

An aerial photograph of the San Juan Islands. The water is a deep blue, and the islands are covered in dense green forest. In the foreground, a small white boat with a dark hull is moving across the water, leaving a white wake. In the background, a range of mountains is visible, with the highest peaks covered in snow under a clear blue sky.

The changing
ecology of
DISEASE
in the San
Juan Islands

The Vashon
glaciation wiped
our ecological
slate clean 20
thousand years
ago...

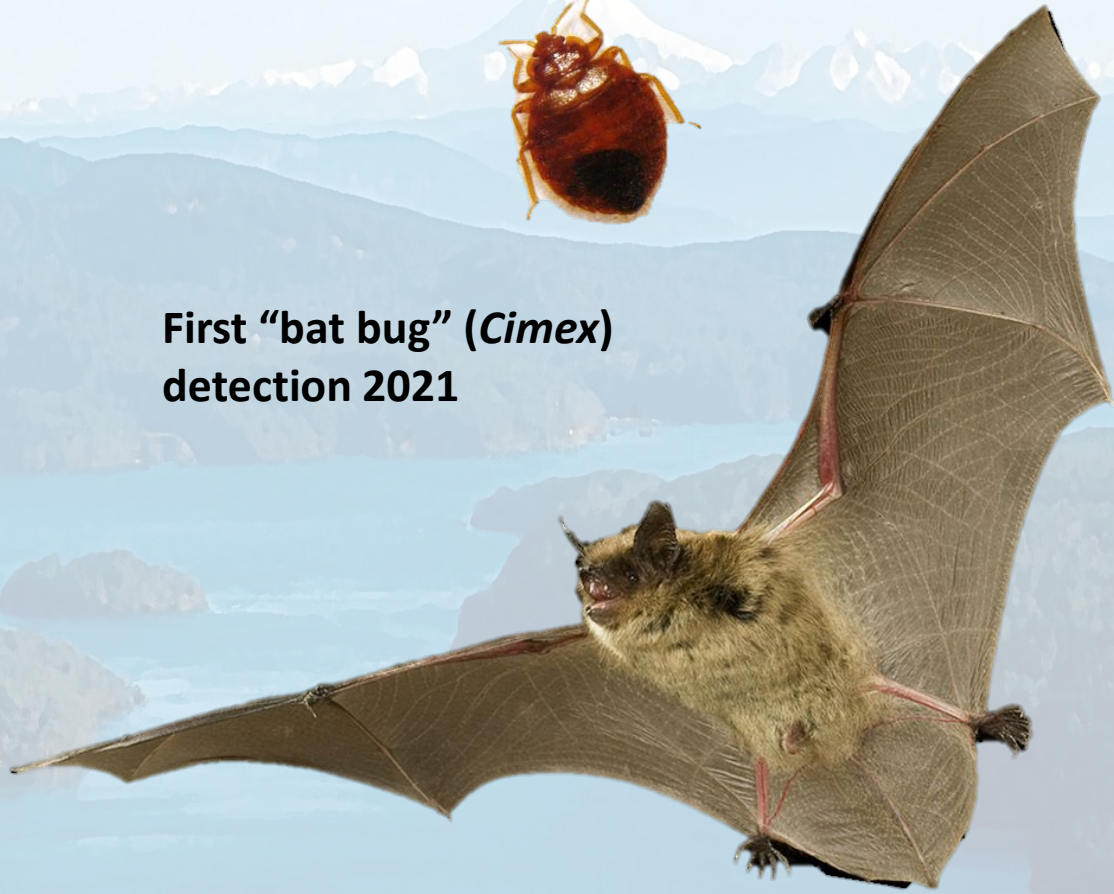


All plants and animals including their pathogens had to swim, fly, or float here (or be brought here by people)



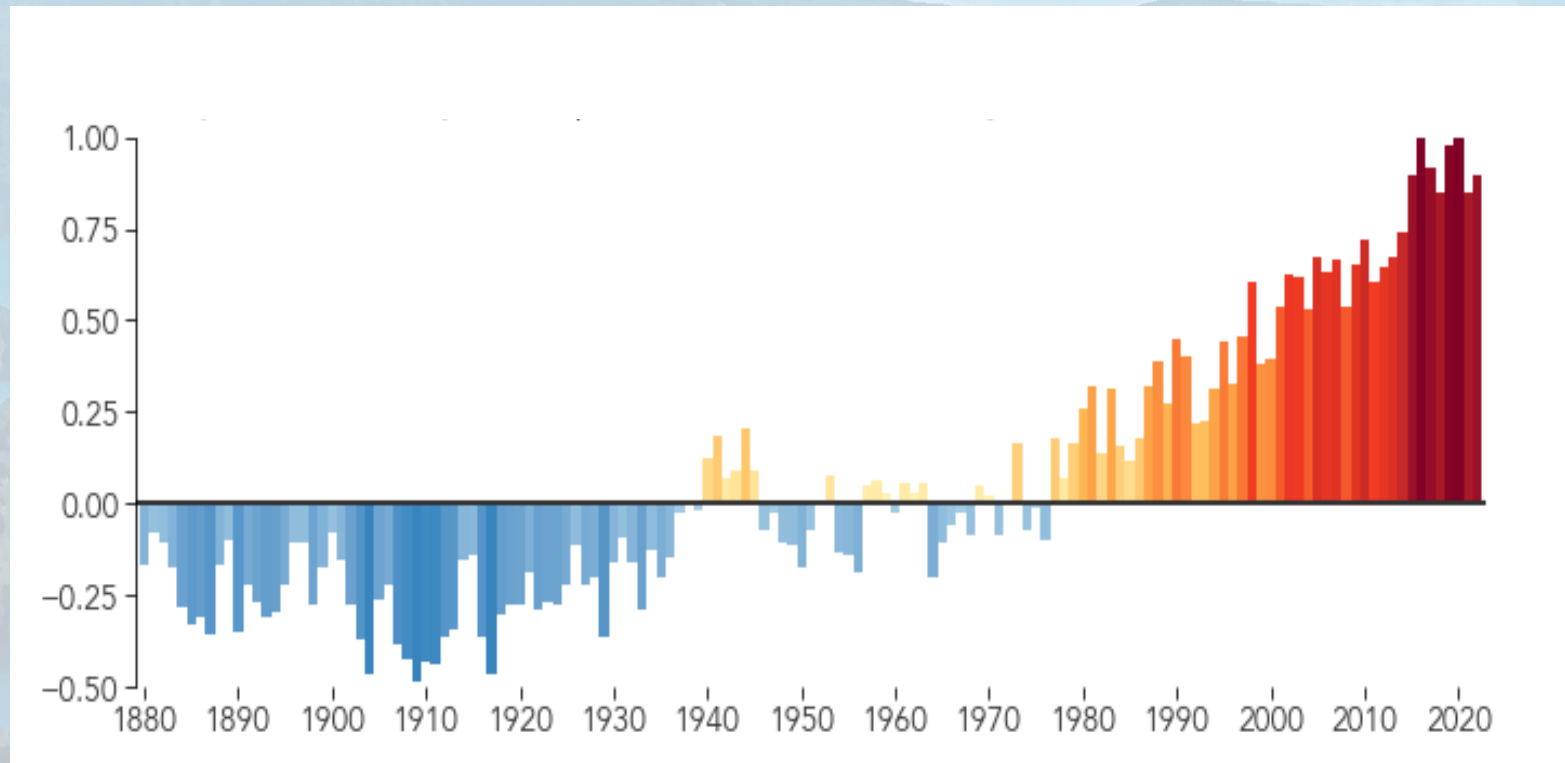
**New parasites
and diseases
continue to
colonize the
islands...**

**First “bat bug” (*Cimex*)
detection 2021**



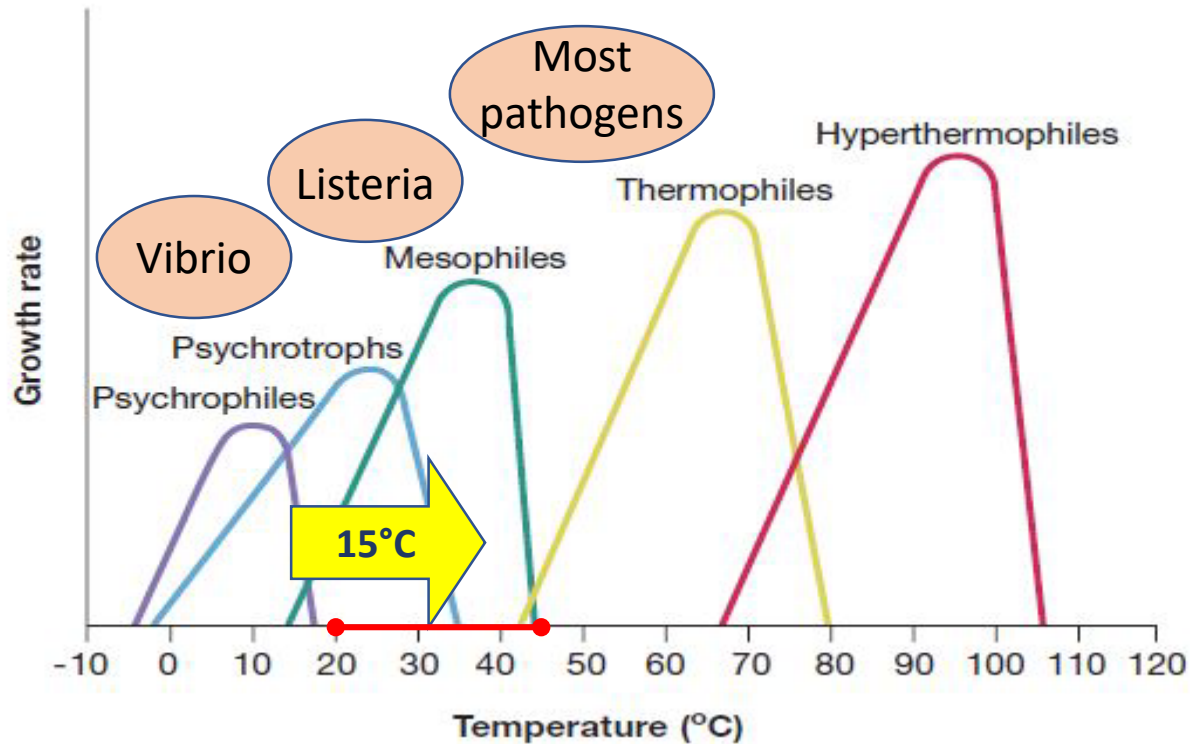
**First rabies detection
2023**

... facilitated by global warming

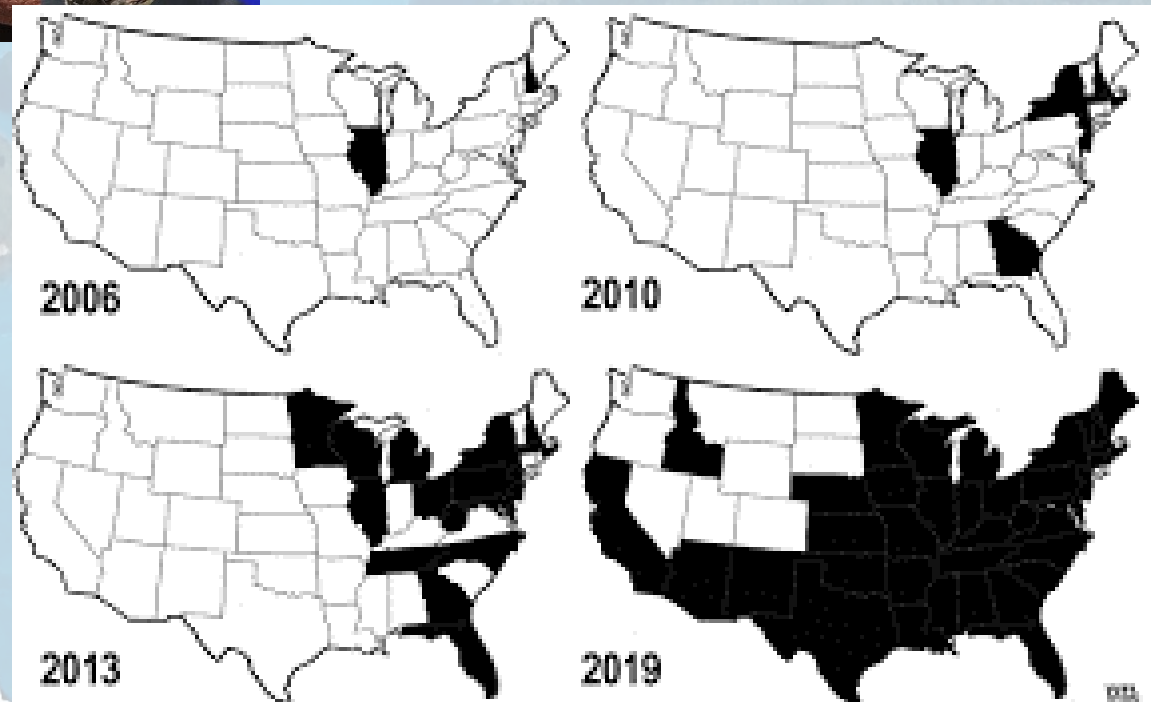
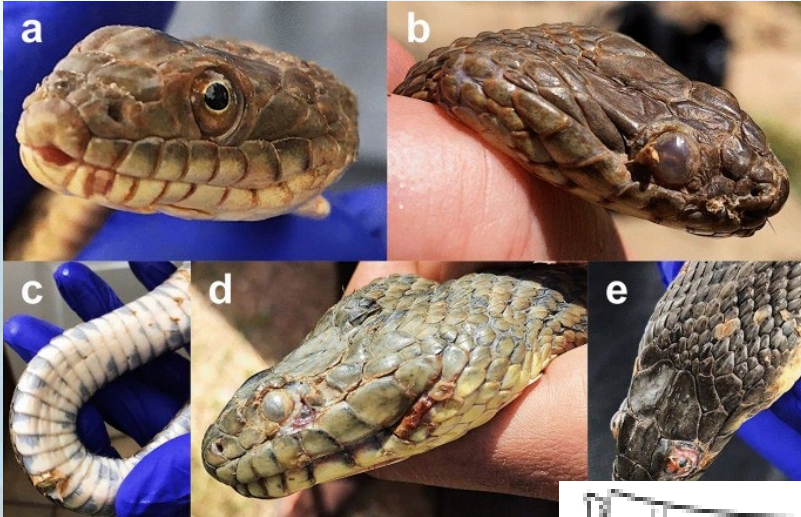


Source: NASA Earth Observatory

Infectious microbes thrive in warmer conditions

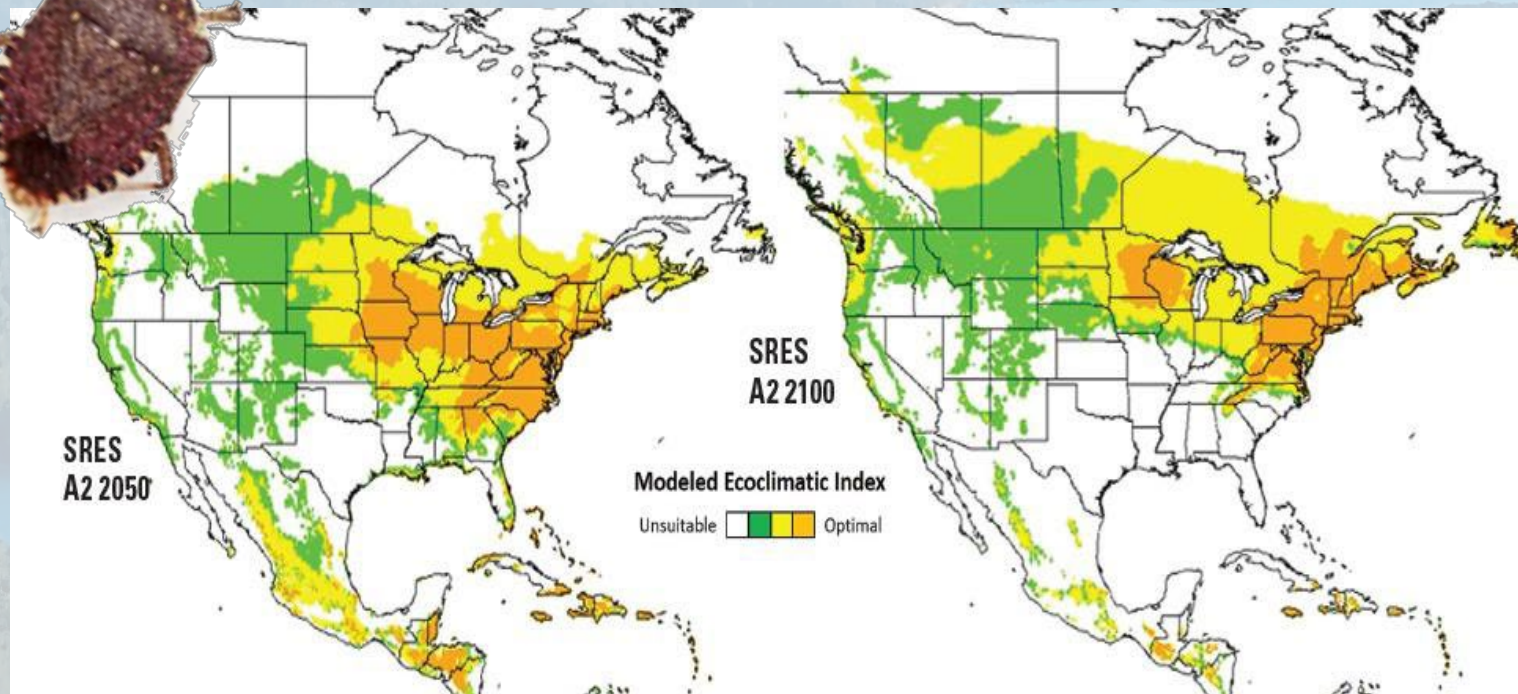
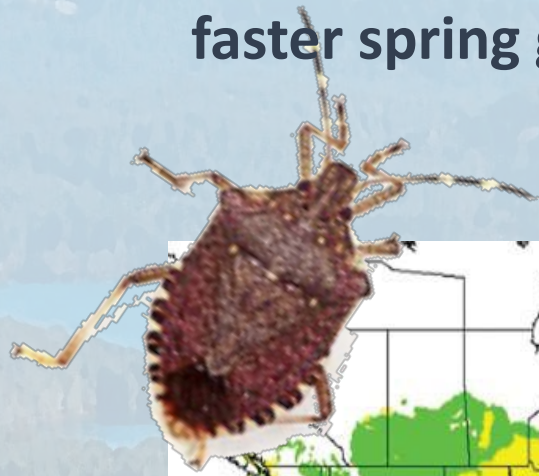


Spread of Ophidiomycosis (SFD)



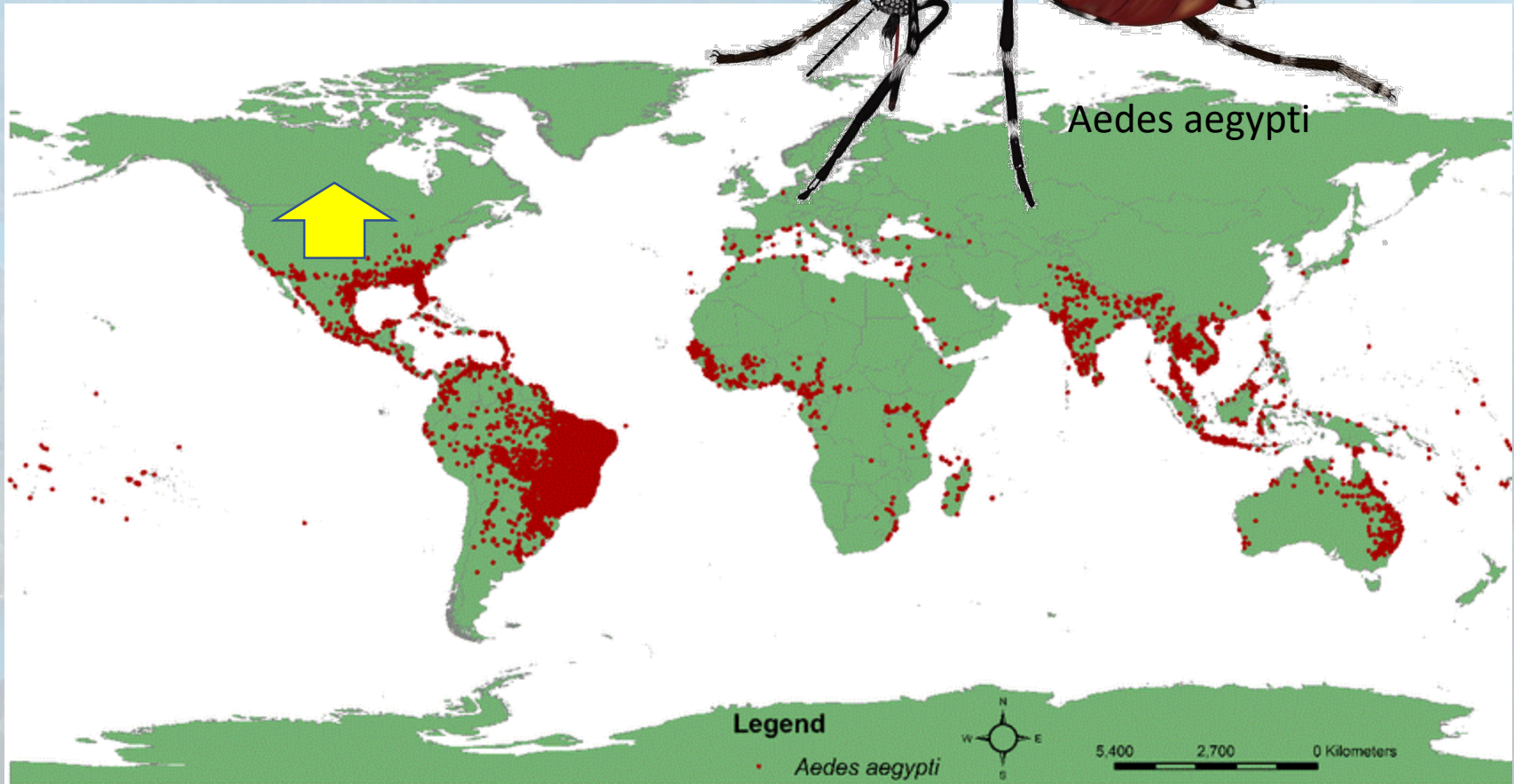
Source: M Allender 2019

For insects, milder winters mean increased winter survival, faster spring growth, and multiple summer generations



Projected range shifts of stinkbugs (*Halyomorpha halys*) Source: E. Kistner 2021

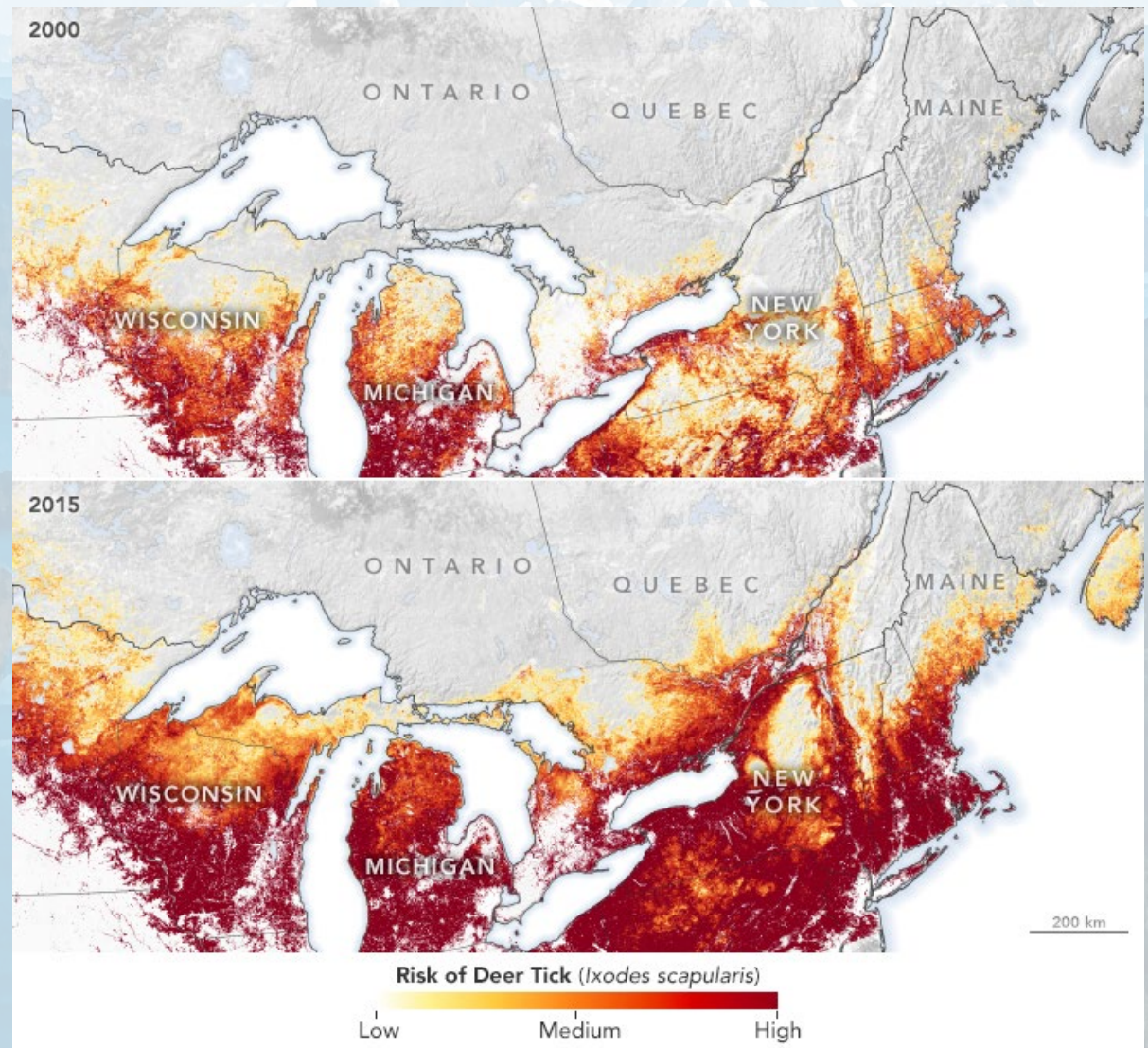
Animal vectors such as mosquitoes, ticks, & fleas are expanding northward



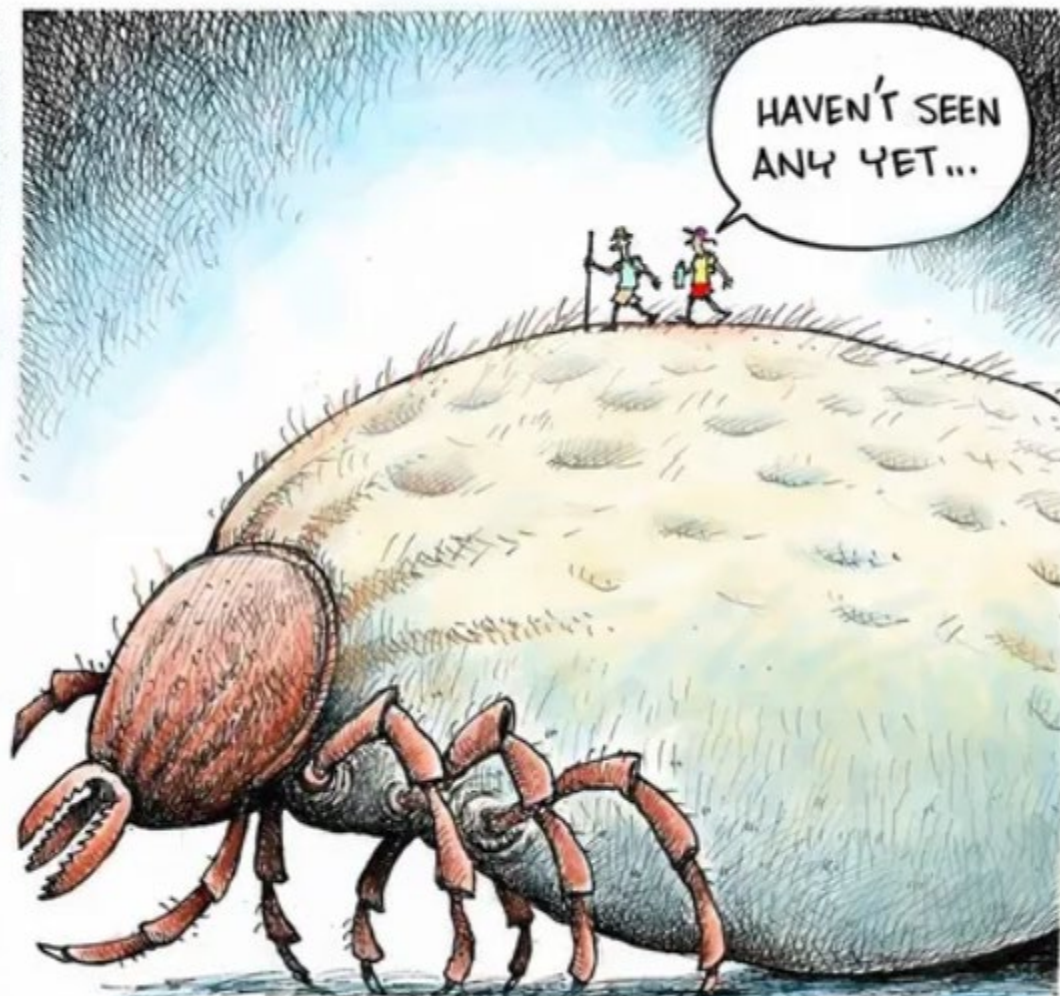
Distribution of the mosquito *Aedes aegypti*

Source: B Trewin 2018

**The northward
spread of Eastern
Deer Ticks and Lyme
Disease is an example**



Source: NASA Earth Observatory



How far can attached ticks travel?

Top land speed for horse-powered travel was 10-12 miles per hour (200/day)

In 1900, trains ran about 40 mph (960/day). Travel coast to coast took 4-6 days.

Today you can drive coast to coast in 52 hours. Or fly it in a little over 6 hours.





Ixodes pacificus

Western Blacklegged Tick
Male



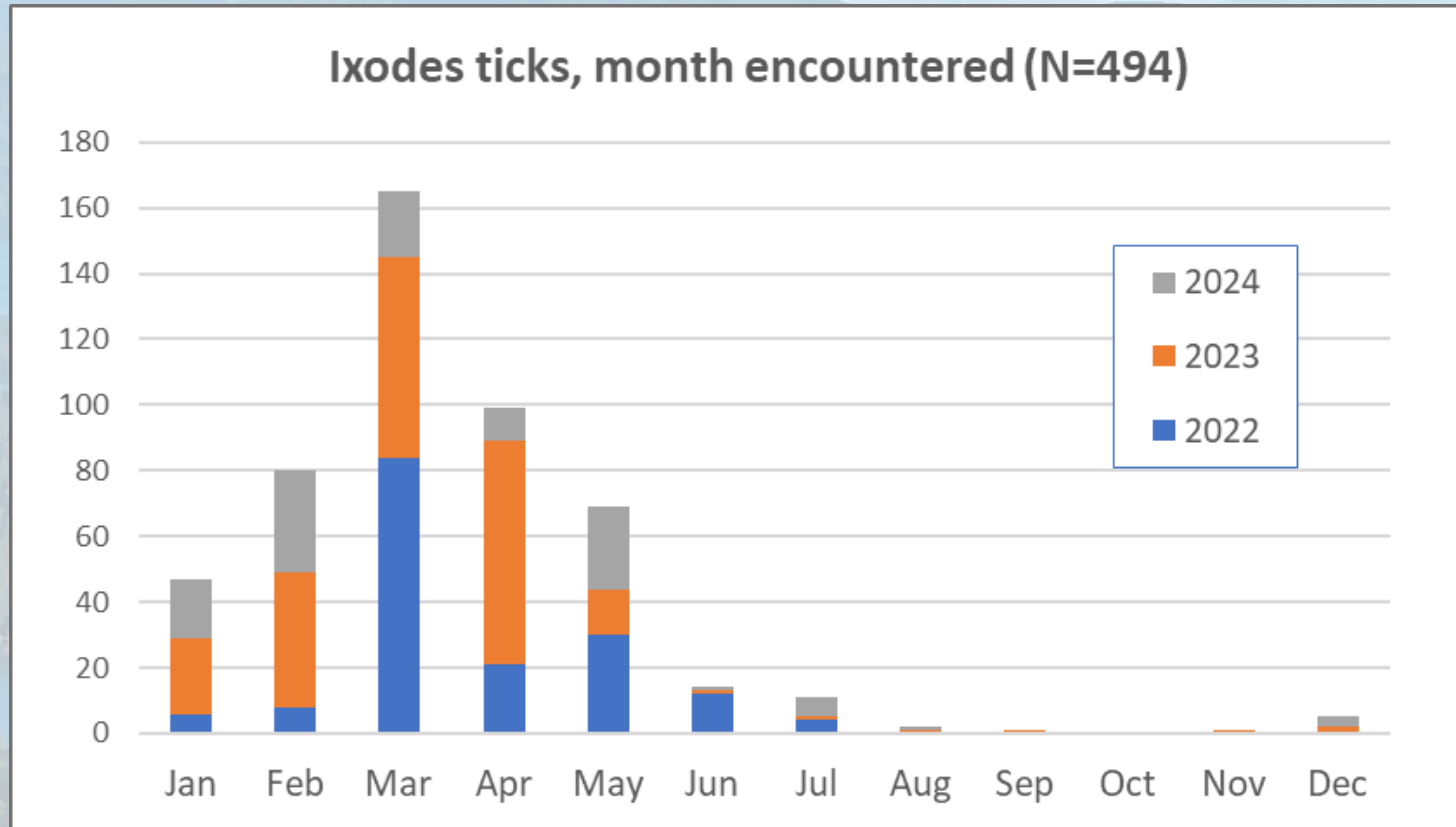
Engorged Female

KWIAHT launched a community call for tick specimens removed from people and pets in 2021. Nearly 600 have been inventoried thus far.



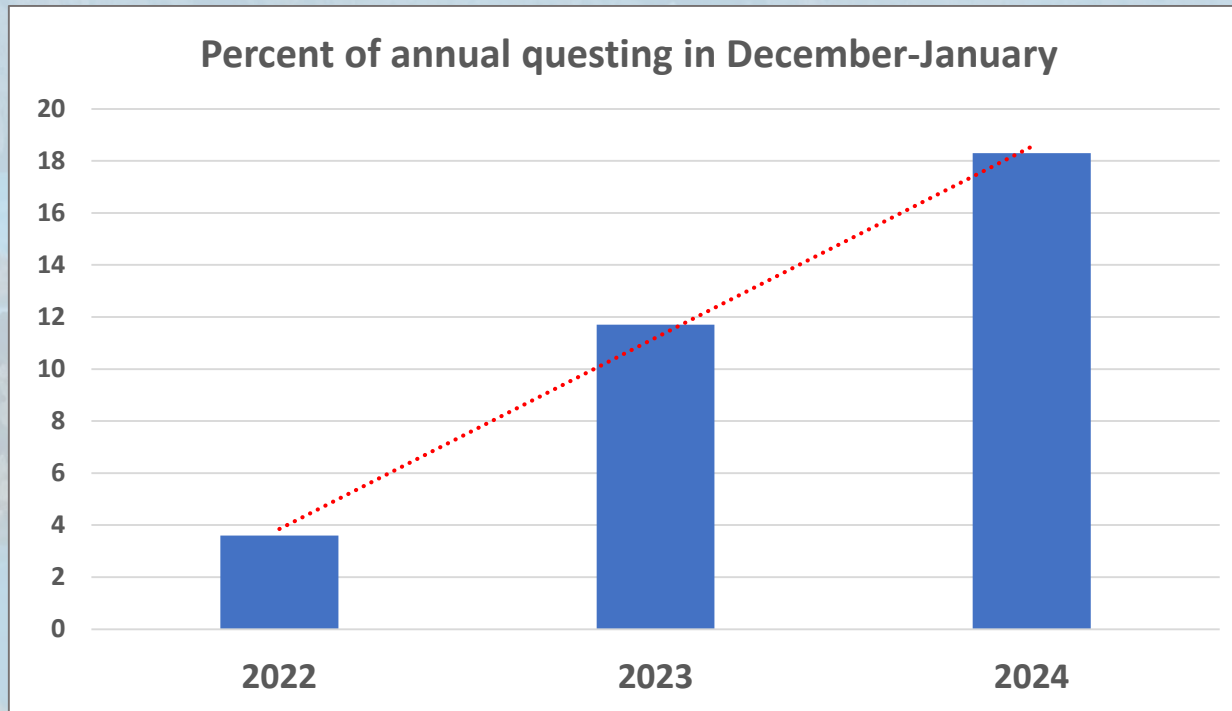
We also conducted small-mammal trapping and “dragging” to sample ticks directly from the environment—with little success, at first.

When do they bite (questing)?



Questing in the islands peaks in early spring rather than summer

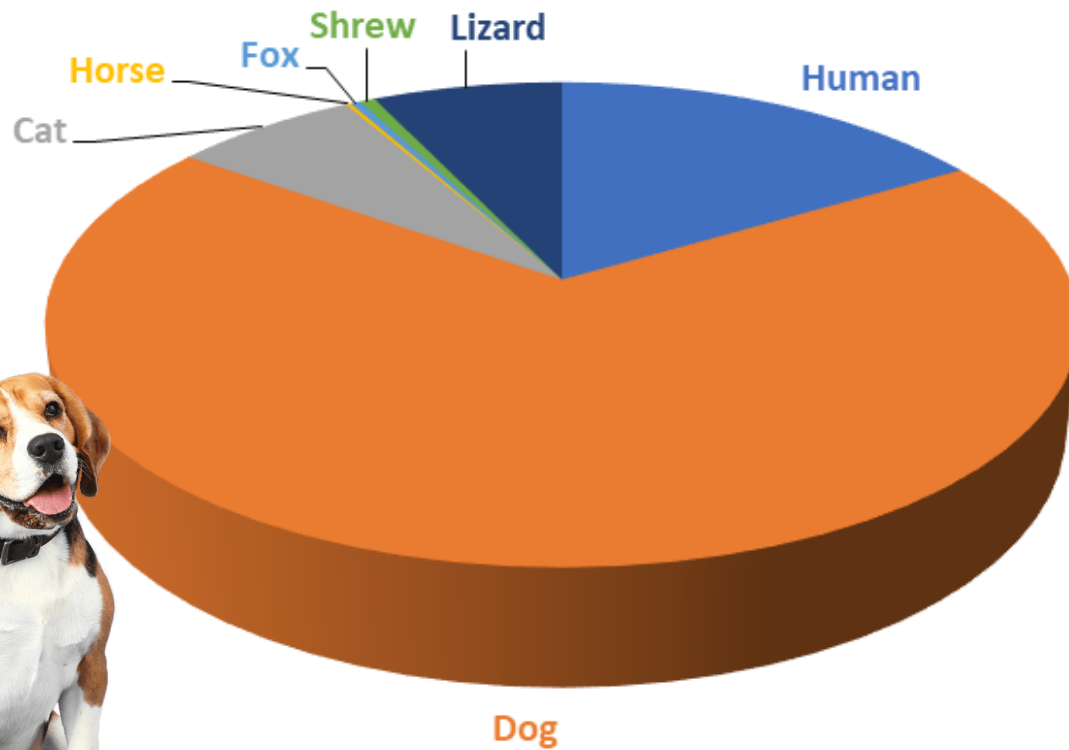
When do they bite – shifting phenology?



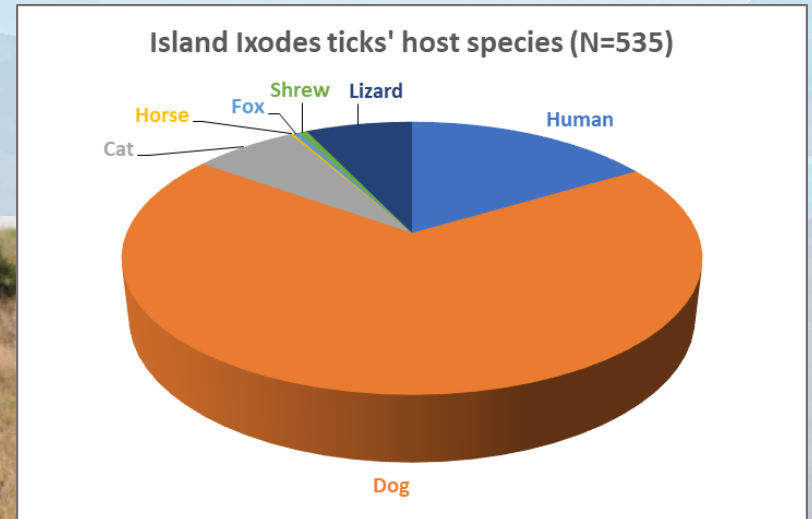
Questing in the islands is shifting earlier due to warmer winters

Who do they bite?

Island Ixodes ticks' host species (N=535)

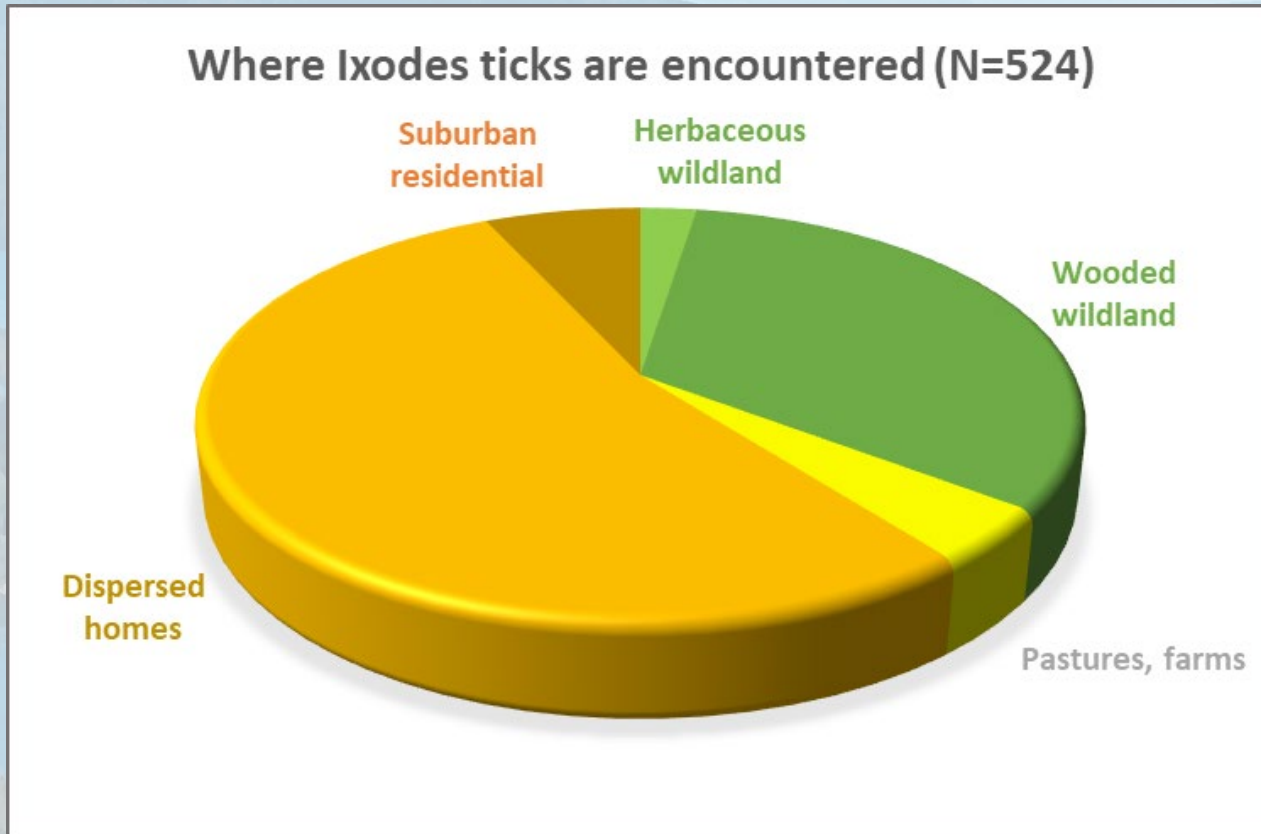


Who do they bite – dispersal agents



Domestic dogs accompanying people are probably the main dispersal agent to, and within the islands.

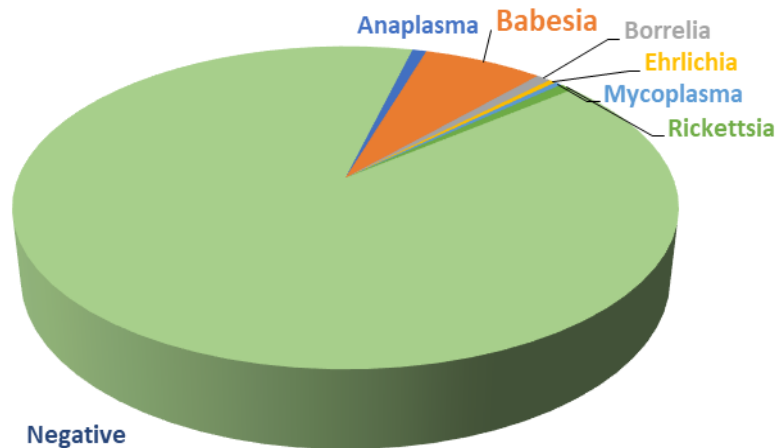
Where do they bite (habitat types)?



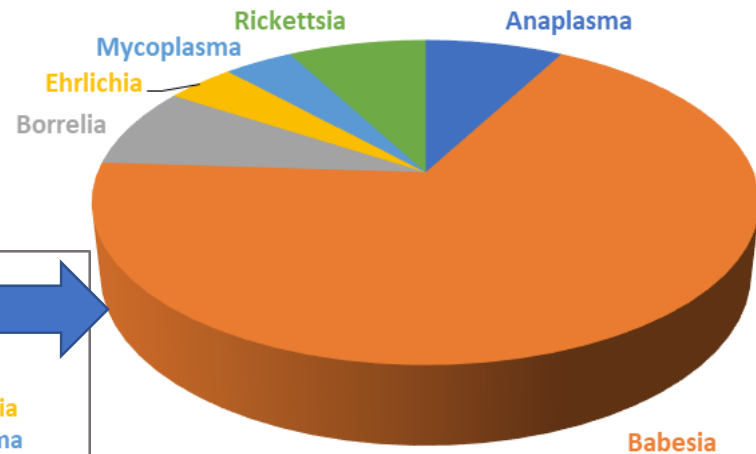
Island ticks are somewhat more likely to be encountered around homes and gardens than wildlands or farms

Is their bite serious?

Pathogen test results (N=245 ticks)

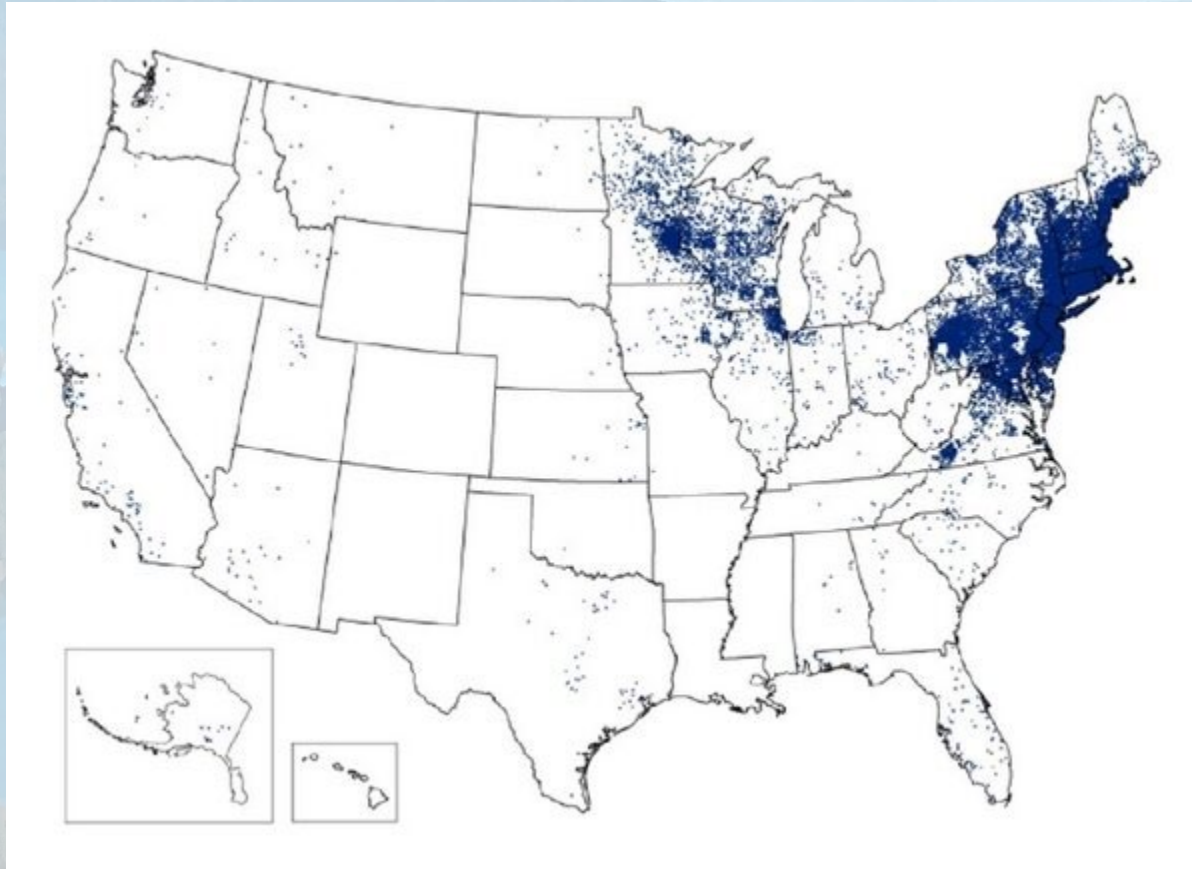


Pathogens/parasites detected

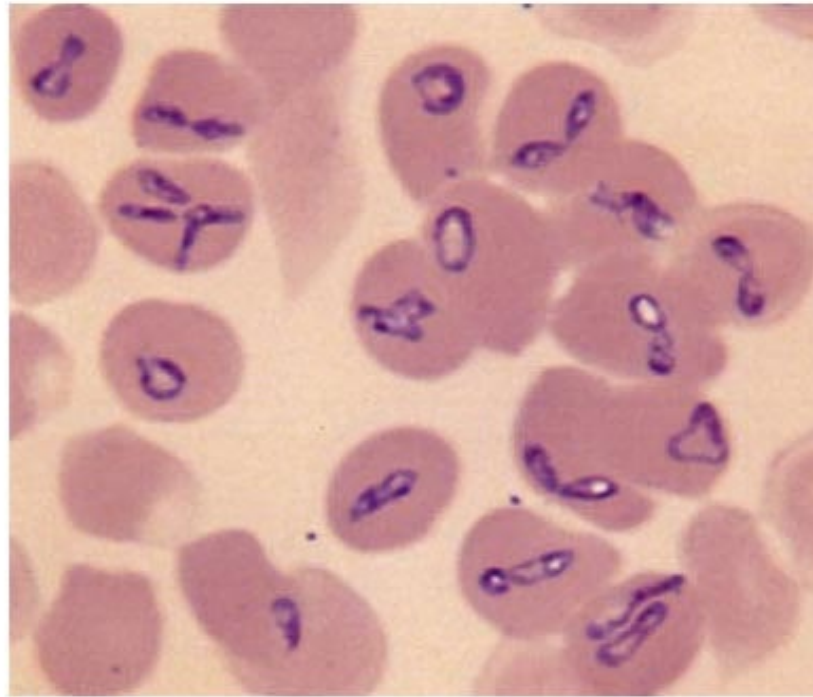


10% of island ticks host pathogens, mainly *Babesia*, a microparasite of red blood cells that can affect people as well as dogs

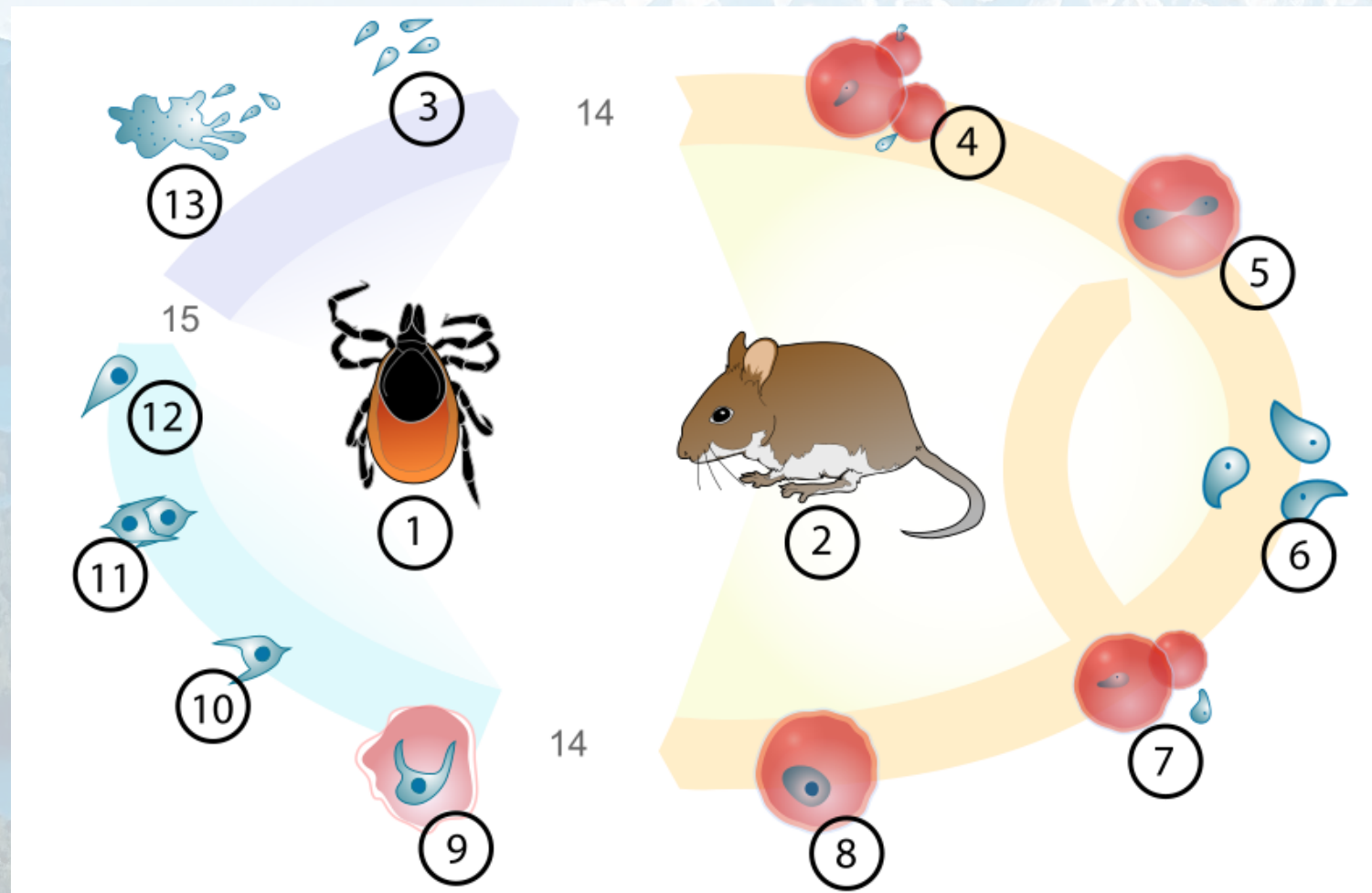
Babesiosis is an emerging disease mainly in the East-Midwest



Knapp & Rice (2015) Journal of Parasitology Research

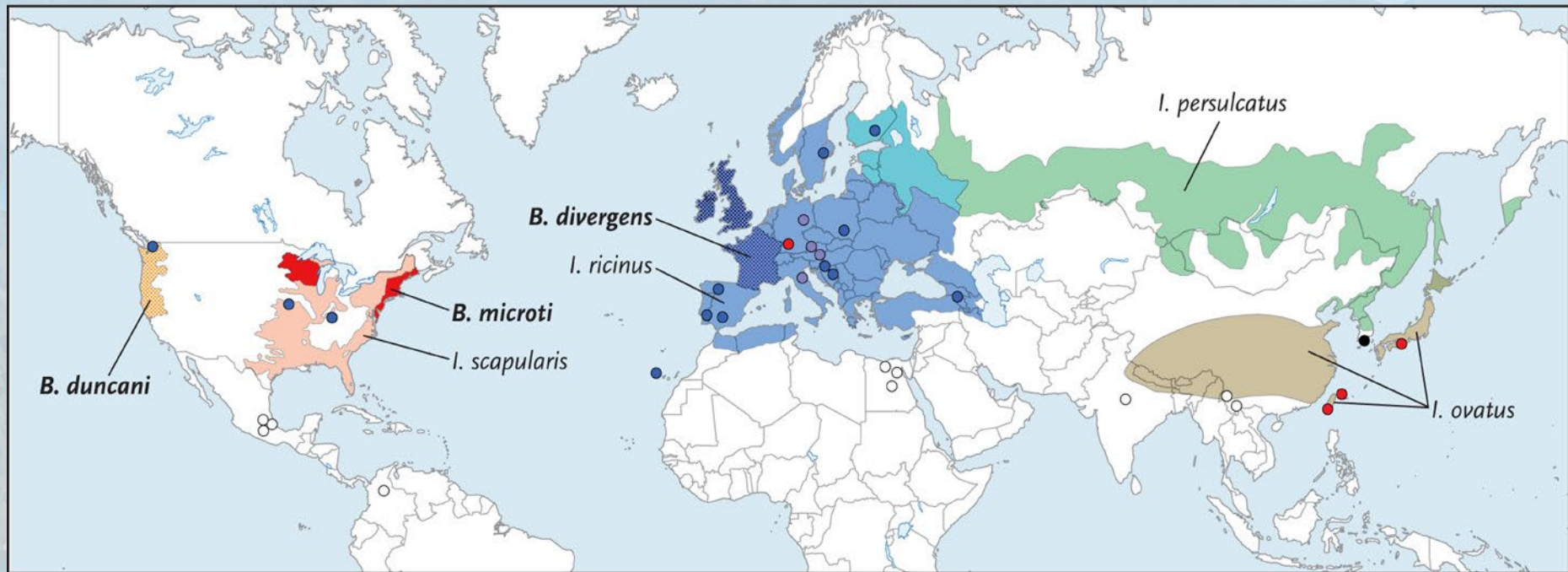


Eastern Babesia species cause persistent Lyme-like symptoms



And depend on mice, voles or other small rodents as reservoirs

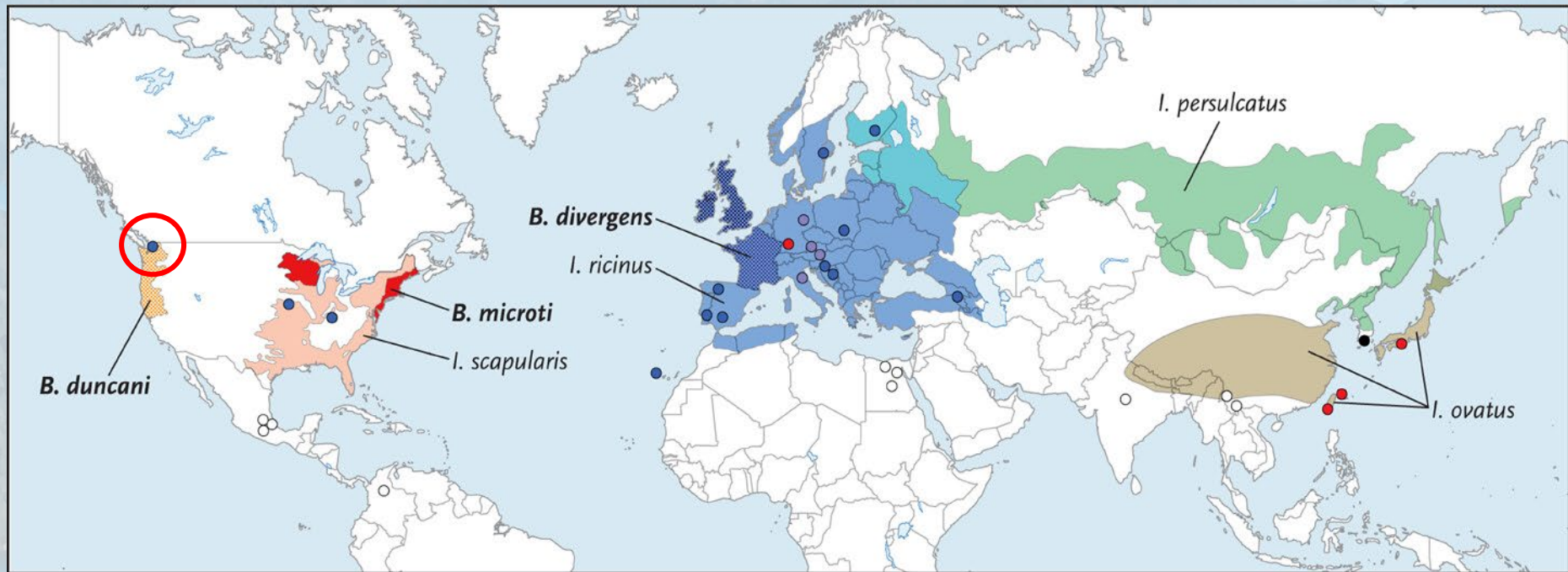
Global distribution of infectious *Babesia* species



Karshima et al 2021, Veterinary Parasitology

***Babesia microti* is spread by Eastern Blacklegged ticks,
Babesia duncani by Western Blacklegged ticks**

Global distribution of infectious *Babesia* species

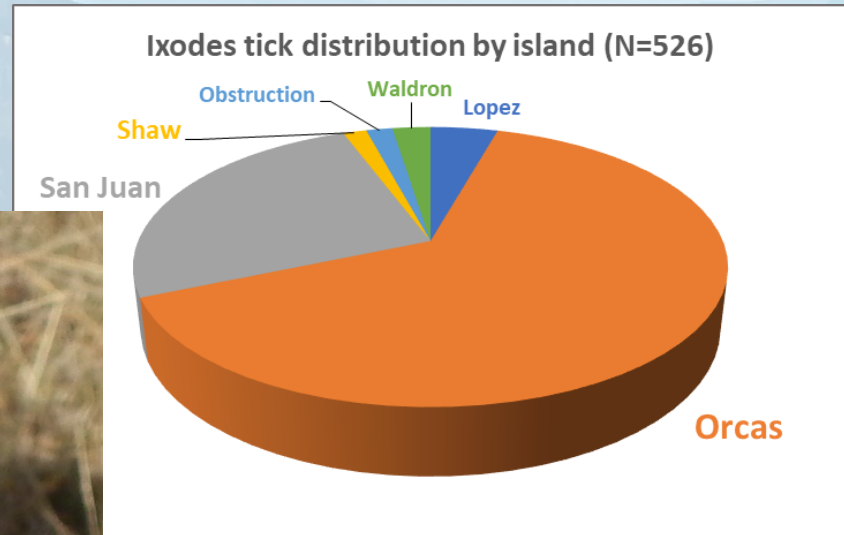


Karshima et al 2021, Veterinary Parasitology

We are seeing novel Babesia species in Western Blacklegged ticks

What is the local reservoir in the islands?

Northern Alligator Lizard
Elgaria coerulea



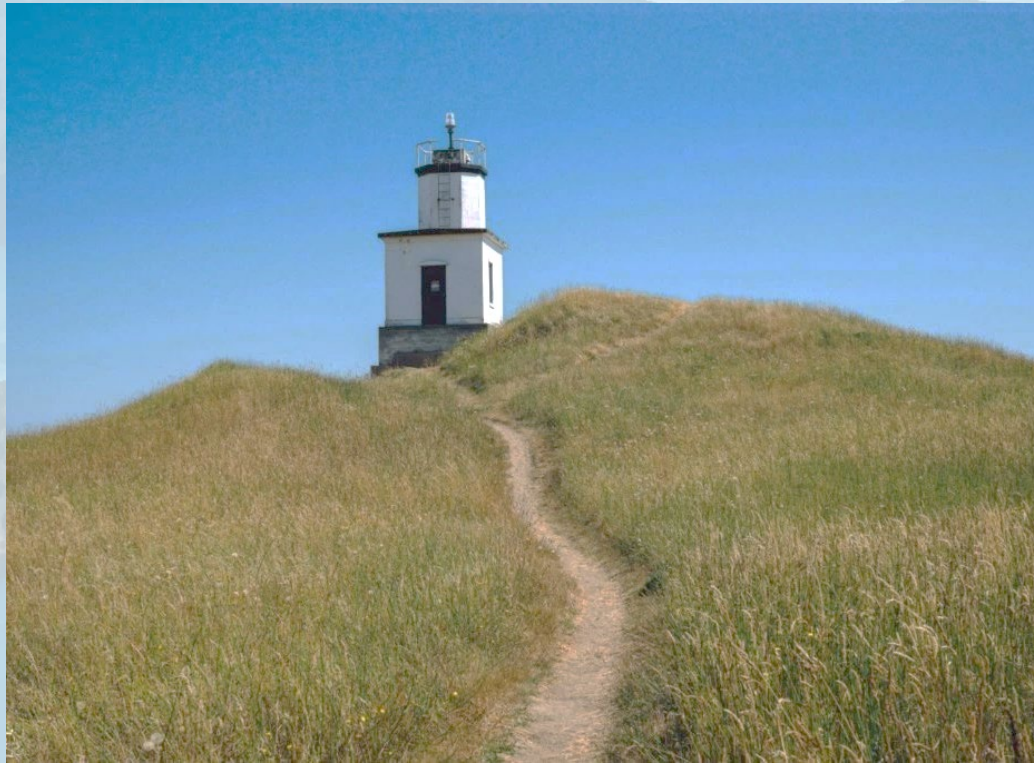
Alligator Lizards may be the explanation. They can host as many as 14 ticks at a time, mainly nymphs, and appear to play a role in island tick ecology



***Ixodes pacificus*
collected 2021-2024,
by island**

**Ixodan ticks are scarce
where Alligator Lizards
are absent**

Cattle Point case study



Domestic dogs can exchange ticks and pathogens with wildlife

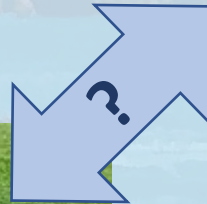
TICKS

Anaplasma

Mycoplasma

Ehrlichia

Babesia



Canine Distemper

Viral, saliva



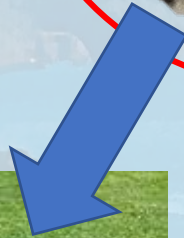
Baylisacaris

Fecal contact



Leptospirosis

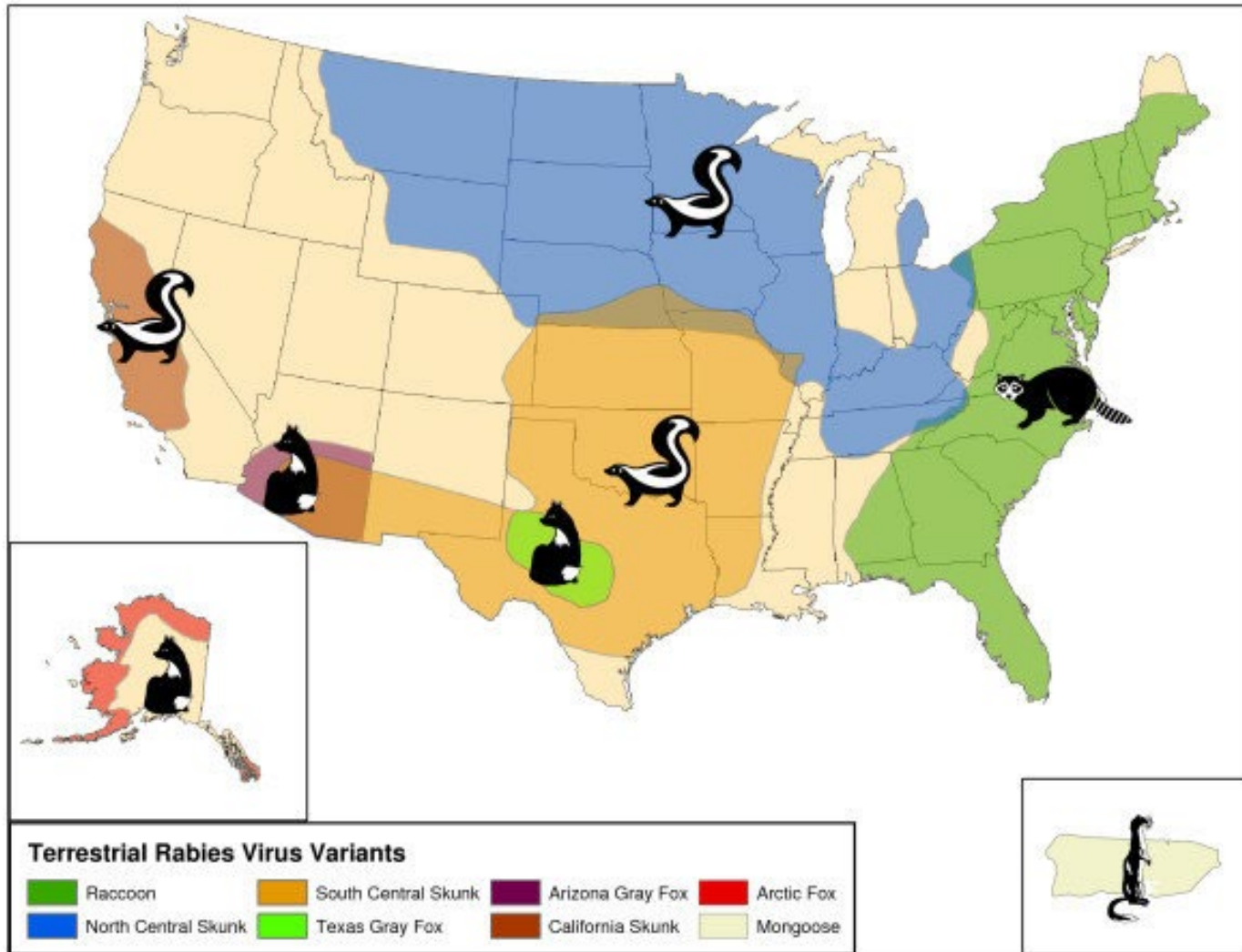
Bacteria in urine



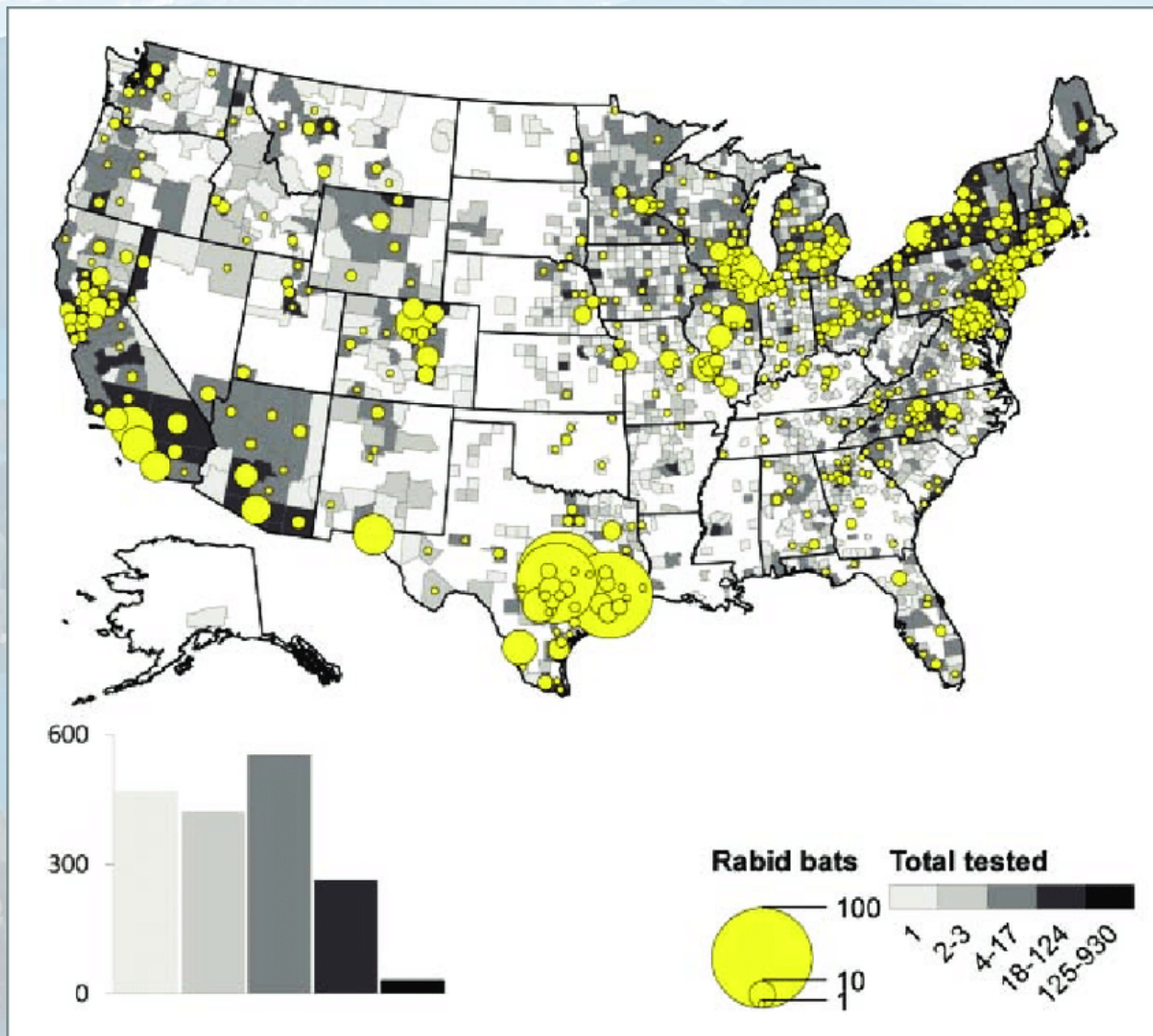
“Takeaway” messages

- **Vaccinate dogs early and fully**
- **Check dogs frequently for ticks (and fleas)**
- **Do not leave food or water bowls outdoors**
- **Do not allow dogs to roam freely off-leash**
- **Do not allow dogs to interact with racoons or foxes, or to investigate their dens, or investigate rabbit warrens**
- **Keep dogs off fecal matter that may come from racoons or foxes. Cover fecal matter with soil.**
- **Do not attract racoons or foxes to your home by feeding them**
- **Be cautious with pet cats, too. Vaccinate and keep indoors, in “cacios” or other secure spaces.**

Rabies: principal reservoirs



Rabies and bats



Rabies and bats



In the last five years, only 4.7% of bats tested in WA were rabies-positive; 24.5% of the positives were from King County.



Rabies symptoms appear in bats about 2 weeks after exposure. It is 100% fatal.

Bats share rabies when grooming and infected bat colonies collapse quickly. This is a barrier to spread of rabies in geographic areas that tend to have small bat colonies of hundreds, rather than thousands of bats.

The probability that any particular bat is infected is far less than 1%.

Acknowledgments

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Fred Hutchinson Cancer Center

Orcas Island Community Foundation
San Juan Island Community Foundation

San Juan Islands National Historical Park
San Juan Islands National Monument
San Juan County Land Bank

and

More than a hundred Islanders that collected ticks