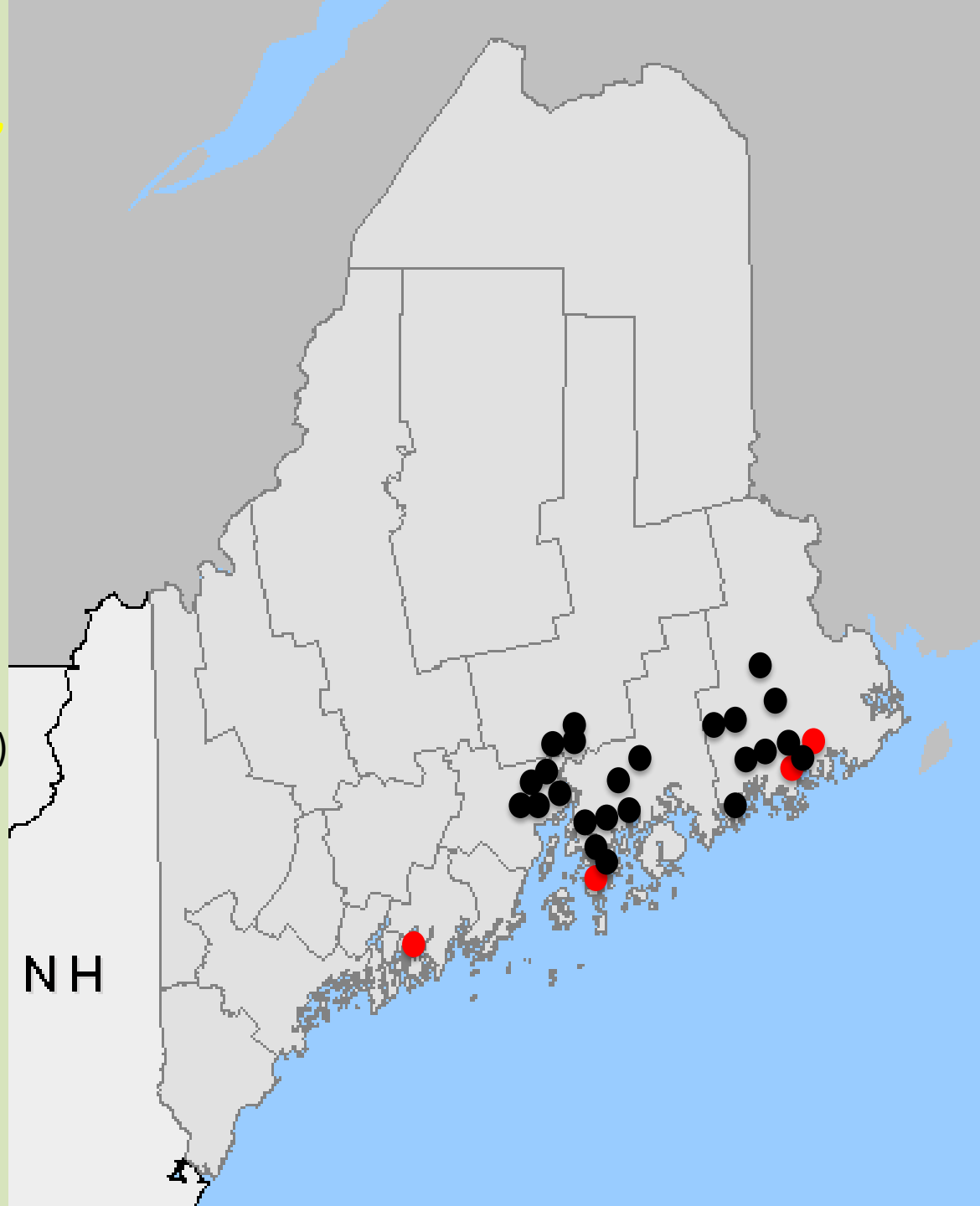
● Observed and confirmed

● NOT observed

1. survey sites in Maine (n=29 confirmed)

2. percent occurrence = 13.8 % (n=29)

3. relative abundance = 2.4% (n=18), compared to 1-2% from 2009-2012.



2014 survey for the yellow banded bumble bee, *Bombus terricola*

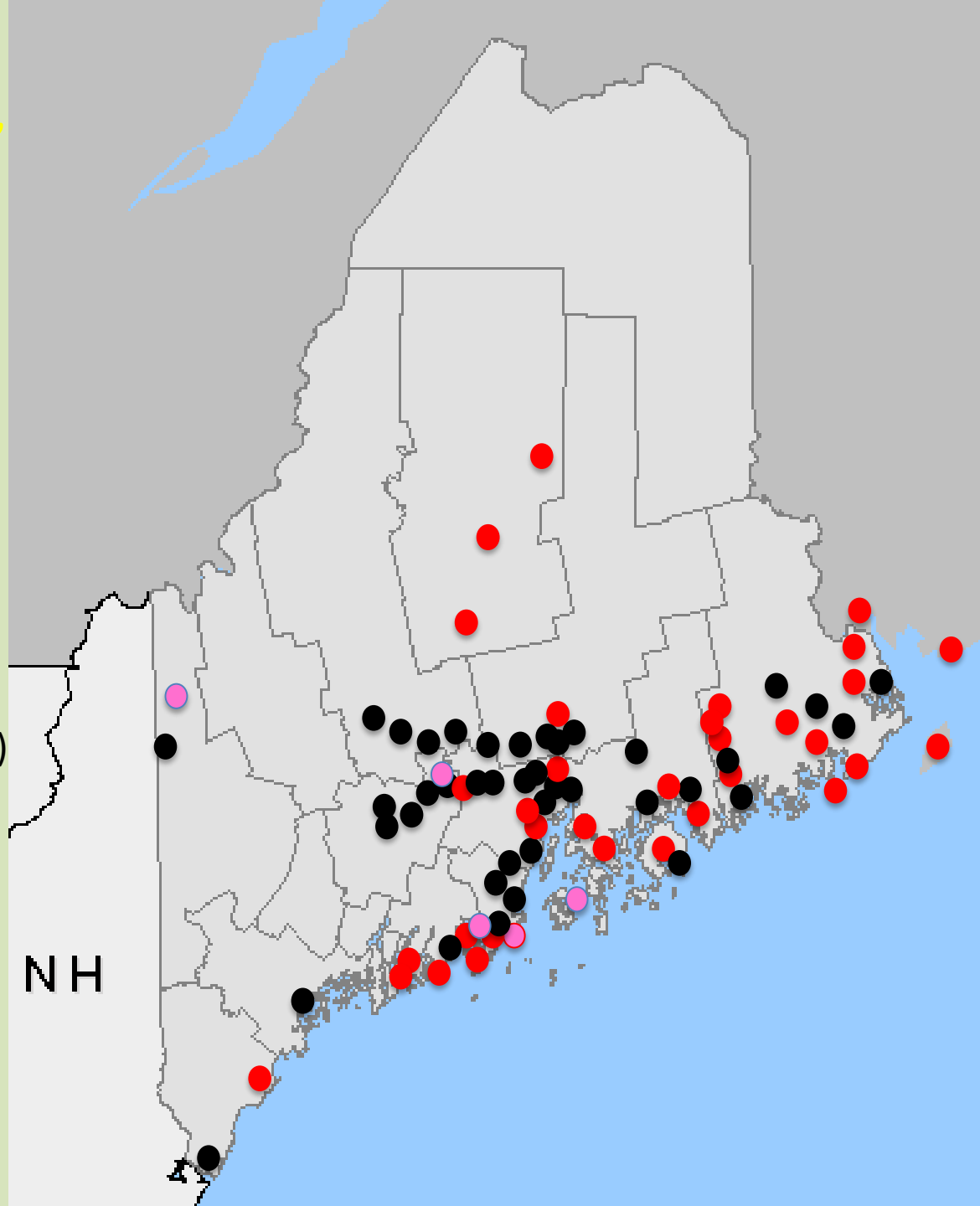
- Observed and confirmed
- Reported, but **NOT** confirmed
- **NOT** observed

1. survey sites in Maine and
New Brunswick (n=87 confirmed)

2. percent occurrence = 49.4 % (n=87)
0% in NH 2014 survey (9 locations,
n = 1349 bees collected, Rehan data)

3. relative abundance = 7.4% (n=18),
compared to 1-2% from 2009-2013.

4. occurrence vs *Bombus* richness, ns
($P = 0.13$, n=18)



2015 survey for the yellow banded bumble bee, *Bombus terricola*

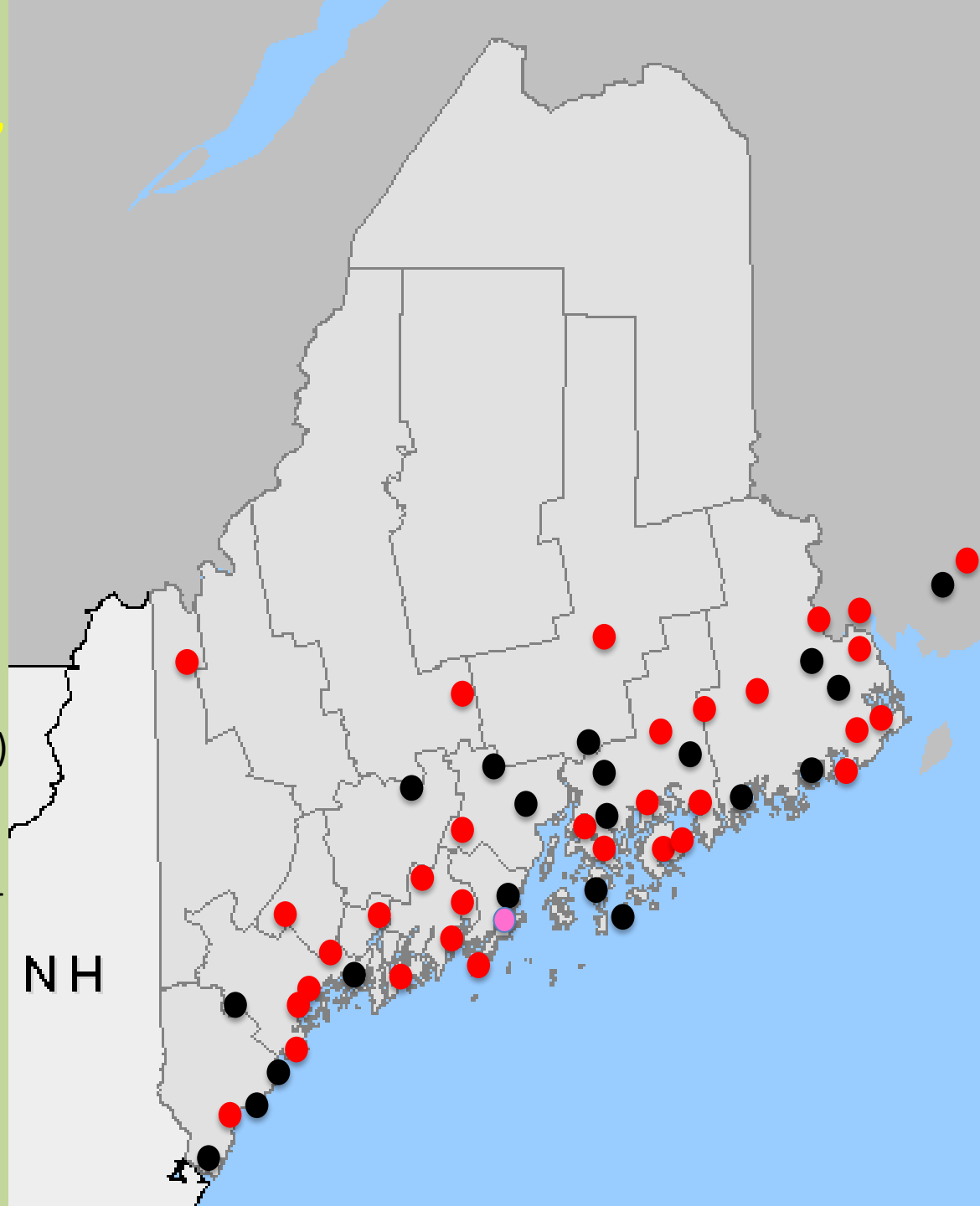
- Observed and confirmed
- Reported, but **NOT** confirmed
- **NOT** observed

1. survey sites in Maine and
New Brunswick (n=52 confirmed)

2. percent occurrence = 61.5 % (n=52)

3. relative abundance = 11.5.4%
(n=32), compared to 1-2% from 2009-
2013.

4. occurrence vs *Bombus* richness, ns
($P = 0.08$, n=32)



factors affecting declines

- climate change?
- habitat fragmentation and shrinking habitat
- pesticides
- pathogens & parasites
 - native pathogens and new stressors
 - exotic new pathogens?
- genetic diversity (bees – low diversity due to breeding system and inbreeding)
- exotic bees – competition ?

pesticides

bumble bees in Maine

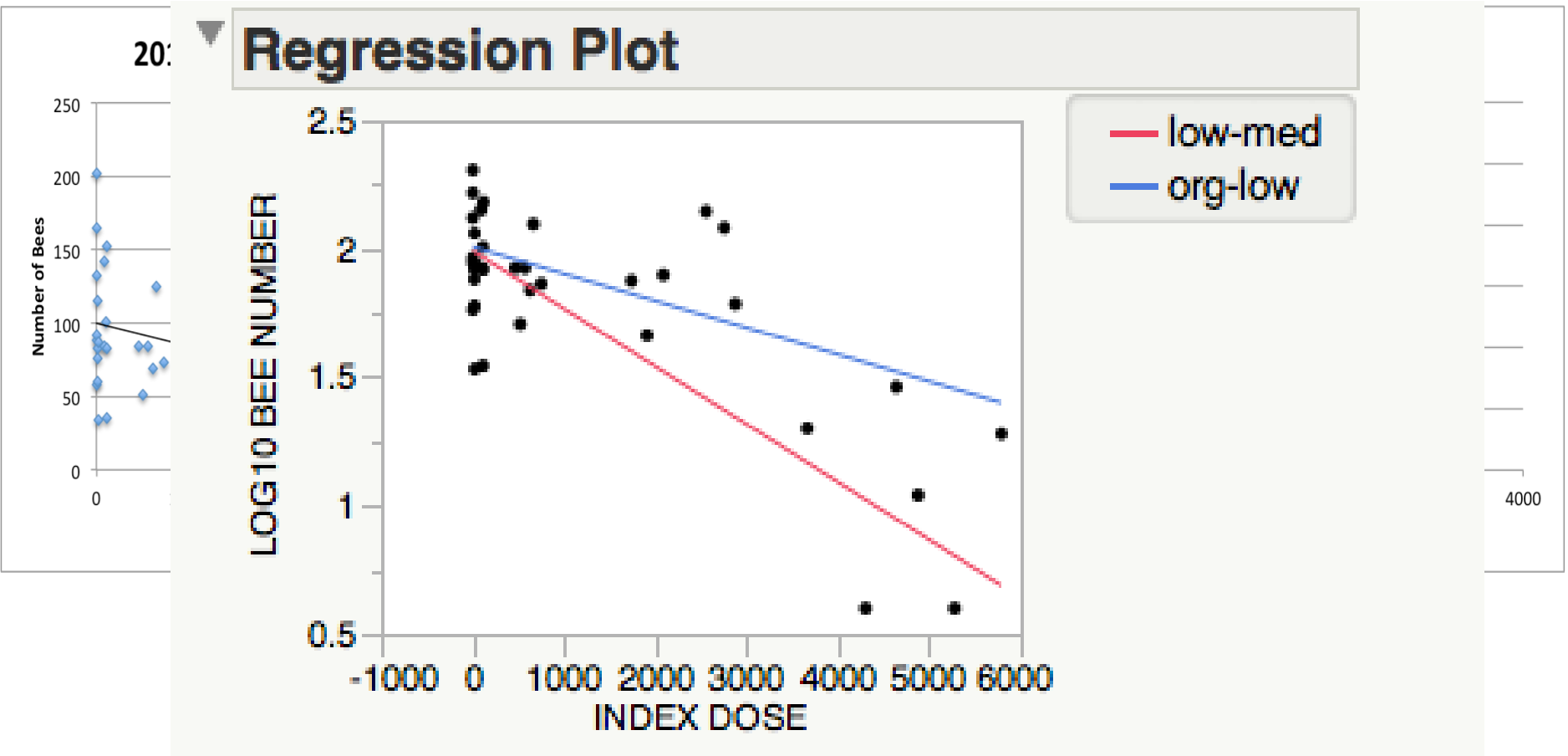
Kalyn Bickerman

PhD Student

University of Maine School of Biology and
Ecology



bumble bees and imidacloprid revisited (2013 & 2014)



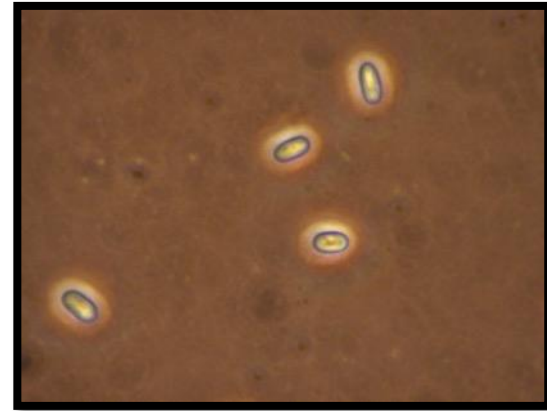
parasites and disease

- native
- exotic ... aka SPILLOVER



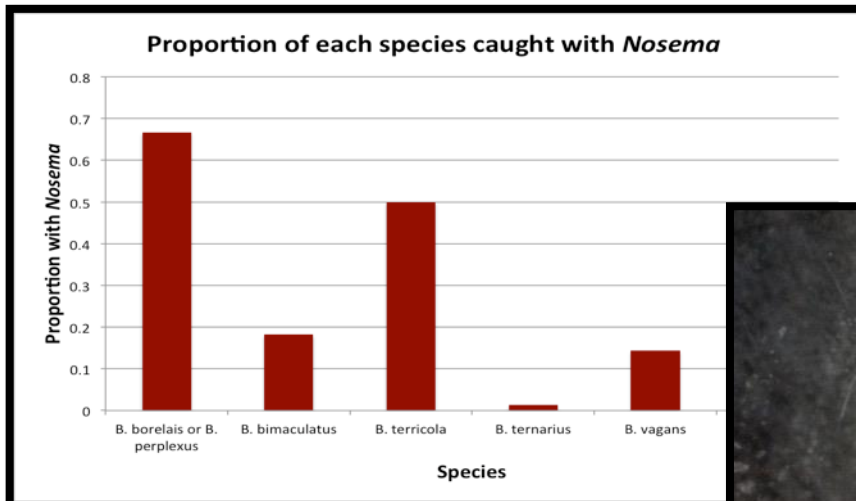
a native bumble bee pathogen

- Fungal pathogen
 - *Nosema bombi*
- Spread through spores



N. Bombi spores, 1000X. Bickerman, 2012

- Prevalence species-dependent



Bickerman and Drummond, unpublished data

No effect - commercial bumble bees
Bushmann et al. (2013)



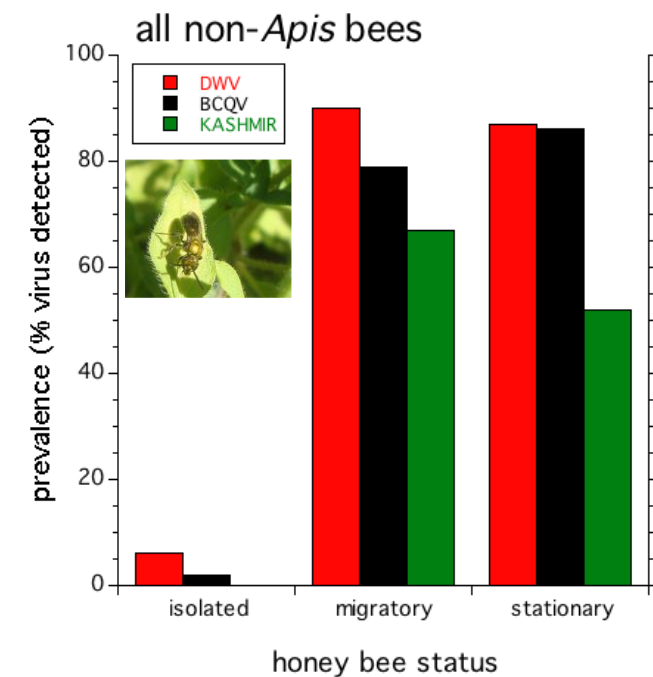
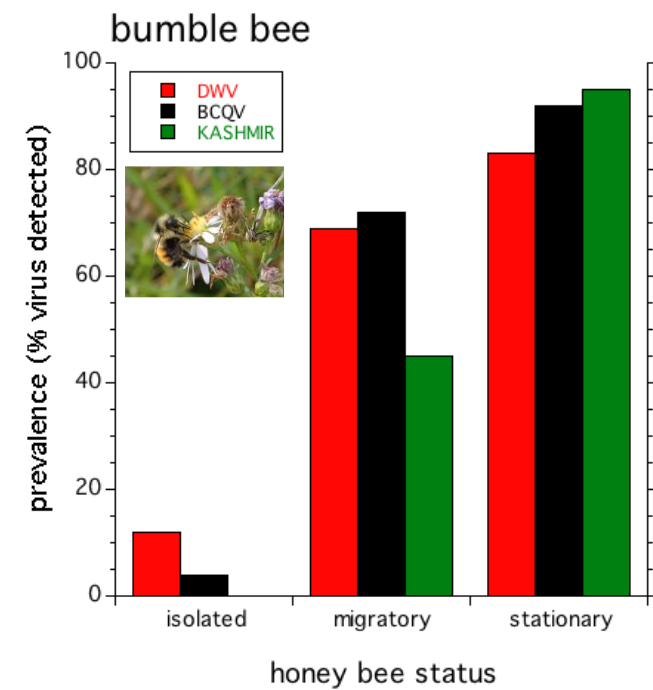
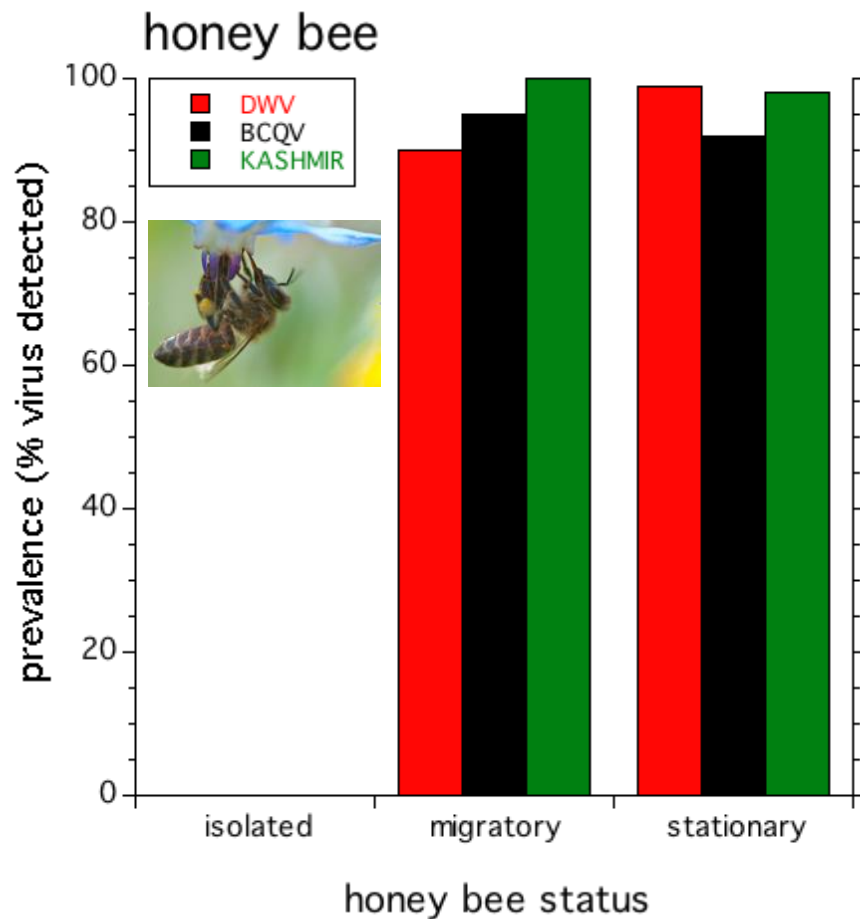
spill-over of pathogens from honey bees to native bees?

Table 5. Percentage of virus-positive *Bombus* sampled from flowers in the vicinity of Stationary Apiaries in Maine, Minnesota, and Washington. Samples were taken in July/August 2010. DWV = Deformed wing virus and BQCV = Black queen shared *Bombus* cell virus.

Apiary and Species		Single infection	Single infection	Dual infection
	n	DWV	BQCV	DWV + BQCV
MAINE				
<i>Bombus ternarius</i>	26	73.1	38.5	30.7
<i>Bombus vagans</i>	5	80.0	40.0	20.0
<i>Bombus</i> spp.	8	87.5	62.5	62.5
Mean		79.4	43.6	35.9
MINNESOTA				
<i>Bombus bimaculatus</i>	5	20.0	40.0	20.0
<i>Bombus impatiens</i>	7	85.7	85.7	71.4
<i>Bombus vagans</i>	5	80.0	100	80.0
Mean		64.7	76.5	58.8
WASHINGTON				
<i>Bombus mixtus</i>	11	81.8	90.9	72.7
<i>Bombus</i> spp.	18	72.2	94.4	72.2
Mean		75.9	93.1	72.5



pathogen spill-over?





Amy Campbell