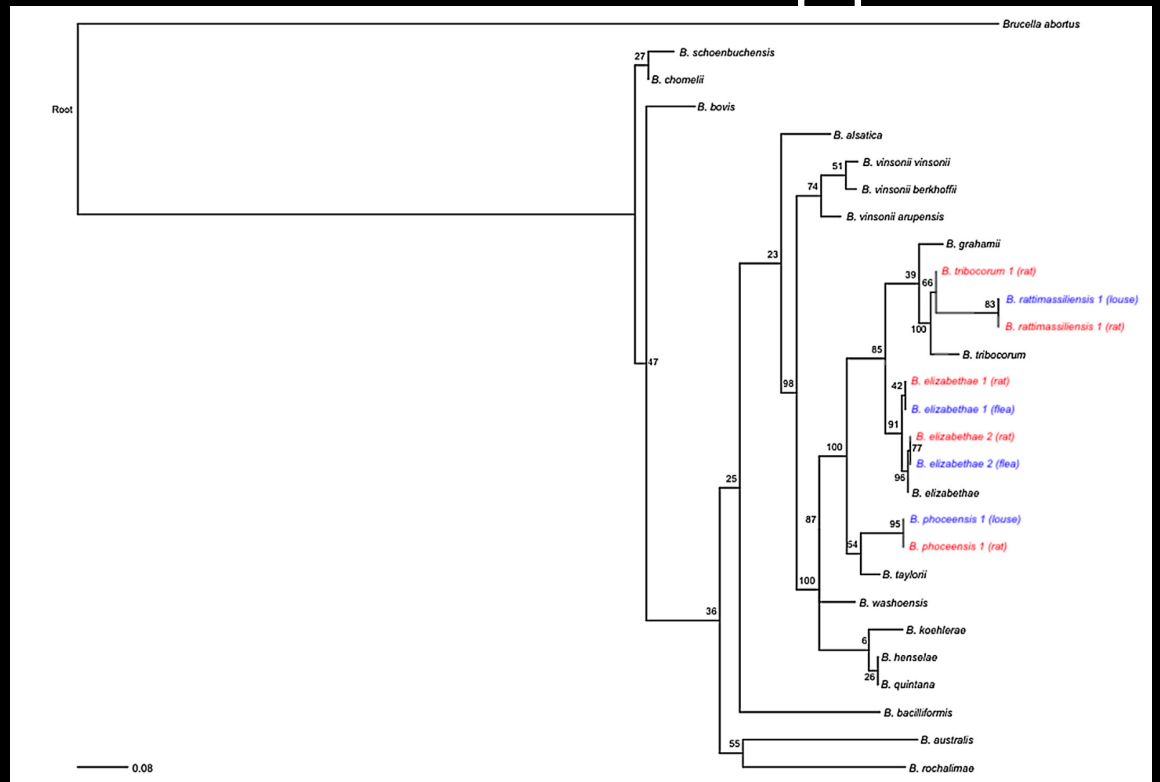
# Transmission dynamics and host-parasite-vector relationships in rodent-borne *Bartonella* spp.

- **Statistical Question:** Is the occurrence of a given species of flea on Malagasy *R. rattus* related to (a) the rest of the ectoparasite community infesting the rat and/or (b) the locality in which the rat is trapped?
- **Mechanistic Question:** How can we explain the prevalence of different serotypes of *Bartonella* spp. by age class in Malagasy *Rattus rattus?*
- **Acknowledgements:** Jess and Christian (readers); Amy (presentation)

*Cara Brook, UC Berkeley*




Epidemics

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Elucidating transmission dynamics and host-parasite-vector relationships for rodent-borne *Bartonella* spp. in Madagascar

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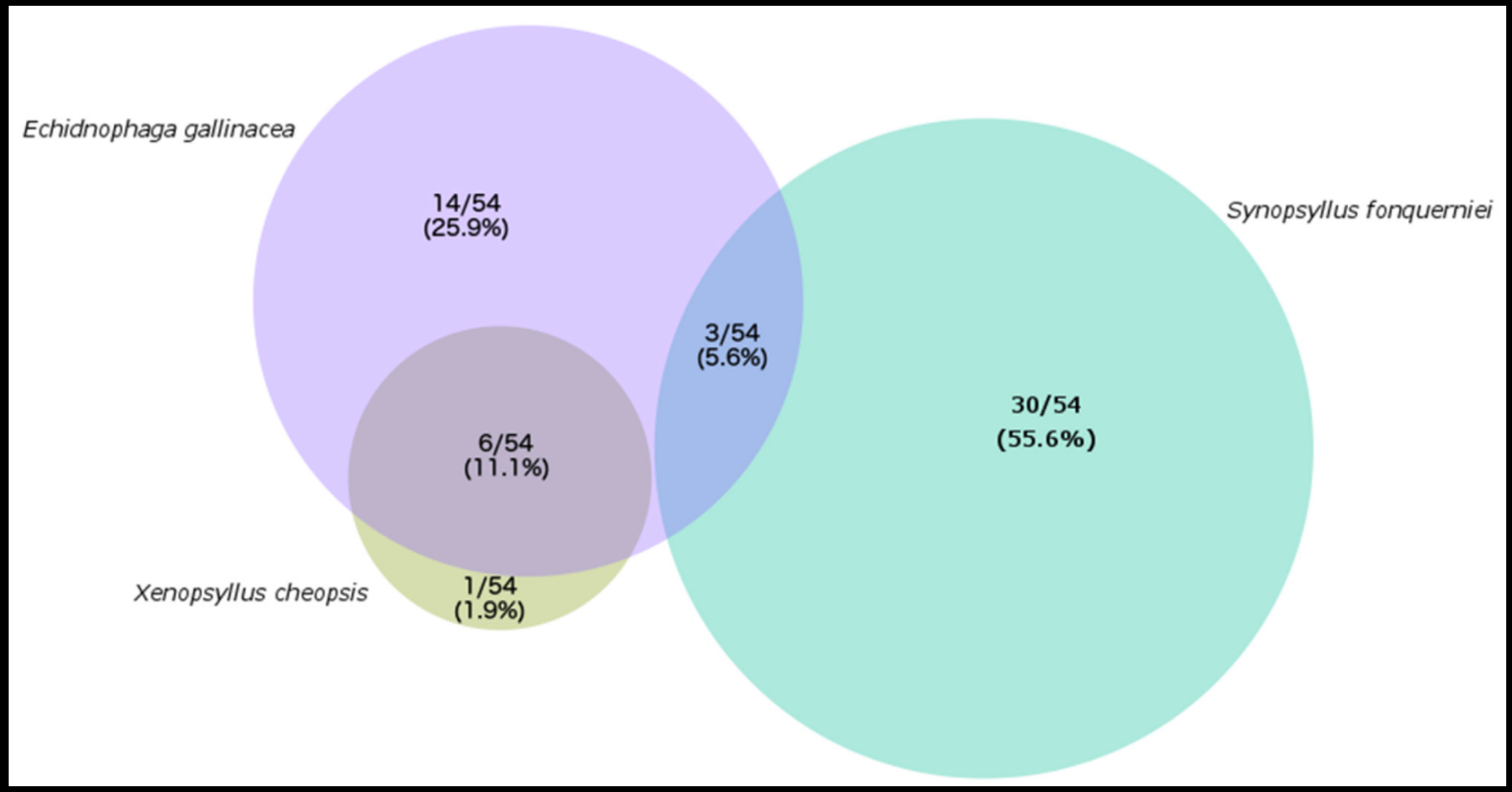
## Statistical Question:

Is the occurrence of a given species of flea on Malagasy *R. rattus* related to (a) the locality in which the rat is trapped and/or (b) the rest of the ectoparasite community infesting the rat?

- **Response Variable:** pres/abs *S. fonquerniei*
- **Predictor Variables:** pres/abs of other two flea species (factor); inside/outside locality (factor)
- **Family:** "binomial"
- **Link:** logit
- **Hypothesis:** *S. fonquerniei* occurrence is related to absence of *X. cheopsis* & outdoor status of trapping locality
- **R code:**

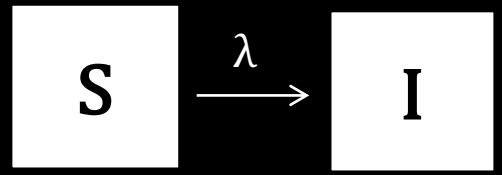



glm(pres/abs *S. fonquerniei* ~ pres/abs *X. cheopsis* + pres/abs *E. gallinacea* + inside/outside site, family="binomial", data = madarat)

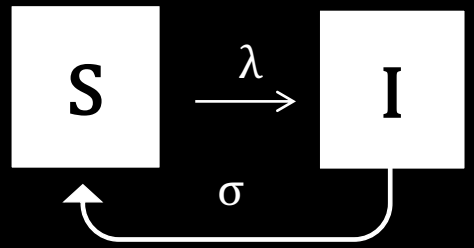
## Mechanistic Question:

How can we explain the prevalence of different serotypes of *Bartonella* spp. by age class in Malagasy *Rattus rattus?*

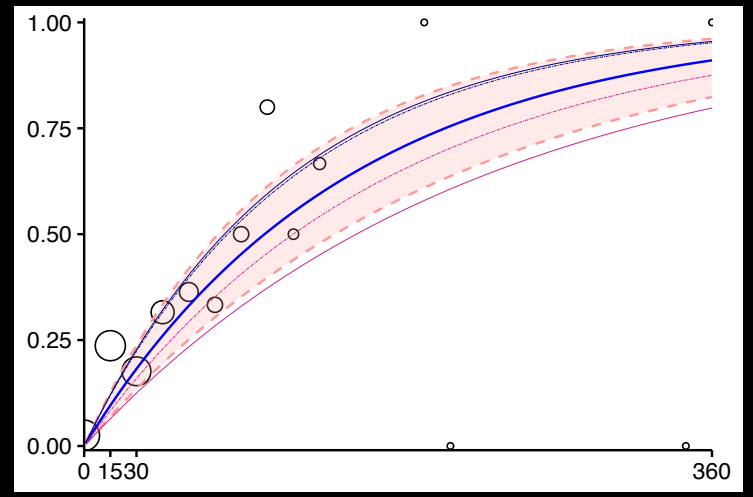
λ = force of infection;
σ = rate of waning immunity

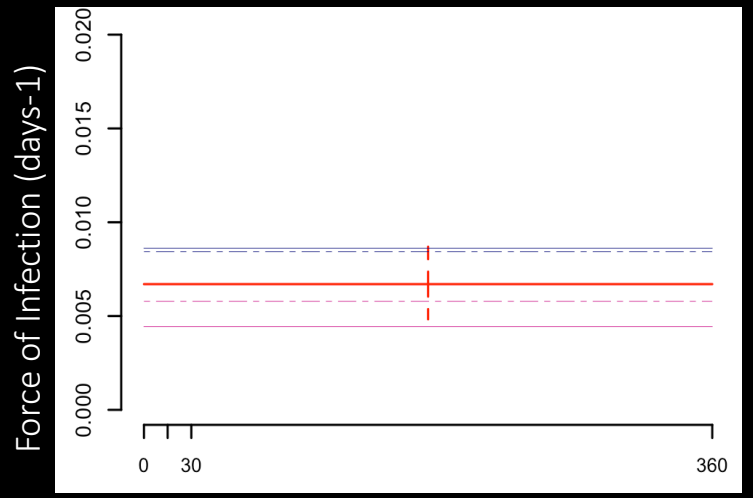


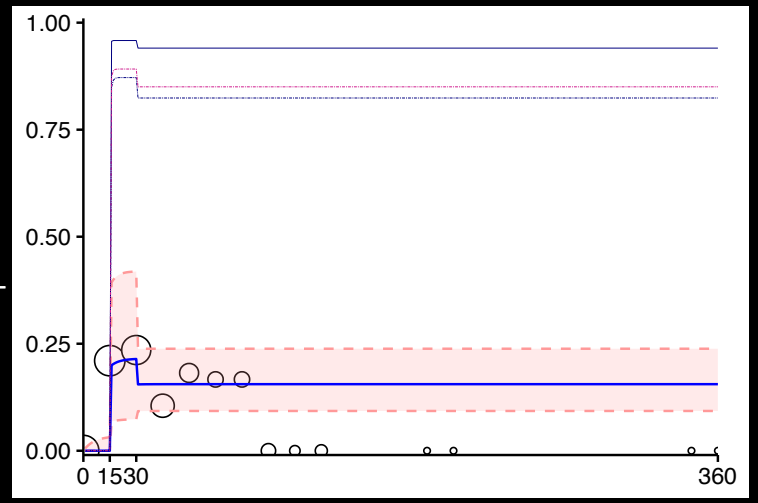

$$\frac{dI(a)}{da} = \lambda(a)\left(1 - I(a)\right)$$

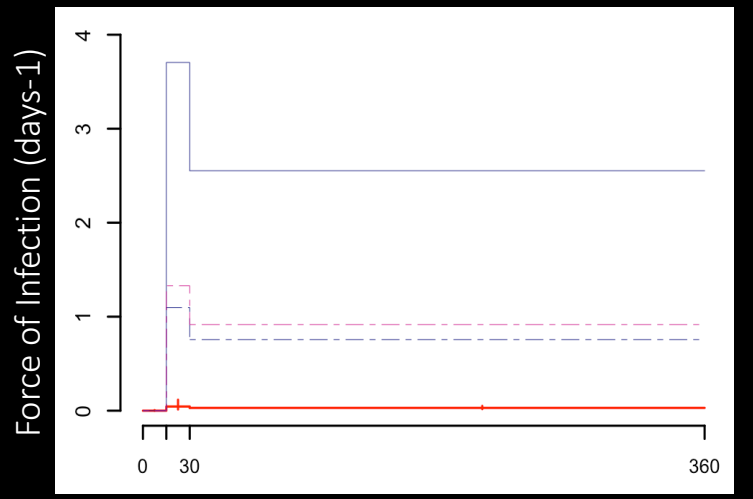



$$\frac{dI(a)}{da} = \lambda(a)\left(1 - I(a)\right) - \sigma I(a)$$



# Next Steps:

1. Conduct further field studies in lowland regions of Madagascar to determine whether the distribution of *B. elizabethae* is limited to the highland range of *S. fonquerniei*
2. Conduct more thorough sampling of *R. rattus* ectoparasite community to augment data suggesting that *Polyplax sp.* lice may serve as a vector for *B. phoceensis*
3. Conduct serological tests on *R. rattus* blood to attempt to identify a whether *Bartonella* spp. negative rats are recovered or susceptible.
4. Fit relevant mechanistic transmission models to age-seroprevalence data.