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**ANGLERS  
CAN HELP PREVENT  
INFECTIONS IN FISH**

Fish secrete a protective mucous coating over the entire length of the body which helps prevent fungal, viral, and bacterial infections. If this mucous coat is damaged, the fish becomes more susceptible to infection. Since there are size limits on many fish, and since catch-and-release fishing is becoming more popular, anglers can help prevent infections by taking extra care when returning fish to the water. The mucous coat probably will not be harmed if the hook is removed while the fish is still in the water or if the angler wets his hands before handling the fish. In addition, the fish should be released gently after the hook is removed, rather than tossed into the water.

## Parasites: Are the Fish Good Enough to Eat?

You've been waiting all day for a bite. You had only a nibble or two a few hours ago. Finally, it happens. You feel the line pull; you gently tug at it, then begin to reel it in. Just what you've been waiting for: a handsome catch for dinner tonight. Or is it? You look closer and notice your fish is marred. Before throwing it away, check the fish carefully—it is probably still edible.

Occasionally, anglers will catch a fish marked by infection or parasitism. Most likely the fish is still edible. Very few fish diseases can be transferred to humans, and virtually all fish can be eaten when thoroughly cooked or hot smoked. In fact most fish parasites, even if consumed alive, will not harm humans. Some parasites, however, will make fish look and taste so unappetizing as to render them inedible. And there are a few fish parasites which can infect humans. For this reason, it is advisable to thoroughly cook all fish whether parasites are observed or not.

This booklet will identify most of the conditions of fish disease or parasitism and will provide recommendations regarding the edibility of infected fish. Usually anglers will see the results of infection or a parasite rather than the organisms themselves. For this reason the visual characteristics of the infection as well as its causative agent are cited here to assist in identification of the causative agent.

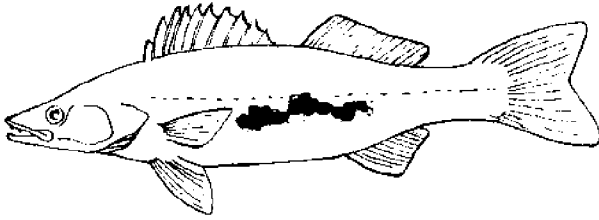
Parasitism is a natural phenomenon and normal fact of life. It occurs in the plant kingdom and in practically every major group of the animal kingdom. A parasite is an organism that lives in or on another larger organism of a different species (the host) from which it derives nourishment. Depending on the particular parasite, the host/parasite relationship may be either temporary or permanent. Damage to fish can be caused in a number of ways—by destroying the host's tissue, by removing blood and cellular fluids, by diverting part of the nutrient supply, and by allowing secondary infections to develop. Parasites seldom seriously harm their hosts, except when the parasites are numerous or the fish is under stress from some other cause. Some parasites, however, can cause severe damage to fish populations and thus become an important concern, both biologically and economically.

**A publication of the Minnesota Sea Grant Extension Program**

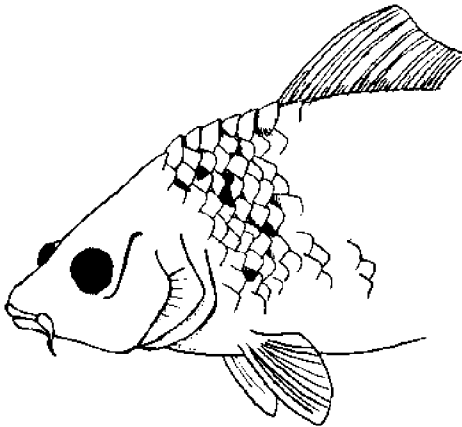
# External Parasites

## Visual Sign

## Cause/Recommendation



1. Cluster of white or cream colored warts erupting from the skin. May be pinkish to red in color and resemble a raspberry.



2. Fish popeyed; scales puffed with fluid (dropsy). Bloody wounds; under scales, inflammation around the mouth.

1

**LYMPHOCYSTIS** (virus). Found on walleye and occasionally on perch and other species. The virus infects fish by entering skin abrasions and attacks cells in the connective tissue. These cells grow to enormous size—as far as cells go—causing lumps in the skin. Practically all fish recover from this infection. *Edible. Remove infected skin; clean fish and prepare as usual.*

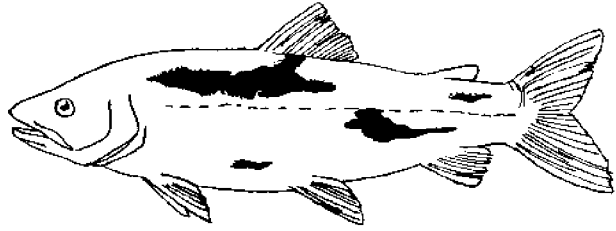
**DERMAL SARCOMA** (virus). Similar to lymphocystis except cells are normal size. *Edible. Remove infected skin; clean fish and prepare as usual.*

2

**VARIOUS BACTERIA** (such as *Aeromonas* sp.). Commonly found in water, *Aeromonas* infects fish when they have undergone stress. Fish with severe popeye or dropsy probably will not bite on a hook, but may be seen dead or in distress along the shore. In some cases, open bloody wounds can result from the bacterial infection. *Edible. If wound is superficial, cut out infected tissues.*

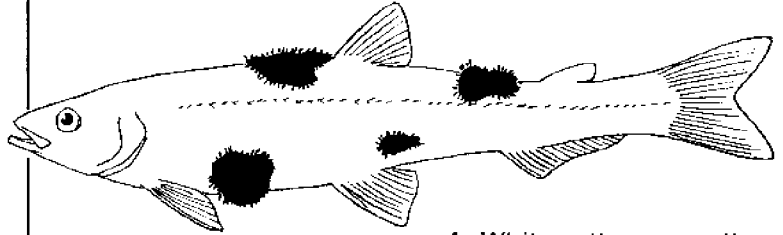
*When a fish exhibits a puffy body and swollen eyes, it should not be eaten.*

3 **COLUMNARIS DISEASE** (*Flexibacter columnaris*). This bacterial infection may be found on catfish, trout, and possibly other species. Frayed fins is another indicator. *Edible. Skin fish and prepare as usual.*



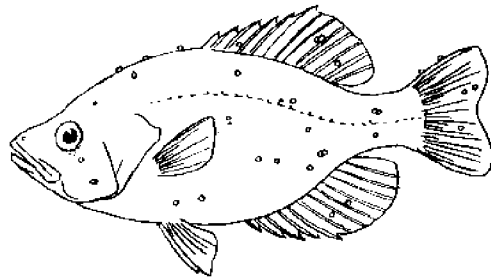
3. Grey-white to yellowish slime on the skin, gills or fins.

4 **FUNGAL INFECTIONS** (*Saprolegnia* sp.). Usually found on fish injured during spawning activities, by improper handling, or other cause. When established, fungus can kill a fish by completely covering it. There is no danger to humans but an unpalatable taste may develop. *Edible. Skin fish; cut out infected area and adjacent flesh and prepare as usual.*



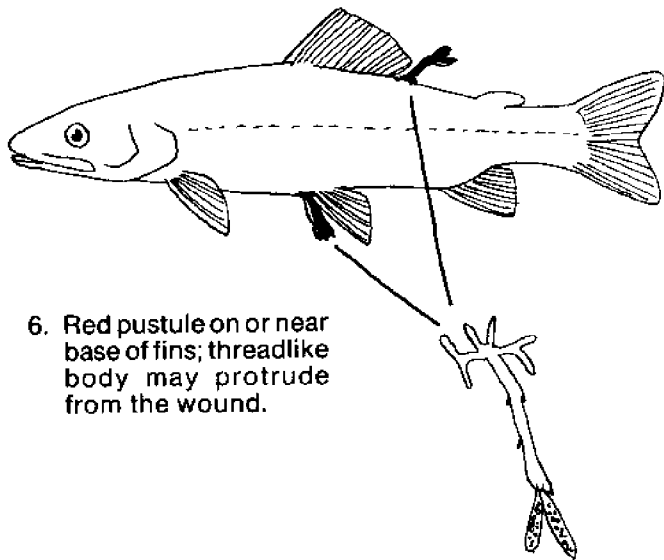
4. White cottony growth on body of fish. Has the appearance of fur or hair which collapses when fish is removed from the water.

5 **ICH** (*Ichthyophthirius multifiliis*). This is the most common protozoan encountered by fishermen. Ich appears as white spots or clusters on the skin or gills. It burrows under the skin and may cause surface lesions. Individuals can be seen with a magnifying glass. *Edible. Clean fish and prepare as usual.*

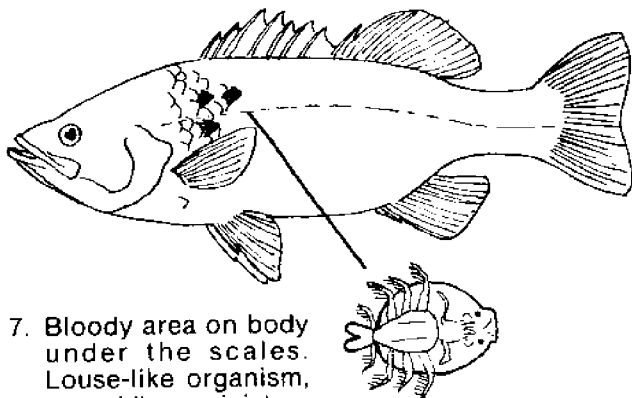


5. Tiny white spots on the skin.

Has anyone ever been infected by a fish parasite? Yes! Just last summer two Minnesotans contracted tapeworms after consuming marinated, uncooked walleye or northern pike caught in Canada. The fishermen had marinated the freshly caught fish overnight in lemon juice. They were following a recipe for Seviche, a South American raw fish dish. Although many Minnesotans don't prepare Seviche, they do pickle raw fish, and pickling alone may not destroy the larval tapeworm. Always cook the fish to 140° F. for at least five minutes or freeze it at 0° F. for 48 hours. Then you'll be sure you've killed any tapeworms present.



6. Red pustule on or near base of fins; threadlike body may protrude from the wound.



7. Bloody area on body under the scales. Louse-like organism, resembling a miniature turtle, present under scales.

See illustration next page.

6

**ANCHORWORM** (*Lernaea* sp.). This copepod ( $\frac{1}{8}$ " to 1" long) buries only its anchor-shaped head into the fish's flesh. The remaining portion of its body will protrude from the wound, where a red inflamed pustule may form. Or the parasite may drop off, leaving only the inflamed area. *Edible. Cut out inflamed area; clean fish and prepare as usual.*

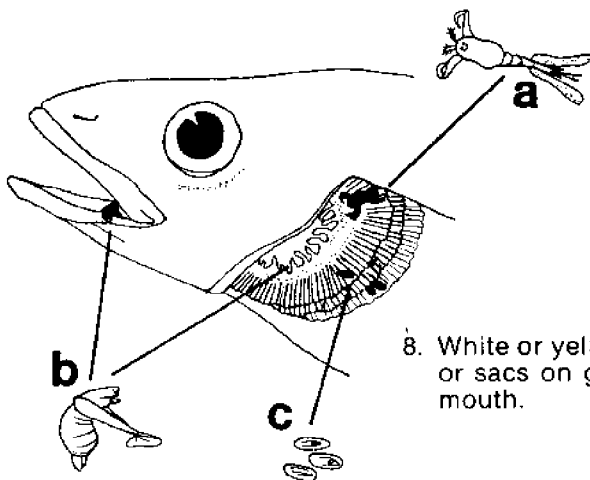
7

**FISH LOUSE** (*Argulus* sp.). This rarely seen parasitic copepod (up to  $\frac{1}{2}$ " in length) often leaves a fish soon after the fish is removed from the water. It feeds on blood by piercing the skin, frequently destroying the skin's protective mucous coat in the process. Thus, secondary infection from bacteria or fungus can result. *Edible. Clean fish and prepare as usual.*

8a

**PARASITIC COPEPOD** (*Ergasilus* sp.). When numerous, these small copepods can kill young fish. Their presence is indicated by V-shaped white egg sacs on the inner edges of the gills. *Edible. Clean fish and prepare as usual.*

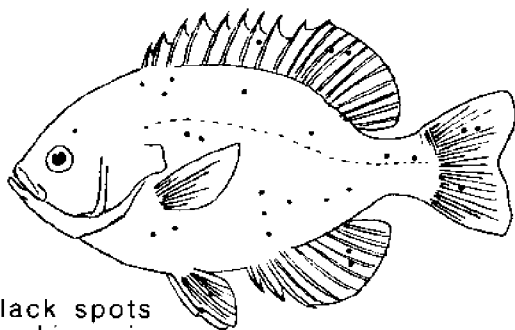
**8b** PARASITIC COPEPOD (*Achtheres* and *Salmincola* sp.). These copepods attach themselves in the mouth or to the inner surface of the gills. *Achtheres* and *Salmincola* are white in color and have short plump bodies with armlike appendages that cling to the fish. Their yellow egg sacs are more obvious than the copepod. Found mainly on trout and salmon. *Edible. Clean fish and prepare as usual.*



8. White or yellow cysts or sacs on gills or in mouth.

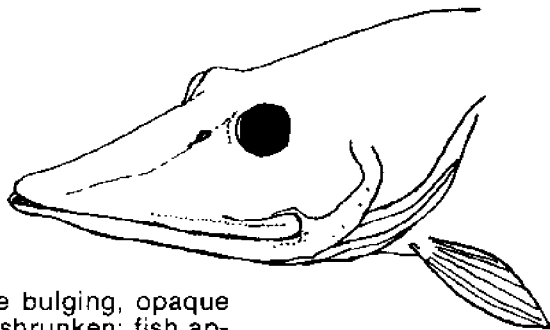
**8c** YELLOW GRUB (*Clinostomum* sp.). This larval fluke forms cream-colored cysts on the gills and under the skin in the mouth (same as in No. 17). *Edible. Clean fish and prepare as usual.*

**9** BLACK SPOT (*Neascus* sp.). The easiest disease to recognize, black spot is caused by larval flukes burrowing under the skin. Appearing as small round black spots, the cysts may also be found in the flesh. *Edible. Clean fish and prepare as usual.*

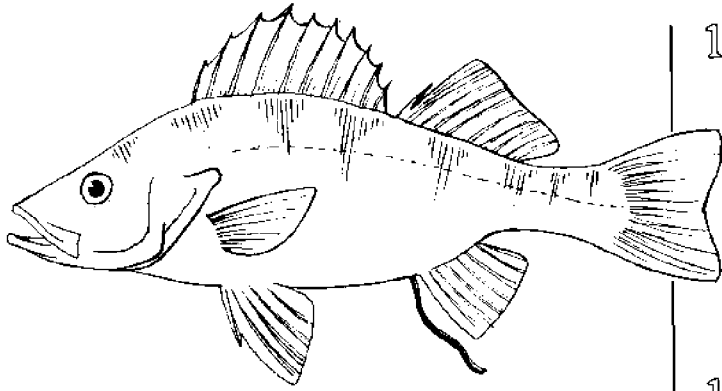


9. Small black spots under the skin or in the flesh.

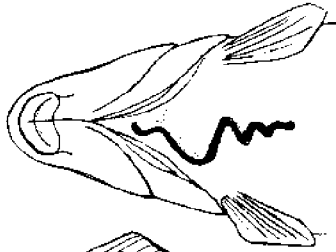
**10** EYE FLUKE (*Diplostomum* sp.). These tiny larval flukes will not be seen. They live in the fluid of the eye often causing popeye. Bulging of the eye gradually disappears but blindness may result. *Edible. Clean fish and prepare as usual.*



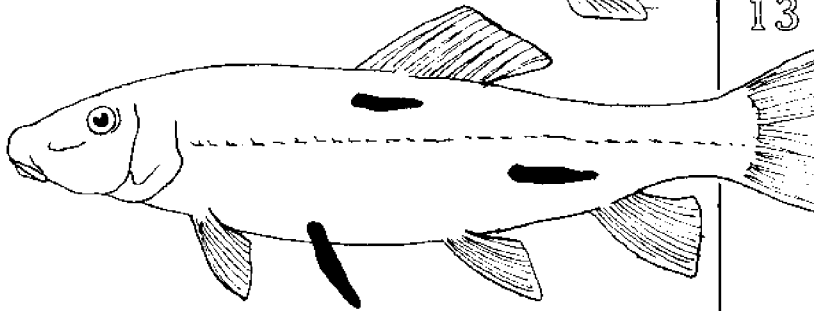
10. Eye bulging, opaque or shrunken; fish apparently blind.



11. Red, thread-like worms extending from the anus.

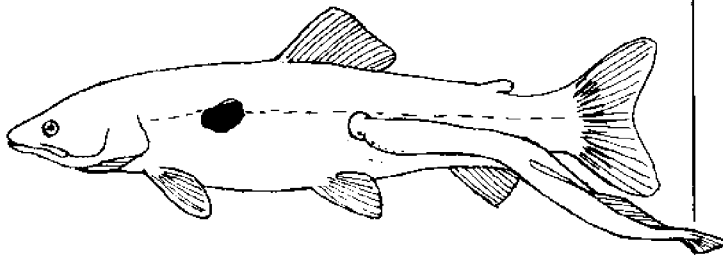


12. White to pink thread-like swelling on head or fins.



13. Undulating, flattened, segmented worms attached to body, gills, fins, or mouth. Con-

tain a sucker on both "head" and "tail" end. Can be greenish to black in color.



14. Eel-like fish, 6 to 25 inches long, attached to fish, or circular

open wound or healed scar  $\frac{1}{2}$  to 1 inch in diameter on fish.

11

**ROUND WORMS** (*Camallanus* sp.). Various roundworms are found throughout the intestine. Occasionally the species that lives in the lower large intestine will extend from the anus. *Edible. Clean fish and prepare as usual.*

12

**ROUND WORMS** (*Philometra* sp.). Normally found on carp, buffalo, and suckers, this adult roundworm lives just under the skin. *Edible. Clean fish and prepare as usual.*

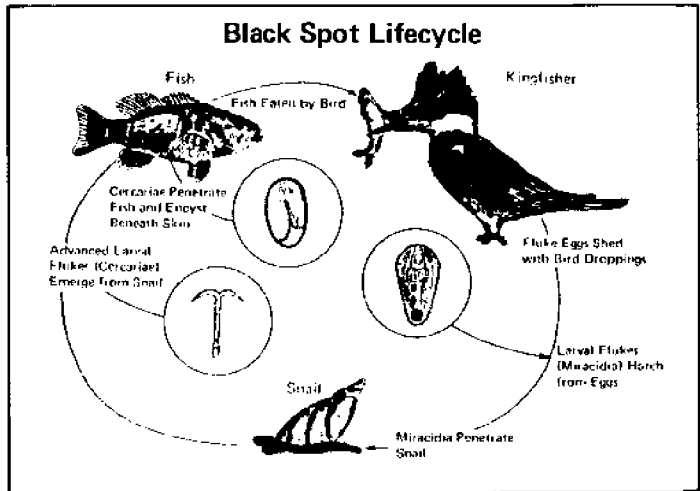
13

**LEECHES.** Conspicuous, blood-feeding, external parasites, leeches produce a small circular wound that remains even though the leech moves or drops off. Seldom more than  $\frac{1}{2}$  to  $1\frac{1}{2}$  inches long. *Edible. Clean fish and prepare as usual.*

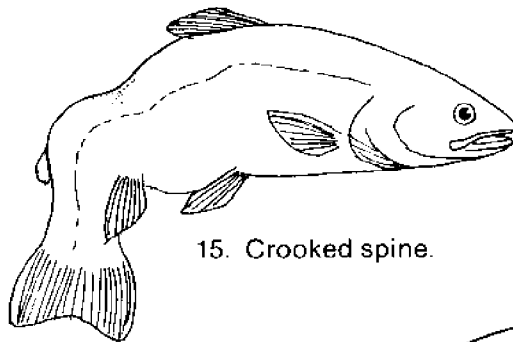
14

**LAMPREY.** The sucker mouth of lamprey is equipped with horny teeth and a rasping tongue which is used to cut through the scales and skin of fish. Lamprey feed on blood and body fluids of the host. Three types of parasitic lamprey are found in Minnesota: the chestnut and the silver lamprey from inland lakes and rivers, and the sea lamprey from Lake Superior. Fish that have been attacked by lamprey bear a circular wound or scar. *Edible. If open sore, remove inflamed area; clean fish and prepare as usual.*

### Black Spot Lifecycle

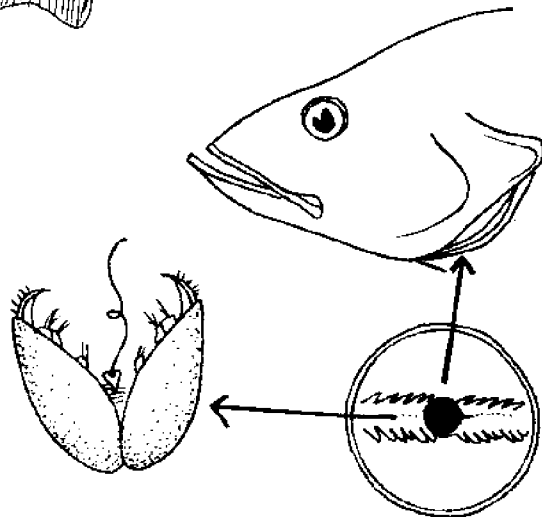


15 CROOKED SPINE. Causes of crooked spine are many and difficult to pinpoint. A protozoan (*Myxosoma cerebralis*) is known to cause spinal deformities when it infects young trout. Other causes include genetic and nutritional defects, bacterial infections, exposure to toxic chemicals and electric shock. *Edible. Clean and prepare fish as usual.*



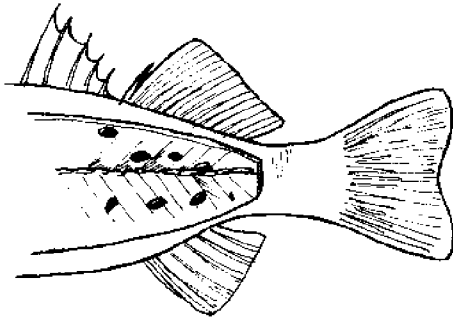
15. Crooked spine.

16 LARVAL STAGE OF FRESHWATER MUSSELS (Glochidia). Many freshwater mussels have a larval stage (called glochidium) which becomes a parasite of fish. Within a short time after attachment to gills or fins the small mussels become encysted and appear as enlargements of the gill filaments. After developing into young clams, they break open the cysts and fall to the substrate below where they develop into nonparasitic adults.



16. Tiny freshwater mussels (clams) attached to gill filaments or fins of fish. May also appear as lumps on gill filaments or fins.

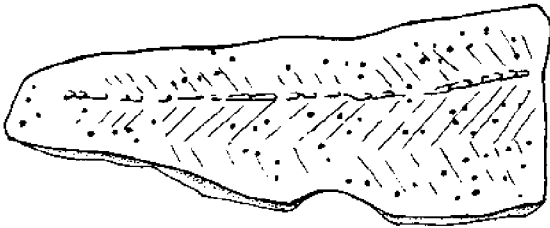
## Parasites in the Flesh



17. White or yellow cysts imbedded in the muscle, especially at base of tail or fins just under skin. In heavy infections may be found in the walls of the body cavity, head, throat, and gills. Living worms very active when squeezed from cyst.

- 17 **YELLOW GRUB** (*Clinostomum* sp.). Cream colored cysts found in many parts of the body contain larval flukes (about ½" long) which become adults in birds. Numerous at times, the Yellow Grub will emerge if the cyst is broken in water. Remove cysts from flesh; clean fish and prepare as usual.

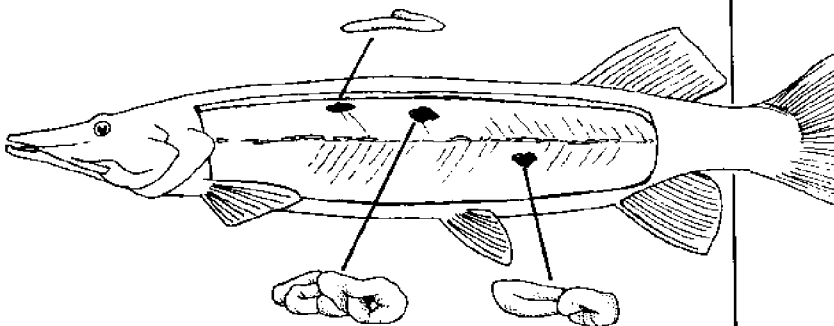
**WHITE GRUB** (*Hystero-morpha* sp.). Smaller and light colored than the Yellow Grub. These larval flukes are most often found in bullheads. Remove cysts from flesh; clean fish and prepare as usual.



- 18 **BLACK SPOT**. See number 9.

18. Black spots under the skin or in the flesh.

- 19 **BROAD FISH TAPEWORM** (*Diphyllobothrium* sp.). Larval form of tapeworm is found in fish; develops into adult in the intestine of man or other mammals and therefore, is harmful to man if not killed by cooking or freezing. Symptoms of infection in man include nausea, vomiting, weakness, dizziness and diarrhea. Tapeworms can attain lengths of 10 to 30 feet. Found most commonly in northern pike, but can occur in walleye and yellow perch. Destroyed by normal cooking and hot smoking to 140°F and by freezing for 48 hours at 0°F. Cold smoking and pickling without either cooking or freezing the fish may not kill tapeworm.

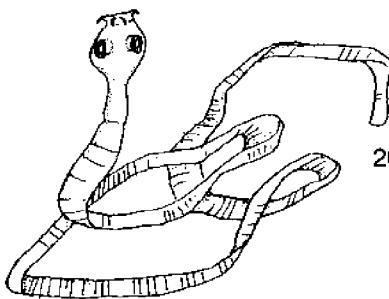


19. White glistening usually unencysted worm about 1 to 1½ inches long found in the muscle of fish. May be coiled and encysted.



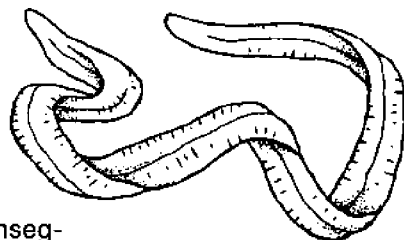
## Internal Parasites

20 BASS TAPEWORM (*Proteocephalus* sp.). Most common in large and smallmouth bass but may be encountered in trout, perch, pike and carp. Adults are found in the intestine; larvae may invade reproductive organs. *Edible. Clean fish and prepare as usual.*



20. Whitish segmented flat worms found in intestine of fish.

21 RIBBON TAPEWORM (*Ligula* sp.). A larval tapeworm found free in the body cavity of minnows, carp, suckers, and some other fish. This tapeworm with its thick fleshy body is uncommonly large and may create an abdominal bulge. *Edible. Clean fish and prepare as usual.*



21. Large, white, unsegmented, flat worm tapered at both ends found free in the body cavity.

22 LARVAL TAPEWORM. These tapeworms are not found in cysts. Numerous worms may infect the ovaries of bass. *Edible. Clean fish and prepare as usual. Roe can be cleaned by removing worms with tweezers before preparing.*

22. White, threadlike worms lying on or moving through the internal organs.

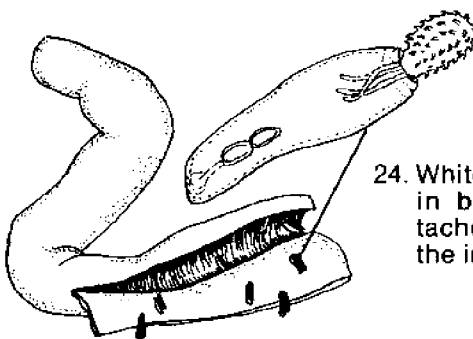
No illustration.

23 WHITE GRUB (*Neascus*, *Posthodiplostemum* and *Uvilifer* sp.). These larval flukes occasionally occur in large numbers. Primary hosts are members of the sunfish family. *Edible. Clean fish and prepare as usual.*



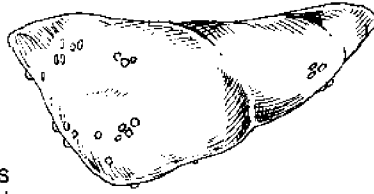
23. Round transparent cysts on the internal organs, typically on the liver.

24 SPINY-HEADED WORM (*Acanthocephala*). Most adult acanthocephalans live inside the intestine and are usually not seen by fishermen. *Edible. Clean fish and prepare as usual.*



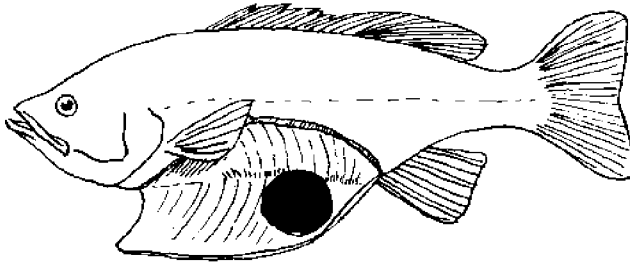
24. White or orange worm in body cavity, attached to the inside of the intestine.

25. Irregular white cysts in or on the internal organs.



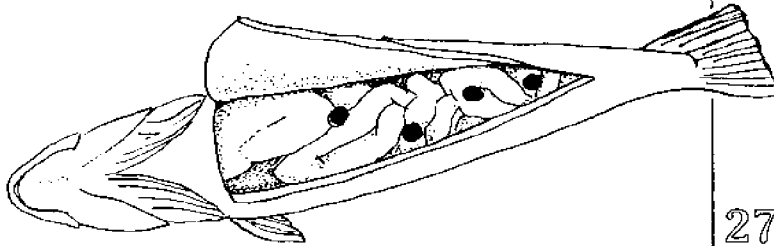
25 LARVAL SPINY-HEADED WORM OR LARVAL TAPEWORM. These cysts are larger, whiter and not as round as those described in No. 23. *Edible. Clean fish and prepare as usual.*

26 CAUSE UNKNOWN. These tumors are infrequently found in the muscle, body cavity, or internal organs of fish. The cause of most of these tumors is unknown, but disease causing organisms are usually not involved. *Edible. Remove growth; clean fish and prepare as usual.*



26. Fibrous or fatty tissue in well defined round ball-like structures.

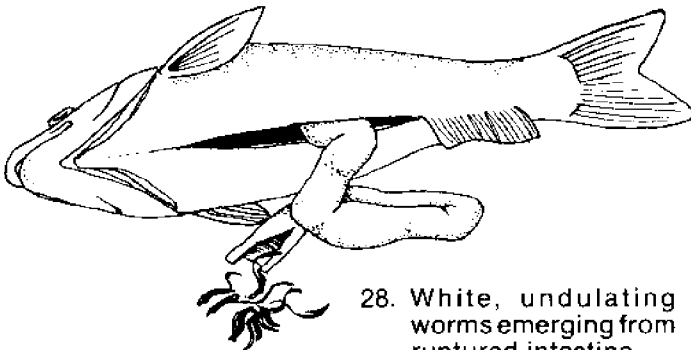
27a ROUNDWORM (*Contracaecum* and *Eustrongylides* sp.). Found on the internal organs or the wall of the body cavity, these larval roundworms are immobile. They become adults only in fish eating birds. *Edible. Clean fish and prepare as usual.*



27a. Coiled (like a watch spring) worm encysted on the internal organs.

27b. Tiny gold-brown cysts on the internal organs.

27b LARVAL ROUNDWORM. Often found in great numbers, these cysts will give a sandy appearance to a fish's entrails. The kidney roundworm, found in the body cavity and viscera of bullheads and northern pike may infect man. Thorough cooking will kill this parasite. *Edible. Clean fish and prepare as usual.*



28. White, undulating worms emerging from ruptured intestine.

28 INTESTINAL WORMS. Adult flukes, tapeworms, roundworms, and spiny-headed worms will not normally be seen by fishermen unless the intestine is accidentally cut in cleaning. *Edible. Clean fish and prepare as usual.*

## List of Terms

**BACTERIA** — includes a large group of one-celled microscopic organisms. While bacteria cannot be seen with the naked eye, the signs of bacterial infection usually are readily visible.

**CESTODE** — see TAPEWORM.

**COPEPOD** — member of a group of small crustaceans. It is very abundant in aquatic systems and commonly used as food by fish. Although most copepods are free swimming, those mentioned here are parasites of fish.

**CYST** — a nonliving sheet-like structure enclosing a parasite. The sheet-like structure or membrane may be produced by the host, the parasite or both.

**FLUKE** — another name for trematodes that are found in fish. These parasites have flattened worm-like bodies and larval stages often produce wart-like cysts in and on fish. For this reason many fishermen call them grubs.

**FUNGUS** — minute thread-like plants that lack chlorophyll. Common in fresh water, most fungi grow on many types of decaying organic matter. Fungi usually attack fish only when the skin has been injured through abrasion or other parasites.

**GRUB** — see FLUKE.

**LARVA** — an immature stage between egg and adult. Many parasites may go through a number of life stages and hosts before becoming adults.

**NEMATODE** — see ROUNDWORM.

**PARASITE** — an organism that lives on or in another organism (host) and depends upon the host for its food.

**PROTOZOA** — single celled organisms of the lowest division in the animal kingdom. Although a few may be seen with a magnifying glass, a microscope is required to see most species. Not all protozoa are parasites.

**ROUNDWORM** — another name for a class of organisms known as nematodes. They have round elongated bodies tapering at both ends and lack segmentation and suckers. They are among the most common of fish parasites. There are free living (nonparasitic) as well as parasitic roundworms.

**SPINY-HEADED WORM** — a common name for a group of parasitic worms called Acanthocephalans. Usually under 1½ inches in length, they live in the digestive tract of various animals.

**TAPEWORM** — as adults tapeworms otherwise known as cestodes are white, flattened, segmented worms, inhabiting the intestine. Some tapeworms occur only as larvae in fish and develop into adults in other animals such as predatory fish, birds, or mammals. All tapeworms are parasitic.

**TREMATODE** — see FLUKE.

**OTHER SOURCES OF INFORMATION:**

- Cheng, T. C. 1964. *The Biology of Animal Parasites*. W. B. Saunders Co., Philadelphia and London, 727 pp.
- Common Parasites of Freshwater Fish*. 1975. Compiled by Betty Les. Wisconsin Department of Natural Resources, Pub. 10-3600 (75). 22 pp.
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- Meyer, F. P. and G. L. Hoffman. 1976. *Parasites and Diseases of Warmwater Fishes*. U. S. Fish and Wildlife Service, Resource Publication 127, 20 pp.
- Rogers, W. A. and J. A. Plumb. 1977. *Principle Diseases of Sportfish: A fisherman's guide to fish parasites and diseases*. Agriculture Experiment Station Special Report, Auburn University, Alabama. 16 pp.

For more information on fish and your health contact your Sea Grant Extension Program, 109 Washburn Hall, University of Minnesota, Duluth, MN 55812.

Other publications on fish from the Minnesota Sea Grant Extension Program:

**Fixin' Fish:** a guide to handling, buying, preserving and preparing fish.

**Kitchi Gami Cookery:** a cookbook of delicious recipes for Lake Superior fish.

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