

Taming the wild: the effects of captivity on the gut microbiome of wild animals



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Photo: R. Brucker



Editorial

Conservation and the Microbiome

April 2012

K.H. Redford, J.A. Segre, N. Salafsky, C. Martinez del Rio, D. McAloose

Outline

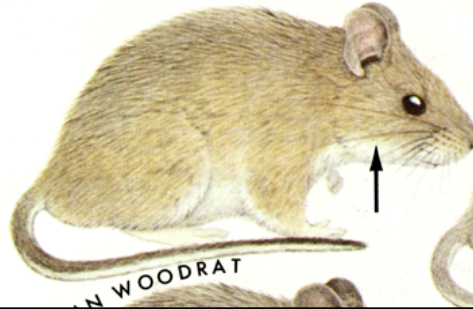
- How does entering captivity alter the microbiota of herbivorous rodents?
- What are the sources of gut microbes in captive-reared amphibians?

Outline

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Woodrats (*Neotoma*)

WHITETHROAT WOODRAT



DESERT WOODRAT



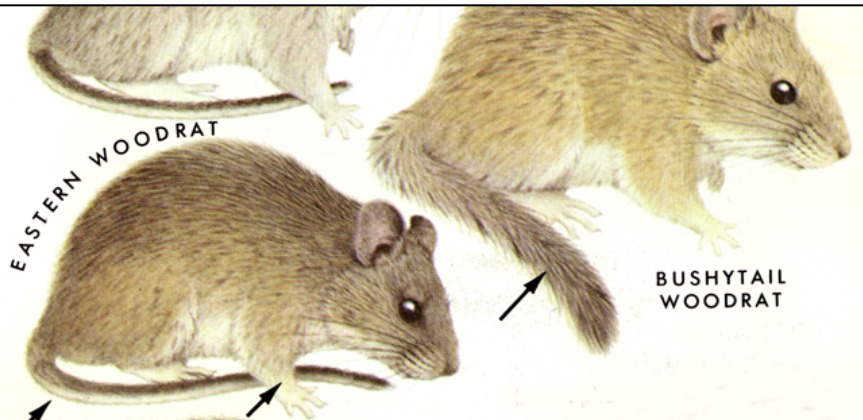
ECOLOGY LETTERS

Ecology Letters, (2014)

doi: 10.1111/ele.12329

LETTER

Gut microbes of mammalian herbivores facilitate intake of plant toxins





Questions

- How does captivity alter the gut microbiota?
- Does feeding on a natural diet restore the natural microbiota?
- How is the microbiota transmitted from mothers to offspring in captivity?



Specialization



N. albigula

Generalist

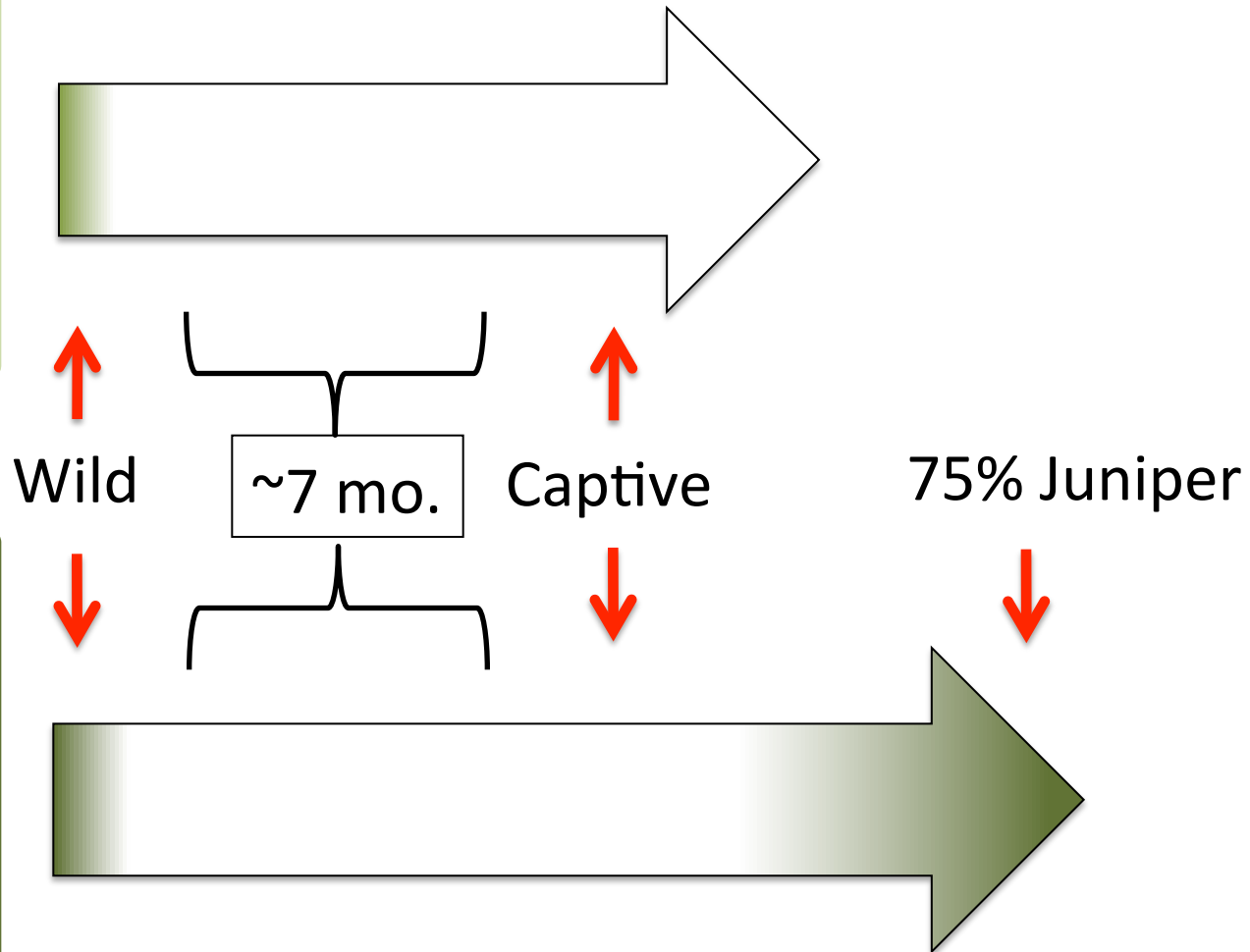


N. stephensi

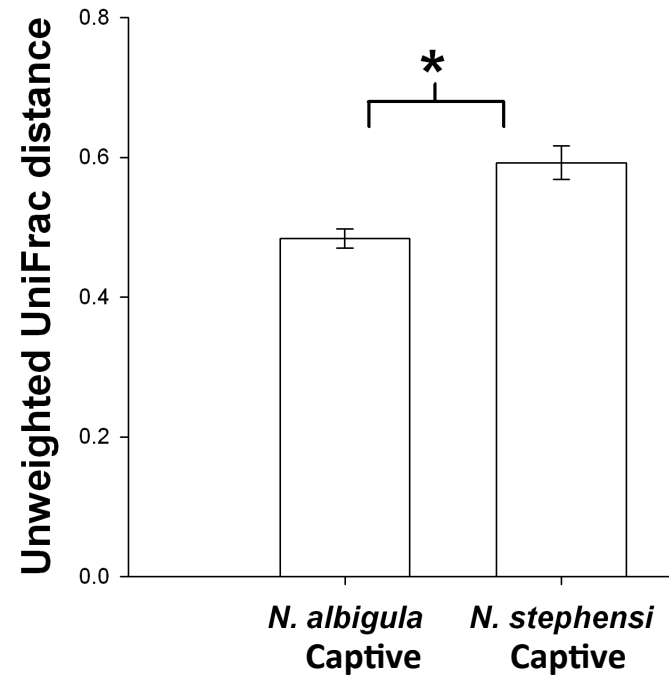
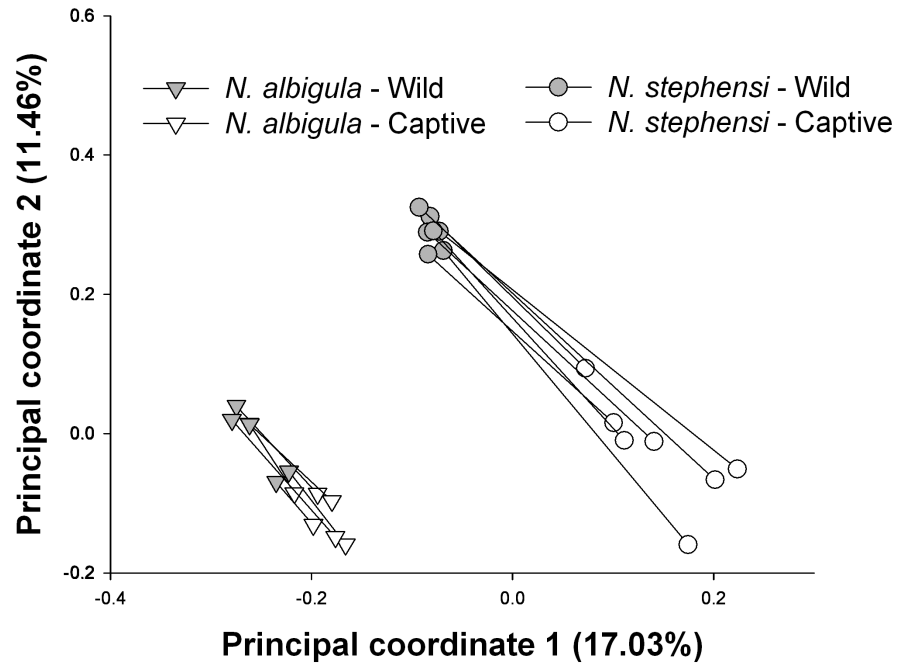
Specialist

65-95% Juniper

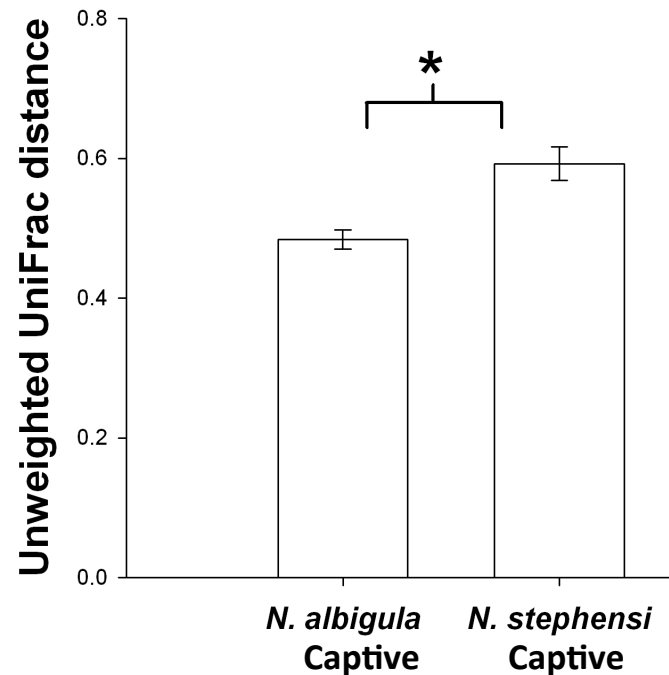
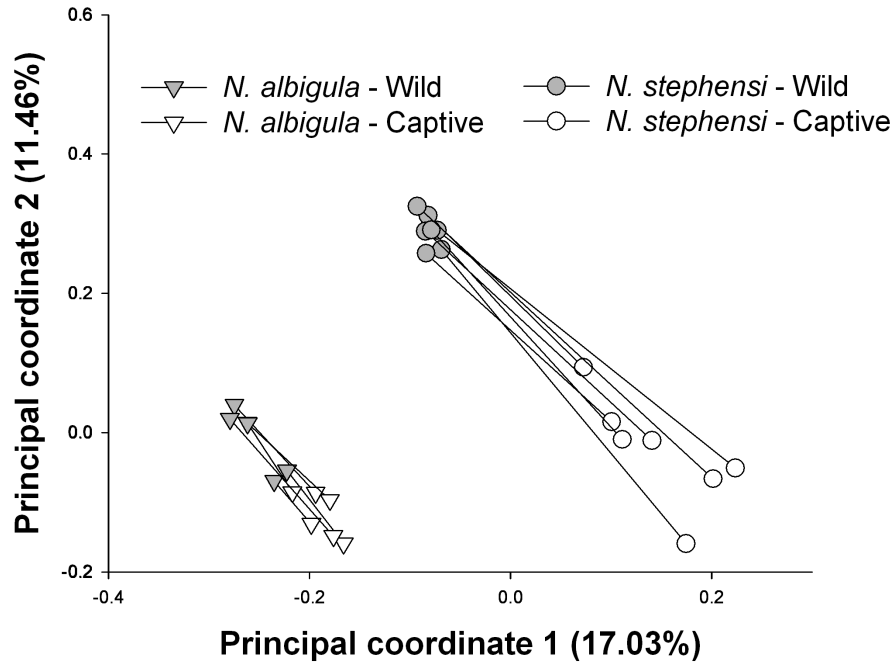
Microbial Inventories



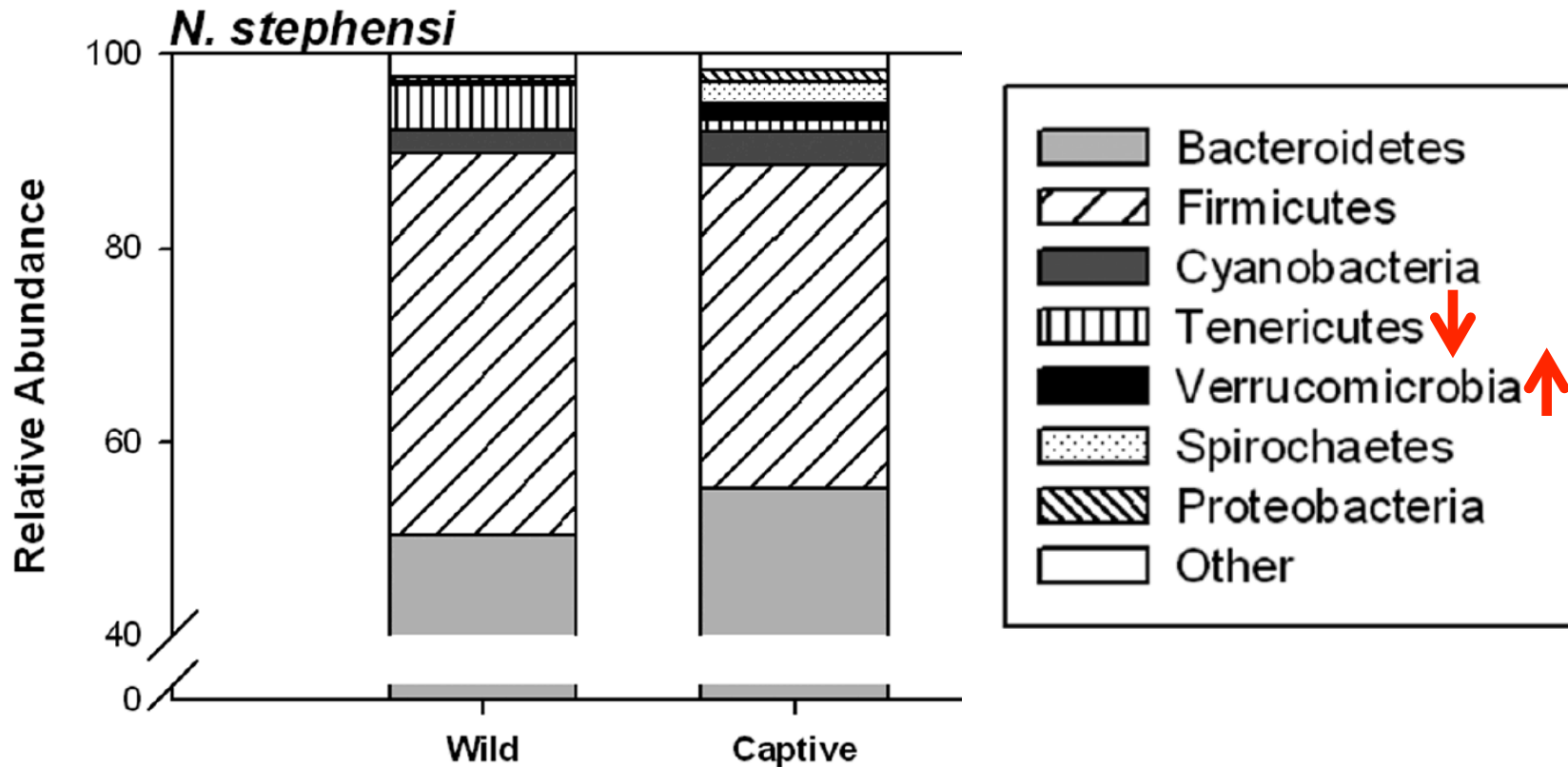
Loss of microbial diversity varies between hosts



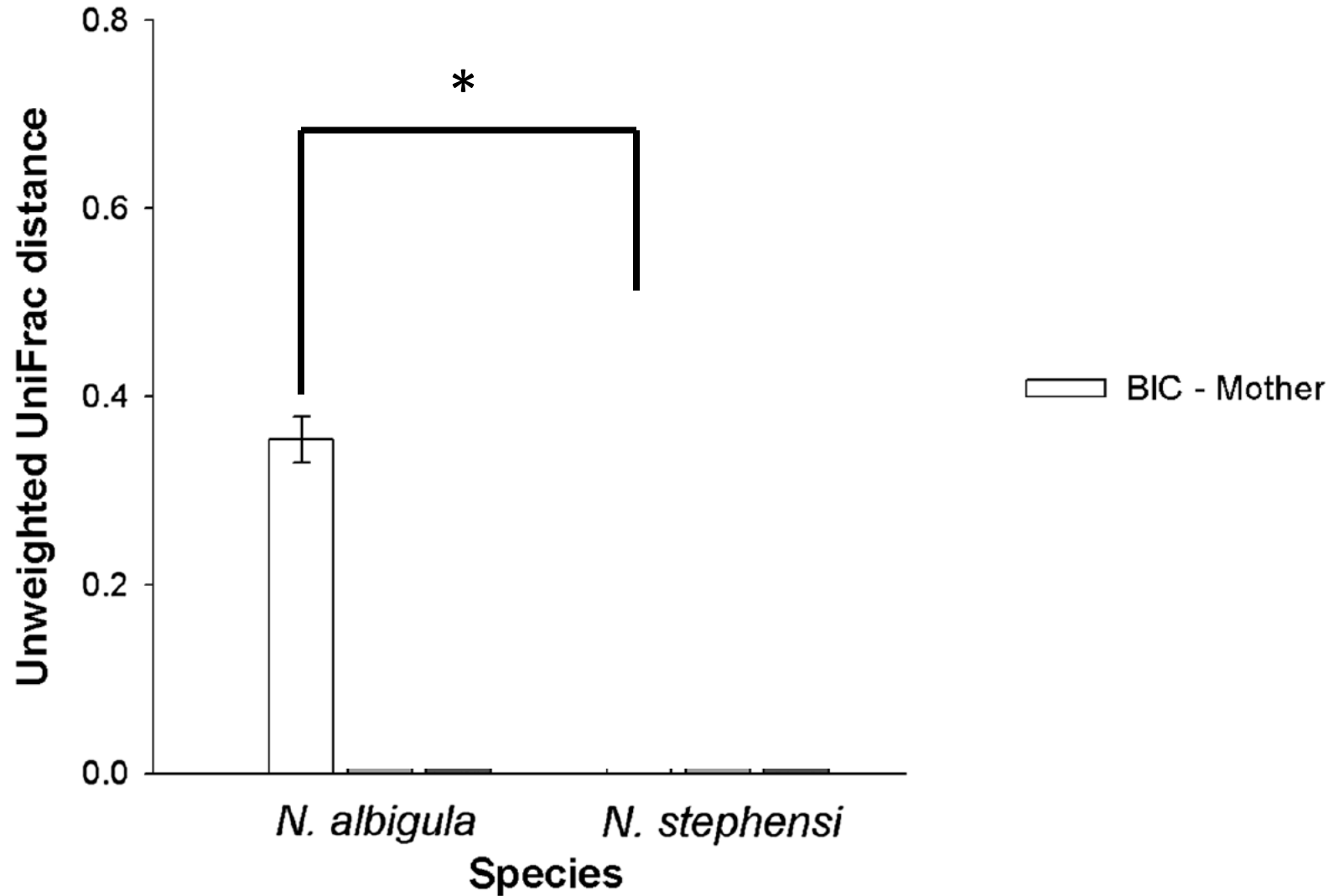
Diversity is not recovered when animals are returned to natural diet



Captivity changes relative abundances of microbial taxa



Maternal transmission of microbes differs between hosts



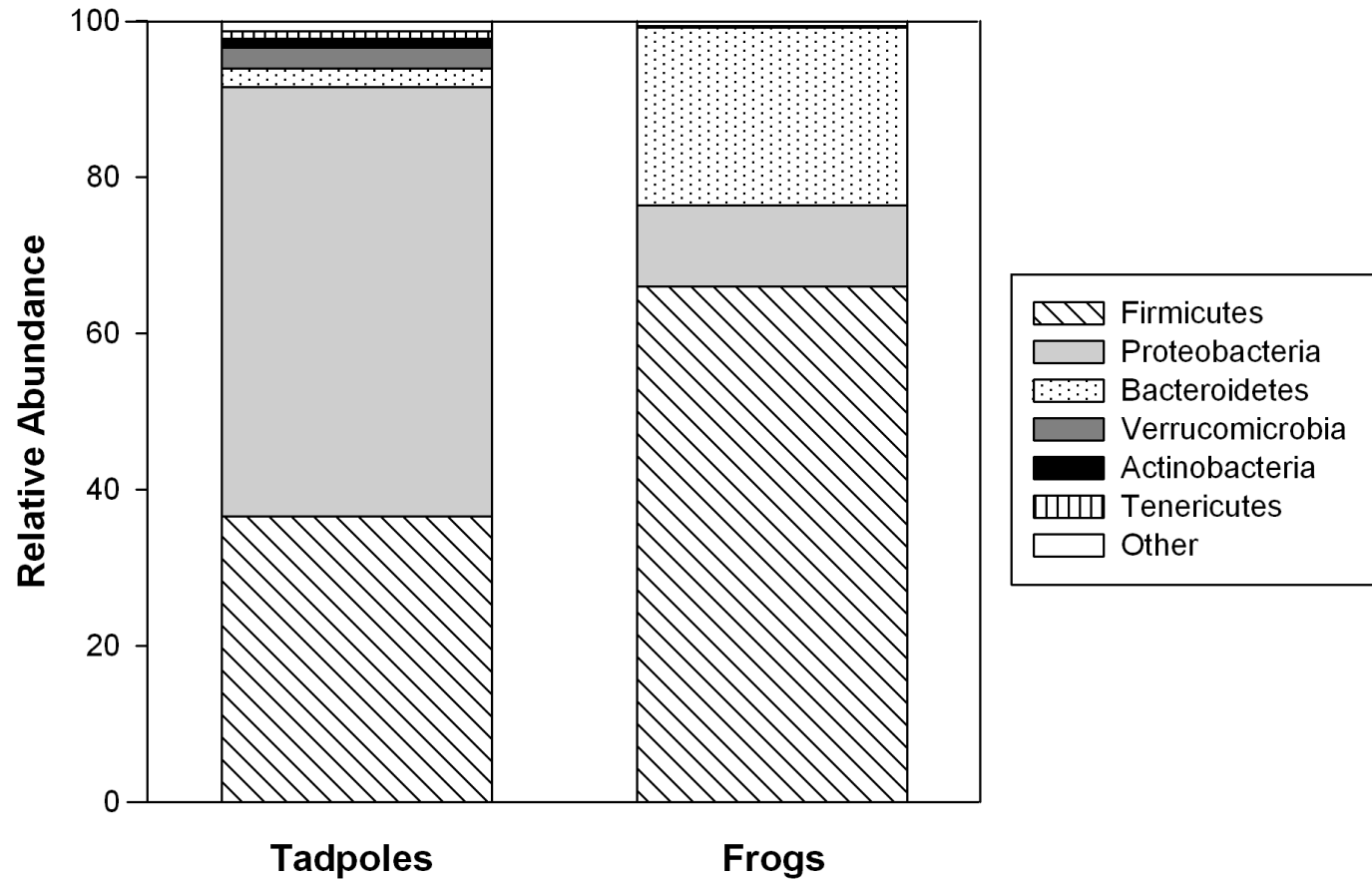
Conclusions and Future Directions

- Altered microbiota may have reduced function, may limit animals if released back into wild
- Future directions
 - Dechlorinated tapwater?
 - Maintenance on natural diet as animals enter captivity?

Outline

- How does entering captivity alter the microbiota of herbivorous rodents?
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Amphibians undergo restructuring of their microbiome through metamorphosis



Rearing amphibians in captivity

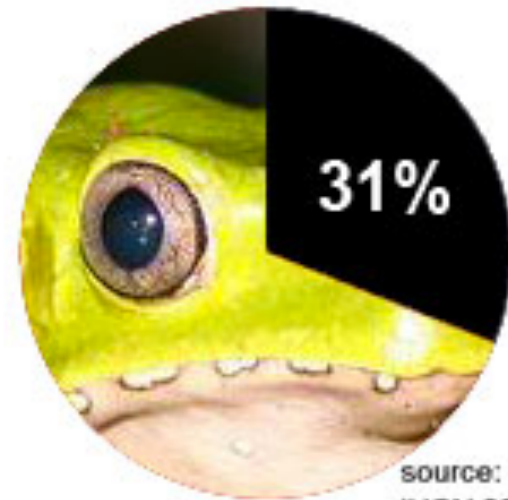




Question

- Where to captive-bred frogs acquire their gut microbiota?

Threatened Amphibians



source:
IUCN 2006

Described species: 5,918
Number assessed: 5,918
% of assessed threatened: 31%

SourceTracker

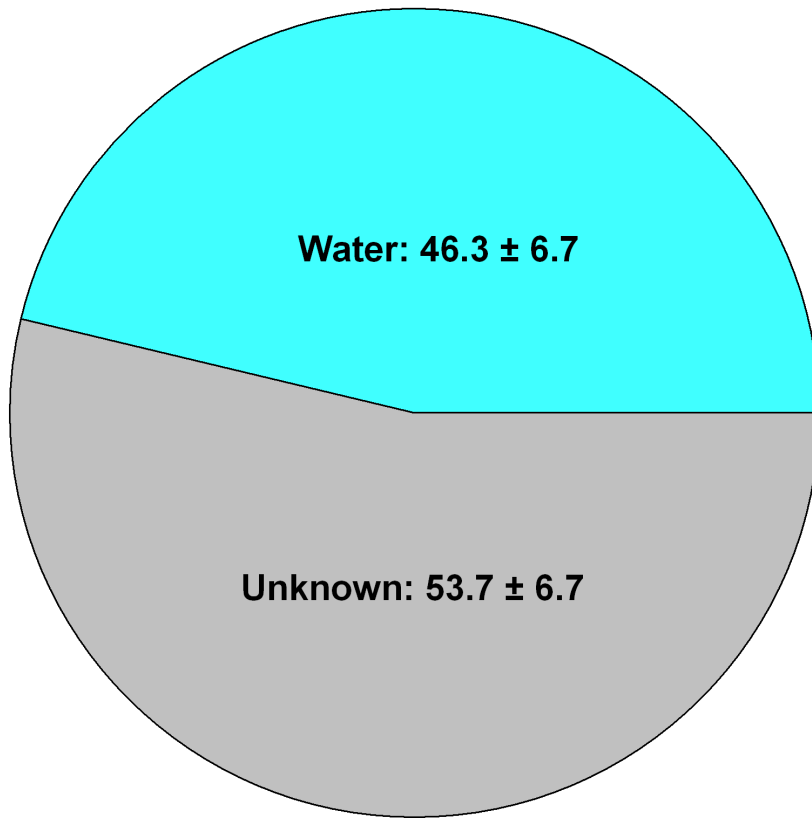
NATURE METHODS | BRIEF COMMUNICATION



Bayesian community-wide culture-independent microbial source tracking

Dan Knights, Justin Kuczynski, Emily S Charlson, Jesse Zaneveld, Michael C Mozer, Ronald G Collman, Frederic D Bushman, Rob Knight & Scott T Kelley

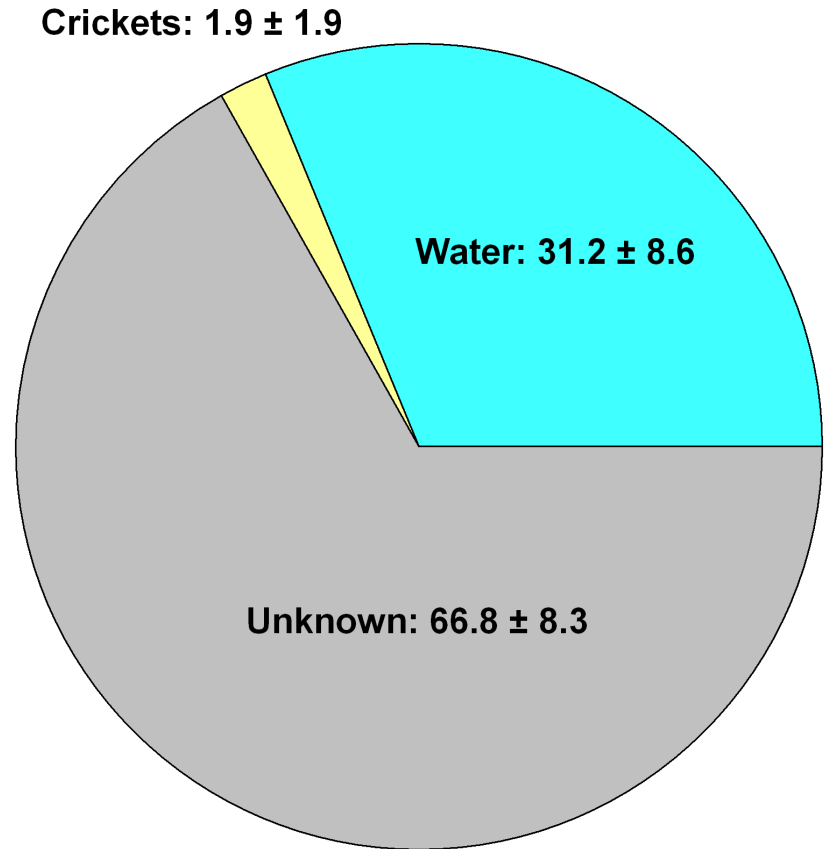
Water microbes are large contributors to the amphibian gut microbiota

Tadpoles



 Tadpole Food: 0.00
 Crickets: 0.00

Frogs



 Tadpole Food: 0.00

Conclusions and Future Directions

- Acquisition of microbiota from water may have impacts for captive-bred individuals
- Future directions
 - Rearing temperature?
 - Pond water vs 'sterilized' water



Photo: R. Brucker