

Common name

black spot, black grub
yellow grub, yellow spot
white grub, white spot

Scientific name

Neascus sp.
Clinostomum spp.
Posthodiplostium sp.
Triaenophorus spp.
Diphylobothrium spp.

What's Bugging Wild Critters?

Fact sheet #40:
Encysted Larvae
in fishes



Significance

Anglers occasionally find soft coloured masses in the skin, in the flesh, or on the internal organs of the fish they catch. These are encysted larvae of various species of trematodes (=flukes) or cestodes (tapeworms) that are waiting to be eaten by something bigger than the fish they are in. These larvae usually cause little or no damage to the fish and are a natural part of Alberta's ecosystems.

What? Where? How?

As a general rule, flukes and tapeworms have difficulty surviving on their own. They often use natural food webs, particularly the relationships between predators (the 'eaters') and prey (the 'eaten'), in order to secure a safe place to live and a means of moving up the food chain. Water is essential to all living things, and fluke and tapeworm life cycles often are closely tied to natural waterbodies in order to avoid drying out.

Usually the intricate balance among species goes unnoticed by human observers. However, a few lucky anglers find larvae of flukes and tapeworms in their fishes. Some want to know what they are, how they got there, and whether they are harmful.

Various species have larvae that occur as cysts in fishes in Alberta. Life cycles of these species include tiny aquatic invertebrates, aquatic snails, small fishes, bigger fishes, and ultimately fish-eating birds or mammals as steps to completing the never-ending cycle from eggs to adults. Larvae that occur at each step are simply travelers on their way to somewhere else. This fact sheet contains information about a few of the most common encysted larvae seen by anglers in our province.

Encysted Larvae in fishes in Alberta

Trematodes/Flukes

Black spot is associated with larvae of several trematodes. In Alberta this most commonly involves species of *Neascus* and is easy to recognise. Tiny pinhead-sized black flecks can occur in the skin, the flesh, and sometimes the eyes. They make it look as if the fish has been sprinkled with coarsely-ground black pepper. The black colouring actually is part of the fish immune response. Black spot in Alberta is seen most often in rainbow trout, but also can be in longnose suckers, mountain suckers, spot-tail shiners, northern pike, lake whitefish, and various minnows and dace. For more information check the separate fact sheet in this series called *Black Spot in Alberta*.

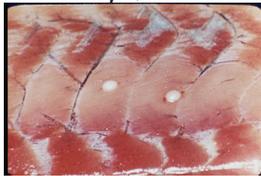


Yellow grub (sometimes called yellow spot) is associated with the larvae of another trematode, *Clinostomum complanatum*. The soft yellow oval cysts are relatively conspicuous (3 to 8 mm) and can occur in the fins, muscles, and gills, or under the skin anywhere on the body. If you look closely you might see that each cyst contains a curled-up creamy white or yellow worm-like larva about 5 mm long. This trematode species has a wide distribution in freshwater fishes throughout North America and it is likely that any fish species can provide suitable habitat for its larvae. The cysts are most often seen in yellow perch, but can occur in lake whitefish, rainbow trout, northern pike, walleye, cisco, and various minnows.

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Although rare, *Henneguya* spp, is yet another critter that forms yellow cysts in the flesh of Alberta fish. However, it is a completely different type of animal and is not considered an encysted larva. It is a single-celled protozoan, so you won't find a wormlike larva inside the cyst.

White grub (white spot) is the common name for encysted larvae of a yet another trematode closely related to those mentioned above. This time the larvae are *Posthodiplostomum minimum*. The cysts (up to 1 mm) are just a bit smaller than those of black spot and, not surprisingly, are whitish rather than black. The cysts of white grub occur in the flesh and liver, kidneys, mesenteries, and other internal organs.



Their size and location make them so inconspicuous that only sharp-eyed anglers notice them. White grub can find suitable habitat in yellow perch, walleye, brook trout, northern pike, various suckers, and other fish species. In regions where white grub is abundant the adults show up occasionally in a few mammals, amphibians, and reptiles.

Cestodes/Tapeworms

Several species of tapeworm use the flesh or viscera (internal organs) of fish as suitable habitat where larvae can form cysts. By far the most common encysted tapeworm larvae in Alberta belong to the genus *Triaenophorus*. There are three species involved: *T. crassus* in lake whitefish, *T. nodulosus* in yellow perch, burbot, 9-spined stickleback, and pike, and *T. stizostedionis* in trout-perch. *Triaenophorus* larvae occur in muscle tissue as conspicuous elongated cysts up to 3 cm long and half a centimetre wide [as seen in the photo on the front page of this fact sheet]. Each cyst contains one coiled larva. If you cut open a cyst you will release a thin tapeworm larva several centi-

metres long. Newly-established cysts are opaque/white, but these darken with age to form the classic 'yellow grub'. For more information check the separate fact sheet in this series called *Triaenophorus in Alberta*.



Other tapeworm larvae that appear as yellow cysts include species of broad fish tapeworm, *Diphylobothrium* spp, mostly in trout, lake whitefish, northern pike, and walleye. These cysts are relatively small (~0.5 cm diameter) and are oval rather than elongate. Their most distinguishing feature is that they usually occur on the internal organs. These species have a worldwide distribution in a wide range of fishes. For more information check the separate fact sheet in this series called *Diphylobothrium in Alberta*.

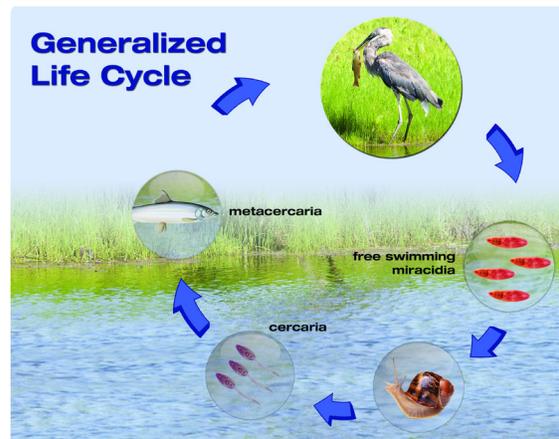
Transmission Cycle

The trematode species with encysted larvae in fishes all have complex life cycles involving several habitats (=hosts). The flukes associated with black spot, yellow grub, and white grub all live as adults in the digestive tract of fish-eating birds such as herons, gulls, and grebes. Eggs leave with the faeces and are released into the water where they hatch into free-swimming larvae (miracidia). These larvae must look for, find, and burrow into an aquatic snail. Chemical cues often are involved in helping the larvae find the

snails. The snail provides suitable habitat in which the larvae can multiply.

These new larvae eventually leave the snail and occur as yet another form of free-swimming larvae (cercariae) that look for and burrow into a suitable fish. In fish they are associated with the coloured cysts (metacercariae) we know as black spot, yellow

grub, and white grub. When the fish (and the encysted larvae) are eaten by the right species of fish-eating bird, the larvae emerge from the cyst and mature into adults. Once mature, the



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adults produce eggs which pass out with the faeces, thus completing the life cycle. Occasionally reptiles and amphibians can eat the larval stages and become yet another means of moving up the food chain when they too get eaten by a bird in which the adult trematodes can mature.

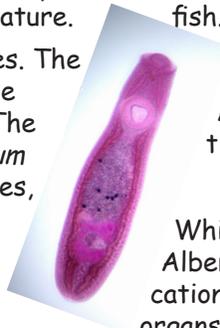
Tapeworms lead similarly complicated lives. The adults of *Trienophorus* species live in the intestines of northern pike and walleye. The adults of some species of *Dipyllobothrium* can live in the intestines of wolves, coyotes, and bears, while other species mature in fish-eating birds. On rare occasions they can occur in humans (although no cases have been reported from Alberta).

In all cases, the tapeworm eggs are shed into the water, where they hatch into larvae (cercaria) that burrow into tiny aquatic invertebrates called copepods and develop into a new larval stage (proceroid). Copepods occur in vast numbers and are one of the primary food items for a wide range of fish species. Once inside a fish that provides suitable habitat, the tapeworms form encysted larvae (pleurocercoids) in the tissues. Now they settle in as passive passengers, waiting--sometimes for years--for their fishy vehicle to be eaten by a predator which provides habitat where they can mature into adult tapeworms. Sometimes the encysted larvae pass through more than one fish species on their way to their final destination (big fish eat little fish that eat littler fish). Who would have thought that growing up as a tapeworm could be so complicated?

Distribution in Alberta

Black spot is the most common of the three trematode species seen as encysted larvae in fish in Alberta. It can be quite common in ponds and lakes throughout the province that have been stocked with rainbow trout. These fish may be easier targets for larvae looking for a place to form their cysts. Stocked rainbows also may be easier targets for fish-eating birds, which increases the opportunities for the trematodes to complete their life cycle. However, you could see black spot in a variety of fishes in any relatively warm waterbody.

Yellow grub is common in eastern Canada, but seems to be less common in Alberta. It has been reported from some populations of yellow perch in the central foothills, and it occasionally turns up in commercial harvests of lake whitefish. Great blue herons provide the primary habitat for the adult worms. We have limited numbers of heron colonies in Alberta and this may limit the opportunities for yellow grub.



White grub also seems to be uncommon in Alberta, although given the inconspicuous location of most encysted larvae on the internal organs it may simply go unseen and unreported. Lack of herons also may limit white grub in Alberta.

Trienophorus species are common in many lakes across Alberta. However they are particularly evident in the northern part of the province, and specifically in Helena, Skeleton, Calling, Lesser Slave, Wabasca, Peerless, Moose, Jarvis, Graveyard, Cache, Gregg, and Bistcho lakes. Other lakes, such as Spencer, Smoke, Iosegun, Shiningbank, Fickle, and Utikuma Lakes, are relatively free of *Trienophorus* larvae.



Dipyllobothrium larvae occur throughout the province in a variety of fish species but rarely are seen or reported.

Importance for Wildlife Management

None of these species is particularly harmful to fish. In rare cases the trematodes can cause problems in very heavily infected fish. For example, some fathead minnows found dead in Missouri in 1979 each had over 2000 yellow grub cysts. Fortunately such situations are not known to occur in Alberta. Nor do the tapeworm larvae appear to damage the fish that carry them. However, anglers who discard fish with cysts can be a source of wasted fish and increased pressure on fish populations.

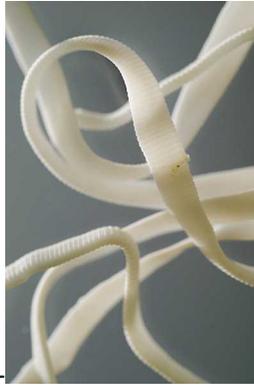
Encysted Larvae in fishes in Alberta

Public Significance

The common species of encysted larvae in fish in Alberta do NOT pose a health risk to humans. In fact, they simply cannot infect people. In addition, the larvae are killed by cooking. The primary concern is that anglers may discard fish that pose no health risk but are unpleasant to look at, let alone serve to family and friends at the dinner table.

In contrast, species of *Diphyllobothrium* are known to sporadically infect humans in northern regions of Europe, Asia, Scandinavia, Canada, and Alaska. Most human infections involve one species, *D. latum*. Fortunately species of *Diphyllobothrium* commonly found in North America are the least likely to infect humans. The few human infections that do occur are the result of eating raw or undercooked fish or snails. Similarly infections can occur in dogs fed uncooked fish. However, since the cysts generally occur only in internal organs, they are removed when the fish is cleaned and thus do not pose a risk to those consuming the flesh of their fish. Moreover, thorough freezing or cooking kills the larvae.

There are two reports of humans in Asia being infected from eating raw fish that carried cysts of yellow grub. However, such cases are rare and the risk of infection is extremely low. There are no documented cases in North America.



There is no evidence that humans can contract disease from black spot, white grub or *Triaenophorus*, so the only problem is that they make the fish appear less appetizing.

Triaenophorus cysts are very abundant in whitefish and walleye, and thus are an ongoing concern for commercial fisheries, especially in lakes in the northern part of the province. For aesthetic reasons, heavily infected fish cannot be exported, which greatly reduces the value of the commercial catch in lakes such as Calling, Lesser Slave, and Wabasca. There is an ongoing program to remove infected fish prior to sale or export.

Prevention/Control

There is little that fisheries or wildlife managers can do to control any of these naturally-occurring species--but fortunately, there is little reason to try. None of these animals causes major problems for the fish or the general public. However, anglers are always encouraged to clean their catch carefully and cook it thoroughly. Although there is little or no risk in Alberta, anglers who travel to other parts of the world are encouraged to learn more about the local risks.

Summary

Encysted larvae on or inside fish look worse than they actually are. For the most part they occur as benign elements of the biodiversity of the province. They generally do not affect the fish and most can be removed by skinning the fish or trimmed out of infected fillets. In addition, the larvae are killed by cooking.

Additional Information

Black spot: Michigan Dept Natural Resources

www.michigan.gov/dnr/0,4570,7-153-10364_52259_10950-27376--,00.html

Yellow Grub: Vermont Fish and Wildlife

www.vtfishandwildlife.com/library/factsheets/fisheries/fish_health/Yellow_grub.pdf

White Grub: Iowa State University

www.ncrac.org/NR/rdonlyres/932C2C7D-CDA1-444E-B3DA-13FB396B2B16/0/TB115.pdf

Nelson, JS and M Paetz. 1992. The fishes of Alberta. University of Alberta Press., Edmonton.

Wildlife diseases in Alberta: esrd.alberta.ca/fish-wildlife/wildlife-diseases/