H-A.1

CUTS, SCRAPES AND SCARS

A-1.1 A-2.1 A-3.1

What are they?

Fish can receive cuts and scrapes just like people. For fish however, one of the most likely times of injury can occur during spawning runs when fish congregate in shallow areas. Some hunters have been seeing more cuts and scrapes on fish than they used to see. They feel that this might be related to changing climate conditions which causes lower water levels.

The use of gill nets can also injure fish. The string of the net may damage the soft skin of the fish. Fish may receive injuries but manage to escape the net. These injuries may eventually heal over into scars.

Some cuts and scrapes will heal over time and may produce a scar while other wounds can become infected with bacteria or fungus resulting in red sores (ulcerated areas). Some of these wounds may not heal and the fish may die.

What do cuts and scrapes look like?

Cuts and scrapes can be many different shapes. Most cuts and scrapes will likely occur on fins, mouth, gill covers and belly of the fish, but they can be found anywhere on the body.

Wounds made by gill nets often involve the fins, mouth and gill covers. Sometimes gill nets may cause damage directly behind the gill on the body of the fish.

H-A.1

Gill net damage to fish.
Photo Credit: J.D. Reist

What species are affected?

- All species of fish can have cuts and scrapes.

Human health concerns

- None. Fish may be less desirable to eat.

Safety of the meat for dogs

- Fish with cuts and scrapes may be fed to dogs.

Samples to collect

- None

H-A.2

PARASITIC COPEPODS (ANCHOR WORMS)

A-1.1 A-2.1 A-3.1

What are copepods?

Copepods are parasitic crustaceans. These small parasites are commonly called anchor worms but are in fact not worms at all.

Copepods attach themselves to the fish by means of an anchor, or bulla.

The adult females of these parasites are usually the ones most easily seen since the males are much smaller. The head of the parasite burrows into the skin and females can often be seen with what looks like two tails, but are in fact two sacs of eggs.

Two genera, *Coregonicola* and *Salmincola,* are found in the Northwest Territories, Nunavut and Nunavik.

Coregonicola is the larger of the two genera and can reach lengths of 10 cm. The two marine species known in this area, *C. orientalis* and *C. productus*, are not common or numerous and are found only on anadromous lake whitefish and broad whitefish, respectively.

Salmincola sp. are relatively common parasites for several Northern fish. Adult female parasites may reach a length of 1 cm. Seven species of *Salmincola* are known. *Salmincola carpionis* is found on Arctic charr. *S. edwardsii* is found on Arctic charr as well as lake trout. Other species of *Salmincola* are also found in broad and lake whitefish.

Small sores may develop where the copepod attaches to the fish. These may offer a point of entry for bacteria, leading to infection.

H-A.2

Where on the fish are they found?

- Depending on the species of fish and species of copepod, the parasite may attach to the side of the fish, its gills, fins or inside its mouth.
- *Coregonicola sp*. are typically found attached to the sides of whitefish.
- *S. carpionis* attaches to the mouth of Arctic charr. As many as 20 *S. carpionis* have been found within the mouth of Arctic charr.
- *S. edwardsii* attaches to the gills of Arctic charr and lake trout, and may be found on the fins of Arctic charr.
- *S. extensus* can be found attached to the fins of whitefish.

What species are affected?

- Arctic charr, lake trout, broad whitefish and lake whitefish.

Human health concerns

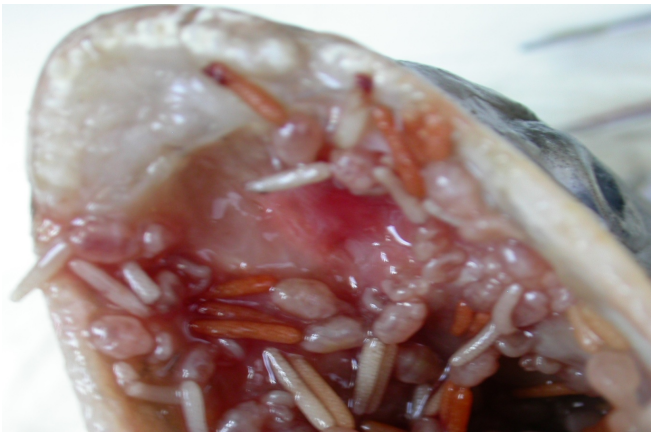
- None.

Safety of the meat for dogs

- Infected fish are safe to feed to dogs.

Samples to collect

- Intact parasites preserved in alcohol or the entire fish.



Salminocola sp. found in the mouth of a fish. (Photo credit: Manon Simard; Makivik Corporation)

H-A.3

FUNGUS IN FISH (Internal fungal infection)

A-1.1 A-2.1 A-3.1

What is this fungal condition?

Infrequently, fish may be seen with a fungal infection inside the body cavity. In extreme cases, these fish may also be identified by a blotchy discolouration underneath the skin resulting from the fungal infection.

The fungus responsible is *Phoma herbarum*. This species of fungus normally lives on plants. It is thought that, on occasion, this fungus may enter the swim bladder of the fish when air is taken in through a tube, called the pneumatic duct, which connects the throat (esophagus) with the swim bladder.

What does it look like?

Infected fish can not maintain their balance and have difficulty swimming properly.

During the early stages of infection, the fungus may appear as small white areas at the front of the swim bladder.

As the fungus progresses, it can fill the swim bladder with fungi and cause the swim bladder to enlarge. At this stage, the walls of the swim bladder break down rapidly and the fungus then spreads to other internal organs causing extensive and severe redness and swelling (inflammation).

The fungus does not spread easily to other fish, and generally less than 5% of the fish in a population die during an outbreak.

Younger fish appear more susceptible than older fish.

What species are affected?

Charr, trout, whitefish.

H-A.3

Human health concerns

- Infected fish should not be consumed, although the likelihood of getting sick from cooked fish is probably low.
- The fungus likely affects the flavour of the fish.

Safety of meat for dogs

- It is not recommended to feed heavily-infected fish to dogs.

Samples to collect

- Collect infected tissue surrounded with a margin of healthy tissue.

Arctic Charr with a *Phoma herbarum* infection. (Photo Credit: DFO)

H-A.4

ROUNDWORMS

A-1.1 A-2.1 A-3.1

What are they?

Roundworms, or nematodes, are parasites of fish. Depending on the species of parasite and species of the fish, the roundworm may occur in either immature (larval) or adult forms. As adult worms, they are white or transparent, round and unsegmented. The size will vary with the species of worm. They can occur in many locations: stomach, intestine, body cavity, swim bladder, sex organs (gonads) and liver. Adult worms generally cause very little tissue damage. However, larvae that move through tissue may cause damage either by their passage or by the host's reaction to their presence.

Where in the fish are they found?

Adult Nematodes

Cystidicola sp. occurs in the swim bladder of Arctic charr, lake trout and whitefish. *C. stigmatura* may be present in very large numbers (thousands) in the swim bladder of Arctic charr and lake trout. *C. farionis* occurs in all species of fish listed above, but usually in small numbers (less than 10).

Hysterothylacium aduncum can be found in Arctic charr as well as lake trout.

Philonema sp. occurs in the body cavity, swim bladder or gonads of Arctic charr, lake trout, least cisco and northern pike. They are large parasites, up to 20 cm in length, and are present in small numbers.

H-A.4

Larval Nematodes

- *Raphidascaris acus* is a nematode in which the adult worm is found in the northern pike (final host). Larval forms of *R. acus* occur in species of fish which the pike may eat, including broad and lake whitefish, burbot and least cisco. In most of these species, the larvae are embedded on the surfaces of the stomach, intestine, or swim bladder in the form of a cyst.

- *Anisakidae* nematodes such as *Contracecum sp.* and *Anisakis simplex* can infect marine fish as well as Arctic charr during the marine portion of its life. Adult stages of these parasites are found in the stomach and intestines of marine mammals (see seal and whale stomach worms in section H-C.10), where they produce eggs. These eggs leave the marine mammal in its droppings (feces). The eggs hatch and the larval worms are eaten by invertebrates, fish and fish-eating birds.

- Not all fish contain larvae, but some do.

- Larval roundworms may cause illness in people and dogs if they are eaten.

- They are killed by cooking or freezing to -20°C for 7 days.

- Nearly all larval roundworms live in the body cavity and the organs the cavity contains. However, they sometimes move into the flesh of the fish after the fish dies.

- Larval roundworms are not always easily visible in fish flesh.

- It is not known how commonly fish are infected with larval roundworms.

- It is difficult to identify the different species and stage of life (adult versus larval) of roundworms within fish.

Human health concerns

- To reduce the chances of becoming infected, people can
    1) Gut the fish as soon as it is caught and killed.
    2) Cook the fish well before eating.
    3) Freeze the fish at -20°C for 7 days.

H-A.4

Safety of the meat for dogs

- Dogs may become infected with larval roundworms. The same advice is given as for human consumption.

Samples to collect

- Collect intact worms preserved in alcohol.

Larval roundworms in the muscle of a fish.
(Photo credit Dr. J.S. Lumsden)

Anisakidae (larval stage) roundworm within the body cavity of a fish.
(Photo credit: Manon Simard; Makivik Corporation)

H-A.5

TAPEWORMS

A-1.5 & A-1.6

A-2.5 & A-2.6

A-3.5 & A-3.6

What are tapeworms?

Tapeworms, or cestodes, are parasitic worms.

Tapeworms often have complex life cycles that involve one or more hosts that harbour the immature worm (intermediate hosts) as well as a host that harbours the adult worm (final host).

In the final host the adult worm is flat and segmented. The size of worm can vary greatly between species, from a few millimeters to many centimeters.

In the intermediate host, the larval worm may be embedded in the flesh in the form of a sac, or cyst, or it may be free in tissue. Intermediate hosts usually acquire the larval tapeworm through the consumption of an invertebrate containing a more immature stage of the tapeworm.

A variety of tapeworms occur in fish in the Arctic. Depending on the species of tapeworm and the species of fish, the fish may act as either the intermediate or final host. Therefore, tapeworms within fish may be seen in the larval stage or adult stage.

It is the larval stage that may be infectious to humans and dogs.

Adult tapeworms

Several species of adult tapeworms may be found in fish. The tapeworms typically are found in the intestine or stomach of the fish where they are attached to the wall of the organ by means of suckers. Tapeworms do not have a digestive tract, and, like thorny-headed worms (see section H-A.6), absorb their food directly through their body wall. Their effect on the fish will vary with the number of parasites present. In large numbers, the worms may cause loss of body condition or even death, through competition for nutrients or by causing blockage of the intestine.

H-A.5

- *Bothrimonus* is a tapeworm that salmonids acquire by eating marine amphipods. Fish that spend parts of their life in fresh and salt water (anadromous) lose this tapeworm in fresh water but are reinfected when in salt water again.

- *Cyathocephalus truncatus* is a small (2-3 cm) tapeworm that occurs in the intestines of Arctic charr, lake trout, and whitefish. This species is not common and is usually present in fairly small numbers in individual fish.

- *Eubothrium sp.* are large (up to 40 cm) tapeworms which can be present in large numbers. They occur quite commonly. *E. crassum* is found in Arctic charr. *E. salvelini* is found in Arctic charr and lake trout.

- *Proteocephalus sp.* are common tapeworms that can be present in large numbers in the intestines of fish (up to 700 in a single fish). They are thin and grow up to 10 cm in length. *P. arcticus* has been found in Arctic charr and lake trout, *P. longicollis* has been identified in Arctic charr. *Proteocephalus sp.* have also been found in lake whitefish.

Immature (Larval) Tapeworms

- Fish are infected with larval tapeworms by eating copepods containing the larval tapeworms.

- *Triaenophorus sp.* form cysts in the meat (muscle) of trout and whitefish. On its route from the stomach of the fish to its muscle, the worm can cause a lot of damage.

- *Diphyllbothrium sp.* can be found in Arctic charr, trout and whitefish. With *D. dendriticum* and *D. ditremum*, the tapeworms go through further development in the fish, migrate through the wall of the stomach, and end up within small cysts that are attached to the outer wall of the stomach or intestines or to the walls of the body cavity itself. Large numbers of these larval cysts may be present. *D. dendriticum* are up to 5 cm in length. *D. ditremum* are only about 1 cm in length. Arctic charr may host over 5000 larvae within the cysts.

- When the fish is eaten by a bird or mammal, the larval tapeworms develop into adult tapeworms.

H-A.5

TAPEWORMS, CONT'D

Human health concerns

If a person eats fish in which the larval stage of the tapeworm is present, that person may become host to the adult tapeworm.

It is recommended to cook the fish well. Cooking or freezing the fish to -21° C will kill any worms and make the fish safe to eat. Smoking the fish alone will not kill the worms.

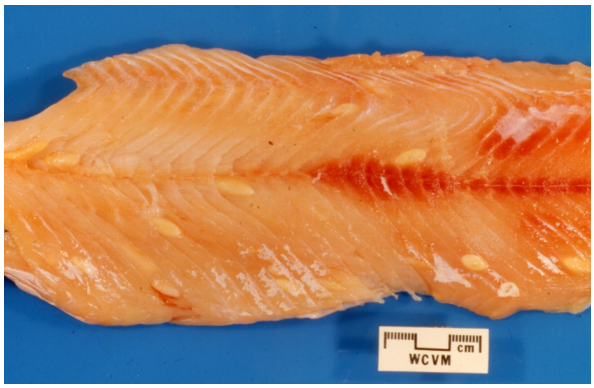
Safety of the meat for dogs

The conditions outlined above for human consumption apply to the feeding of infected fish to dogs.

Samples to collect

Intact worms preserved in alcohol or the entire fish.

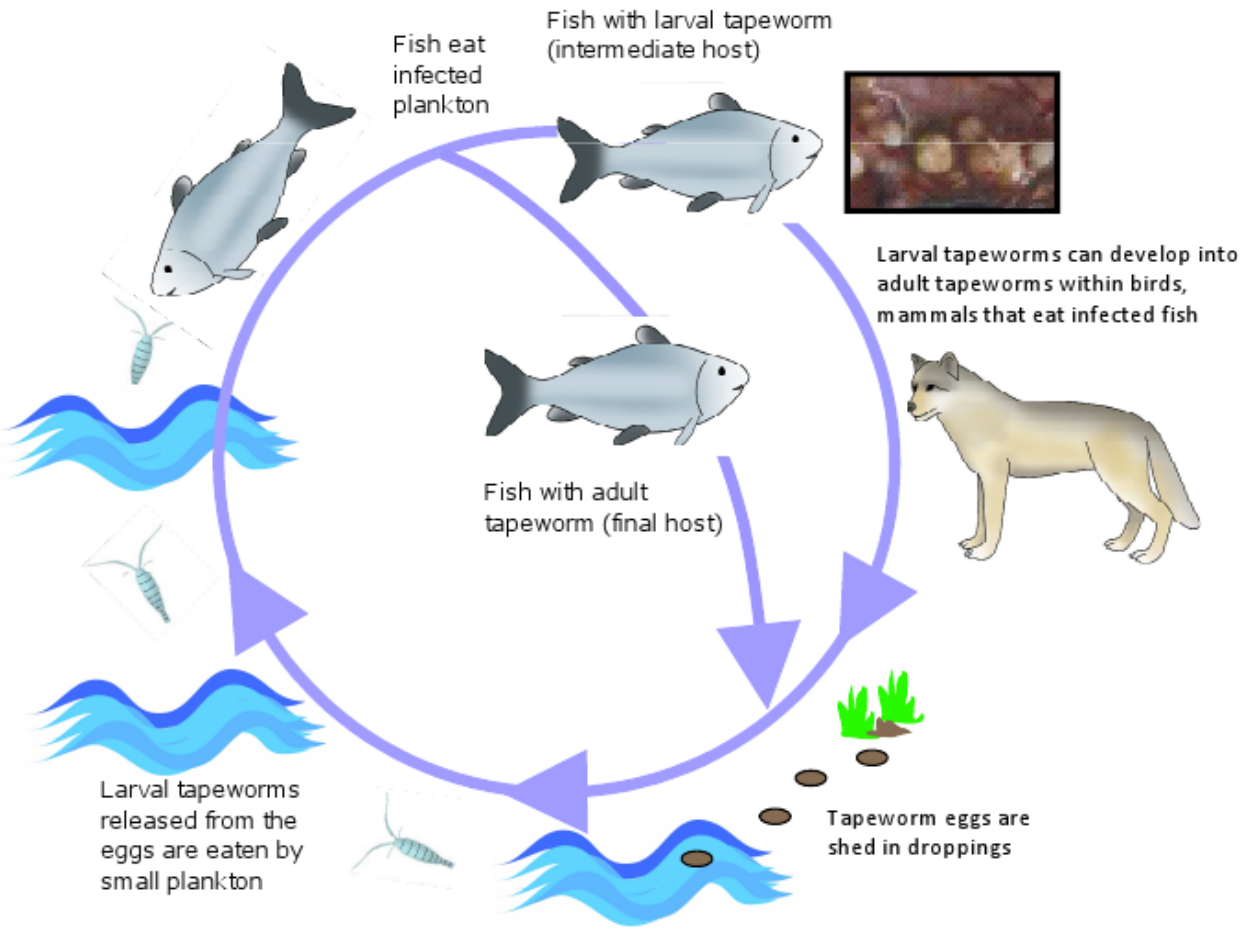
Adult *Diphyllobothrium* sp. tapeworm, preserved in alcohol. This species of tapeworm does not mature to adults within fish. The worm in the jar likely came from a fish eating-bird which became infected after eating a fish containing larval tapeworm cysts. (Photo credit: WCVM)



Triaenophorus sp. in the muscle of lake trout.
(Photo credit: Dr. G. Wobeser)

H-A.5

Tapeworm life cycle



H-A.6

THORNY-HEADED WORMS

A-1.7 A-2.7 A-3.7

What are thorny-headed worms?

Thorny-headed worms are parasitic worms belonging to the phylum Acanthocephala. These worms have complex life cycles involving more than one host. Eggs passed out into the environment from an animal that hosts the adult worm (final host) infect an animal that hosts the immature (larval) worm (intermediate host).

There can be more than one intermediate host during the life cycle of this parasite. In the marine environment, the first intermediate host is often a crustacean. The crustacean containing the larval worm can be eaten by either the final host or a second intermediate host such as a fish. The intermediate host(s) and final host(s) for the parasitic worm are specific for each species of thorny-headed worm.

When the larval worm is eaten by the final host it will develop into an adult worm. The final host for some of these worms is a fish; for others, it is a bird or marine mammal.

Thorny-headed worms attach to the intestinal wall of their host by means of a hollow structure, armed with hooks, that forms on one end of the worm. They have no digestive tract, and, like tapeworms (see section H-A.5), absorb their food directly through their body wall.

Thorny-headed worms in Arctic fish

a) Fish as intermediate hosts

Larvae of one small marine species, *Corynosoma strumosum*, have been found in Arctic charr on the Melville Peninsula. The final host in which the adult occurs is a seal (see thorny-headed worms of seals in section H-C.7).

H-A.6

b) Fish as final hosts

- There are 3 species of *Echinorhynchus* which affect salmonid fish. One, *E. gadi*, is acquired in salt water and two, *E. leidyi* and *E. salmonis*, are acquired in fresh water. These are found in the intestines, and less commonly the stomach, of the fish and are attached to the inner wall of the organ. They are 10-30 mm in length and they may be present in large numbers (several hundred worms in a single fish).

- A smaller (7 mm) species called *Neoechinorhynchus rutili* is found in Arctic charr and broad whitefish.

Effects on the fish

- The worms may damage the stomach or intestinal wall by their method of attachment, and they will compete for nutrients with the fish host.

Human health concerns

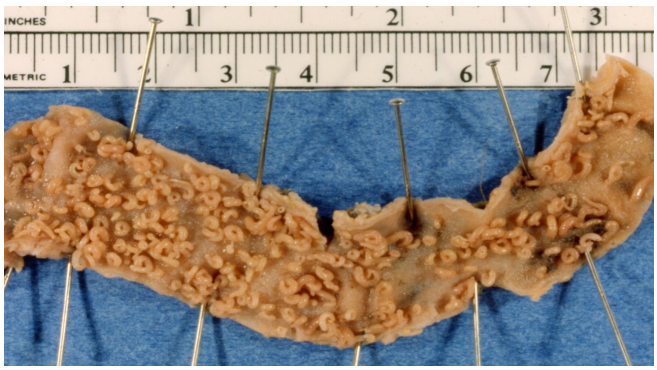
- These worms do not affect the quality of the fish for eating. Humans can not be infected by these worms.

Safety of the meat for dogs

- Infected fish are safe to feed to dogs.

Samples to collect

- Intact thorny-headed worms preserved in alcohol.



Acanthocephala in the small intestine of a fish.
(Photo credit: Dr. G. Wobeser)