The Whitefish - Pike Parasite

TRIAENOPHORUS CRASSUS

DR. TERRY A. DICK
AND REG WATSON

DEPARTMENT OF ZOOLOGY AND BIOLOGY TEACHING
UNIT UNIVERSITY OF MANITOBA

"Parasites"! This word conjures up two unpleasant images in the thoughts of man; the first, individuals who benefit at the expense of other members of society without themselves making a contribution. The second image is that of death caused by parasites such as malaria, of malnutrition caused by hookworms, and of damage to the productivity of crops and livestock. It is not surprising then that any host animal which has parasites is immediately condemned unfit to eat. But this is not always the case and certainly not so for the tapeworm *Triaenophorus crassus* in whitefish. The presence of *T. crassus* larvae (an immature stage) coiled in a cyst in the flesh of whitefish or ciscoes is objectionable to the consumer housewife, who quickly reaches for unparasitized marine fishes. Wormy fish are condemned and the commercial fishermen receive little reward for their efforts to harvest these products of our great western lakes.

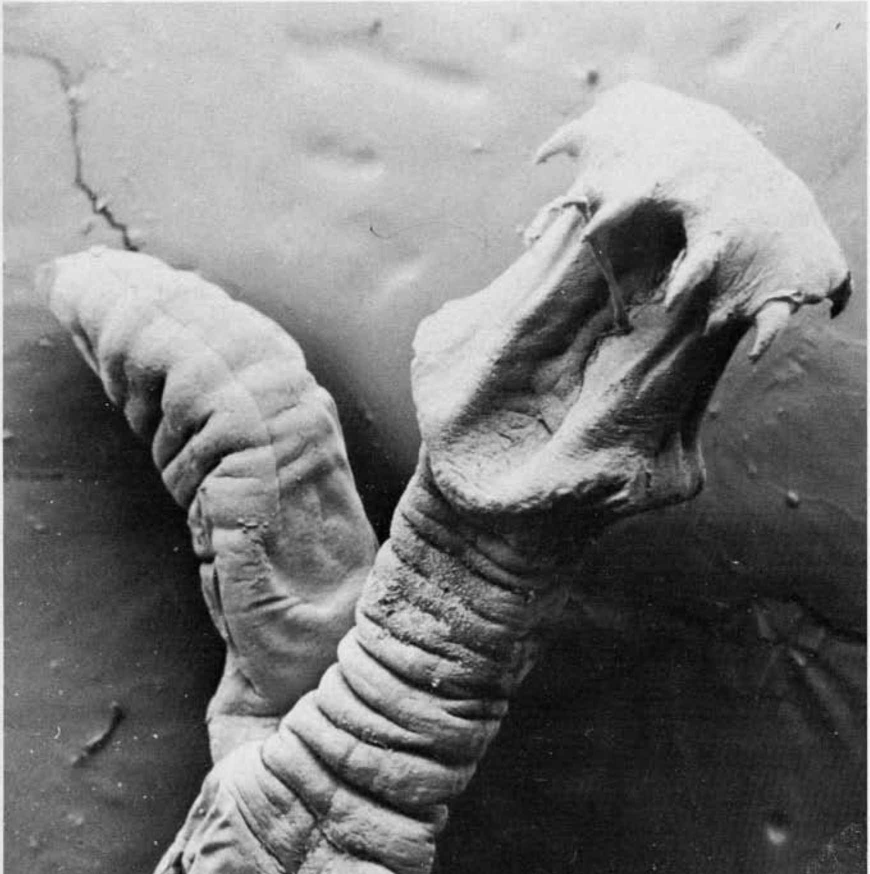
Frequently we avoid what we do not know. Perhaps, the following comments may give the reader some understanding of the life cycle of *T. crassus*, an explanation of why this parasite is harmless to humans, and an acquaintance with the research aimed at ridding our fish of this parasite and improving the commercial value of our fish. Such knowledge may lead more consumers to try the gastronomical epicurean delights of fresh whitefish or ciscoes.

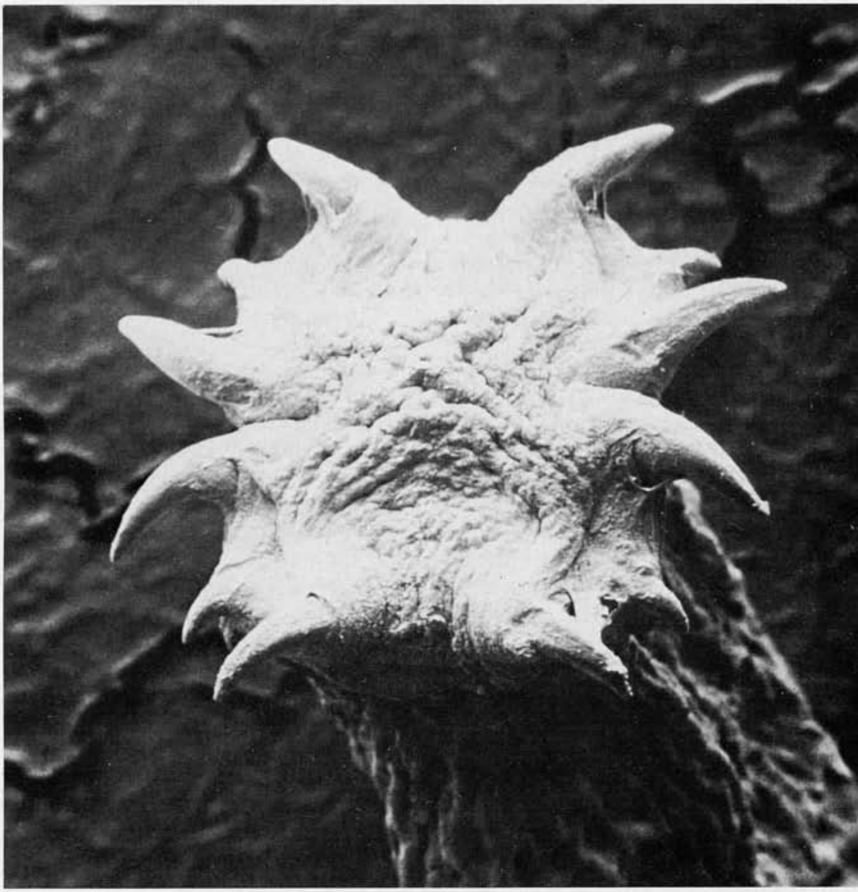
It is generally thought that all adult worms are lost from the pike intestine from mid-May to mid-June and that the worms are regained by predation on infected cisco and/or whitefish later in the year. The authors found that the pike in Southern Indian Lake have adult tapeworms throughout the entire year. Like all tapeworms, *T. crassus* is comprised of many segments budded successively from behind the head so that the segments farthest from the head are the oldest. Posterior segments of the mature *T. crassus* break away from the remainder of the tapeworm and are passed in the faeces. These segments break up on contact with water and release their eggs. If one examines adult *T. crassus* in a glass dish, eggs are released in such numbers that they appear as a white cloud.

Within each egg is an embryo which is very active. A small cap at one end of the egg eventually pops open and allows the embryo to squeeze out and leave the egg shell. This stage of the embryo (a coracidium) has six moveable hooks and is known technically as the onchosphere. This entire structure is surrounded by a gelatinous layer of large cells bearing cilia (hairlike processes capable of lashing) which give the coracidium mobility. The coracidium is short-lived and must be swallowed by a suitable host to survive. A small (1-mm long) crustacean copepod, *Cyclops bicuspidatus,* often serves as the first intermediate host. After entering the crustacean's stomach the coracidium loses its ciliated coat, penetrates the stomach wall, and gains entry into the body cavity. Here it may penetrate antennae, body appendages or remain in the body cavity which is filled with a rich fluid akin to blood. The onchospheres rapidly grow in approximately eight days into the next larval stage, the procercoid. This stage marks the end of development of the first intermediate stage, and the animal begins a resting stage.

Development can only continue if the crustacean *Cyclops* is swallowed by a plankton-feeding cisco or whitefish, which then becomes the second intermediate host. Within the new host the procercoid moves through the intestinal wall to the body wall muscles where it becomes a second larval stage, a plerocercoid within a

Second stage larva (plerocercoid) of the tapeworm, **Triaenophorus crassus.**





Hooks on the head of **Triaenophorus crassus.**

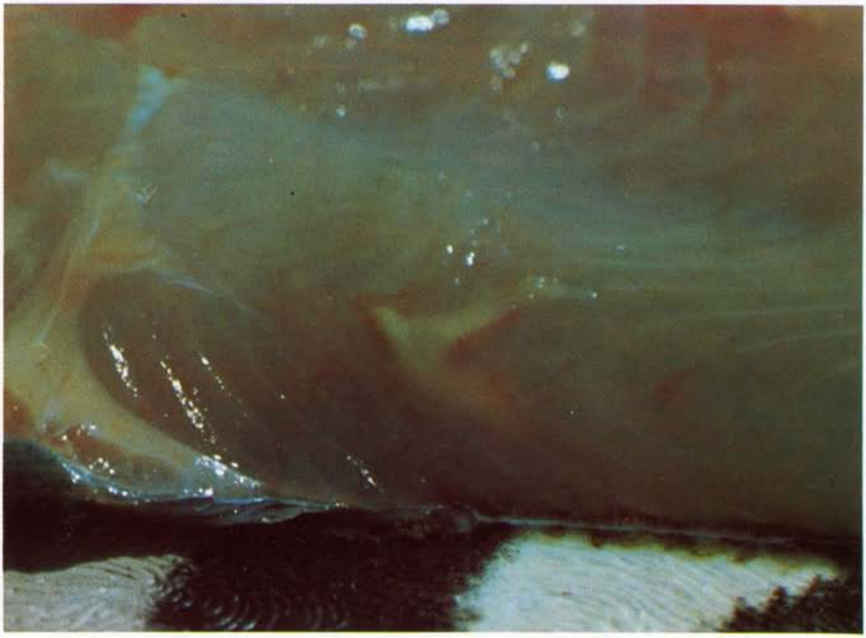
cyst. This is the stage familiar to most fishermen. At this stage a complete head (scolex) is formed with its accompanying hooks. The larva may survive five to six years in a cyst, but in order to continue its life cycle the whitefish or cisco host must be eaten by a pike. In the intestine of the pike the whitefish is soon digested and the plerocercoid is released to grow into an adult in about eight to ten months, and to attain maturity by the time that the pike spawns in spring.

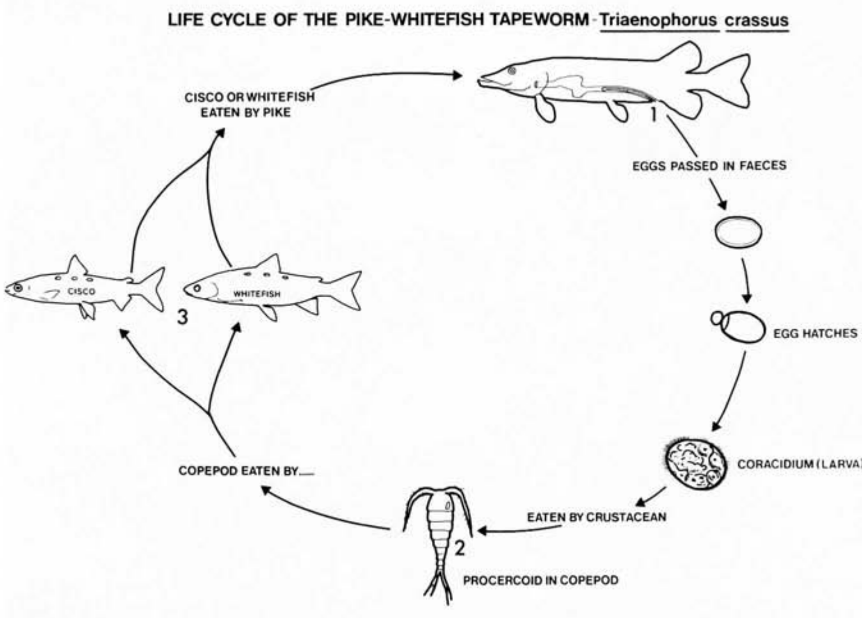
Knowledge of the life cycle gives us a number of ways to "break" the life cycle and reduce the number of cysts in whitefish. These include: (1) removal of pike, a relatively unimportant commercial fish, by selectively fishing for pike in a lake; (2) removal of the first intermediate host, the copepods (a much more difficult problem); (3) destruction of the free-swimming coracidium when it hatches from the egg (an impossible task). The first method, the only one that is at all feasible, has been accomplished to some degree in certain small lakes. Since a complete removal of a well-adapted species like pike from a stable lake is virtually impossible, the best that can be expected is a marked decrease in the cysts of *T. crassus* from cisco and whitefish; not its complete eradication. Furthermore, intensive fishing of pike must be maintained to ensure low cyst levels in whitefish. Heavy fishing of whitefish in fertile lakes helps to speed growth so that whitefish are soon beyond the size limits that pike can attack and consume.

What about consumer protection from whitefish containing cysts ? Infections have been attempted with *T. crassus* plerocercoids in dogs and other warm-blooded animals without success. Furthermore there are no records of *T. crassus* infections in man from Canada, Sweden, Norway, Finland or the U.S.S.R. Currently inspection of whitefish is carried out by the Federal Department of Fisheries where standards (numbers of cysts per 100 pounds of fish) are rigidly adhered to. Lakes are classified according to levels of cysts, thus ensuring that only quality fish are used for human consumption.

It is well known that certain lakes

Cyst of **Triaenophorus crassus** in situ.





Hatched areas refer to adult tapeworm in pike intestine (1), procercoid in body cavity of copepod (2) and plerocercoid (3) in musculature of whitefish and cisco.

Section through a fillet of whitefish illustrating part of **Triaenophorus crassus** larva.

contain whitefish that are "*Triaenophorus*-free." Are pike present? Do ciscoes abound in these lakes? Are there strains of whitefish which cannot become infected with the tapeworm? Are certain intermediate hosts present or absent? We do not have answers to all these questions, but work is underway at Southern Indian Lake to attempt to answer some of these questions by examining a water system dramatically altered by development for hydro-electric power. Consequently for the past two years we have been looking at the parasites of whitefish and pike, particularly *T. crassus,* in Southern Indian Lake prior to and eventually following impoundment and diversion of the Churchill River. As a considerable number of other ecological factors in Southern Indian Lake are being studied by scientists from the Freshwater Institute, Winnipeg, we hope to correlate parasite changes with these factors and thus answer some of these questions.