As the worm turns: tubificids and whirling disease

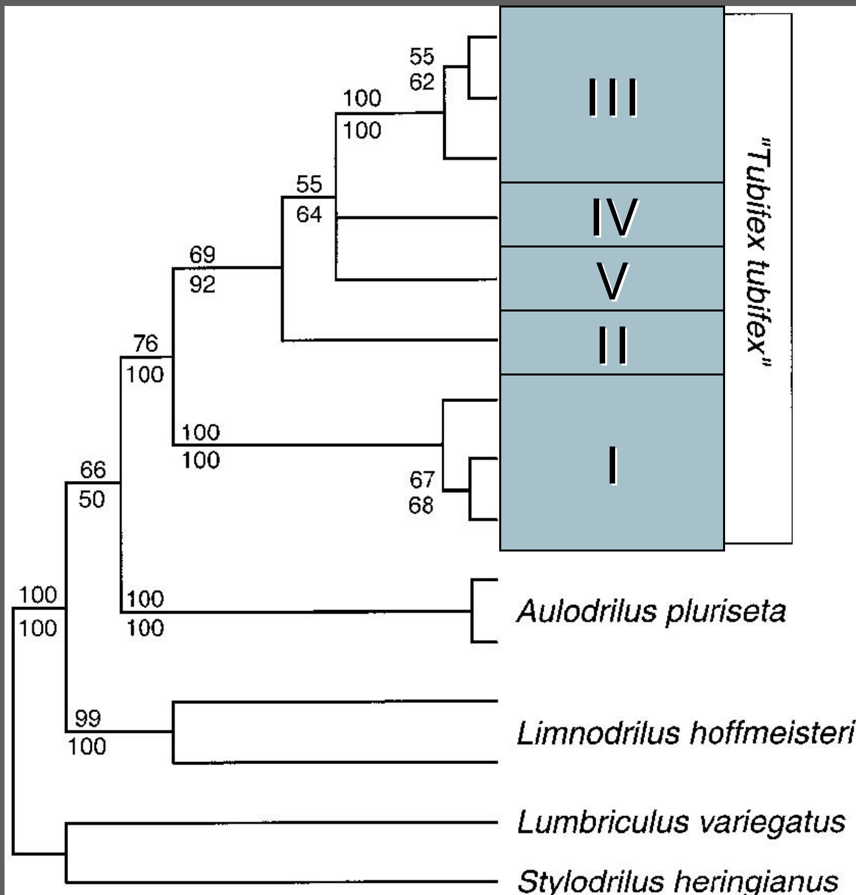
Billie L. Kerans
Department of Ecology
Montana State University

National Partnership on Wild and Native Fish
National Science Foundation EPSCOR
Montana Department of Fish, Wildlife & Parks
National Park Service

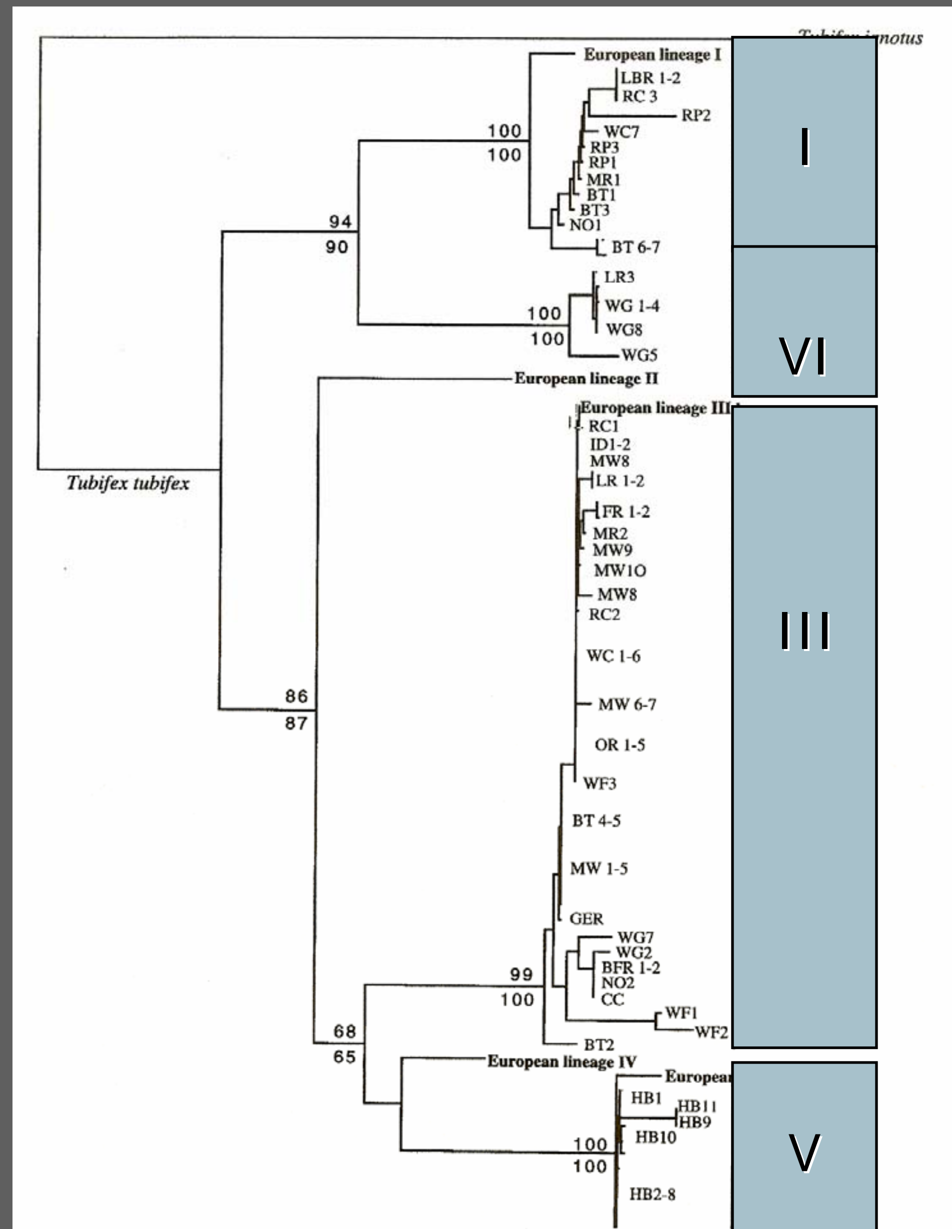
Tubifex tubifex

- Normal components of benthos of streams & lakes
- Feed on sediments
- Great genetic diversity—cryptic species?

Europe
Sturmbauer et al. 1999



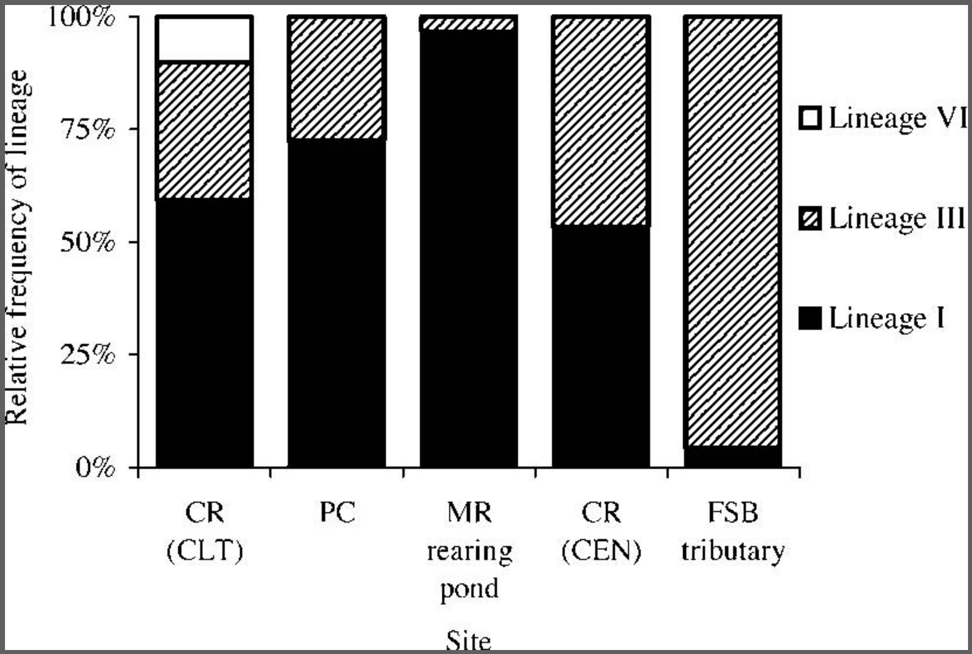
North America
Beauchamp et al. 2001



❖Other molecular markers also show distinct clades and great genetic diversity (Kerans et al. 2004)

Lineages coexist

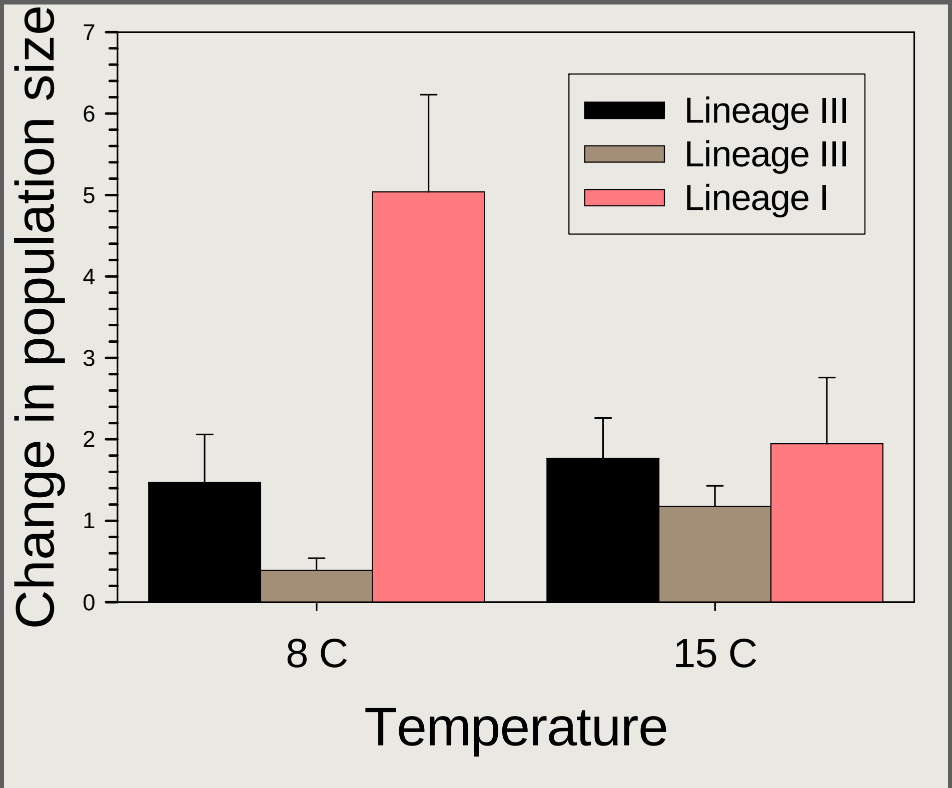
- Colorado—Windy Gap and Breeze Bridge (I, III, V, VI) (Beauchamp et al. 2002, 2004)
- New Mexico—San Juan River (I, III, VI) (DuBey & Caldwell 2004)
- Montana—Madison River (I, III) (Stevens & Kerans unpublished)
- Wyoming—Yellowstone River drainage (III, VI) (J. Alexander, MSU, unpublished)



Pennsylvania
(Kaeser et al. 2006)

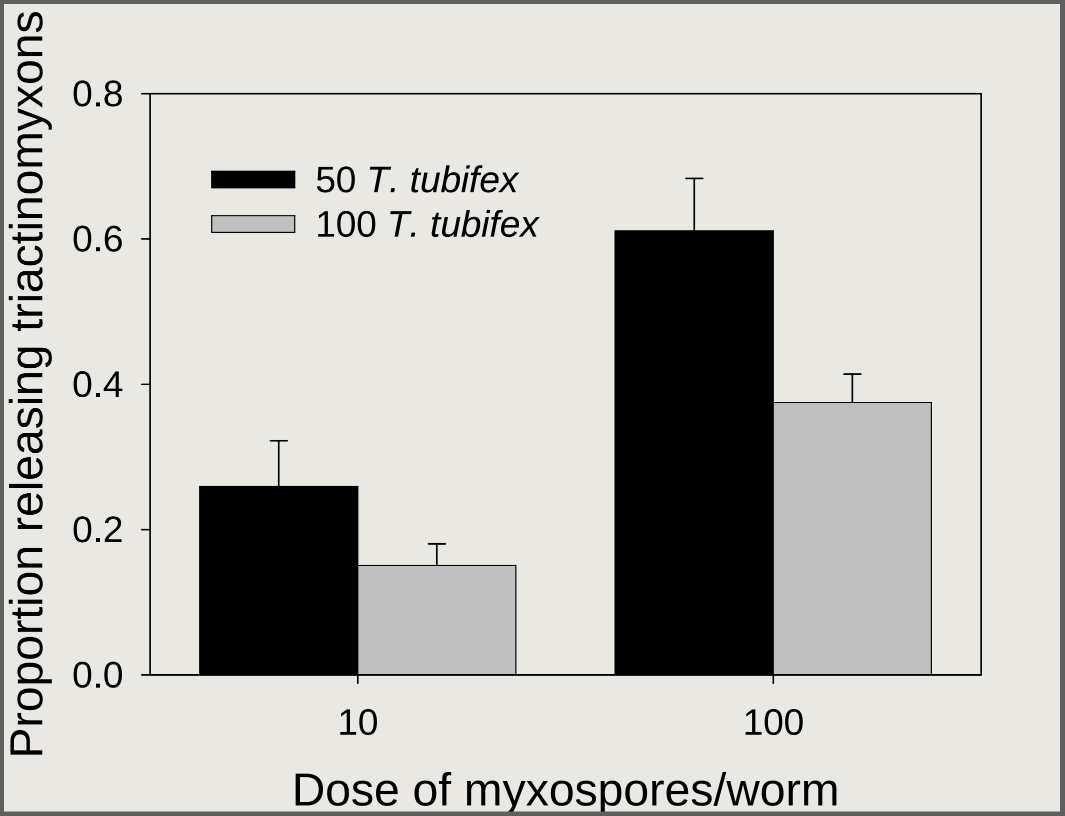
Environmental tolerances & strains

- Cadmium resistance (Sturmbauer et al. 1999)
- Water temperature (Kerans et al. 2005)



Prevalence of infection—dose and density

- Proportion infected dose and density dependent (Steinbach 2003, Steinbach Elwell et al. in prep.)



Environmental conditions

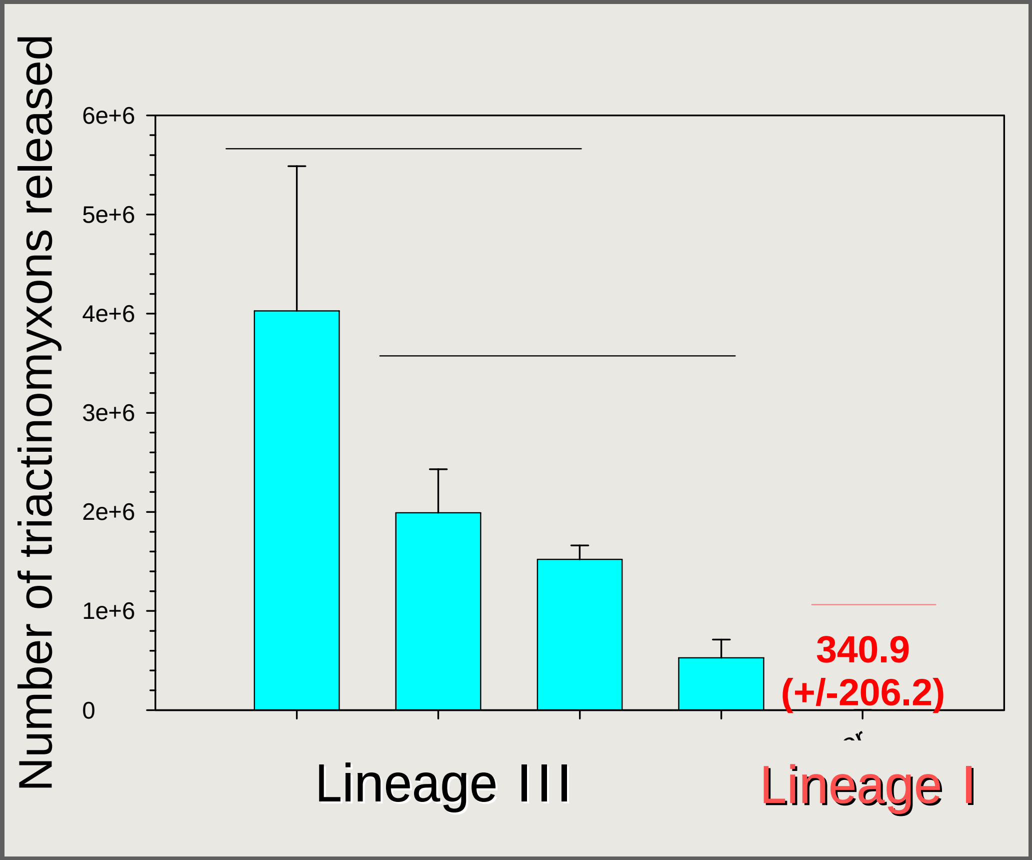
- Water temperature
  - ✓ Prevalence of infection declined as temperature decreased (17 to 9°C) (Blazer et al. 2003)
  - ✓ Development time decreased with increasing temperature (El-Matbouli et al. 1999, Kerans et al. 2005)
  - ✓ Longer release time at lower temperatures (Blazer et al. 2003)
  - ✓ High temperatures (20 – 30 °C) stops release (El-Matbouli et al. 1999)
- Sediment type
  - ✓ Prevalence of infection higher in sand or silt than leaf material (Blazer et al. 2003)

Susceptibility—lineages & strains

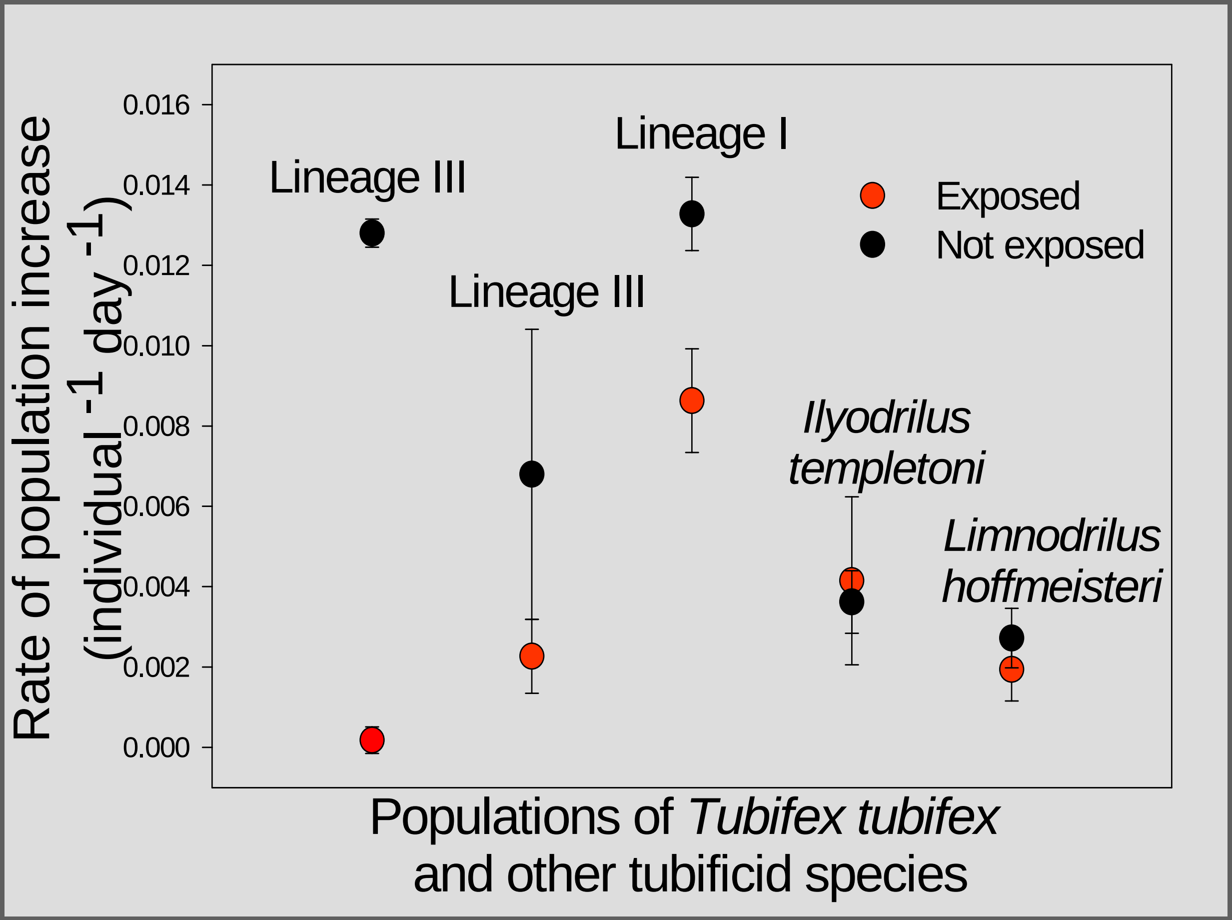
- Strains within some lineages appear resistant to *M. cerebralis* infection
  - ✓ V—Not infected in monoculture laboratory studies (Steinbach Elwell et al. 2006)
  - ✓ V & VI—Not infected in mixed culture challenges (Beauchamp et al. 2002)
  - ✓ I & VI—No infection found in field collections (Dubey & Caldwell 2004)
  - ✓ I less infected than III in Madison River, MT (Stevens & Kerans unpublished)

Parasite propagation—lineages & strains

- Rassmussen et al. (in prep.)
- Similar variable results with lineage III (Baxa et al. 2004, Kerans et al. 2004)

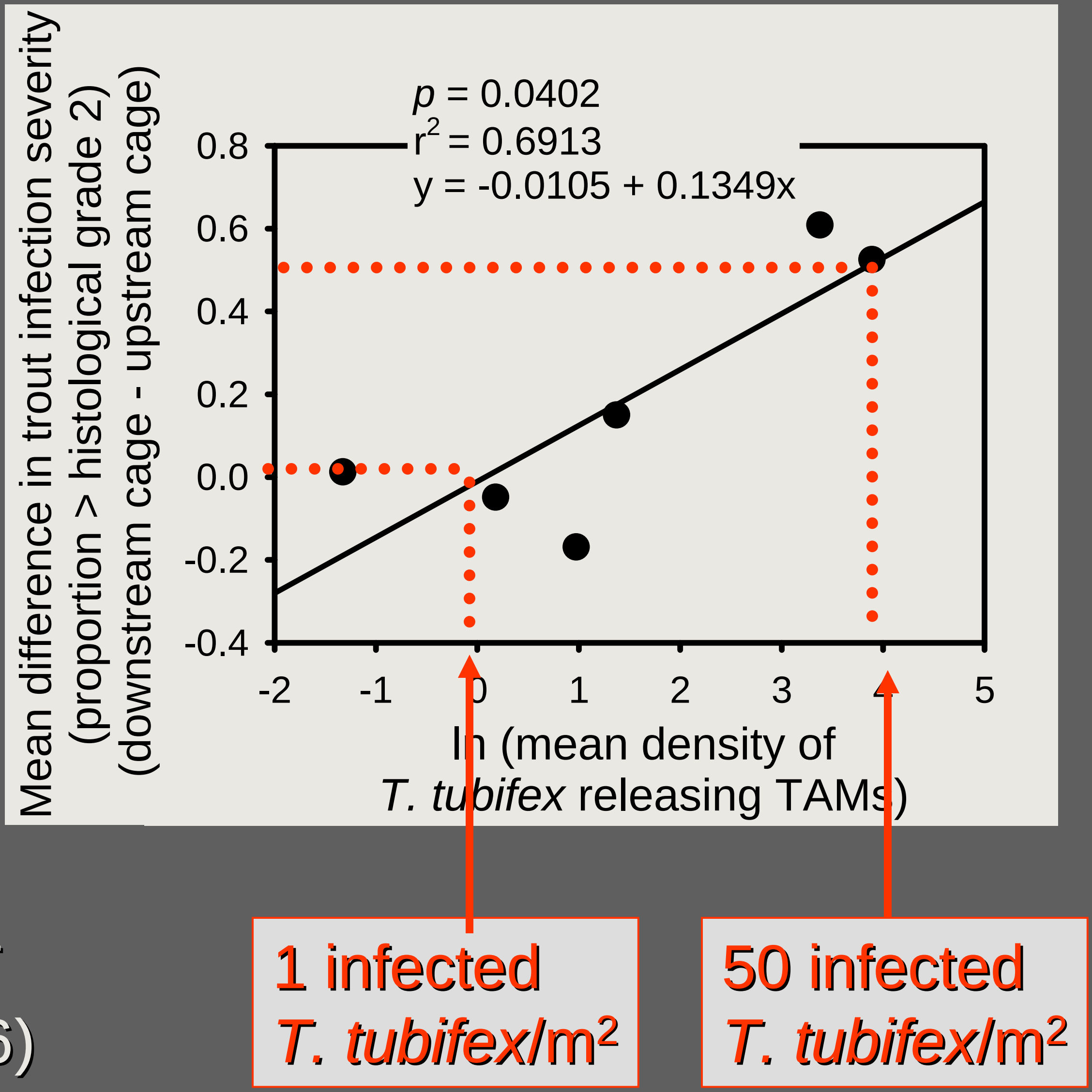


T. tubifex get sick



- Lower growth in infected *T. tubifex*
- Growth rates of *T. tubifex* populations inversely correlated to TAM production ($r = -0.917$, $p = 0.0005$, $n = 9$)

Abundance of *T. tubifex* & disease risk



Madison River, MT
Krueger et al. (2006)

Lineages, disease risk and wild trout

- I & III most common where impacts to trout the greatest, V & VI most common where impacts to trout lowest (Colorado, Beauchamp et al. 2004)

Can we generalize about *T. tubifex*?

- Lineages coexist
- Strains have different environmental tolerances and ability to propagate the parasite
- Prevalence of infection dose and density dependent
- Evidence that disease risk correlates to number of infected *T. tubifex*

Some remaining questions

- Do lineages indicate susceptibility/resistance?
  - ✓Few of strains of lineages other than III have been adequately tested
  - ✓Lineage III highly variable
- Does variation in propagation of parasite among lineage/strains contribute to variation in disease in wild trout?
- What is the relationship between environmental conditions, lineages/strains and variation in disease in wild trout?