Evaluation of *Acilius* larvae (Coleoptera: Dytiscidae) for **biocontrol** of **mosquito larvae**

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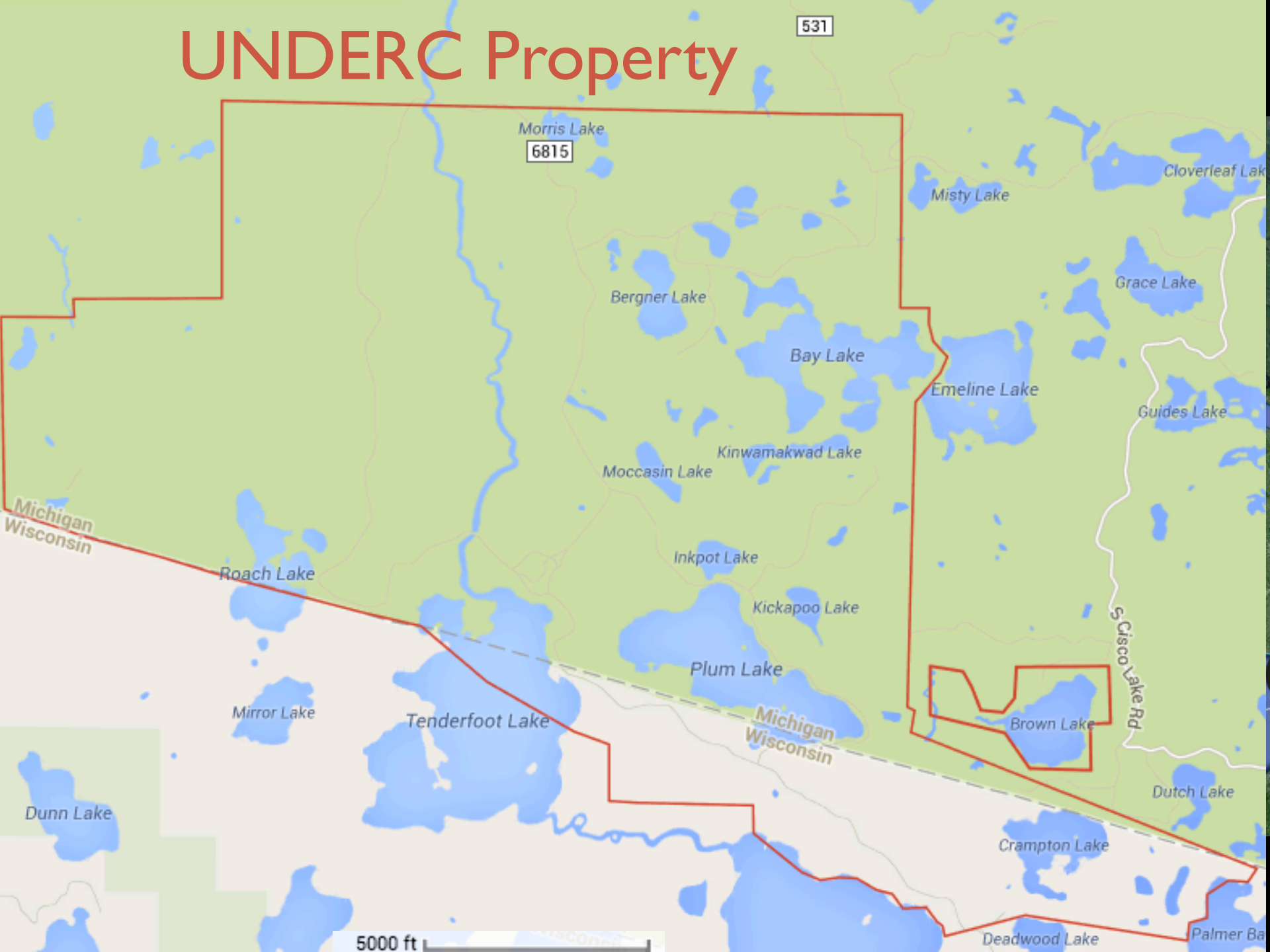
Photograph by Radek Sejkora


UNDERC Property
531
Morris Lake
6815
Misty Lake
Cloverleaf Lak
Grace Lake
Bergner Lake
Bay Lake
Emeline Lake
Guides Lake
Kinwamakwad Lake
Moccasin Lake
Michigan
Wisconsin
Roach Lake
Inkpot Lake
Kickapoo Lake
Plum Lake
Cisco Lake Rd
Mirror Lake
Tenderfoot Lake
Michigan
Wisconsin
Brown Lake
Dutch Lake
Dunn Lake
Crampton Lake
Deadwood Lake
Palmer Ba
5000 ft

Photographs by Ivy Yen

Research Goal

To determine if *Acilius* are potential candidates for the biological control of mosquito larvae.

Why mosquitoes?

Mosquito Control

Insecticides

Currently the most effective method, but harmful to environment and mosquitoes may gain resistance

Biological Control

Recent work: copepods in Vietnam, mosquitofish in Australia

Biocontrol: Predaceous Diving Beetles

- Voracious predators
- May have selective feeding habits
- Native and plentiful in many areas

Original photograph by Jan Hamrsky

Experimental Overview

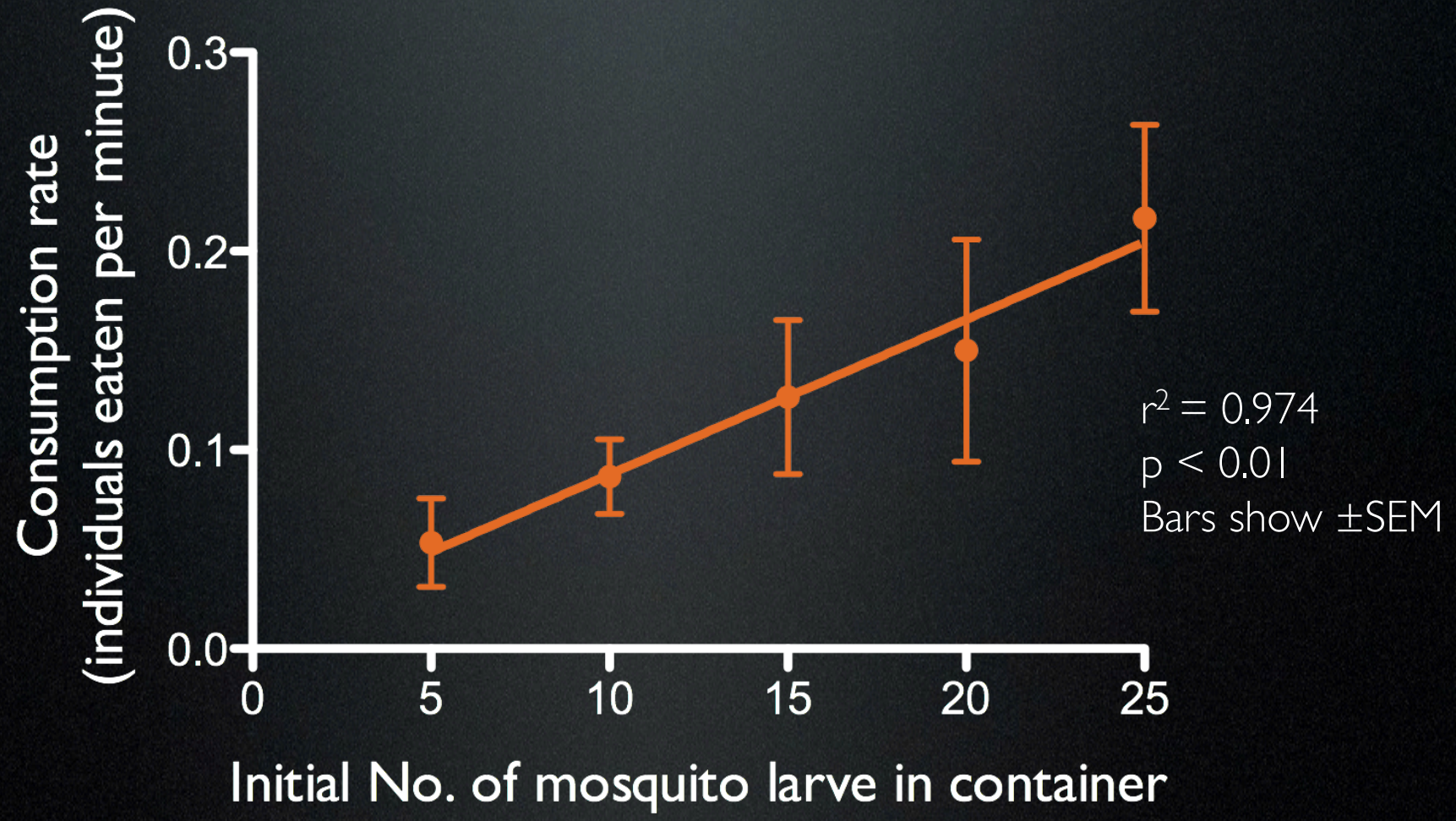
Criterion for biocontrol	Experiment
Efficient predation	Predation rate assay
Long term effectiveness	Outdoor mesocosm trials
Selective Predation	Laboratory choice tests

Predation Rate Assay: Methods

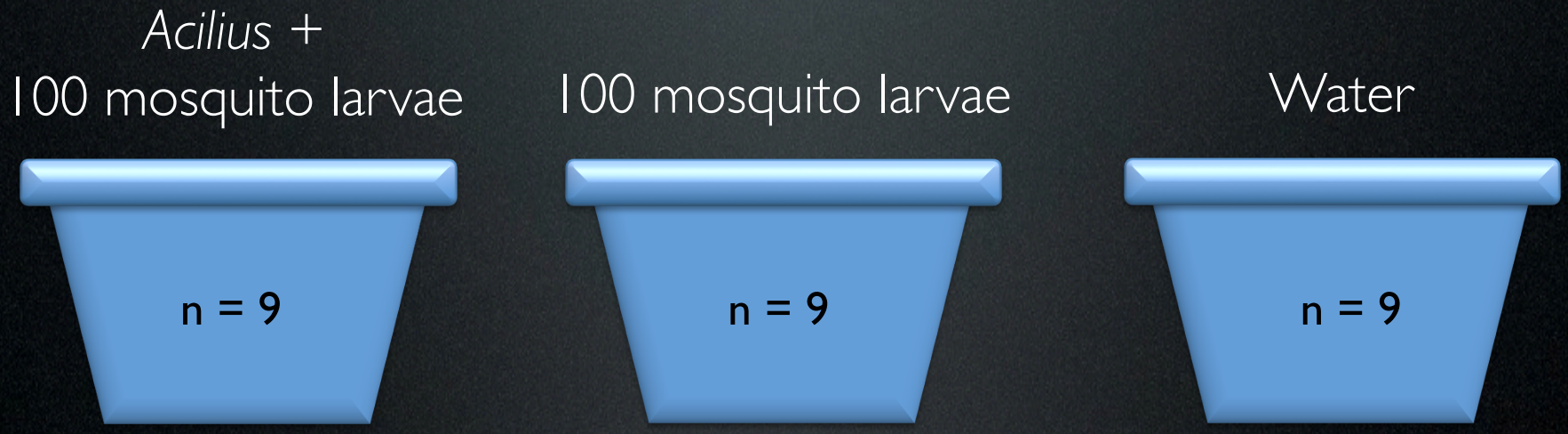
- Beetles (n = 10) starved for one day
- Placed singly into containers with different densities of mosquito larvae (5, 10, 15, 20, 25 individuals)
- Fed for 30 minutes. Repeated on 5 successive days

Hypothesis: *Acilius* beetles will consume mosquito larvae and increase predation rate at higher densities of prey

Results: Predation rate increased as the initial density of mosquito larvae was increased



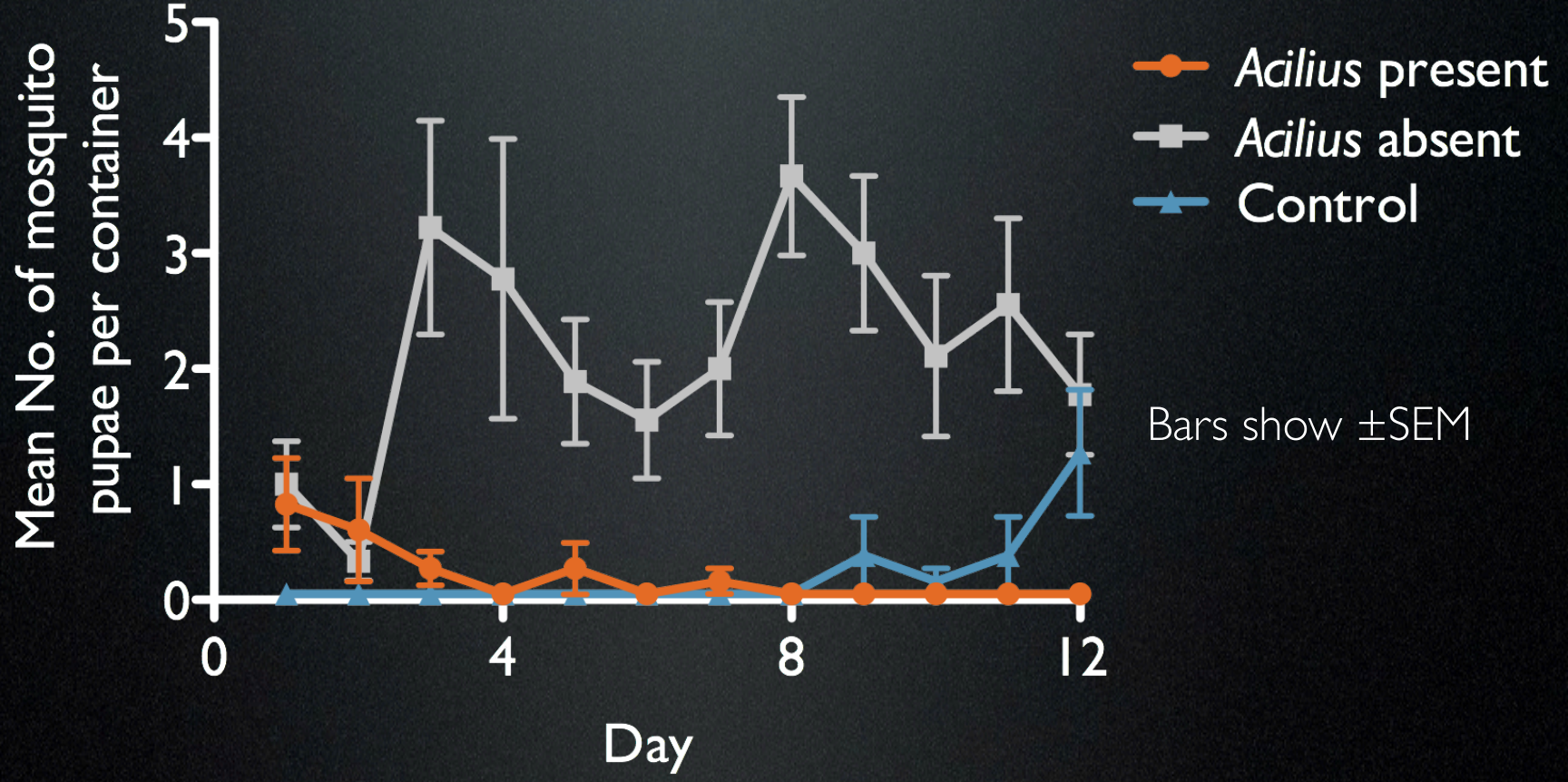
Outdoor Aquatic Mesocosms: Methods



- Buckets placed outside and left open for new oviposition
- Checked every night for 12 days for appearance of mosquito pupae

Hypothesis: *Acilius* will consume mosquito larvae before pupal stage can be reached, including larvae that result from oviposition

Results: Buckets with *Acilius* produced less mosquito pupae than buckets without *Acilius**



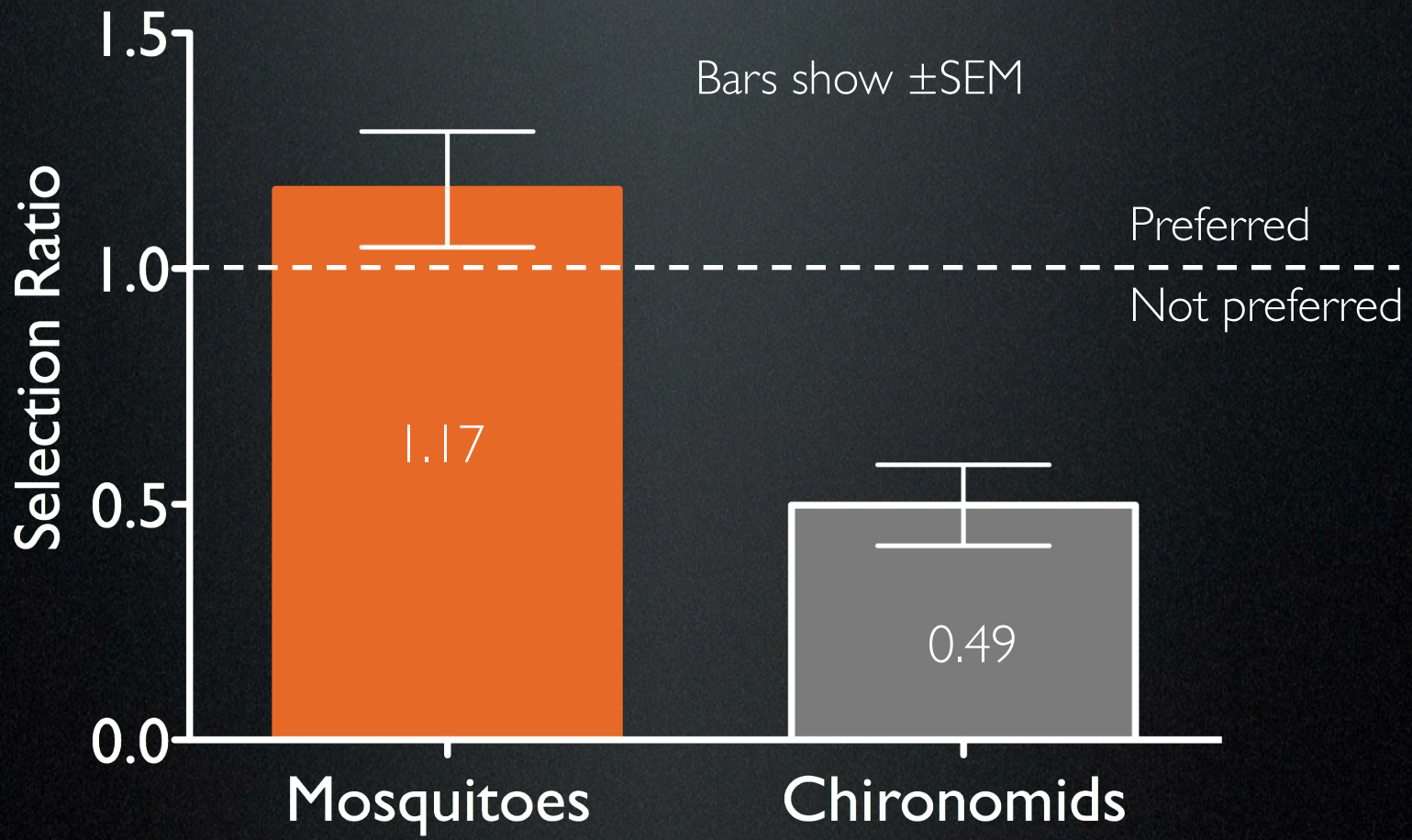
* $p < 0.05$ in Friedman ANOVA, followed by Dunn's Multiple Comparison

Selective Predation Assay: Methods

- Beetles (n = 30) starved for one day
- Placed singly into containers with 5 mosquito larvae and 5 chironomid larvae
- Fed for one hour

Hypothesis: *Acilius* will preferentially feed on mosquito larvae

Results: *Acilius* significantly preferred to feed on mosquitoes more than chironomids*



* $p < 0.01$ in paired t-test

Conclusions

- *Acilius* show potential as agents of mosquito control
  1. efficient predators of several mosquito genera
  2. successful control in outdoor mesocosms
  3. some selectivity in predation

- May be useful man-made ecosystems with low diversity: artificial backyard ponds, roadside ditches, newly constructed wetlands

- Ecosystems already populated by *Acilius* dytiscids should be managed with a policy of conservation

Future Research

- Predation preference of *Acilius* with other invertebrates and amphibians as prey
- Determine saturation and satiation points of predator
- Foraging behavior of *Acilius* at different prey densities
- Influence of dytiscids on mosquito oviposition preference

Acknowledgements

Todd Crowl
Larissa Herrera
Claire Mattison
Rob McKee
Patrick Roden-Reynolds
Hannah Olsen
Ryan Davila
Michael Cramer
Gary Belovsky
The Bernard J. Hank Family Endowment


Questions?