B Samuel University of Alberta

Triaenophorous tapeworm

(*Triaenophorous crassus*)

in Alberta

Common name

none that we know of

Scientific name

a tapeworm, *Triaenophorous crassus*

What's Bugging Wild Critters?

Fact sheet #27: Triaenophorous

Significance

Cysts containing larval Triaenophorous crassus occur in the flesh of whitefish and their close relatives. Although the larvae cannot survive in humans, the presence of the larvae in individual fish causes concern for anglers who eat them, consumers who purchase them, as well as commercial export markets that need to avoid infected fish.

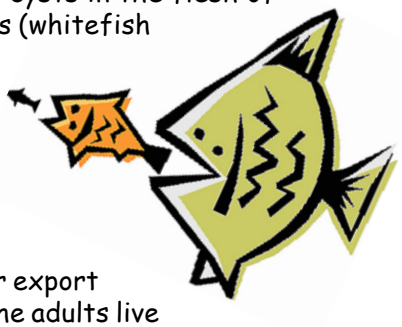
What? Where? How?

Tapeworms are uniquely adapted to making good use of habitats found in every vertebrate animal group that has an intestine! They are an amazing group of animals superbly designed to live where others dare not go. Over eons of time, tapeworms lost their digestive system in the interests of dedicating most of their internal space and resources to staggering levels of reproductive output. And indeed, they are successful! Nearly every species of vertebrate has one or more species of tapeworm that can find suitable habitat within the bowels of other beasts.

Tapeworms all look pretty much the same regardless of whether they live in the intestines of mammals, birds, or fishes. Adult worms are invariably white, flat, ribbon-like critters. Each worm has a front end (scolex) that is expanded into a bulb, often with suckers and/or hooks, and is used to hold onto the wall of the intestine. Otherwise, the worms would be swept downstream and out of the gut before they were ready.

The rest of the tapeworm is a series of identical segments in various stages of reproductive development. In most tapeworms, each segment contains a complete male and female reproductive system that can either produce its own fertilized eggs, produce sperm to fertilize other segments, receive sperm from other segments, or receive sperm from other worms. The segments farthest from the scolex are the most mature. These segments, which contain millions of eggs, may break apart in the gut and release the eggs directly into the intestine or they may simply break off from the rest of the worm and pass out still intact in the faeces.

There are actually three species of *Triaenophorous* tapeworms in Alberta: *T. crassus* is the most notorious because it survives as cysts in the flesh of coreogonids (whitefish family), which are often caught by anglers or netted for commercial domestic or export markets. The adults live in northern pike; *T. nodulosus* survives as larvae in cysts in the abdominal organs of burbot and perch. Adult worms live in northern pike; and *T. stizostedionis* larvae survive as cysts in the abdominal organs of trout-perch, and the adults live in walleye. All use the same species of copepod (a tiny see-through critter that looks like a small lobster) as the first step up the food chain. *T. nodulosus* originally came from Europe, no doubt in translocated fishes, whereas the other two species originated in North America.



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Transmission Cycle

Simple tapeworms have complicated life histories. Adult *Trianenophorus crassus* can survive only in the intestines of northern pike. In order to get to an uninfected pike, the eggs and larval stages must negotiate the aquatic food chain, moving first from the water into copepods, then small fishes, then bigger fishes.

Let's start with the adult tapeworm in the intestines of northern pike. In April, fully mature segments burst and each one releases a cloud of tiny tapeworm eggs, which then pass down the intestine and out into the water. The eggs hatch in the water, but only after the embryo repeatedly throws itself at one end of the eggshell until finally the little lid on the egg opens, freeing the larva. Each newly hatched larva (coracidium) is armed with 6 moveable hooks and must be eaten by a *Cyclops bicuspidus* (the copepod) within three or four days or they die. If eaten in time, the hooks are used to tear through the stomach wall of the copepod. Free from the stomach, the larvae move throughout the copepod's body, grow, and develop into a new larval stage (procercoid). An infected *Cyclops* lives for only a month, so it must be eaten by a fish, along with the tapeworm larva before the month is over in order to pass on the tapeworm.

The larvae are not too choosey at this point, and encysted larvae (plerocercoids) survive in a variety of fishes of the whitefish family, although ciscoes (=tullibee) and lake whitefish are where most of the larvae end up. In fact, if there are no ciscoes available, the tapeworm cannot maintain a population and will disappear from the lake. Lake whitefish accidentally provide habitat for larvae when they swallow the copepod in the water they drink. Once inside suitable fish habitat, the larvae use enzymes to digest their way through the stomach wall and move through the muscles. The best site for the larvae is in muscles along the back of the fish. A cyst wall then forms around each larva and it does not move any further. Within the cyst, the larva continues to eat, grow, and develop. Encysted larvae can survive for about four years, after which they die and are absorbed by the fish. However, more cysts are added each summer and older (and/or larger) fish tend to support more larvae.

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Ciscoes and whitefish cannot provide suitable habitat for adult worms and thus the larvae in their muscles cannot develop further until they are eaten by a northern pike. Once in a pike gut, the larvae are activated, escape from the cysts, and anchor themselves in the intestinal wall. Nutrients from the intestinal contents are absorbed through the surface of the tapeworm (remember, tapeworms have no digestive system!) and provide energy for growth of the tapeworm and development of new eggs. Once the eggs are released, the spent worm dies and floats out of the intestine in the faeces.

Distribution in Alberta

Cysts of *T. crassus* are relatively common in some of the prime fishing lakes in northern Alberta, in part because we have relatively few lakes in the province. Significant numbers of cysts can be found in fishes from Helena, Skeleton, Calling, Lesser Slave, North Wabasca, Peerless, and Bistcho lakes. In general, this tapeworm maintains populations in drainages north of the North Saskatchewan River in which ciscoes and pike are abundant.

Importance for Wildlife Management

Anglers are less and less likely to see these tapeworm cysts. Although catch-and-release regulations result in more recreational activity, it also means fewer fish in the fry pan and thus fewer fish being filleted. In those fish heading for the fry-pan, the presence of the harmless cysts can cause anglers to needlessly throw the fish away. The toll this takes on fisheries that are already stressed with low productivity and high mortality has not been calculated.

For more information on wildlife diseases in Alberta: http://www3.gov.ab.ca/srd/fw/diseases/index.html

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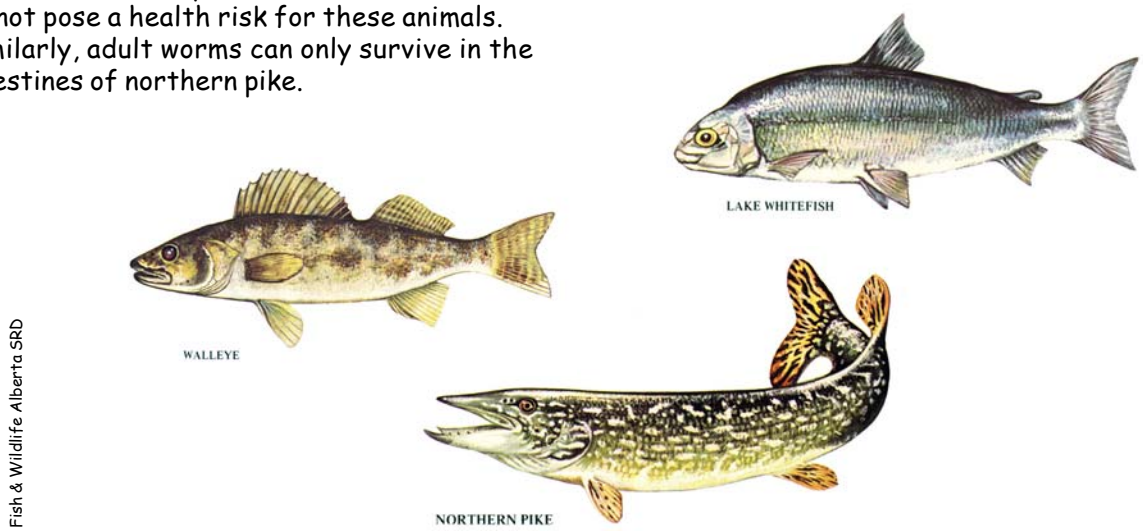
The much greater concern about tapeworm cysts is associated with commercial fishing in northern portions of the province. Commercial fish managers identify 27 lakes for which there are concerns regarding tapeworm larvae encysted in the flesh of lake whitefish, walleye, and/or ciscoe. These include a number of the important commercially fished lakes in Alberta. The cysts of *T. crassus*, although harmless to humans, are unsightly and decrease the market value of the fish. Whitefish with more than 50 cysts in 45 kg of fish cannot be exported.

Prevention/Control

In the 1950s, Dr. R.B. Miller, one of the founding fish researchers in Alberta, tried a number of experiments to control or eradicate *Triaenophorous* from northern lakes. In a nutshell, he was outdone each time by the tapeworm! Since then fisheries managers, anglers, and commercial fishermen have learned to live with these tapeworms, which are widespread, native residents of the province. Surveillance programs are in place to limit the number of infected fish entering commercial markets.

Public Significance

Larvae of *Triaenophorous* species cannot survive in humans, pets, or livestock and thus do not pose a health risk for these animals. Similarly, adult worms can only survive in the intestines of northern pike.



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Summary

Triaenophorous tapeworms are just really neat critters which occur naturally in northern lakes that provide fish and copepods as suitable habitats for these harmless animals. They are remarkably adapted to where they live and pose no threat to humans, fish, or others.

Additional Information

University of Manitoba: http://www.umanitoba.ca/faculties/science/zoology/faculty/dick/z346/triaehome.html

For more information on wildlife diseases in Alberta: http://www3.gov.ab.ca/srd/fw/diseases/index.html

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