



Whirling Out of Control; What we know about whirling disease in Alberta so far

Dani Jakovljevic

Whirling Disease

- Fish disease caused by parasite *Myxobolus cerebralis*
- Under correct conditions leads to $\geq 90\%$ mortalities in salmonid populations
- Affects species differently



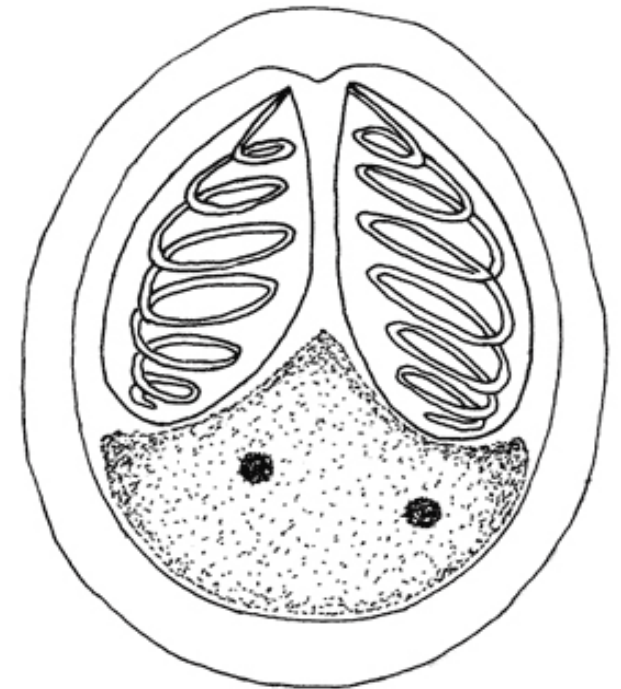
Clinical signs:

- Blackened tail
- Shortened operculum
- Sloped skull
- Primarily kills susceptible young

Myxobolus cerebralis

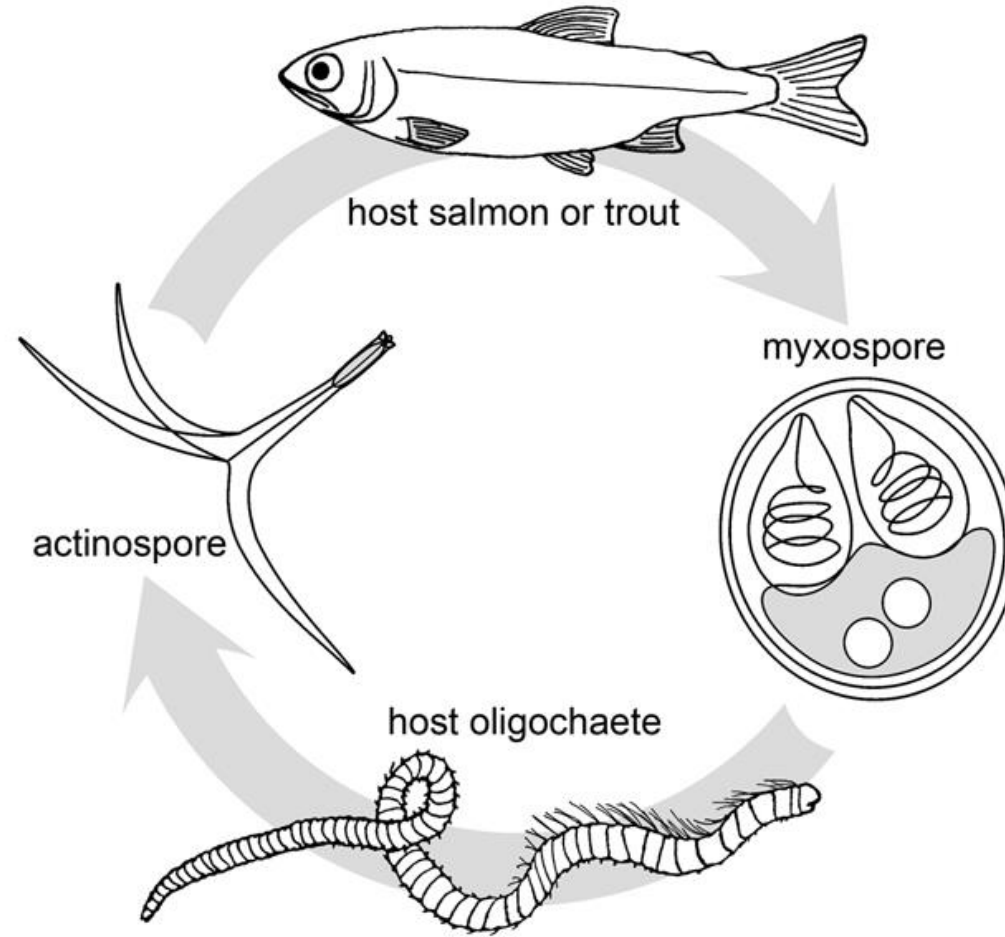


A nematocyst in a cnidocyte - Cnidarian

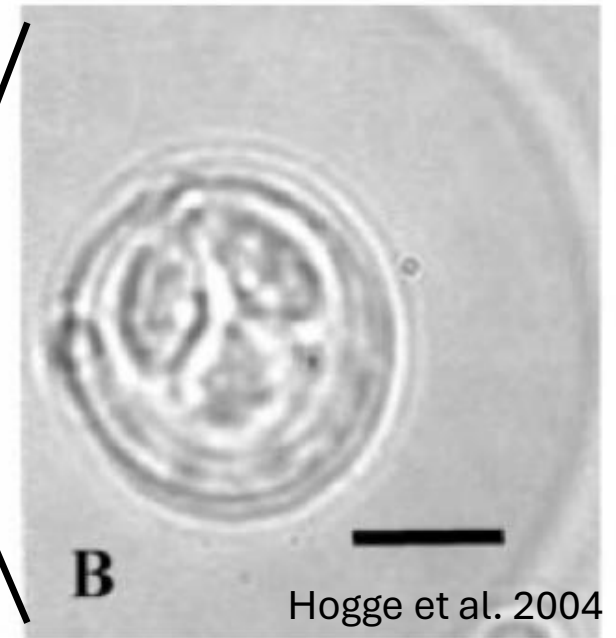
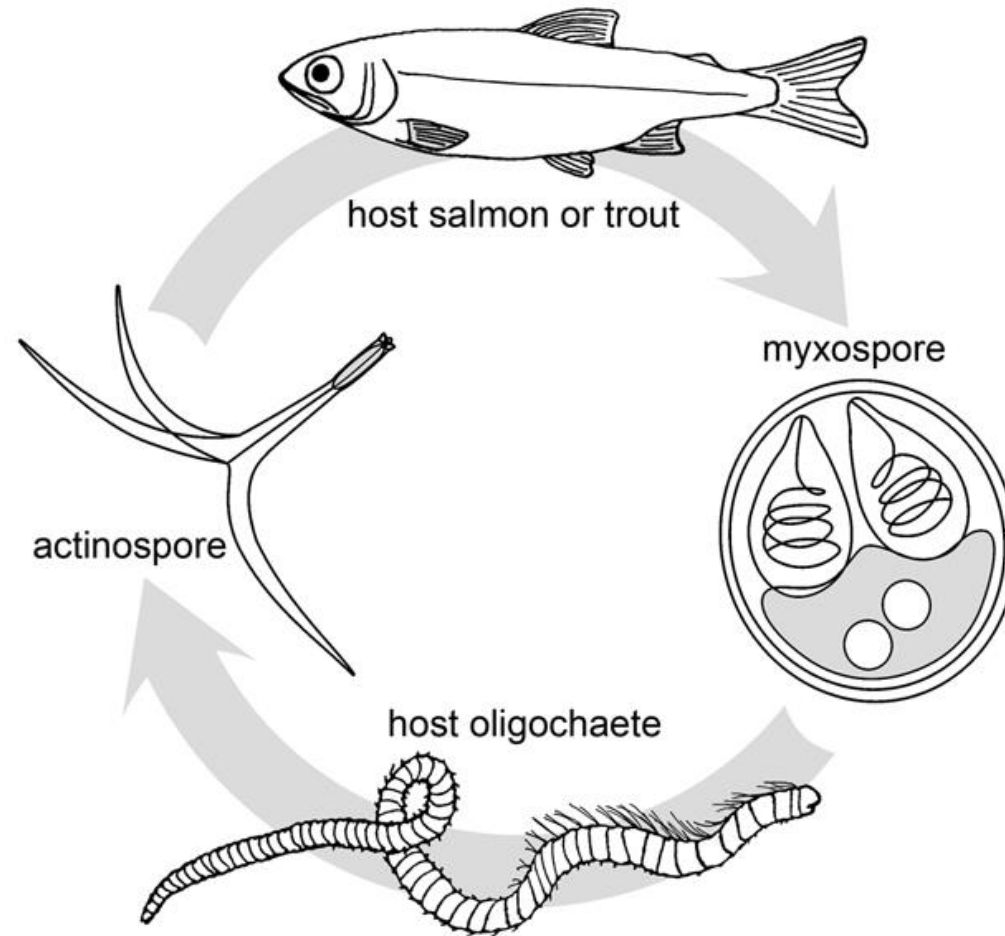


A polar capsule - Myxozoan

Life Cycle



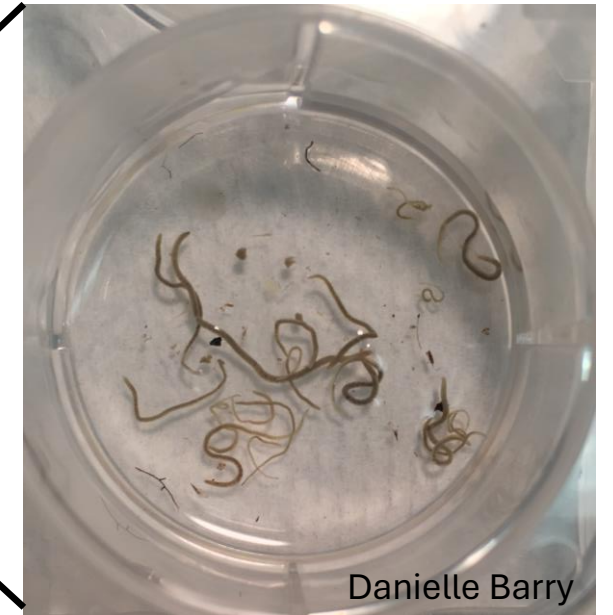
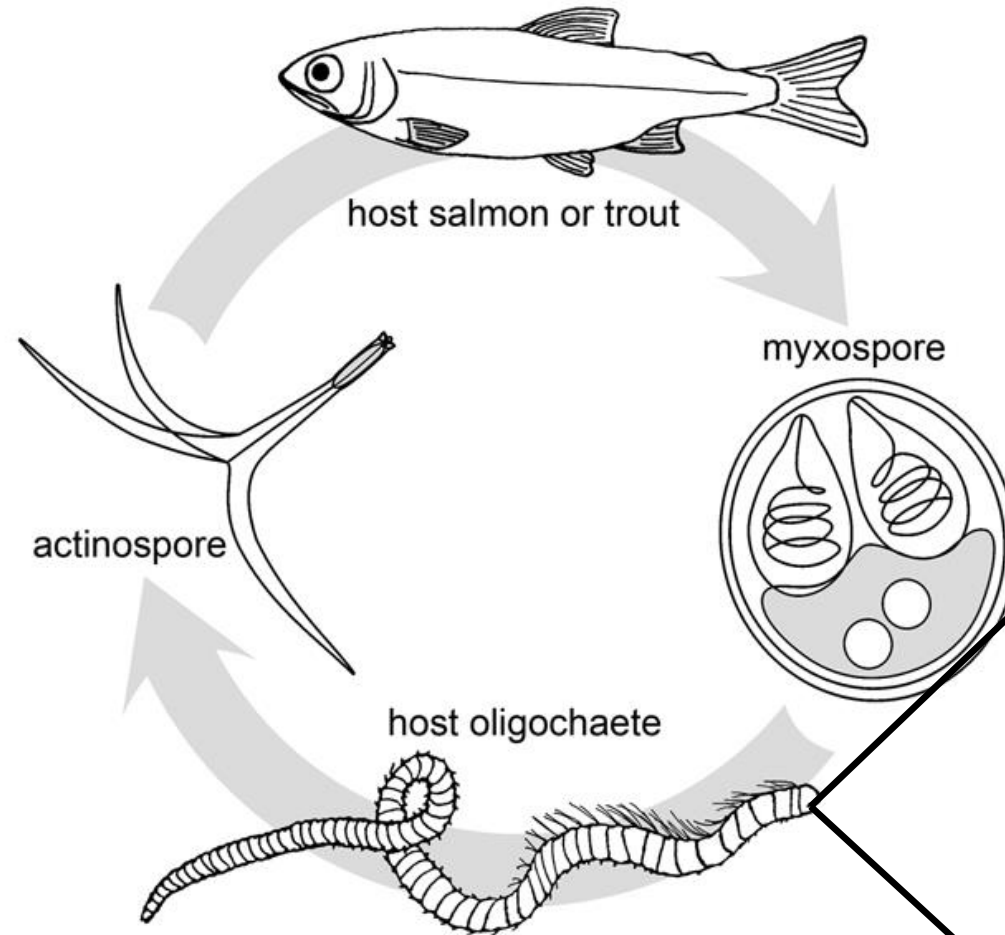
Life Cycle



Hogge et al. 2004

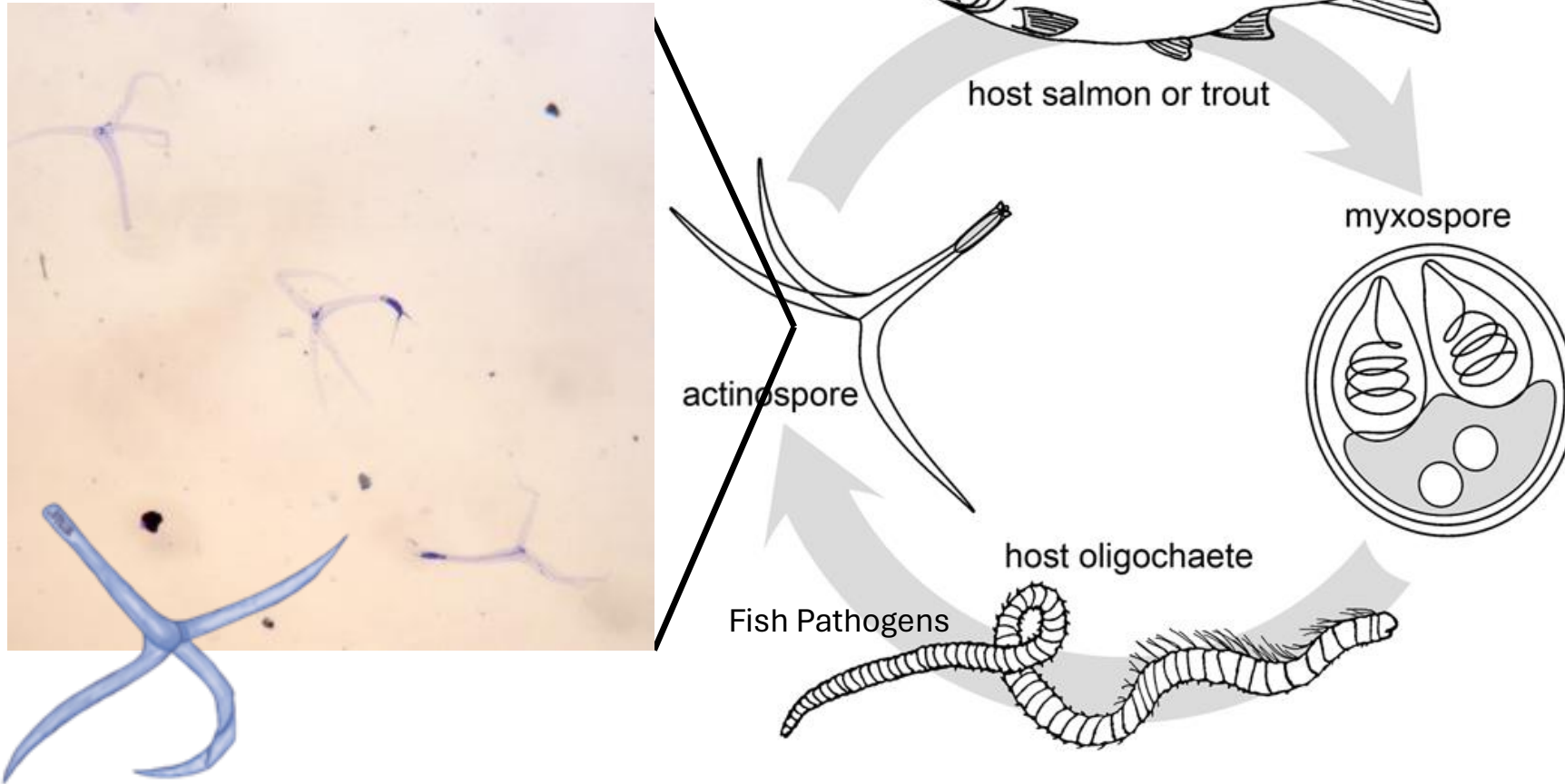
Bartholomew & Hallet, 2013

Life Cycle

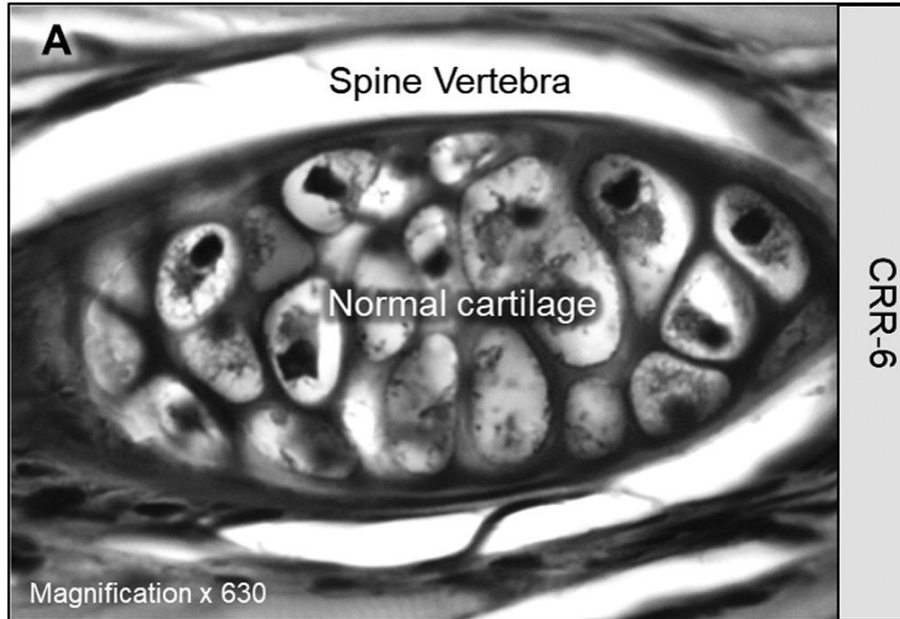


Danielle Barry

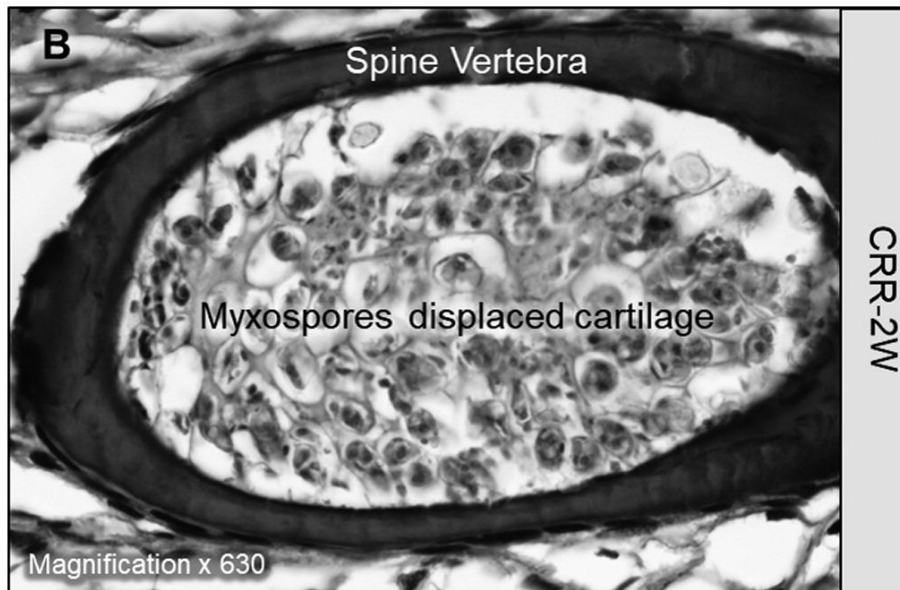
Life Cycle



Pathology



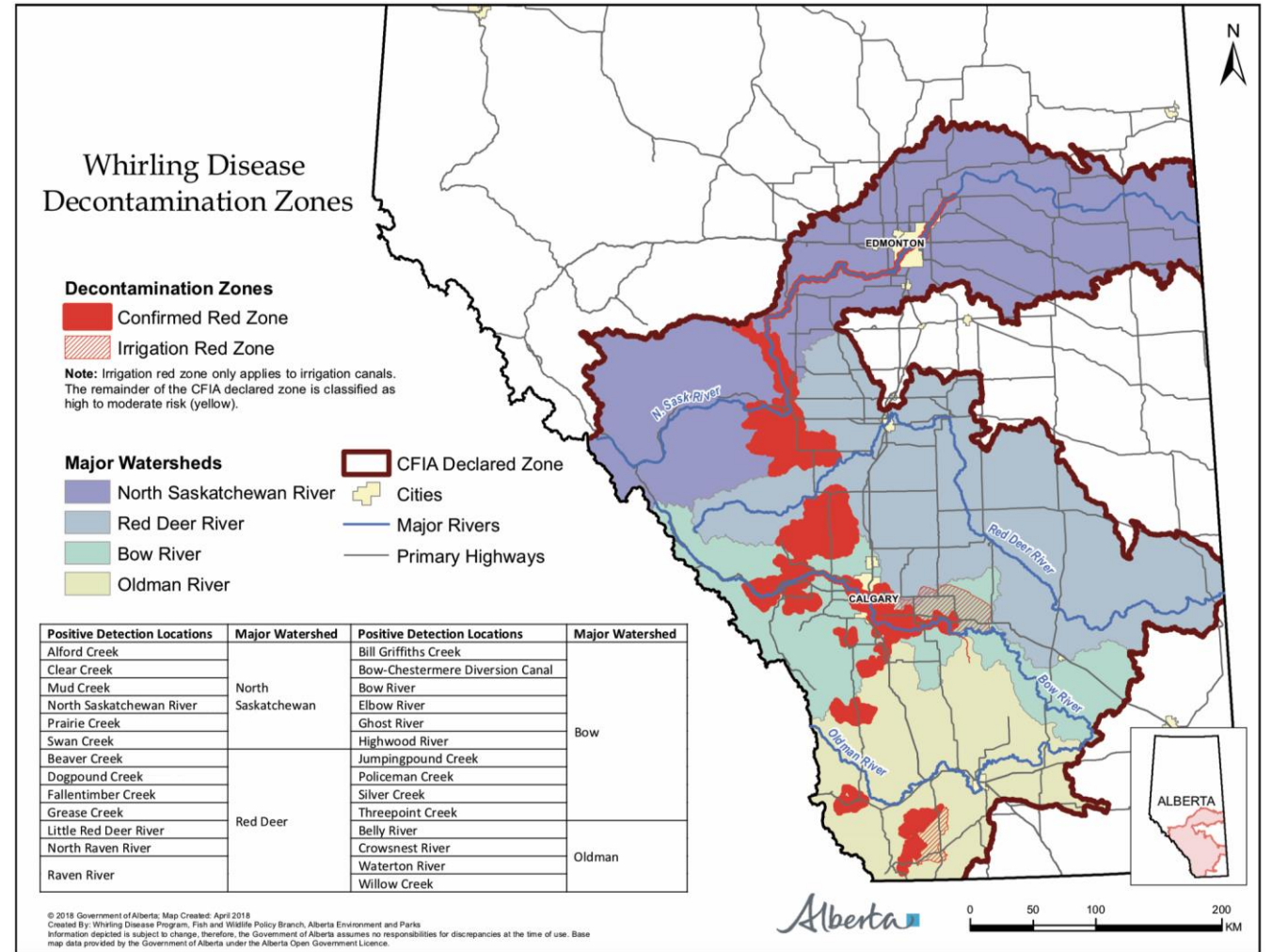
Healthy rainbow trout spinal tissue



Infected rainbow trout spinal tissue
from Crownest River

History and Spread

- European origins
- Brought to North America via stocking
- Well-established in Alberta—four watersheds declared positive by CFIA
- Recent BC detections



Recent British Columbia Detection



Photo by Ho at The Canadian Press

Yoho National Park
Parc national Yoho

RESTRICTED ACTIVITY

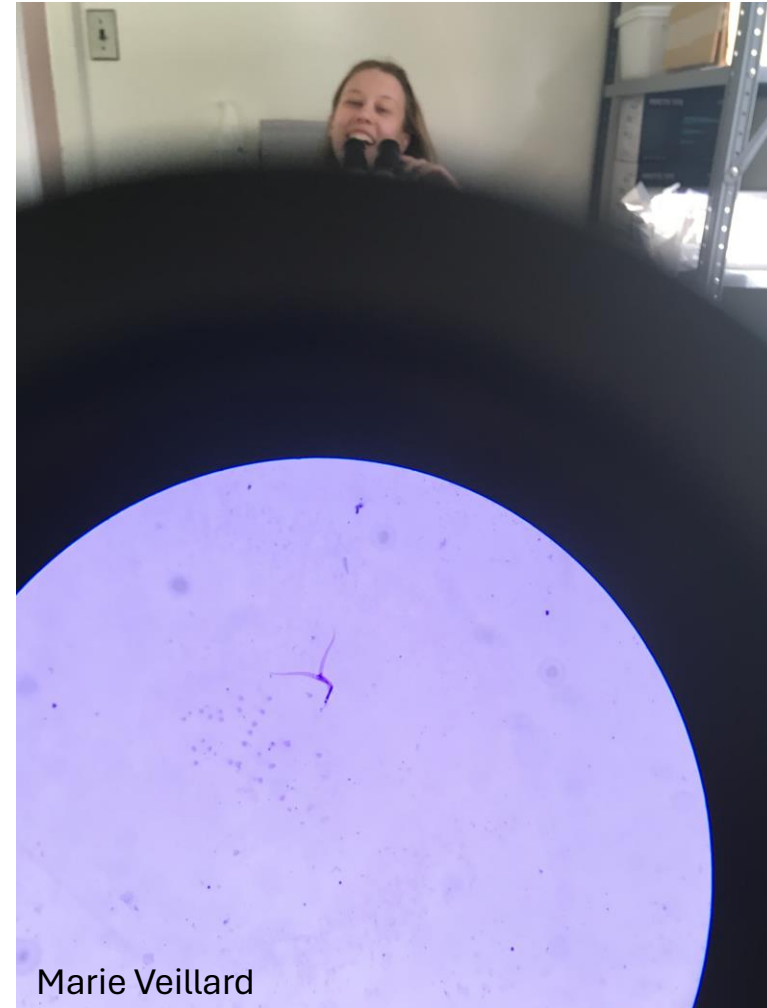
ACTIVITÉ RESTREINTE

Water based activities	Activités aquatiques
<p>WHAT: Pursuant to Section 7(1) of the National Parks General Regulations, of the Canada National Parks Act, the following activity is restricted or prohibited by order of the Superintendent:</p> <p>All in-water and shoreline activities are prohibited. It is prohibited to enter a waterbody or have any object or equipment in a waterbody. It is prohibited to approach or remain within 3m of any waterbody. Prohibited shoreline activities include but are not limited to hiking, walking or cycling. Prohibited in water activities include but are not limited to fishing, swimming, diving, wading and the use of any watercraft such as a boat, paddle board, raft, or any other vessel. The following exceptions apply:</p> <ul style="list-style-type: none"> -Crossing a waterbody on approved trails, bridges, and fords, -Collecting treatable water for the purposes of drinking, -Crossing a frozen waterbody or shoreline. <p>Use of rental canoes at Emerald Lake is permitted.</p>	<p>ACTIVITÉ : En vertu du paragraphe 7(1) du Règlement général sur les parcs nationaux, découlant de la Loi sur les parcs nationaux du Canada, le directeur restreint ou interdit la pratique de l'activité suivante :</p> <p>Toute activité menée en milieu aquatique ou le long des rives. Il est interdit d'entrer dans un plan d'eau ou d'y mettre un objet ou de l'équipement. Vous ne pouvez pas non plus vous approcher ou vous tenir à moins de 3 m d'un plan d'eau. Les activités interdites sur le rivage comprennent, sans s'y limiter, la randonnée, la marche ou le cyclisme. Les activités interdites dans l'eau comprennent, sans s'y limiter, la pêche, la baignade, le plongeon, le patage et l'utilisation de toute embarcation comme un bateau, une planche à pagaie ou un canot pneumatique. Il existe toutefois des exceptions, et vous pouvez :</p> <ul style="list-style-type: none"> - traverser un plan d'eau à partir de sentiers, de ponts ou de gués approuvés; - puiser de l'eau pouvant être traitée afin de la boire; - traverser une rive ou un plan d'eau gelé. <p>L'utilisation sur le lac Emerald de canots loués est permise.</p>
<p>WHERE: All waterbodies and shorelines in Yoho National Park (see map)</p>	<p>ENDROIT : Tous les plans d'eau et toutes les rives du parc national Yoho (voir la carte)</p>
<p>WHY: To prevent the potential spread of whirling disease. This parasitic disease affects some fish species but does not present any health risks for people or other mammals. The risk factors for spreading the disease include the movement of fish, mud/sediment, aquatic vegetation, and water. It will remain in effect until alternate management strategies are implemented.</p>	<p>RAISON : Pour prévenir la propagation potentielle du tournis des truites, une maladie parasitaire qui affecte certaines espèces de poissons, mais qui ne présente aucun danger pour la santé des personnes et de autres mammifères. Les facteurs de risque de propagation comprennent le déplacement de poissons, de boue et de sédiments, de plantes aquatiques et d'eau.</p> <p>La restriction demeurera en vigueur jusqu'à ce que d'autres stratégies de gestion soient mises en œuvre</p>

Canada

Issues with Traditional Methods of Detection

- Sentinel fish cages
 - Labour intensive
- Electrofishing
 - Labour intensive
 - subtractive
- TAM water filtrations
 - Microscopy
 - Labour intensive
 - Time sensitive



Traditional Methods of Detection

- Sentinel fish cages
 - Labour intensive
- Electrofishing
 - Labour intensive
 - subtractive
- TAM water filtrations
 - Microscopy
 - Labour intensive
 - Time sensitive

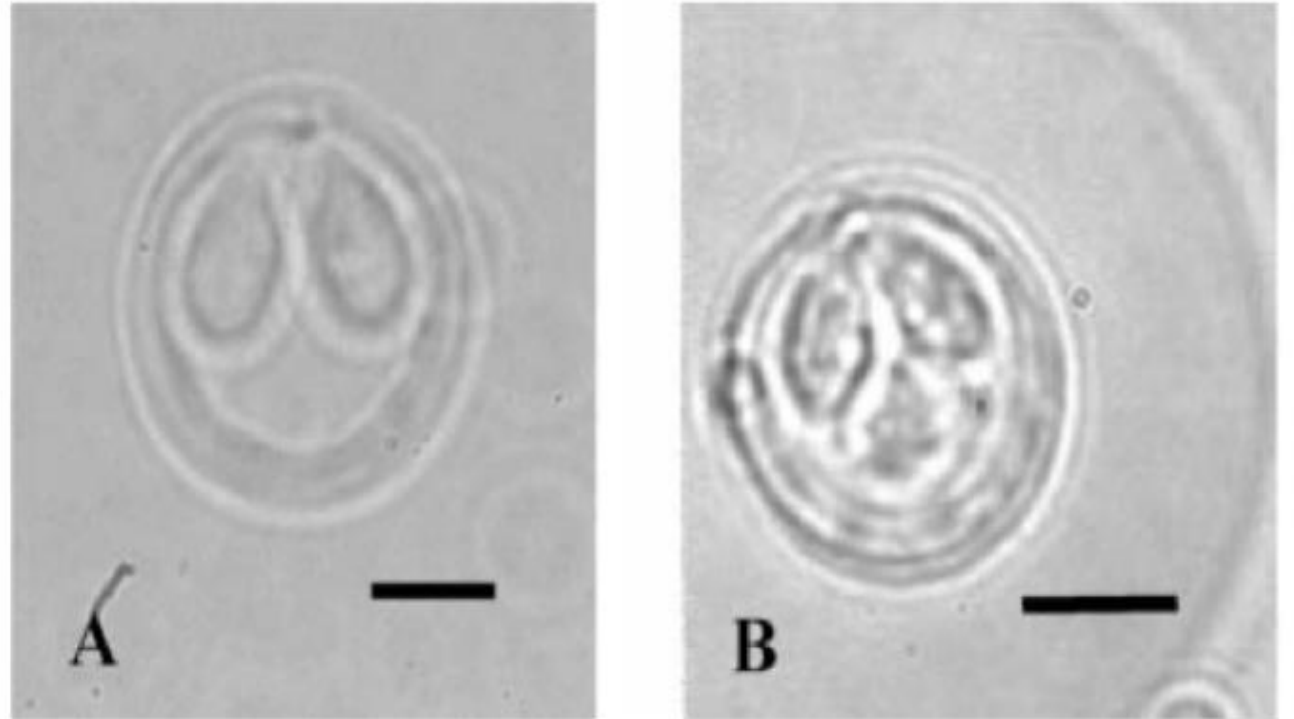


FIGURE 3.—Pepsin–trypsin digests of the spores of (A) neurotropic *Myxobolus* sp. and (B) *M. cerebralis* showing no obvious morphological differences; bars = 4 µm.

Quantitative PCR Assay and Environmental Monitoring



- qPCR assay for environmental detection
 - Can be used for worms, TAM filtrations, eDNA
- Non-lethal early detection
- Can be used pre-establishment in fish population
- Combats problems in previous slide

Temperature Threshold for Parasite Release from Worms

- El-Matbouli et al., 1999
 - Period of 10-17° C required for TAM release
- James et al., 2021 in Crowsnest River
 - Up to 96% of time spent in this threshold



1855

ARTICLE

Whirling disease in the Crowsnest River: an emerging threat to wild salmonids in Alberta

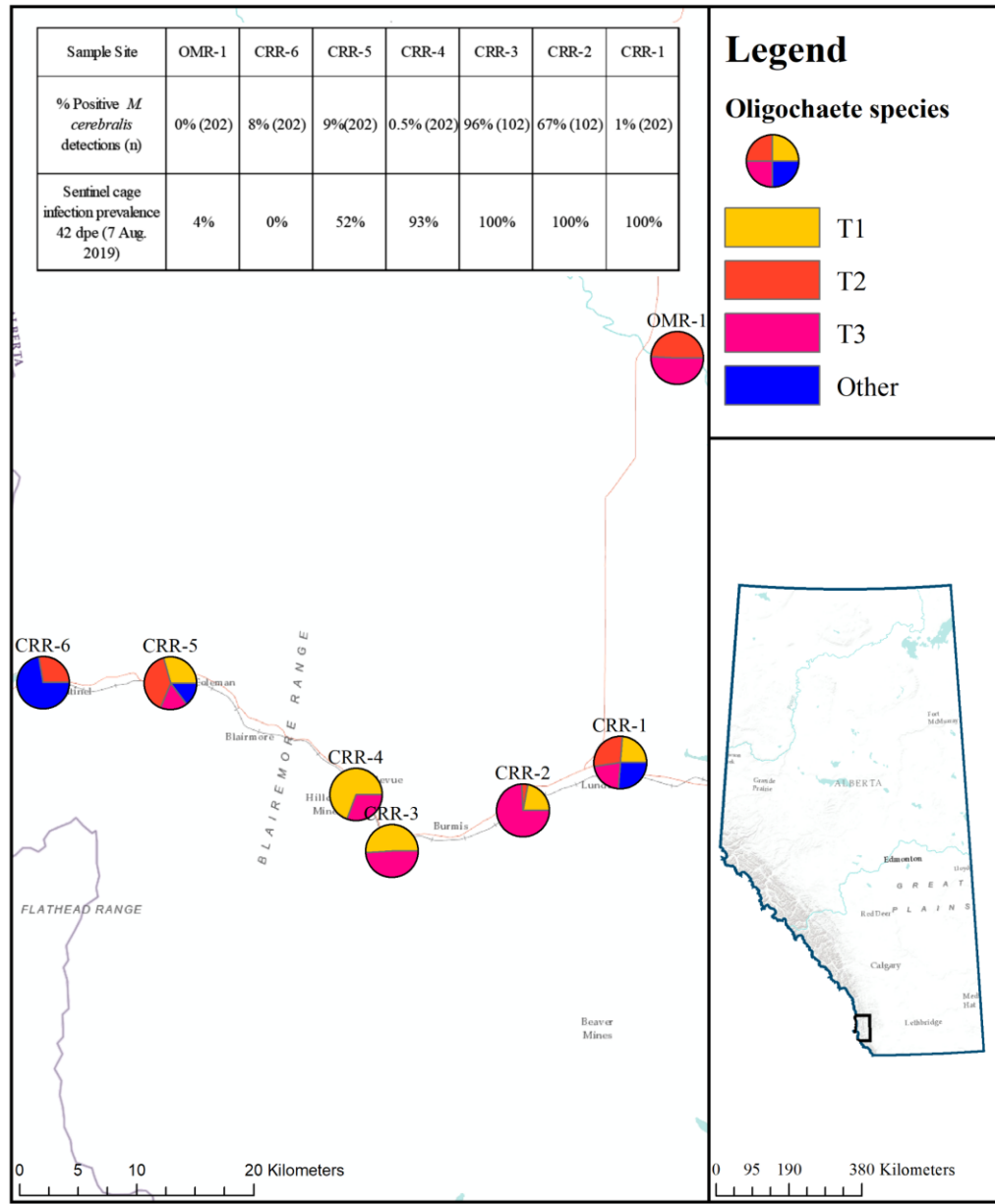
Clayton T. James, Marie F. Veillard, Amanda M. Martens, Emmanuel A. Pila, Alyssa Turnbull, Patrick Hanington, Andreas Luek, Julie Alexander, and R. Barry Nehring

Worm Analysis

- *Tubifex tubifex*
- Density can impact fish infection prevalence
- Novel phylogenetic groupings reveal information on parasite transmission
 - Five subspecies

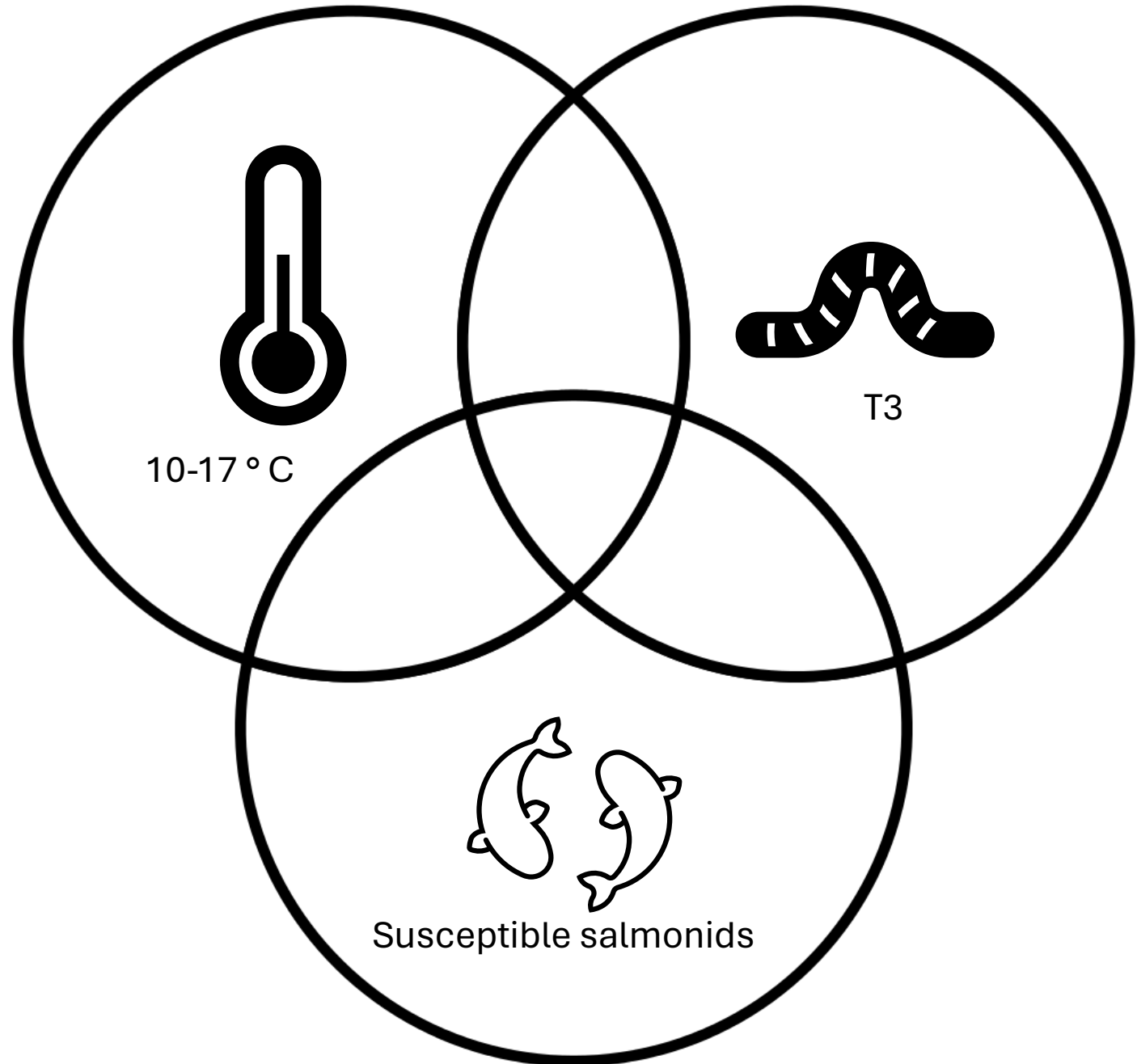


Tubifex subspecies defines transmission

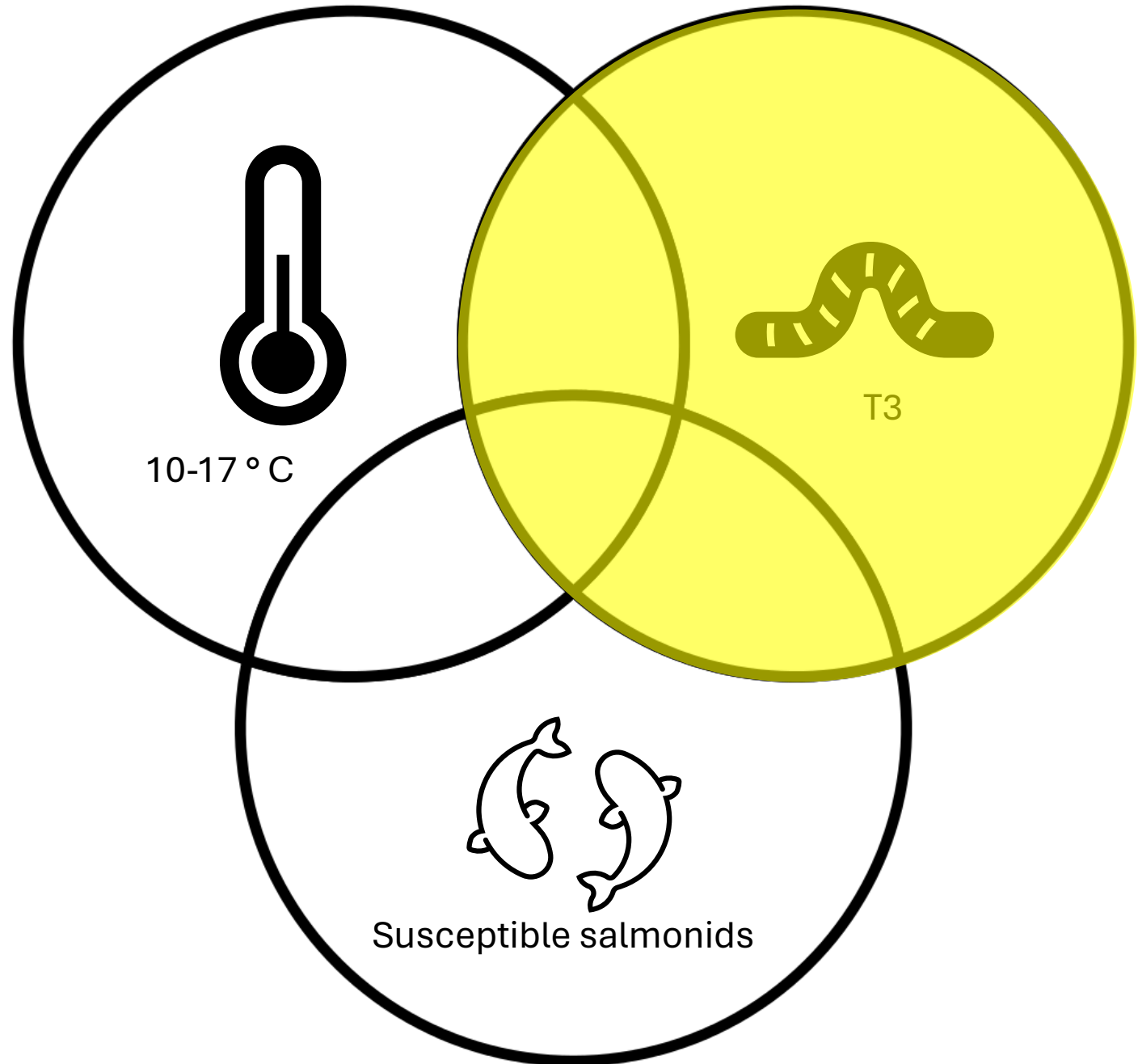


Service Layer Credits: Sources: Esri, USGS, NOAA Sources: Esri, Garmin, USGS, NPS

Thesis Work

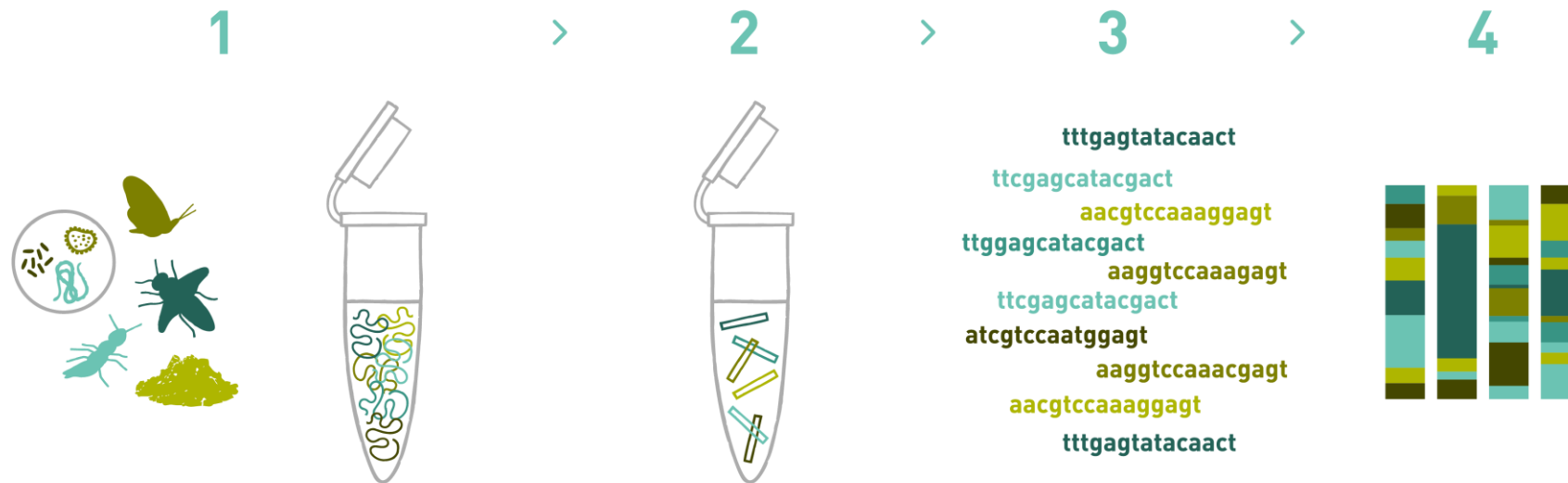


Thesis Work



Methods - Worm Metabarcoding

- Assess biodiversity and identify multiple species in one sample
- Will be used to assess worm communities
- Looking for T3 allows prediction of spread intensity and region



Methods - eDNA

- Growing in use
- One sample can be used to test for countless organisms including plants or animals
- Early detection of *M. cerebralis* possible



Chloe Christenson

Significance in Alberta

- Crowsnest indicates rainbow trout population decline (James et al., 2021)
 - Other populations not yet determined
- World class fisheries
 - Economic effects on guiding industry

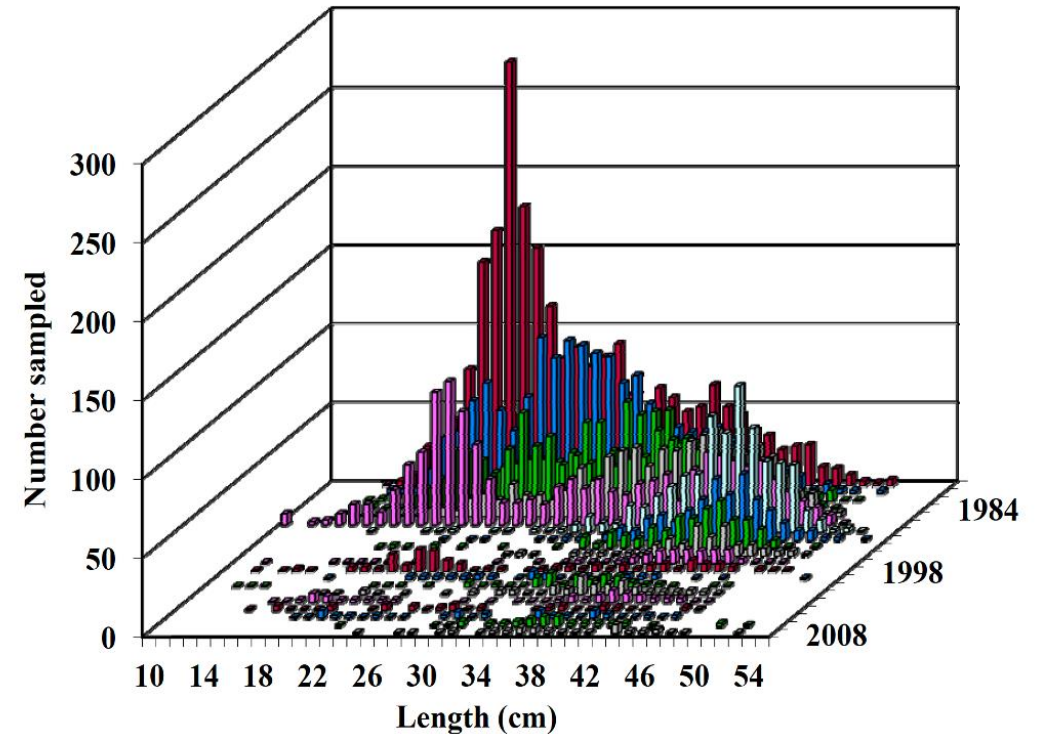


Figure 4.2. Upper Colorado River historic rainbow trout length-frequencies at Kemp-Breeze State Wildlife Area.

Going Forward

- Clean Drain Dry programs
- Continue monitoring for spread and impact
 - Whirling disease is dynamic



Dani Jakovljevic

Acknowledgments

- Hanington Lab members and Dr. Patrick Hanington
- Alberta Environment and Protected Areas
- Chloe Christenson, Clayton James

