PARASITES AND SELECTED ANOMALIES OF SOME FISHES OF THE NORTH CENTRAL UNITED STATES AND CANADA

Iowa, Michigan, Minnesota, No. & So. Dakota, Wisconsin
Canada (Manitoba, Ontario, Saskatchewan)

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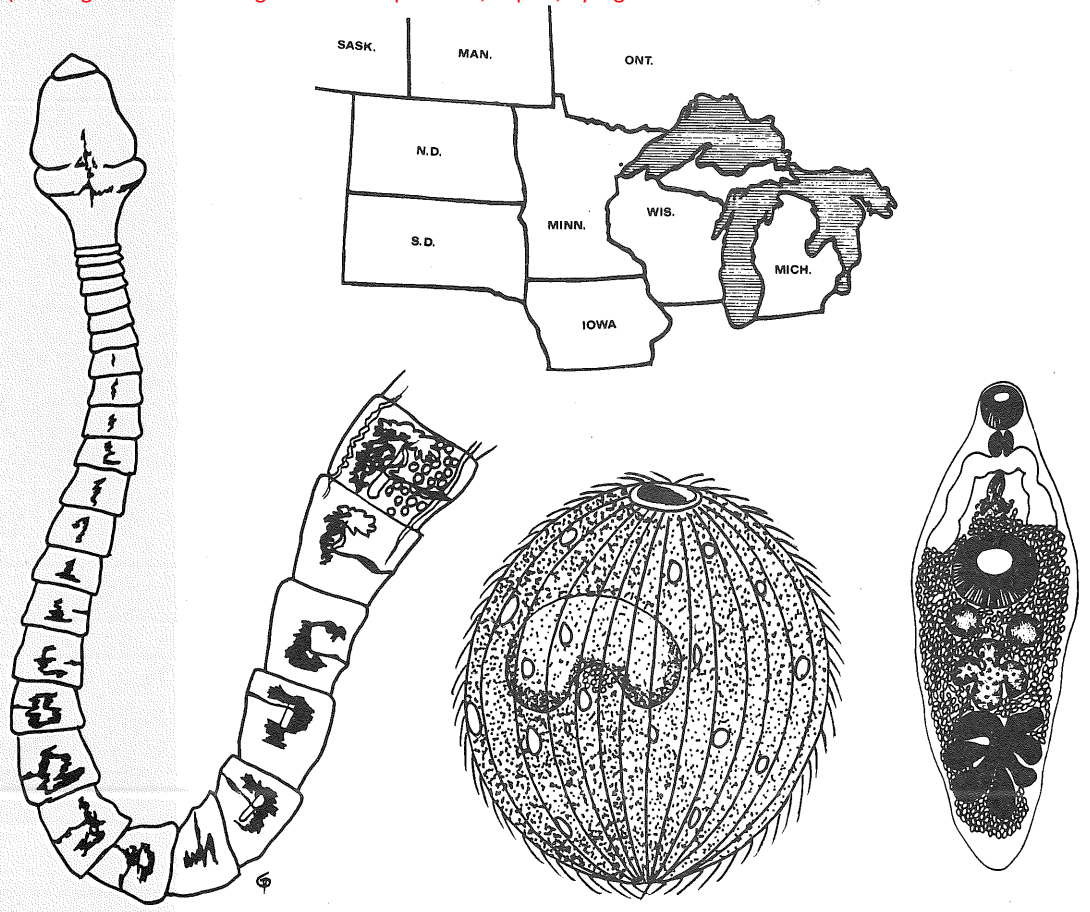

MINNESOTA DEPARTMENT OF NATURAL RESOURCES
DIVISION OF FISH AND WILDLIFE
ECOLOGICAL SERVICES SECTION

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Iowa, Michigan, Minnesota, No. and So. Dakota, Wisconsin,

Canada - (Manitoba, Ontario, Saskatchewan)

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INTRODUCTION

A large body of information has been published in the generally accessible literature regarding diseases of fish. Other information obviously resides in files of individuals working for state, federal or other agencies who are engaged in fish pathology and management of the fishery resource. Two regional bulletins of recent vintage that deal with parasitic diseases are Hugghins (1972), "Parasites of Fishes in South Dakota" and Allison, Hnath and Yoder (1977), "Manual of Common Parasites and Anomalies of Michigan Fishes."

Hoffman's "Parasites of North American Freshwater Fishes", 1967, is a comprehensive work dealing with the literature up through 1965. Parasite hosts, sites of infections, geographical distribution, life cycles where they are known, synonomy, keys to the identification of the parasites, drawings, and a comprehensive bibliography are included in his book.

The format and information for this bulletin is based primarily upon the above work by Hoffman. However, there seemed to be little value in recapitulating what has been thoroughly described regarding life cycles, hosts, sites of infections, micrology, and the like. Sport fishery abstracts from 1966 through 1979 were used to identify published papers and reports of fish parasites that fall within the geographic area covered. If sufficient information was found in the abstract then the original paper was not read. A bibliography of all papers which were read is included.

Shortly after this work was begun, Margolis and Arthur (1979) published the book, "Synopsis of the Parasites of Fishes of Canada." This is a very well done checklist of the diseases of fish in the Canadian provinces. The parasites of fishes listed from the provinces of Manitoba, Ontario, and Saskatchewan were carefully checked against the parasite-host lists previously compiled. Those not appearing on the lists were added and are shown with an asterisk (*) designation.

Records in the files of the biology-pathology laboratory of the Minnesota Department of Natural Resources were searched for parasitological data. The symbol (†) denotes organisms which have been found in or on the given fish in Minnesota. It is important to note that not all parasites found in fishes of Minnesota have been documented with a DNR memorandum. Only those so documented are included in this checklist.

It is obvious that Hoffman's book stimulated research into new hosts, geographical distributions, etc. The bibliography of Margolis and Arthur is very useful because it deals with accessible literature as well as certain more or less in-house reports and bulletins that would be rather difficult to find or are not readily available.

This bulletin was prepared to assist parasitologists, pathobiologists and field biologists to conveniently narrow down the known parasites of fishes covered from this region and to stimulate work on those not previously known. The oblique changes in our natural environment may very well be recorded through the changes manifested by parasites which inhabit fishes in our lakes and streams; as well as the measurements of pH, PCB's, and other parameters being looked at so carefully. Baseline studies so conspicuously lacking in the past are sorely needed today to measure these future changes. The complex life cycle of many of these parasitic forms depends upon several intermediate organisms for completion. This could make the paristofauna an excellent barometer for environmental change.

TAXONOMY

The taxonomy used here has general significance as well as sufficient scientific accuracy to be useful to the specialist. Strict scientific accuracy may be sacrificed here for a more general taxonomy which was thought to have a broader application, for example, a dissertation could be written as to the reasons why the Myxosporidans probably are not Protozoa. However, they have been so long considered to be in this group that it would be of little value to change their name here for the person who is trying to figure out the nature and significance of a specific organisms in this group. The same is true for certain other taxonomic categories of organisms. A brief review of the taxonomy used follows.

Protista

In recent years biologists have generally given up trying to categorize all unicellular and certain multicellular organisms that have no more than one kind of non-reproductive cell into the single category of the Protozoa. Instead the term Protista has been revived and used for fungi, algae, and heterotrophic organisms that fit the above definition. Protozoa has generally been reserved for certain of those heterotrophic non-filamentous organisms.

Fungi - Generally reserved for heterotrophic multicellular or syncytial filamentous living things. The most ubiguitous fish disease organism in this group is represented by members of the genus *Saprolegnia*. This agent is generally conceded to require damaged or necrotic tissue for it to invade its host. Fish eggs are frequently attacked, especially if damaged or non-fertile eggs are in the group.

Protozoa

Mastigophora or Flagellata - Organisms that at some stage of the life cycle move by means of one or more flagella. Members of the genera *Costia* and *Hexamita* are found with almost all fish at some point in their life cycle. This group includes blood dwelling organisms, some of which are transmitted by leeches. *Trypanosoma* and *Cryptobia* are common genera.

Sporozoa - No organelles for movement. Reproduction by spores.

Coccidia - Parasitic in the epithelial cells of the gut. Some are also found in blood cells. Spores with sporozoites pass the infection to other fish.

Microsporida - Feeding stages live and reproduce within cells. Spores are the infective units. Each spore has a single polar filament and is generally small (6-8 µm). The genera *Glugea* and *Plistophora* have caused mortalities of fish, especially in culture operations.

Myxosporida - Feeding stages live and reproduce outside of cells in tissues or in spaces of the body of the host. Spores have 1 to 4 polar capsules and are generally much larger than those of the Microsporida. Fish to fish transmission by spores has been shown for some coelozoic genera but not for histozoic forms. (Because they differentiate into more than one non-reproductive cell and for other

technical reasons these are thought to represent a divergent line of multicellular organisms with certain convergent evolution of structures). *Myxosoma cerebralis* is a serious disease which involves the cartilage of the head and gill arches of salmonid fish. It is international in distribution. It causes "whirling disease" and distortions of the spine (lordoscoliosis) of fish that are infected when young. Its spread should be vigorously avoided.

Ciliophora or Ciliata - Organisms that move by means of cilia. Nuclei of two types, a large macronucleus and a smaller micronucleus. The organisms *Ichthyophthirius multfiliis* probably infects all fish. It is one of the most costly fish pathogens especially of fish in hatcheries or under other culture. *Trichodina* and similar genera are probably found on all fish during some stage of their development.

Suctoria - This is a group of ciliates that are found on the gills of fish. As mature forms they do not have cilia but rather suctorial tentacles. Larval forms have cilia. Sexual reproduction has recently been found to occur in this group.

Platyhelminthes

Trematoda (Monogenea) - Monogenetic trematodes are flatworms that with few exceptions live on the exterior surface of fish (gills, fins, or body). They have only a single host; hence monogena. *Gyrodactylus* is a common genus.

Trematoda (Digenea) - Digenetic trematodes are flatworms (flukes) which have at least two hosts in their life cycle. Those of fish have as a first intermediate host either snails or clams. Inside of the hepatopancreas of this host, asexual reproduction takes place. The first product of this is a "sack" made up of many cells which is called a sporocyst. Variations of the cycle are numerous and are of the following themes: The sporocysts produce more internal "sacks" called daughter sporocysts. The original sporocyst or the daughter may produce more specialized "sacks" called redia. In some cases asexual daughter redia are produced from the original. The redia produce by asexual reproduction several units infective for fish or other organisms which are called cercaria. These usually have a tail appendage. The usual case is for the cercaria to bore through the tissues of the snail or clam to the water where it seeks out the next host, which may be a fish or some other organism; larval insects, crustacea, leeches or forage fish are some usual intermediate hosts. If it is a fish it may become attached to the lumen of the alimentary tract and develop into an egg producing adult or migrate to the skin, fins, muscle or some internal organ and encyst as a metacercaria. Certain cercaria may attempt to enter the skin of humans causing a dermatitis called "swimmer's itch." Metacercaria in the skin or fins may cause "blackspot" disease which concerns fisherman. If the encystment is in the fish muscle a yellow or white "grub" may be seen in heavy

infestations. These may be equally displeasing to fisherman when seen in filleting the fish. In rare cases, a phenomemon called progenesis occurs. Either in the snail-clam first host or in the second host, the larval form develops reproductive organs and becomes sexually mature. Another phenomena is, where the infected snail is eaten and the cercaria need not enter the water to cause infection in the next host, usually the final or definitive host. Digenea have as final or definitive hosts, fish, amphibia, reptiles, birds or mammals. These are either infected directly by cercaria, (two host cycle) or by the metacercaria which is obtained by eating the intermediate host carrying it. Adult trematodes live in the intestine or other spaces of the body of the host. They shed thousands of eggs which hatch in the water. The eggs have within them a ciliated larvae which is called a miracidium. This seeks out and bores into the appropriate snail or clam host to once again begin the cycle. Digenea life cycles are complicated with some being entirely unknown, others partly elucidated and others thoroughly understood. In some cases larval stages have been assigned to a generic and specific name which differs from that of the name of the adult form due to the difficulty of establishing the relationship. Some major larval genera include *Diplostomulum*, *Tetracotyle*, *Neascus*, *Prohemistomulum* and several others with fewer organisms placed in them.

Cestoidea or Cestoda - Flatworms with no gut, anterior end with a scolex made up of grooves, suckers or hooks. Most forms have a series of similar segments. Segments adjacent to the scolex are immature, becomeing progressively more mature and gravid posteriorly.

The life cycle of tapeworms involves aquatic crustacea. The embryonated eggs are ingested by copepods, amphipods or isopods. The eggs hatch and develop into a procercoid stage in the haemocoel of the crustacean, which in turn is eaten by the definitive or final host or by another host, which may be a fish or an oligochaete. The stage in the second intermediate host is a plerocercoid. Many life cycles are unknown.

Diphyllobothrium latum is found as a plerocercoid larvae in the flesh of *Esox lucius*, *Perca flavescens*, *Stizostedion vitreum vitreum*, *S. canadense*, *Lota lota*, and possibly other fish. This is thought to be the only tapeworm that infects man through fish hosts in the continental United States. Adequate cooking of fish will prevent such infections.

Proteocephalus ambloplitis, the bass tapeworm is known to be a serious pest in fish culture operations. The plerocercoid is sometimes so abundant and destructive in the ovaries of young black bass that sterility may result.

Ligula intestinalis is a plerocercoid in the body cavity of fish. It is frequently quite large equaling or exceeding the length of the host fish. The final

hosts are fish eating birds.

Nematoda - Nematodes or round worms are multicellular organisms having a fixed cell number and a highly developed tough cuticle that must be shed in order for the animal to grow. Thus, they must go through several larval stages and molts before becoming adults. They have been placed in a phylum with organisms containing a complete gut but they possess a pseudocoelom or false body cavity. Life cycles in this group involve as a first host an arthropod. Frequently this is an aquatic insect larvae; sometimes mayfly nymphs, and others occur in crustacea. Larval forms are also found in forage fish of various kinds. Many life cycles are not known. Larvae are seen as white coils in muscle or visceral organs and if noticed disturb the aesthetic sensibilities of the fisherman.

Acanthocephala - Spiny headed worms are placed in the same phylum as the nematoda along with five other kinds of organisms. Adults have a proboscis armed with hooks for attachment to the intestinal wall of the final host. Females lay eggs which pass into the water and are eaten by crustacea. The eggs hatch and become a larval stage called an acanthor which bores into the haemocoel of the crustacea where it grows and differentiates into the acanthella stage. Male worms have prominent testes but females produce eggs from cells in a ligament in their body. In certain genera larvae infect the fish host directly when the crustacean is eaten. In other cases where the larval worm is less than about 30 days old the crustacean may be eaten by a fish causing the larvae to encyst in the fishes mesenteries. The final host is infected with adult male and female worms after eating this fish.

Oligochaeta - These are segmented worms with a true body cavity. Earthworms and tubifex worms are relatives of the Oligochaeta. The Hirudinea or leeches are sometimes external parasites of fish from which they obtain a blood meal. Most leeches do not ingest blood and are free living. Blood flagellates and other fish diseases may possibly be transmitted by them. A few harbor the metacercaria of digenetic trematodes which consequently infect the fish when the leech is eaten.

Crustacea - The Arthropoda includes more individuals and kinds of living things than almost any animal phyla. Among these are the crustacea which include the copepods which are consumers of algae and protozoa in the fresh waters and oceans of the world. A few have adopted the parasitic way of life. They live on the fins, body surfaces and gills of fish. Like nematodes (which are also very abundant) they have a strong exoskeleton made of chiton and as they grow they must molt until the adult stage is reached. Some retain many of the features of their free living cousins and others become highly modified and almost non-recognizable. Some form "anchors" and become partially embedded in the tissue of the fish host.

Coelenterata - This group is best known for its free living members such as corals, sea anenomes and jellyfish. All of these except one type of jellyfish are found in the oceans of the world. *Hydra* is a free living fresh water coelenterate. In the last few years coelenterates have been uniquely found to occur in the body cavities among the eggs of sturgeon and very recently the paddlefish.

SELECTED ANOMALIES OF MINNESOTA FISH

SELECTED ANOMALIES

Preface

The immediate objective of this writing is to assist the fisheries staff of the Minnesota Department of Natural Resources. Their consistent cooperation in the Fish Pathology Laboratory's general survey of fish diseases and parasites has been invaluable. The future success of this phase of the Department's program will depend on the continuation of this support. It is our earnest hope that any assistance derived from this manual by the field staff will in part repay them for their active participation.

In Minnesota, in recent years, there has been an increase in the number of anglers with a correspondingly greater harvest of fish species. It is also apparent that anglers are now showing more interest in the health aspects of their fish. Commercial fishermen also appear to be more aware of abnormalities in the species that they catch. Consequently, field personnel of the Section of Fisheries are frequently being asked to provide information concerning the diseases and parasites that occur in fishes of their region.

The purpose of this section of the manual is twofold. First, the written descriptions of the diseases of fishes should assist the field staff in the identification of abnormal conditions. Secondly, with the cooperation of the field staff in recording all pathologies observed, an effective method will be established to provide increased information about the incidence, frequency and distribution of fish diseases and parasites on a continuing basis. Such information, when received annually from all parts of the State, will assist in assessing the influence of diseases and parasites on the dynamics of wild fish populations. Moreover, there is the added advantage that current problems that might require further investigation will become more apparent.

As the title indicates, certain anomalies have been singled out for presentation. It should be pointed out that, in general, only those diseases have been described that (1) can be readily seen on the surface of the body or tissues or become obvious when the fish is dressed or skinned, (2) can be readily distinguished from any other disease and (3) can be identified with some degree of certainty without laboratory examination. Comparatively few of the diseases that may be found in native fish populations are described in this anomaly section. In the future, the manual will be expanded to cover other diseases and related subjects. As this bulletin has been prepared primarily as an aid to fishery management personnel, any suggestions that would improve the effectiveness of the publication would be welcome.

In identifying a diseased or parasitized specimen, the diagnostic descriptions should be consulted first and compared with the specimen in question. When a determination has been made, field staff should record the occurrence of the disease or parasite and forward a report to the laboratory. If there is any doubt about the identity of any disease or parasite, the specimen should be forwarded to the Fish Pathology Laboratory at St. Paul for examination.

Foreword

A variety of skin lesions have been found in fishes from this area (Economon, 1957-58). Some of the more conspicuous processes are tumorous growths, of which the walleye seems to demonstrate a peculiar susceptibility. Walleyes can be effected by various skin tumors including lymphocystis, dermal fibroma, and epidermal hyperplasia. A different virus is associated with each of these surface lesions. However, a conclusive viral etiology has been established thus far only for lymphocystis (Wolf, 1966). These walleye lesions are benign processes which are confined to the external surfaces of the body. They are cyclical in nature, with the relative frequency appearing to fluctuate in successive years. They are also seasonal with the incidence more pronounced during the winter months. Typical examples of these lesions are often found on walleyes at the time of their spawning run. Cutaneous tumors may occur in both males and females, and probably in all age groups. Although these lesions are ordinarily regarded as harmless in adult walleyes, the adverse impact that these infections might possibly have upon immature walleyes should be considered in any walleye management program. There is no public health threat known or postulated for these superficial tumors.

DERMAL FIBROMA

Fibromatous tumors vary in appearance from small, round, variably pigmented papules (2-5 mm) to rather large nodular growths (1-2 cm) which often coalesce to form papillary clusters that superficially resemble the warty growths of lymphocystis. However, the pearly granulation tissue aspect of the latter is completely absent in fibroma. Occasionally, both types of warts may be found side by side on a walleye, but it is not too difficult to differentiate between these two lesions. In contrast to lymphocystis, the nodules of dermal fibroma are more hemispheric and possess a smooth, firm textured surface. Larger lesions generally show a thinly stretched or torn epidermal covering over a grayish-pink nodular

mass, the crown of which is frequently inflammed. If a skin tumor deviates in any way from the written descriptions given here for lymphocystis and dermal fibroma, judgment concerning the edibility of the fish fillets should be deferred until the tumor has been examined microscopically. There are various types of tumors and in order to determine whether they are benign or malignant, a histopathological examination must be performed in the laboratory. The presence of a malignant growth seriously detracts from the value of the affected fish, which should not be used for food purposes.

EPIDERMAL HYPERPLASIA

Nonpapillomatous epithelial growths have been observed in successive years in walleye from several lakes in northern Minnesota. These film-like lesions appear as smooth, grayish-white spots and patches of slightly elevated, or thickened epidermis. Neither fungus nor slime bacteria are involved in these flat, non-necrotic surface lesions which vary in size up to several centimeters in diameter. The plaques are harder than the normal skin surrounding the affected parts, and are resistant to abrasion. These indurations may occur on any part of the body, including the fins. Dorsal and caudal fin lesions, which seem to appear more frequently, are perhaps just more noticeable due to the pronounced thickening and contrasting shades of color shown between affected and unaffected portions of the fin. The superficial character of these plaques is quite obvious from examinations that show there is no tendency for lesions found on one side of the fin to penetrate the thin interspinous membrane to the opposite lateral surface. The presence of epidermal hyperplasia, as it is benign and localized in the skin of the walleye, does not interfere with the edibility of the fillets.

LYMPHOCYSTIS

This viral disease is characterized by the formation of wart-like growths on various parts of the body and fins of fishes, including the walleye, which appears to be particularly susceptible. The external lesions have a marked

cellular appearance. They may take the form of small bead-like clusters (5-10) mm) of a yellowish-white color in the early stages of the infection, or appear as grayish-pink colored lumps several centimeters in diameter in older lesions. The coloration of lymphocystis lesions varies according to their location on the body and proximity to blood vessels. The granular surface texture has a striking resemblance to that of cauliflower. A magnifing glass may be used to bring out the cellular features so distinctive for this epithelial process. The lesion consists of hypertrophic connective tissue cells which have become infected with the lymphocystis virus. The cellular swelling that is induced by this virus is spectacular, and although the infected cells increase enormously in size, there is no hyperplasia or proliferation of cells as in malignant tumors. The rounded cells may reach a diameter of several millimeters before they finally rupture, or are sloughed off. If large numbers of spawning walleyes have lymphocystis, it may be possible to control the disease by using only those brood stock which are free of gross lesions.

MYOFIBROGRANULOMA

Myofibrogranuloma (MFG) is a muscular dystrophy-like anomaly of walleye in which the skeletal muscle has undergone profound structural changes (Economon, 1970, 1975, 1978). The myopathy is recognized by its swollen, coarsely fibrous, granular, and fatty characteristics. The lesion has an opaque yellow-brown color. Included in this pattern of striated muscle deformation is a consolidation and fusion of contiguous muscle fibers to form prominent aggregates of rough, cord-like strands, which eventually undergo a coagulation necrosis and calcification. The latter, more advanced stages of MFG are frequently found in the paravertebral muscle surrounding the spinal column. Less advanced lesions appear to radiate from the spinal area into adjoining muscle segments. The myomeres adjacent the skin are frequently affected and such lesions often appear isolated or detached from the more deeply seated myopathy. The swelling and general deterioration of

the muscle is usually not apparent externally. A notable exception is found in walleyes that occasionally have gross involvement of the cheek muscle which has a tendency to protrude, forming an outward puffiness or swelling that stretches the overlying epidermis. Neither hyperplasia nor hemorrhage is evident in these non-suppurative muscle fiber processes, and there is no visible evidence of lesion resorption or muscle regeneration. Congestion and swelling of the blood vessels with local erythema is an occasional early symptom. The scenario for MFG in *Stizostedion* is that of a progressive, irreversible muscular dystrophy which may, over a period of several years, spread through virtually the entire skeletal musculature. The lesions appear to be confined exclusively to the striated muscle, with the cardiac and smooth muscle showing no such aberrancies.

MFG has been found exclusively in adult walleyes whose ages range from 3 to 10 years. The sex frequency ratio of the myopathy is about equal. According to the catch data available on MFG affected walleyes, including those cases with patently gross muscle lesions, very few display any outward manifestations of paralysis or unusual motor function when captured. However, the walleye is recognized as being somewhat submissive when hooked and removed from the water, so that these traits make it difficult to detect or assess with precision any abnormal behavior or muscular incoordination that is present. Controlled captive conditions are required to study any disability phenomena more fully. The absence of outward symptoms has limited the collection and rapid identification of diseased walleyes in the general population. Detailed information on the incidence, distribution, and behavior of affected walleyes will aid in determining what influence factors such as heredity, nutrition, and environment might have on the development of this myopathy.

MFG has been recovered from widely distributed locations in Minnesota, but there is an apparent difference in incidence of the myopathy between eutrophic and mesotrophic waters of about two to one, respectively. A higher frequency of this anomaly has been observed to occur in walleyes from comparatively small,

fertile lakes and ponds in which the species is maintained exclusively by periodic stocking of hatchery-reared walleyes.

The histopathological similarities of MFG in walleye specimens to those of muscular dystrophy in man and hereditary dystrophy-like myopathies in animals, suggests that this anomaly might have a genetic basis. An unusual occurrence of a mixed pathology of MFG and dermal fibroma came to our attention recently. A walleye was submitted to our laboratory with multiple epithelial tumors. Histopathological examination confirmed dermal fibroma. In addition, small foci of MFG were found in the skeletal muscle in close proximity to the fibromas. Further work is planned to determine what significance or relationship this mixed pathology might have in the pathogenesis of myofibrogranuloma.

LYMPHOSARCOMA

Lymphosarcoma is a malignant tumor of blood cell origin. Although cancerous growths are generally quite scarce in our fishes, lymphosarcoma is the most frequently encountered neoplasm in Minnesota, where it has been found exclusively in northern pike. The origin of these tumors is considered to be lymphoid stem cells (Mulcahy, et al., 1970). Reports of its occurrence in muskellunge and pike from other parts of the U.S.A., Canada, Sweden, and Ireland indicates a wide geographical distribution of this neoplasm.

Lymphosarcoma is characterized by the development of external hemorrhagic sores, welts, and lumps. In Minnesota pike, the cutaneous lesions occur more often on the left side of the body. The lesions are often distributed on the posterior lateral surfaces near the pelvic fins. The jaw is also frequently affected. Lymphosarcoma tumors exhibit seasonal periodicity coupled with morphologic variations. The development of the neoplasm is promoted by lower water temperatures, and correspondingly inhibited at elevated water temperatures. Coinciding with this temperature control mechanism, an oncorna virus has been found in pike tumors which has psychrophilic enzyme activity (Papas, et al., 1976).

The largest, most active lymphomas are found in late winter or early spring, usually after a prolonged period of cold water with temperatures near freezing. They often appear as hemispheric or ovoid swellings of from 7-15 cm in diameter. The cutaneous mass is firm and elastic, and often inflammed. The scales may be loose or missing and a reticulated network of blood capillaries, shallow fissures, and pittings are usually found over the crown of the tumor.

Transmission probably occurs at spawning time through a transplantation process in which infected tumor cells are sloughed off and implanted in the skin of another pike through body contact. The lesions in the early stages of the disease may appear as small reddish-blue pimples.

The lymphosarcoma tumors of winter that are carried over into summer, show profound changes in size and consistency. A spontaneous regression occurs where the height of the mass may shrink to only a few millimeters in elevation. The highly inflammed area is loosely knit, soft and spongy. There is considerable weeping of serosanguineous fluid. The tumor may break down to such an extent that the underlying muscle becomes exposed and necrotic. However, it appears that a substantial number of northern pike with necrotic lesions manage to survive, to infect or become reinfected again at spawning time. Occasionally, northern pike may be found in late summer with a healing lymphosarcoma lesion on one area of the body, and the early pimple stages of the disease at another site.

An experimental study[1/] has shown that of several test groups of northern pike yearlings that were injected subcutaneously or intraperitoneally with lymphosarcoma tumor homogenate, gross tumors developed in about one year. Also, the tumorous pike survived from 2-5 years at a mean water temperature of 9.0° C. However, in other similarly controlled groups of northern pike injected with cell-free filtrate prepared from the same tumor homogenate, neither internal nor external lesions of lymphosarcoma developed during the same five year period.

1/ Economon, P. (1975) Unpublished data, Minn. Dept. of Nat. Resources, Fish Pathology Laboratory, St. Paul, Minn.

Accordingly, it seems probable that lymphosarcoma is transmitted through a process of transplantation of virus-infected tumor cells, and not through exposure to the free virus. The source of the lymphosarcoma tumor for the test injections was from one of several infected northern pike that were netted from the Minn-Tac Reservoir near Mountain Iron, Minnesota in May 1974. Successive nettings showed a 15 percent incidence of lymphosarcoma in the northern pike population from this body of water.

The possibility that carcinogens are etiologically related to the occurrence of lymphoreticular neoplasms is suggested by the recent demonstration of more than a four-fold increase of these tumors in northern pike from polluted waters (Brown, et al., 1973). It is possible that pollution *per se* is not the cause of the neoplasia, but that its presence enhances carcinogenesis.

PARASITE HOSTS

Symbols and Notations in the Parasite Host Section

The symbol * (see also bottom of page 1) indicates that the organism was found in Margolis and Arthur 1979. This work is primarily a checklist with an extensive bibliography and usually contains little information except the host and the site of infection. In some cases, the latter are not stated.

The symbol † (see also top of page 2) indicates that the organism was found on or in this fish in Minnesota, according to information in the files of the DNR biology-pathology laboratory.

The term "Not available", regarding where in a host a parasite was found or details regarding its life history, may have several meanings. First, the references consulted by the authors (see Introduction) in which the organism was listed as being in a host, may have said nothing about where it was found or given any details regarding its life cycle. This may not have been known to the author because research notes were incomplete, or the life cycle was not known to that author, or not yet studied. Second, a published paper not seen by the authors of this manual or reviewed by other authors, may have contained more specific information regarding the parasite. It is recommended that when more specific information is desired the reader should consult Hoffmann 1967, Margolis and Arthur 1979, or an abstracting publication to obtain the collation of the original paper to determine if further information is available. It was not possible for us to do this additional research because of time constraints, and the methodology decided upon at the beginning of this project.

POLYODONTIDAE

Polyodon spathula - *Paddlefish, spoonbill*

MONOGENEA	
Cotylaspis cokeri	Esophagus
Diclybothrium hamulatum	Gills
DIGENEA	
Halipegus perplexus	Adult in intestine
DIGENEA METACERCARIA	
Clinostomum marginatum	Cercaria in snail, Helisoma; metacercaria in this fish as yellow grub; adult in heron in mouth, esophagus
CESTOIDEA	
†Marsipometra hastata	Procercoid in Cyclops; adult in intestine and caeca
NEMATODA	
†Camallanus sp.	Larvae as hyperparasites of Marsipometra hastata in intestine and pyloric caeca
Thynnascaris dollfusi	Adult in stomach
OLIGOCHAETA	
Illinobdella moorei	Not available
CRUSTACEA	
Ergasilus elongatus	Not available
COELENTERATA	
Polypodium hydriforme	Eggs

ACIPENSERIDAE

Acipenser fulvescens - *Lake sturgeon*

MONOGENEA	
Diclybothrium armatum	Not available
D. hamulatum	Gills
*Paradiclybothrium sp.	Gills
DIGENEA	
*Allocreadium sp.	Intestine
*Bunodera luciopercae	Intestine
Crepidostomum lintoni	Not available
*Homalometron armatum	Intestine
*Skrjabinopsolus manteri	Digestive tract
DIGENEA METACERCARIA	
Clinostomum marginatum	Cercaria in snail, Helisoma; adult in heron
Diplostomulum sp.	Eye
NEMATODA	
Cucullanus chitellarius	Intestine
Rhadbochona cascadilla	Larvae in mayflies; adult in intestine
*Spinitectus sp.	Digestive tract
*Truttaedacnitis clitellarius	Digestive tract
ACANTHOCEPHALA	
Echinorhynchus salmonis	Larvae in amphipods; second intermediate host, Osmerus
Metechinorhynchus salmonis	Not available

OLIGOCHAETA

*Macrobdella decora	Not available

CRUSTACEA

Argulus stizostethi	Not available

COELENTERATA

Polypodium hydriforme	Eggs

Scaphirhynchus platorynchus - *Shovelnose sturgeon*

DIGENEA

Crepidostomum lintoni	Cercaria in clam; metacercaria in insects and crustacea; adult in this fish

DIGENEA METACERCARIA

Clinostomum marginatum	Cercaria in snail, Helisoma; metacercaria in this fish as yellow grub; adult in heron in mouth, esophagus

NEMATODA

"Ascaris" scaphirhynchi	Intestine

LEPISOSTEIDAE

Lepisosteus platostomus - *Shortnose gar*

PROTOZOA	
Myxosporida	
Trophozoites	Gall bladder
DIGENEA	
Macroderoides spinifera	First host snail, Helisoma; metacercaria in fish and tadpoles; adult in intestine of this fish
DIGENEA METACERCARIA	
Clinostomum marginatum	Cercaria in snail, Helisoma; metacercaria in this fish as yellow grub; adult in heron in mouth, esophagus
CESTOIDEA	
Proteocephalus perplexus	Plerocercoids in Hyborhynchus, Roccus, Ictalurus
P. singularis	Not available
ACANTHOCEPHALA	
Leptorhynchoides thecatum	Larvae in amphipods; if larvae here less than 30 days, small fish may be second host
CRUSTACEA	
Ergasilus elegans	Not available
Lernaea variabilis	Larvae on gills

Lepisosteus osseus - *Longnose gar*

PROTOZOA	
Myxosporida	

Trophozoite	Gall bladder
DIGENEA	
Macroderoides parva	Cercaria in snail, Helisoma; metacercaria in fish and tadpoles; adult in this fish in intestine
*M. spiniferus	Digestive tract
DIGENEA METACERCARIA	
Clinostomum marginatum	Cercaria in snail, Helisoma; metacercaria in this fish as yellow grub; adult in heron in mouth, esophagus
CESTOIDEA	
*Bothriocephalus sp.	Adult in pyloric caeca, intestine
*Proteocephalus ambloplitis	Plerocercoids in fish, encysted in viscera, adult in intestine
P. perplexus	Procercoids in haemocoel of crustacea; plerocercoids in small fish
*P. singularis	Adult in intestine
NEMATODA	
*Cystidicola lepisostei	Intestine
ACANTHOCEPHALA	
Leptorhynchoides thecatum	Larvae in amphipods; if larvae here less than 30 days, small fish may be second host
OLIGOCHAETA	
*Placobdella montifera	Body surface
CRUSTACEA	
Ergasilus elegans	Not available

AMIIDAE

Amia calva - *Bowfin*

PROTOZOA	
Myxosporida	
Henneguya amiae	Gills
DIGENEA	
Azygia acuminata	Cercaria in snail; metacercaria in host fish or carrier fish; adult in this fish in stomach
A. angusticauda	Cercaria in snail; metacercaria in host fish or carrier fish; adult in this fish in stomach
A. longa	Cercaria in snail; metacercaria in host fish or carrier fish; adult in this fish in stomach
Crepidostomum cornutum	Cercaria in clam; metacercaria in crayfish
C. sp.	Cercaria in clam; metacercaria in insects, crustacea
Leuceruthrus micropteri	Stomach
Macroderoides parva	First host snail, Helisoma; metacercaria in fish, tadpoles; adult in this fish in intestine
M. typica	Cercaria in snail, Helisoma; metacercaria in fish, tadpoles; adult in this fish in intestine
Microphallus opacus	Metacercaria in crayfish
DIGENEA METACERCARIA	
*Apophallus venustus	Metacercaria in musculature
Clinostomum marginatum	Cercaria in snail, Helisoma; metacercaria in this fish as yellow grub; adult in heron in mouth, esophagus

*Diplostomulum sp.	Metacercaria in eye, brain, pharynx
Echinochasmus donaldsoni	Cercaria in snail; metacercaria in this fish in gills; adult in grebes
CESTOIDEA	
Haplobothrium globuliforme	Procercoid in Cyclops; plerocercoid encysted in liver of Ictalurus nebulosus, Lebistes reticulatus, L. gibbosus; adult in gut of this fish
*Proteocephalus ambloplitis	Plerocercoid in this fish encysted in viscera; adult in intestine in this fish
P. perplexus	Plerocercoids in Hyborhynchus, Roccus, Ictalurus
NEMATODA	
Haplonema immutatum	Adult in stomach or intestine
Spinitectus carolini	Larvae in mayfly larvae; adult in stomach or intestine
Spiroxys sp.	First host Cyclops; larvae in mesenteries of fish and amphibia, dragonfly nymphs, snails
ACANTHOCEPHALA	
Echinorhynchus dirus	Larvae in amphipods; no second host
E. salmonis	Larvae in amphipods and Osmerus
Leptorhynchoides thecatum	Larvae in amphipods; if larvae less than 30 days, small fish may be second host
Neoechinorhynchus cylindratum	Larvae in crustacea; some have second host
Pomphorhynchus bulbocolli	Larvae in amphipods and small fish
OLIGOCHAETA	
Illinobdella sp.	Not available

CRUSTACEA	
Argulus americanus	Not available
ARTHROPODA	
Acarina	Gills

HIODONTIDAE

Hiodon alosoides - *Goldeye*

DIGENEA

Crepidostomum illinoiense	Metacercaria in mayfly nymphs
*C. sp.	Adult in intestine and gall bladder

DIGENEA METACERCARIA

*Paurorhynchus hiodontis	Metacercaria in body cavity
P. tergisus	Metacercaria in body cavity

CESTOIDEA

Bothriocephalus cuspidatus	Procercoid in copepod; plerocercoids at times in small fish

CRUSTACEA

*Ergasilus sp.	Gills

Hiodon tergisus - *Mooneye*

MONOGENEA

Mazocraeoides sp.	Gills

DIGENEA

Crepidostomum hiodontos	Cercaria in clam; metacercaria in aquatic insects and crustacea
C. illinoiense	Cercaria in clam; metacercaria in aquatic insects and crustacea
Plagioporus serratus	Cercaria in snail; metacercaria in crustacea

DIGENEA METACERCARIA

Paurorhynchus hiodontos	Metacercaria in body cavity
Tetracotyle sp.	Metacercaria encysted in this fish

CESTOIDEA	
Bothriocephalus cuspidatus	Procercoids in copepod; plerocercoids at times in small fish
*Proteocephalus sp.	Intestine, pyloric caeca
NEMATODA	
Camallanus oxycephalus	Larvae in copepods, other crustacea?; adult in stomach and intestine of fish
Cystidicola stigmatura	Larvae in Gammarus, adult in swim bladder
Rhabdochona cascadilla	Larvae in mayflies, adult in intestine
ACANTHOCEPHALA	
Leptorhynchoides thecatum	Larvae in amphipods, if larvae less than 30 days also in mesenteries of fish; adult in pyloric caeca
Pomphorhynchus bulbocolli	Larvae in amphipods and small fish

CLUPEIDAE

Alosa pseudoharengus - *Alewife*

DIGENEA METACERCARIA	
Diplostomulum flexicaudum	Cercaria in snails; metacercaria in this fish in lens of eye; adult in gulls
*Diplostomum spathaceum	Metacercaria in vitreous humor, lens
Neascus sp.	Cercaria in snails; metacercaria in this fish in lens of eye; adult in gulls
*Tetracotyle intermedia	Metacercaria in heart, mesente ies
NEMATODA	
Contracaecum sp.	Adult in piscivorous fish, birds and mammals
ACANTHOCEPHALA	
Acanthocephalus jacksoni	Larvae in amphipods; no second host
A. parksidei	Larvae in amphipods; no second host
Echinorhynchus salmonis	Larvae in amphipods
Leptorhynchoides thecatum	Larvae in amphipod; if larvae less than 30 days also in mesenteries of fish
Metechinorhynchus salmonis	Not available
CRUSTACEA	
Argulus alosae	Not available
ARTHROPODA	
Hydrachna sp.	Larvae on gills

Dorosoma cepedianum - *Gizzard shad*

PROTOZOA	
Microsporida	
†Plistophora cepedianae	Cysts in visceral cavity
Myxosporida	
†Coccomyxa sp.	Body cavity
MONOGENEA	
Mazocraeoides olentangiensis	Gills
Pseudomazocraeoides ontariensis	Gills
DIGENEA METACERCARIA	
Clinostomum sp.	Cercaria in snail, Helisoma; adult in heron in mouth, esophagus
Diplostomulum sp.	Cercaria in snails; adult in piscivorous birds
CESTOIDEA	
Glaridacris confusus	Not available
Proteocephalus sp.	Procercoid and plercercoid in haemocoel of crustacea
CRUSTACEA	
Argulus appendiculosus	Not available
A. sp.	Not available

SALMONIDAE

Salvelinus fontinalis - *Brook trout*

PROTOZOA	
Ciliata	
Suctoria	
Trichophyra piscium	Gills
"True Ciliates"	
Balantidium sp.	Intestine
*Trichodina sp.	Gills, urinary bladder, ureters
Trichodinella sp.	Gills
Sporozoa	
Sarcocystis salvelini	Muscle
Coccidia	
Eimeria salvelini	Anterior gut epithelium
E. truttae	Anterior gut epithelium
Haemosporidia	
Dactylosoma salvelini	In red blood cells
Leucocytozoon salvelini	In red blood cells
Myxosporida	
Myxobolus ovoidalis	In skin
Unicauda fontinalis	In skin
Zschokkela salvelini	Kidney capsule
MONOGENEA	
*Discocotyle sagittata	Gills
D. salmonis	Gills

DIGENEA	
Azygia angusticauda	Stomach, intestine
A. longa	First host snail; metacercaria in fish host or carrier fish; adult in stomach, intestine
Crepidostomum cooperi	Cercaria in clam; metacercaria in insect, crustacea
C. cornutum	Cercaria in clam; metacercaria in crayfish
C. farionis	Cercaria in clam; metacercaria in mayfly, Gammarus
C. sp.	Cercaria in clam; metacercaria in insect, crustacea
Phyllodistomum lachancei	First host clam; metacercaria sporocyst in clam, arthropods; adult in urinary bladder
Pleurogenes sp.	Accidental (usually in frogs), metacercaria in crayfish
DIGENEA METACERCARIA	
Aphophallus brevis	Cercaria in snails, Amnicola; metacercaria in fish as black cyst; adult in gulls, loons, muskrats
*A. imperator	Metacercaria in skin, fins
Clinostomum marginatum	Cercaria in snail, Helisoma; metacercaria in fish as yellow grub; adult in heron in mouth, esophagus
Diplostomulum scheuringi	First host snail, Helisoma; metacercaria in vitreous chamber of eye in fish and newts
*D. sp.	Metacercaria in eye, brain, pharynx
*Posthodiplostomum minimum	Metacercaria in mesenteries, liver, kidney

CESTOIDEA	
Diphyllobothrium sebago	Plerocercoids in fish
D. sp.	Not available
Eubothrium salvelini	Procercoids in copepods; no second intermediate host required
Ligula intestinalis	Procercoids in copepods; plerocercoids in body cavity of fish; adult in fish eating birds
*L. sp.	Plerocercoids in body cavity
*Proteocephalus ambloplitis	Adult in intestine
P. arcticus	Procercoids in copepod; plerocercoids in small fish
P. parallacticus	Procercoids in Cyclops; plerocercoids in Cyclops
P. pinguis	Procercoids in copepod; plerocercoids in fish
*P. sp.	Adult in intestine, pyloric caeca
†Triaenophorus crassus	Procercoid copepod; plerocercoid forage fish; adult in intestine
NEMATODA	
*Cystidicola farionis	Adult in swim bladder
Hepaticola bakeri	Intestine
Metabronema canadense	Larvae in mayfly nymphs
†M. harwoodi	Larvae in mayfly nymphs
M. salvelini	Larvae in mayfly nymphs
Oxyuridea sp. sp.	Not available
Philometra sp.	Larvae in copepods; adult in tissue
Raphidascaris alius	Larvae in small fish; adult in teleosts

Raphidascaris canadense	Larvae in small fish; adult in teleosts
Rhabdochona cascadilla	Larvae in mayflies; adult in intestine
R. laurentianus	Larvae in small fish; adult in teleosts
*Skrjabinocapillaria bakeri	Adult in intestine
*Thynnascaris brachyura	Adult in intestine

ACANTHOCEPHALA

Acanthocephalus lateralis	Larvae in Asellus and Gammarus
Leptorhynchoides thecatum	Larvae in amphipod, if larvae less than 30 days also in small fish
Neoechinorhynchus cylindratum	Larvae in crustacea, fish
N. rutili	Larvae in crustacea, fish
Pomphorhynchus bulbocolli	Larvae in amphipod; small fish

OLIGOCHAETA

Piscicola punctata	Not available

CRUSTACEA

Argulus coregoni	Not available
A. stizosthethi	Not available
Salmincola edwardsi	Not available

Salvelinus namaycush - *Lake trout*

PROTOZOA

Ciliata

Suctoria

Trichophyra piscium	Gills

"True Ciliates"	
†Chilodenella sp.	Gills
†Ichthyophthirius multifilis	Skin
†Trichodina sp.	Gills
DIGENEA	
Azygia angusticauda	Adult in intestine, stomach
A. longa	Adult in intestine, stomach
Crepidostomum farionis	Adult in intestine, pyloric caeca, gall bladder
DIGENEA METACERCARIA	
Apophallus brevis	Cercaria in snail, Amnicola; metacercaria in fish as black cyst; adult in gulls, loons
*A. sp.	Metacercaria in skin
Clinostomum marginatum	Cercaria in snail, Helisoma; metacercaria in fish as yellow grub; adult in heron in mouth, esophagus
Diplostomulum scheuringi	Cercaria in snail, Helisoma; metacercaria in brain, vitreous chamber of eye, fish and newts
*D. sp.	Metacercaria in eye, brain, pharynx
CESTOIDEA	
*Bothriocephalus cuspidatus	Pyloric caeca, intestine
†B. sp.	Pyloric caeca, intestine
*Diphyllobothrium dendriticum	Plerocercoid in viscera
*D. latum	Plerocercoid in musculature, body cavity
D. sp.	Procercoid in copepod, other fish; plerocercoids, immature adult
Eubothrium crassum	Procercoid in copepod; no second intermediate host required; adult intestine of fish

Eubothrium salvelini	Procercoid in copepod, no second intermediate host required; adult intestine of fish
*Proteocephalus ambloplitis	Intestine
P. parallacticus	Procercoid and plerocercoid in copepod
*P. pusillus	Intestine, pyloric caeca
P. salvelini	Procercoid and plerocercoid in Cyclops
*P. sp.	Intestine, pyloric caeca
Triaenophorus crassus	Procercoid in copepod, plerocercoid in muscle, adult in fish
NEMATODA	
Cystidicola cristivomeri	Larvae in Gammarus, swim bladder, air vessels, esophagus
*C. farionis	Swim bladder
†C. stigmatura	Swim bladder
Hepaticola bakeri	Not available
Metabronema salvelini	Larvae in mayfly nymphs
Philonema agubernaculum	Larvae in Cyclops, larger trout get by eating smelt
*P. oncorhynchi	First host copepod; larvae in body cavity, wall of swim bladder
*P. sp.	Larvae in body cavity, wall of swim bladder, stomach
ACANTHOCEPHALA	
Acanthocephalus parksidei	Larvae in amphipods, no second intermediate host required
Echinorhynchus leidyi	Larvae in amphipods
E. salmonis	Larvae in amphipods, Osmerus mordax
Leptorhynchoides thecatum	Larvae in amphipods; if larvae here less than 30 days, small fish may be second host

Metechinorhynchus salmonis	Intestine
Neoechinorhynchus cylindratum	Larvae in crustacea and fish
N. rutili	Larvae in crustacea and fish
Pomphorhynchus bulbocolli	Larvae in amphipods, small fish
OLIGOCHAETA	
*Piscicola milneri	Body surface, fins
CRUSTACEA	
Argulus coregoni	Not available
Achtheres coregoni	Not available
†Salmincola beani	External surface of body
*S. siscowet	Gills, body, fins
†*S. sp.	Body, gills, fins

Salmo gairdneri - *Rainbow trout*

PROTOZOA	
Ciliata	
Suctoria	
Trichophyra piscium	Gills
"True Ciliates"	
Carchesium sp.	On eggs
Myxosporida	
Henneguya salmonis	Subcutaneous
Myxosoma cerebralis	Cartilage of brain and gill arches
MONOGENEA	
Discocotyle sagittata	Gills
D. salmonis	Gills

DIGENEA	
Azygia longa	Snail eaten; metacercaria in host fish or carrier fish; adult in stomach, intestine
Crepidostomum cooperi	Cercaria in clam; metacercaria in insect, crustacea
C. cornutum	Cercaria in clam; metacercaria in crayfish
C. farionis	Cercaria in clam; metacercaria in mayfly and Gammarus
C. sp.	Cercaria in clam; metacercaria in insects, crustacea
Phyllodistomum lachancei	Metacercaria in sporocyst in clam or in arthropods; adult in urinary bladder
DIGENEA METACERCARIA	
Apophallus brevis	Cercaria in snail, Amnicola; metacercaria enclosed in black cyst in fish; adult in gulls, loons, muskrats
Clinostomum marginatum	Cercaria in snail, Helisoma; metacercaria in fish as yellow grub; adult in heron in mouth, esophagus
*C. sp.	Not available
Diplostomulum scheuringi	Cercaria in snail, Helisoma; metacercaria in vitreous chamber of eye of fish and newts
†*D. sp.	Lens of eye; cataract
†Neascus sp.	Skin
CESTOIDEA	
†Caryophyllaeidae	Intestine and liver
†Diphyllobothrium sp.	Not available
Eubothrium crassum	Procercoid in copepods; no second host required; adult in fish

Eubothrium salvelini	Procercoid in copepods; no second intermediate host required
†E. sp.	Procercoid in copepods; no second intermediate host required
Proteocephalus pinguis	Procercoid in copepods; plerocercoid in fish
P. sp.	Not available

NEMATODA

Camallanus oxycephalus	Larvae in copepod; adult in intestine, shows red from anus
*Cystidicola sp.	Not available
†C. stigmatura	Not available
*Cystidicoloides tenuissima	Not available
Hepaticola bakeri	Intestine
Metabronema salvelini	Larvae in mayfly nymphs
Rhabdochona cascadilla	Larvae in mayflies; intestine
Spinitectus carolini	Larvae in mayfly larvae; adult in stomach and intestine

ACANTHOCEPHALA

Acanthocephalus parksidei	Larvae in crustacea, no second intermediate host
Echinorhynchus leidyi	Larvae in amphipods
E. salmonis	Larvae in amphipods, Osmerus
†E. sp.	Not available
Leptorhynchoides thecatum	Larvae in amphipod; if less than 30 days, small fish may be second host
Neoechinorhynchus cylindratum	Larvae in crustacea and fish
N. rutili	Larvae in crustacea and fish
†N. sp.	Larvae in crustacea and fish
Pomphorhynchus bulbocolli	Larvae in amphipods and small fish

OLIGOCHAETA	
Illinobdella sp.	Not available
Piscicola geometra	Not available
P. punctata	Not available
CRUSTACEA	
†Argulus coregoni	External body surfaces
Salminicola edwardsi	Not available
COELENTERATA	
Hydra sp.	Eggs and fry

Salmo salar - *Atlantic salmon*

DIGENEA	
Brachyphallus crenatus	Not available
Derogenes varicus	Adult in esophagus and stomach
Podocotyle simplex	Adult in intestine
DIGENEA METACERCARIA	
Clinostomum marginatum	Cercaria in snail, Helisoma; metacercaria in fish as yellow grub; adult in heron in mouth, esophagus
Diplostomulum scheuringi	Cercaria in snail, Helisoma; metacercaria in vitreous chamber of eye of fish and newts
CESTOIDEA	
Eubothrium crassum	Procercoid in copepod, no second intermediate host required; adult in intestine of fish
NEMATODA	
Camallanus oxycephalus	Larvae in copepod; adult in intestine, shows red from anus

Cystidicola stigmatura	Adult in swim bladder
Hepaticola bakeri	Intestine
ACANTHOCEPHALA	
Leptorhynchoides thecatum	Larvae in amphipod; if less than 30 days, small fish may be second host
Neoechinorhynchus cylindratum	Larvae in crustacea and fish
N. rutili	Larvae in crustacea and fish
Pomphorhynchus bulbocolli	Larvae in amphipods and small fish
OLIGOCHAETA	
Illinobdella sp.	Not available
CRUSTACEA	
Argulus coregoni	Not available
A. stizostethi	Not available

Salmo trutta - *Brown trout*

PROTOZOA	
Ciliata	
†Trichodina sp.	Gills
MONOGENEA	
*Discocotyle sagittata	Not available
D. salmonis	Gills
Gyrodactylus elegans salmonis	Not available
DIGENEA	
Azygia longa	Cercaria in snail; metacercaria in carrier fish
Bunodera luciopercae	Cercaria in clam; metacercaria in crayfish and copepods

Crepidostomum cooperi	Cercaria in clam; metacercaria in aquatic insects and crustacea
C. farionis	Cercaria in clam; metacercaria in mayfly nymphs or Gammarus
DIGENEA METACERCARIA	
Apophallus brevis	Metacercaria black cyst in this fish; adult in gulls, loons, muskrats
Diplostomulum scheuringi	Cercaria in snail, Helisoma; metacercaria in cyst in vitreous chamber, brain, eye
D. sp.	Cercaria in snail, Helisoma; metacercaria in fish as black cyst in muscle; adult in pelican
Neascus sp.	Snail; metacercaria in fishes, blackspot cyst; adult in heron
CESTOIDEA	
†Caryophyllaeidae	Intestine
Diphyllobothrium sp.	Procercoid in copepods; plerocercoid in fish; adult in mammals, birds
Proteocephalus parallacticus	Procercoid and plerocercoid in Cyclops
P. pinguis	Procercoid in copepods; plerocercoid in fish
P. sp.	Primarily plerocercoids
NEMATODA	
Camallanus oxycephalus	Larvae in crustacea and copepods; adult in stomach and intestine; shows red from vent
Contracaecum sp.	Adult in piscivorous birds, fish and mammals
†Metabronema canadense	Intestine
†M. harwoodi	Not available

Metabronema salvelini	Larvae in mayfly nymphs
Spinitectus gracilis	Larvae in mayfly nymphs; adult in stomach and intestine
ACANTHOCEPHALA	
Acanthocephalus parksidei	Larvae in amphipods; no second intermediate host required
Echinorhynchus salmonis	Larvae in amphipods; second host Osmerus mordax
Neoechinorhynchus rutili	Larvae in crustacea; sometimes have second host
CRUSTACEA	
Lernaea cruciata	Not available

Oncorhynchus spp. - *Salmon*

PROTOZOA	
Ciliata	
Suctoria	
Trichophyra piscium	Gills
Myxosporida	
Myxosoma cerebralis	Cartilage of brain, gill arches
MONOGENEA	
Discocotyle sagittata	Gills
DIGENEA	
Crepidostomum farionis	Cercaria in clam; metacercaria in mayfly nymphs or Gammarus
C. sp.	Cercaria in clam; metacercaria in insects, crustacea
DIGENEA METACERCARIA	
Clinostomum marginatum	Cercaria in snail, Helisoma; metacercaria in fishes as yellow grub; adult in heron in mouth, esophagus

*Tetracotyle intermedia	Metacercaria in heart, mesenteries
CESTOIDEA	
Diphyllobothrium sp.	Not available
Proteocephalus arcticus	Procercoid in copepods; plerocercoid in small fish
*Triaenophorus nodulosus	Plerocercoids in liver, viscera
NEMATODA	
*Cystidicola farionis	Swim bladder
†C. stigmatura	Swim bladder
Hepaticola bakeri	Intestine
Metabronema salvelini	Larvae in mayfly nymphs
Rhabdochona cascadilla	Larvae in mayflies; intestine
*Spinitectus gracilis	Intestine
*Thominx catenata	Intestine
ACANTHOCEPHALA	
*Acanthocephalus jacksoni	Intestine
A. parksidei	Larvae in amphipods; no second intermediate host
Echinorhynchus salmonis	Larvae in amphipods; second host Osmerus mordax
†E. sp.	Intestine
*Leptorhynchoides thecatus	Larvae found encysted in mesenteries; adult in intestine
*Metechinorhynchus salmonis	Intestine
*Neoechinorhynchus pungitius	Intestine, stomach
N. rutili	Larvae in crustacea and fish
*N. tumidus	Intestine
Pomphorhynchus bulbocolli	Larvae in amphipods, small fish; in this fish in intestine, encysted in mesenteries

OLIGOCHAETA	
Placobdella parasitica	Not available
CRUSTACEA	
Ergasilus caeruleus	Not available
Salmincola edwardsi	Not available
COELENTERATA	
Hydra sp.	Fry
ARTHROPODA	
*Hydrachna sp.	Larvae on gills

Coregonus artedii - *Cisco or Lake herring*

PROTOZOA	
Myxosporida	
Henneguya sp.	Gills
MONOGENEA	
Discocotyle sagittata	Gills
D. salmonis	Gills
Tetraonchus variabilis	Gills
DIGENEA	
Crepidostomum cooperi	Cercaria in clam; metacercaria in insects or crustacea
C. farionis	Cercaria in clam; metacercaria in mayfly nymphs or Gammarus
Phyllodistomum sp.	Cercaria in clam; metacercaria in clam sporocysts or in arthropods; adult in ureters
DIGENEA METACERCARIA	

Clinostomum marginatum	Cercaria in snail, Helisoma; metacercaria in fish as yellow grub; adult in heron in stomach, esophagus
Diplostomulum flexicaudum	Cercaria in snail; metacercaria in small fish; adult in birds
D. scheuringi	Cercaria in snails, Helisoma; metacercaria in vitreous chamber of the eye of fish and newts
*D. sp.	Metacercaria in eye, brain, pharynx
Tetracotyle intermedia	Metacercaria in heart, mesenteries
*T. sp.	Metacercaria in heart, pericardium, mesenteries, kidney, musculature; adult in gulls
CESTOIDEA	
*Bothrimonus sturionis	Adult in intestine
*Bothriocephalidae gen. sp.	Plerocercoid in intestinal wall or encysted on stomach wall
Bothriocephalus cuspidatus	Procercoid in copepod; plerocercoid in small fish sometimes; adult in intestine
*Cestoda gen. sp. metacestode	Plerocercoid encysted in musculature, mesenteries, viscera, or free of intestine
Cyathocephalus truncatus	Procercoid in amphipod; plerocercoid in small fish; adult in intestine
*Diphyllobothrium ditremum	Plerocercoid in viscera
D. laruei	Procercoid in copepod; plerocercoids in fish; adult in birds, mammals, cats, dogs
D. oblongatum	Procercoid in copepods; plerocercoids in fish; adult in gulls, and terns
D. sp.	Not available
Eubothrium crassum	Procercoid in copepods; second intermediate host not required; adult in fish

Eubothrium salvelini	Procercoid in copepods; adult in intestine
Proteocephalus exiguus	Procercoid in copepods; plerocercoid in small fish
P. filicollis	Procercoid in copepods; plerocercoid in small fish
P. laruei	Procercoid in haemocoel of crustacea; plerocercoid in small fish; adult in intestine
*P. pusillus	Adult in intestine, pyloric caeca
P. sp.	Procercoid in haemocoel of crustacea; plerocercoid in small fish; adult in intestine
P. wickliffi	Procercoid in copepods; plerocercoid in small fish
†Triaenophorus crassus	Procercoid in copepods; plerocercoid in skeletal muscle

NEMATODA

Cystidicola canadensis	Larvae in Gammarus; adult in swim bladder, air vessels
*C. farionis	Adult in swim bladder
*C. sp.	Adult in swim bladder, body cavity
C. stigmatura	Larvae in Gammarus; adult in air bladder
Philometra sp.	Larvae in copepods; adult in fish tissue
*Philonema oncorhynchi	Larvae in body cavity; wall of swim bladder
Spinitectus carolini	Larvae in mayfly larvae; adult in esophagus, stomach and intestine
S. gracilis	Larvae in mayfly larvae; adult in intestine

ACANTHOCEPHALA	
Echinorhynchus leidyi	Larvae in amphipods
E. salmonis	Larvae in amphipods, Osmerus
Leptorhynchoides thecatum	Larvae in amphipod; if less than 30 days may go to small fish
Metechinorhynchus salmonis	Larvae in crustacea, intestine
Neoechinorhynchus cylindratum	Larvae in crustacea
*N. sp.	Intestine
OLIGOCHAETA	
Piscicola milneri	Not available
CRUSTACEA	
Achtheres ambloplitis	Not available
A. coregoni	Not available
†A. sp.	Not available
Argulus canadensis	Surface of body
A. stizostethi	Not available
*A. sp.	External surface
Ergasilus caeruleus	Not available
E. sp.	Gills
†Salmincola edwardsi	Not available
*S. extensus	Body, fins
*S. extumescens	Gills, gill cavity
S. intermis	Not available
S. wisconsinensis	Not available

Coregonus clupeaformis - *Lake whitefish*

MONOGENEA	
Discocotyle sagittata	Gills

Discocotyle salmonis	Gills
DIGENEA	
Crepidostomum cooperi	Cercaria in clam; metacercaria in aquatic insects and crustacea; adults in intestine, pyloric caeca, gall bladder
*C. farionis	Adult in intestine, pyloric caeca, gall bladder
*Digenea gen. sp.	Adult in intestine, caeca, stomach, urinary and swim bladders
Phyllodistomum coregoni	Cercaria in clam; metacercaria encysts in sporocysts in clam or arthropods; adult in urinary bladder
DIGENEA METACERCARIA	
Diplostomulum scheuringi	Cerceria in snail, Helisoma; metacercaria in vitreous chamber, brain, eye
*D. sp.	Metacercaria in eye, brain, pharynx
*D. spathaceum	Metacercaria in vitreous humor, lens
*D. spathaceum indistinctum	Eye
Tetracotyle intermedia	Metacercaria in heart, mesenteries; adult in birds
CESTOIDEA	
*Bothriocephalus sp.	Adult in pyloric caeca, intestine
*Cestoda gen. sp.	Plerocercoid encysted in musculature, mesenteries
Cyathocephalus truncatus	Procercoid in copepods; plerocercoid in forage fish; adult in intestine and pyloric caeca
Diphyllobothrium sp.	Procercoid in copepods; plerocercoid in fish; adult in mammals, birds
Diplocotyle olrikii	Not available

*Eubothrium crassum	Adult in intestine, pyloric caeca
*E. salvelini	Adult in intestine, pyloric caeca
Proteocephalus exiguus	Procercoid in crustacea; plerocercoid in small fish; adult in fish
P. laruei	Procercoid in crustacea; plerocercoid in small fish; adult in fish
*P. singularis	Adult in intestine
P. sp.	Not available
*Schistocephalus sp.	Plerocercoid in body cavity
†Triaenophorus crassus	Procercoid in copepods; plerocercoid in forage fish and this fish; adult in this fish

NEMATODA

*Cystidicola farionis	Swim bladder
*C. sp.	Swim bladder, body cavity
C. stigmatura	Larvae in Gammarus, adult in swim bladder, air vessels, rarely esophagus
*Nematoda gen. sp.	Viscera, musculature, mesenteries, intestine, stomach
*Philometra sp.	Body cavity, intestine
*Philonema oncorhynchi	Body cavity, wall of swim bladder
*Rhabdochona sp.	Adult in intestine
*Spinitectus gracilis	Adult in intestine

ACANTHOCEPHALA

*Acanthocephalus jacksoni	Intestine
Echinorhynchus salmonis	Larvae in amphipods; second host of this species is Osmerus mordax

Leptorhynchoides thecatum	Larvae in amphipods; if less than 30 days larvae may encyst in mesenteries of fish; adult intestine
Metechinorhynchus lateralis	Intestine
M. salmonis	Intestine
*M. sp.	Intestine
Neoechinorhynchus tumidum	Intestine

OLIGOCHAETA

Piscicola milneri	Not available
P. punctata	Not available

CRUSTACEA

Achtheres ambloplitis	Not available
A. coregoni	Not available
A. corpulentus	Not available
Argulus canadensis	Not available
A. stizostethi	Not available
Ergasilus caeruleus	Not available
*E. sp.	Gills
*Salmincola extensus	Body, fins
*S. extumescens	Gills, gill cavity

Prosopium cylindraceum - *Round whitefish*

MONOGENEA

*Discocotyle sagittata	Gills
D. salmonis	Gills
*Tetraonchus variabilis	Gills

DIGENEA	
Crepidostomum cooperi	Cercaria in clam; metacercaria in insects, crustacea
C. farionis	Cercaria in clam; metacercaria in mayfly nymphs or Gammarus
DIGENEA METACERCARIA	
Clinostomum marginatum	Cercaria in snail, Helisoma; metacercaria in fish as a yellow grub; adult in heron in mouth, esophagus
Diplostomulum scheuringi	Cercaria in snail, Helisoma; metacercaria in vitreous chamber of eye of fish and newts
*D. sp.	Metacercaria in eye, brain, pharynx
Tetracotyle intermedia	Metacercaria encyst in pericardium; adult reared in chick
CESTOIDEA	
Proteocephalus exiguus	Procercoid in copepod; plerocercoid in small fish
*P. laruei	Intestine
NEMATODA	
*Cystidicola farionis	Swim bladder
C. stigmatura	Swim bladder
Hepaticola bakeri	Intestine
Philometra sp.	Larvae in copepods; adult in fish tissue
Spinitectus carolini	Larvae in mayfly larvae; adult in stomach and intestine
*S. gracilis	Intestine
ACANTHOCEPHALA	
Echinorhynchus salmonis	Larvae in amphipod; second host is Osmerus mordax

*Metechinorhynchus salmonis	Intestine
Neoechinorhynchus rutili	Larvae in crustacea and fish
N. tumidum	Larvae in crustacea and fish
Pomphorhynchus bulbocolli	Larvae in amphipod and small fish
OLIGOCHAETA	
Piscicola milneri	Not available
CRUSTACEA	
Achtheres coregoni	Not available
*Ergasilus caeruleus	Gills
*E. sp.	Gills
*Salmincola extensus	Body, fins
*S. sp.	Body, gills, fins

Thymallus arcticus - *Arctic grayling*

MONOGENEA	
Tetraonchus rauschi	Not available
DIGENEA	
Crepidostomum farionis	Cercaria in clam; metacercaria in mayfly nymphs and Gammarus
C. sp.	Cercaria in clam; metacercaria in insects, crustacea
DIGENEA METACERCARIA	
Clinostomum marginatum	Cercaria in snail, Helisoma; metacercaria in fish as yellow grub; adult in heron in mouth, esophagus
Diplostomulum scheuringi	Cercaria in snail, Helisoma; metacercaria in vitreous chamber of eye of fish and newts

CRUSTACEA

Argulus coregoni	Not available

OSMERIDAE

Osmerus mordax - *Rainbow smelt*

PROTOZOA	
Coccidia	
*Eimeria osmeri	Intestine
Microsporida	
Glugea hertwigi	In many organs, intestine, gonads, etc.
DIGENEA	
Azygia longa	Cercaria in snail, eaten; metacercaria in host fish or carrier fish; adult in stomach or intestine
A. sebago	Adult in stomach or intestine
Brachyphallus crenatus	Not available
Derogenes varicus	Adult in esophagus, stomach
Hemiurus appendiculatus	Adult in stomach
DIGENEA METACERCARIA	
Diplostomulum flexicaudum	Cercaria in snail; metacercaria in lens of eye; adult in birds
D. scheuringi	Cercaria in snail, Helisoma; metacercaria in vitreous chamber of fish and newts
*D. sp.	Not available
*D. spathaceum	Metacercaria in eye, brain, pharynx
*D. spathaceum indistinctum	Metacercaria in eye
*Tetracotyle intermedia	Metacercaria in heart, mesenteries
*T. sp.	Metacercaria in heart, pericardium, mesenteries, kidney, musculature; adult in birds

CESTOIDEA	
Cyathocephalus truncatus	Procercoid in amphipod; plerocercoid in small fish
Ligula intestinalis	Procercoid in copepods; plerocercoid in body cavity of fish; adult in fish eating birds
Proteocephalus sp.	Procercoid in haemocoel of crustacea; plerocercoid in small fish; adult in intestine, pyloric caeca
NEMATODA	
*Cystidicola farionis	Swim bladder
†C. sp.	Swim bladder
†C. stigmatura	Larvae in Gammarus; adult in swim bladder, air vessels, rarely esophagus
*Philometra sp.	Body cavity, intestine
Spinitectus gracilis	Larvae in mayfly larvae; adult in stomach or intestine
*Thominx catenata	Intestine
ACANTHOCEPHALA	
*Acanthocephalus jacksoni	Intestine
A. parksidei	Larvae in amphipods; no second intermediate host
Corynosoma hardweni	Adult in seal
Echinorhynchus salmonis	Larvae in amphipod
Leptorhynchoides thecatum	Larvae in amphipod; second intermediate host, small fish
Metechinorhynchus salmonis	Intestine
*Neoechinorhynchus pungitius	Intestine, stomach
*N. rutili	Intestine
N. tumidus	Larvae in small crustacea, some have second intermediate host

Pomphorhynchus bulbocolli	Larvae in amphipod; second intermediate host, small fish
OLIGOCHAETA	
†Piscicola geometra	Not available
P. punctata	Not available
CRUSTACEA	
Argulus coregoni	Not available
Ergasilus centrarchidarum	Not available

CATOSTOMIDAE

Ictiobus bubalus - *Smallmouth buffalofish*

PROTOZOA	
Ciliata	
Trichodinella sp.	Gills
Myxosporida	
Myxobolus bubalis	Gall bladder
M. transovalis	Gills
Myxosoma endovasa	Gills
M. multiplicatum	Gills
M. ovalis	Gills
DIGENEA	
Nematobothrium texomensis	Adult in tissue of ovary, 8-9' long
DIGENEA METACERCARIA	
Clinostomum marginatum	Cercaria in snail, Helisoma; metacercaria in fish as yellow grub; adult in heron in mouth, esophagus
CESTOIDEA	
Biacetabulum giganteum	Procercoid and plerocercoid in Oligochaeta, Tubificidae
Glaridacris confusa	Procercoid and plerocercoid in Oligochaeta, Tubificidae
Monobothrium ulmeri	Procercoid and plerocercoid in Oligochaeta, Tubificidae
NEMATODA	
Philometra nodulosa	Larvae in copepods; adult in fish tissue

ACANTHOCEPHALA

Leptorhynchoides thecatum	Larvae in amphipod, if larvae less than 30 days, also in small fish
Pomphorhynchus bulbocolli	Larvae in amphipod; second intermediate host, small fish

Ictiobus cyprinellus - *Bigmouth buffalo*

MONOGENEA

Gyrodactylus dakotensis	Gills, fins
Icelanochohaptor icelanochohaptor	Gills
Pellucidhaptor planacrus	Nares

DIGENEA

Lissorchis gullaris	Intestine

CESTOIDEA

Biacetabulum giganteum	Not available
Hypocaryophyllaeus paratarius	Procercoid and plerocercoid in Oligochaeta, Tubificidae; adult in intestine
Monobothrium ingens	Procercoid and plerocercoid in Oligochaeta, Tubificidae
M. ulmeri	Procercoid and plerocercoid in Oligochaeta, Tubificidae
Protocephalus sp.	Procercoid in copepods; plerocercoid in this fish
Spartoides wardi	Not available

NEMATODA

Camallanus ancylodirus	Larvae in copepods, other crustacea; adult in stomach and intestine
Philometra nodulosa	Larvae in copepods; adult in fish tissue
P. sp.	Larvae in copepods; adult in fish tissue

ACANTHOCEPHALA	
Pomphorhynchus bulbocolli	Larvae in amphipod; second host, small fish
OLIGOCHAETA	
Piscicola punctata	Not available
CRUSTACEA	
Argulus appendiculosus	Not available
A. biramosus	Not available

Carpiodes cyprinus - *Quillback*

PROTOZOA	
Ciliata	
Trichodina sp.	Not available
Trichodinella sp.	Gills
Myxosporida	
Myxosoma rotundum	Gills
MONOGENEA	
Acolpenteron catostomi	Ureters
Anonchohaptor anomalum	Gills, fins
*A. sp.	Not available
Icelanonchohaptor fyviei	Gills
Neodiscocotyle carpioditis	Gills
Pellucidhaptor sp.	Not available
DIGENEA	
Lissorchis attenuatum	Adult in intestine
Sanguinicola sp.	Cercaria in snail; no second intermediate host; adult in blood vessels

Triganodistomum attenuatum	Adult in intestine
DIGENEA METACERCARIA	
Clinostomum marginatum	Cercaria in snail, Helisoma; metacercaria in fish as yellow grub; adult in heron in mouth, esophagus
Posthodiplostomum minimum minimum	Metacercaria in fish; adult in herons
CESTOIDEA	
Biacetabulum carpiodi	Procercoid and plerocercoid in Oligochaeta
Glaridacris confusa	Procercoid and plerocercoid in Oligochaeta, adult in intestine
Hypocaryophyllaeus paratarius	Adult in intestine
Monobothrium ulmeri	Procercoid and plerocercoid in Oligochaeta, Tubificidae
*Proteocephalus sp.	Intestine, pyloric caeca
Spartoides wardi	Not available
NEMATODA	
Camallanus ancylodirus	Larvae in copepods, other crustacea; adult in stomach and intestine of fish
C. oxycephalus	Larvae in copepods; adult in intestine, shows red from anus
Philometra nodulosa	Larvae in copepods; adult in fish tissue
*Philometroides nodulosa	Cheek galleries
Rhabdochona cascadilla	Larvae in mayflies; adult in intestine
ACANTHOCEPHALA	
Leptorhynchoides thecatum	Larvae in amphipod, if larvae less than 30 days also in small fish

Neoechinorhynchus carpiodi	Larvae in small crustacea; some have second intermediate host
N. crassus	Larvae in small crustacea; some have second intermediate host
N. cylindratum	Larvae in crustacea
Pomphorhynchus bulbocolli	Larvae in amphipod; second host, small fish

CRUSTACEA

Ergasilus caeruleus	Gills

Moxostoma spp. - *Redhorse*

PROTOZOA

Myxosporida

Myxobolus conspicuus	Subdermal cysts
M. sp.	Gut, gills
Trophozoites	Gall bladder

MONOGENEA

Anonchohaptor anomalum	Gills, fins
*Dactylogyrus sp.	Gills
D. urus	Gills
*Gyrodactylus sp.	Gills, fins, skin
G. spathulatus	Gills, fins
Pellucidhaptor sp.	Not available
Pseudomurraytrema copulata	Gills
P. moxostomi	Not available
P. sp.	Gills

DIGENEA

*Lissorchis attenuatum	Adult in intestine

Lissorchis hypentelii	Not available
Phyllodistomum sp.	Cercaria in clam; metacercaria in sporocysts in clam or arthropods; adult in ureters, urinary bladder
Plagioporus serotinus	Not available
Sanguinicola sp.	Cercaria in snail; adult in blood vessels
Triganodistomum attenuatum	Metacercaria in Oligochaeta and planaria; adult in intestine
DIGENEA METACERCARIA	
*Apophallus venustus	Metacercaria in musculature
Clinostomum marginatum	Cercaria in snail, Helisoma; metacercaria in fish as yellow grub; adult in heron in mouth, esophagus
Diplostomulum flexicaudum	Cercaria snail; metacercaria in eye; adult in gulls
*D. spathaceum industinctum	Metacercaria in eye
Neascus sp.	Skin
Sellacotyle mustelae	Cercaria snail; metacercaria in fish in flesh, mesenteries; adult in mammals in intestine
CESTOIDEA	
Biacetabulum infrequens	Procercoid and plerocercoid in Oligochaetes
Glaridacris catostomi	Not available
Isoglaridacris folius	Procercoid and plerocercoid in body cavity of Oligochaetes; plerocercoid may be in fish
I. longus	Procercoid and plerocercoid in body cavity of Oligochaetes; plerocercoid may be in fish
Monobothrium ulmeri	Procercoid and plerocercoid in Oligochaetes
Triaenophorus nodulosus	Procercoid in copepods; plerocercoid in liver

NEMATODA	
Contracaecum brachyurum	Larvae in fish in liver, mesenteries; adult in fish eating birds, fish, and mammals
*Rhabdochona cascadilla	Intestine
R. milleri	Some larvae in aquatic insects, adult in intestine
Spinitectus gracilis	Larvae in mayfly larvae; adult in intestine
*Thynnascaris brachyura	Intestine
ACANTHOCEPHALA	
*Leptorhynchoides thecatus	Larvae in amphipod, if larvae less than 30 days, also is small fish in intestine, encysted in mesenteries
Neoechinorhynchus strigosum	Larvae in crustacea and fish
Pomphorhynchus bulbocolli	Larvae in amphipod; second intermediate host, small fish; adult in intestine, encysted in mesenteries
OLIGOCHAETA	
Piscicola punctata	Not available
CRUSTACEA	
*Ergasilus caeruleus	Gills
E. sp.	Gills

Hypentelium nigricans - *Northern hog sucker*

PROTOZOA	
Coccidia	
*Eimeria catostomi	Intestine
E. fernandoae	Anterior gut epithelium

MONOGENEA	
Acolpenteron catostomi	Ureters and urinary bladder
*Dactylogyrus apos	Gills
DIGENEA	
Bucephalus elegans	Cercaria in clam; metacercaria in fin and muscle of fish; adult in fish in intestine
Lissorchis hypentelii	Not available
DIGENEA METACERCARIA	
Clinostomum marginatum	Cercaria in snail, Helisoma; metacercaria in fish as yellow grub; adult in heron in mouth, esophagus
CESTOIDEA	
Glaridacris sp.	Not available
Isoglaridacris wisconsinensis	Larvae in Tubifex oligochaetes; plerocercoid may be in fish
Monobothrium ulmeri	Procercoid and plerocercoid in Oligochaete, Tubifex
NEMATODA	
Philometra sp.	Larvae in copepod; adult in fish tissue
Rhabdochona cascadilla	Larvae in mayfly larvae; adult in intestine
ACANTHOCEPHALA	
Leptorhynchoides thecatum	Larvae in amphipod, if larvae less than 30 days also may be in small fish
Pomphorhynchus bulbocolli	Larvae in amphipod; second intermediate host, small fish
CRUSTACEA	
Argulus catostomi	Not available

Catostomus commersoni - *White sucker*

PROTOZOA	
Flagellata	
Cryptobia catostomi	Blood
Trypanosoma catostomi	Blood
Ciliata	
†*Ichthyophthirius multifiliis	Skin, fins, gills
*Trichodina sp.	Gills, urinary bladder, ureters
Coccidia	
Eimeria catostomi	Intestine, epithelium of anterior gut
E. fernandoae	Intestine, epithelium of anterior gut
*E. sp.	Intestine, kidney
Myxosporida	
Chloromyxum catostomi	Gall bladder
Myxidium macrocapsulare	Gall bladder
*M. sp.	Gall bladder, kidney
Myxobolus catostomi	Mouth subepithelium, muscle
M. subcircularis	In muscle of fin
M. sp.	Not available
Myxosoma bibullatum	Gills
M. catostomi	Muscle and connective tissue
M. commersonii	Skin
M. ellipticoides	Sides of cleithrum
Thelohanellus notatus	Subdermal cysts
MONOGENEA	
Acolpenteron catostomi	Ureters and bladder
Anonchohaptor anomalum	Gills

*Dactylogyrus sp.	Gills
*Gyrodactylidae gen. sp.	Gills
†Gyrodactylus sp.	Body, fins
G. spathulatus	Gills, fins
G. stunkardi	Gills, fins
Octomacrum lanceatum	Gills
Pellucidhaptor nasalis	Nasal cavity
Pseudomurraytrema copulata	Gills

DIGENEA

Allocreadium ictaluri	Cercaria in clams, limpets; metacercaria in arthropods and clams
A. lobatum	Cercaria in clam and limpets; metacercaria in arthropods or clams and undergo progenesis
Bucephalus elegans	First host clam; metacercaria in fish, fin and muscle; adult in intestine of fish
Crepidostomum cooperi	Cercaria in clam; metacercaria in insect, crustacea
*Lissorchis attenuatum	Adult in intestine
*L. simeri	Adult in digestive tract
Phyllodistomum etheostomae	Cercaria in clam; metacercaria in sporocysts in clam, arthropods; adult in urinary bladder
P. lysteri	Cercaria in clam; metacercaria in sporocysts in clam, arthropods; adult in urinary bladder
Plagioporus sinitsini	Cercaria in snail; metacercaria in sporocysts of same snail
Sanguinicola sp.	Cercaria in snail; adult in blood vessels
Triganodistomum attenuatum	Metacercaria in Oligochaetes, Planaria; adults in intestine

Triganodistomum sp.	Metacercaria in Oligochaetes, Planaria; adult in intestine
DIGENEA METACERCARIA	
Amphimerus pseudofelinus	Cercaria in snail, Amnicola; metacercaria in flesh of this fish; adult in reptiles, birds, mammals
Clinostomum marginatum	Cercaria in snail, Helisoma; metacercaria of fish as yellow grub and in gills, gill cavity, fins, musculature, mesenteries; adult in heron in mouth, esophagus
*Cotylurus communis	Metacercaria in mesenteries, liver
Cryptocotyle concavum	Cercaria in snail, Amnicola; metacercaria in flesh of fish; adult in intestine of birds and mammals
Diplostomulum flexicaudum	Cercaria in snail; metacercaria in eye of fish; adult in gulls
D. of Diplostomum spathaceum	Cercaria in snail, Lymnaea; metacercaria in Catostomus; adult in gulls
D. of Hysteromorpha triloba	Snail Gyraulus hirsutus; large metacercaria in muscle of Ictalarus catostomus; adult in heron, cormorrants, unfed chicks
*D. spathaceum	Metacercaria in vitreous humor, lens of eye
*D. spathaceum indistinctum	Eye
Metorchis conjunctus	Cercaria in snail; metacercaria in flesh of this fish; adult in mink, dog, man
Neascus pyriformis	Metacercaria in fins, skin
N. sp.	Metacercaria integument, fins, flesh, eye socket, cranial cavity, mesentery and peritoneal surfaces of viscera
N. of Posthodiplostomum minimum	Metacercaria fish; adult in herons
Tetracotyle communis	Metacercaria in mesentery of fish; adult in gulls

*Tetracotyle intermedia	Metacercaria in heart, mesenteries
*T. sp.	Metacercaria in heart, pericardium, mesenteries, kidney, musculature
Tetracotyle of Cotylurus communis	Metacercaria in pericardial cavity; adult in gull, Larus argentatus
*Uvulifer ambloplitis	Metacercaris in skin, musculature, fins, gills
CESTOIDEA	
Biacetabulum biloculoides	Procercoid and plerocercoid Oligochaetes
B. infrequens	Not available
B. macrocephalum	Procercoid and plerocercoid Oligochaetes
Bothriocephalus biloculoides	Procercoid in copepods; plerocercoids sometimes in small fish
B. cuspidatus	Procercoid in copepods; plerocercoids sometimes in small fish
*Diphyllobothrium sp.	Plerocercoids in viscera, musculature, body cavity, blood vessels of heart of this fish
Glaridacris catostomi	Procercoid and plerocercoid in Oligochaetes
G. confusus	Not available
G. intermedius	Not available
G. laruei	Not available
G. oligorchis	Procercoid and plerocercoid Oligochaetes
G. sp.	Intestine
Hunterella nodulosa	Procercoid and plerocercoid in Oligochaetes; adult in intestine
†Ligula intestinalis	Procercoids in copepods; plerocercoids in body cavity of this fish; adult in fish eating birds
Monobothrium hunteri	Procercoid and plerocercoid oligochaetes

Monobothrium ingens	Not available
M. ulmeri	Procercoid and plerocercoid in Oligochaete, Tubificidae
Proteocephalus sp.	Procercoid in haemocoel of crustacea; plerocercoid in small fish
Triaenophorus nodulosus	Procercoid in copepods; plerocercoid in liver; adult in piscivorous fish
Triganodistomum attenuatum	Procercoid in crustacea

NEMATODA

Camallanus oxycephalus	Adult in intestine, shows red from vent
Capillaria catenata	Gut, liver, urinary bladder of vertebrates
Contracaecum sp.	Liver, mesenteries
Dacnitoides cotylophora	Intestine
Dorylaimus sp.	Not available
*Eustrongylides sp.	Larvae in viscera, muscle, body cavity, ovary
Hepaticola bakeri	Intestine
*Nematoda gen. sp.	Viscera, muscle, mesenteries, intestine, stomach
Philometroides huronensis	Larvae in haemocoel of Cyclops; adult in fins, peritoneum around swim bladder
*Philometra kobuleji	Under serosa of air bladder, body cavity
P. nodulosa	Larvae in copepods; adult in fish tissue
P. sp.	Larvae in copepods; adult in fish tissue
Rhabdochona cascadilla	Larvae in mayflies; adult in intestine
*R. sp.	Intestine

*Skrjabinocapillaria bakeri	Intestine
Spiroxys sp.	First host Cyclops; larvae in mesenteries of fish and amphibia, dragonfly nymphs and snails
ACANTHOCEPHALA	
Acanthocephalus dirus	Larvae in Asellus and Gammarus; no second intermediate host
*A. jacksoni	Intestine
A. lateralis	Larvae in Asellus and Gammarus
A. parksidei	Larvae in amphipods; no second intermediate host
Echinorhynchus leidyi	Larvae in amphipods
E. salmonis	Larvae in amphipods; second host, Osmerus
Leptorhynchoides thecatum	Larvae in amphipod, if larvae less than 30 days also may be in small fish
*Metechinorhynchus leidyi	Intestine, stomach
M. salmonis	Not available
Neoechinorhynchus crassum	Larvae in crustacea and fish; adult in intestine
N. cristatus	Larvae in small crustacea; some have second intermediate host; adult in fish
N. cylindratum	Larvae in crustacea and fish
N. rutili	Larvae in crustacea and fish
*N. sp.	Intestine
N. strigosum	Larvae in crustacea and fish
Octospinifer macilentus	Larvae in ostracod, crustacea
Pomphorhynchus bulbocolli	Larvae in amphipod; second intermediate host, small fish
*P. sp.	Digestive tract
*Tanaorhamphus sp.	Intestine

OLIGOCHAETA	
*Actinobdella inequiannulata	Gill cavity, inner surface of operculum
A. triannulata	Gill cover (inner)
Illinobdella sp.	Not available
Piscicola punctata	Not available
CRUSTACEA	
†Argulus appendiculosus	Not available
A. biramosus	Not available
A. catostomi	Not available
A. stizostethi	Not available
Ergasilus caeruleus	Not available
E. confusus	Not available
E. sp.	Not available
E. versicolor	Not available
Lernaea cyprinacaea	Not available

CYPRINIDAE

Cyprinus carpio - *Carp*

MONOGENEA

Dactylogyrus anchoratus	Gills
D. extensus	Gills
Gyrodactylus fairporti	Body and Gills
Pseudocolpenteron pavlovskii	Not available

DIGENEA

Crepidostomum cooperi	Cercaria in clam; metacercaria in insect, crustacea
C. sp.	Cercaria in clam; metacercaria in insect, crustacea

DIGENEA METACERCARIA

Clinostomum marginatum	Cercaria in snail, Helisoma; metacercaria in fish as yellow grub; adult in heron in mouth, esophagus
Diplostomulum flexicaudum	Not available
D. scheuringi	Metacercaria in vitreous chamber of eye and brain of fish, newts
*D. spathaceum indistinctum	Metacercaria in eye
*D. sp.	Metacercaria in eye, brain, pharynx
*Neascus sp.	Metacercaria in mesenteries, gills, skin

CESTOIDEA

Archigetes iowensis	Procercoid and plerocercoid in Tubificidae; plerocercoid may be in body cavity of fish; adult in intestine
Atractolytocestus huronensis	Not available

Khawia iowensis	Procercoid and plerocercoids in oligochaetes
Ligula intestinalis	Procercoid in copepods; plerocercoid in fish; adult in fish eating birds
NEMATODA	
†Philometra sp.	Under skin near eye
Rhabdochona cascadilla	Larvae in mayflies; adult in intestine
Spinitectus carolini	Larvae in mayfly larvae; adult in stomach and intestine
*S. gracilis	Intestine
Spiroxys sp.	First intermediate host Cyclops; mesenteries of fish and amphibia, dragonfly nymphs and snails
ACANTHOCEPHALA	
Acanthocephalus parksidei	Larvae in amphipods
Leptorhynchoides thecatum	Larvae in amphipod, if larvae less than 30 days may also be in small fish
Pomphorhynchus bulbocolli	Larvae in amphipod; second intermediate host, small fish
OLIGOCHAETA	
Piscicola geometra	Not available
Placobdella montifera	Not available
CRUSTACEA	
*Argulus appendiculosus	Fins
A. biramosus	Not available
A. catostomi	Not available
A. japonicus	Not available
†A. sp.	Not available

Ergasilus caeruleus	Not available
*Lernaea cyprinacaea	Head in musculature with body protruding

Carassius auratus - *Goldfish*

MONOGENEA

Dactylogyrus anchoratus	Gills
D. vastator	Gills
Gyrodactylus elegans muelleri	Gills and body

DIGENEA METACERCARIA

Clinostomum marginatum	Cercaria in snail, Helisoma; metacercaria in fish as yellow grub; adult in heron in mouth, esophagus

CESTOIDEA

Triaenophorus nodulosus	Procercoid in copepods; plerocercoid in forage fish

NEMATODA

Agamonema sp.	Not available
Philometra carassii	Larvae in copepods; adult between caudal fin rays
P. sanguinea	Tail fin

ACANTHOCEPHALA

Neoechinorhynchus rutili	Larvae in crustacea and fish
Pomphorhynchus bulbocolli	Larvae in amphipod; second intermediate host, small fish
*P. sp.	Digestive tract

CRUSTACEA

Argulus japonicus	Not available
Lernaea cyprinacaea	Not available

ICTALURIDAE

Ictalurus punctatus - *Channel catfish*

PROTOZOA	
Ciliata	
Suctoria	
Trichophyra ictaluri	Gills
T. piscium	Gills
"True ciliates"	
Tripartiella symmetricus	Gills
Myxosporida	
Henneguya exilis	Gills
Myxidium macrocapsulare	Gall bladder
MONOGENEA	
Cleidodiscus floridanus	Gills
C. pricei	Gills
*Gyrodactyloidea gen. sp.	Gills, skin
DIGENEA	
Acetodextra ameiuri	Metacercaria in liver of stonecat; adult in ovary and air bladder
A. sp.	Adult in ovary and air bladder
*Alloglossidium corti	Adult in intestine
A. kenti	Metacercaria in dragonfly nymphs; adult in intestine
*Azygia angusticauda	Adult in intestine, stomach
Crepidostomum ambloplitis	Metacercaria in mayfly nymphs
*C. cornutum	Intestine, pyloric caeca, gall bladder

*Macroderoides sp.	Digestive tract
*Megalogonia ictaluri	Intestine
*Microphallus opacus	Intestine
Phyllodistomum lacustris	Cercaria in clam; metacercaria in sporocyst in clam or arthropod
*P. sp.	Ureters, urinary bladder
*Vietosoma parvum	Digestive tract
DIGENEA METACERCARIA	
*Diplostomulum sp.	Eye, brain, pharynx
CESTOIDEA	
*Bothriocephalus sp.	Pyloric caeca, intestine
Corallobothrium fimbriatum	Procercoid in Cyclops; plerocercoid in Notropis blennius; adult in intestine
Haplobothrium globuliforme	Procercoid in copepods; plerocercoid encysts in liver of fish
*Megathylacoides giganteum	Digestive tract
NEMATODA	
Camallanus oxycephalus	Larvae in copepod; adult in intestine, shows red from vent
Dacnitoides cotylophora	Intestine
*Nematoda gen. sp.	Viscera, musculature, mesenteries, intestine and stomach
Spinitectus carolini	Larvae in mayfly larvae; stomach and intestine
S. gracilis	Larvae in mayfly larvae; stomach and intestine
Spiroxys sp.	First host Cyclops; mesenteries of fish and amphibia, dragonfly nymphs, snails

ACANTHOCEPHALA	
Leptorhynchoides thecatum	Larvae in amphipod, if larvae less than 30 days may also be in small fish
Neoechinorhynchus rutili	Larvae in small crustacea; some have second intermediate host
Pomphorhynchus bulbocolli	Larvae in amphipod; second intermediate host in small fish
*P. sp.	Digestive tract
OLIGOCHAETA	
Cystobranchus verrilli	Not available
Illinobdella moorei	Not available
*Myzobdella moorei	Fins
Piscicolaria sp.	Not available
CRUSTACEA	
Achtheres micropteri	Not available
A. pimelodi	Not available
Ergasilus caeruleus	Not available
E. megaceros	Not available
E. versicolor	Not available

Ictalurus nebulosus - *Brown bullhead*

PROTOZOA	
Flagellata	
*Bodomonas concava	Gills
Ciliata	
Apiosoma sp.	Fins, gills, skin
*Ichthyophthirius multifiliis	Skin, gills, fins
*Trichodina sp.	Gills, urinary bladder, ureters
Trichophrya sp.	Gills

Myxosporida	
Henneguya exilis	Gills
Myxobolus sp.	Gills
Coccidia	
*Eimeria ictaluri	Intestine
MONOGENEA	
Cleidodiscus floridanus	Not available
C. pricei	Gills
*Gyrodactyloidea gen. sp.	Gills, skin
Gyrodactylus nebulosus	Fins
G. rarus	Not available
DIGENEA	
Acetodextra ameiuri	Metacercaria in stonecat liver; adult in ovary and air bladder
*Alloglossidium corti	Adult in intestine
A. geminus	Cercaria in snail; metacercaria in dragonfly nymphs; adult in intestine
Allocreadium ictaluri	Cercaria in clam, limpet; metacercaria in arthropods and clams
Azygia angusticauda	Cercaria in snail, snail eaten; metacercaria in small fish carriers; adult in intestine
Crepidostomum ambloplitis	Cercaria in clam; metacercaria in insects, crustacea
*C. cornutum	Adult in intestine, pyloric caeca, gall bladder
C. ictaluri	Cercaria in clam; metacercaria in aquatic mayflies and crustacea; adult in intestine
Glossidium geminum	Intestine
Macroderoides spinifera	Cercaria in snail, Helisoma; metacercaria in fish muscle; adult in intestine

*Megalogonia ictaluri	Adult in intestine
*Microphallus opacus	Adult in intestine
Petasiger nitidus	Cercaria in snail, Helisoma, snail eaten; metacercaria in fish; adult in intestine
Phyllodistomum americanum	Cercaria in clam; metacercaria in sporocysts in clam, arthropods; adult in urinary bladder
P. sp.	Cercaria in clam; metacercaria in sporocysts in clam, arthropods; adult in ureters
P. staffordi	Cercaria in clam; metacercaria in sporocysts in clam, arthropods; adult in urinary bladder
*Polylekithum ictaluri	Adult in intestine
*Vietosoma parvum	Adult in digestive tract

DIGENEA METACERCARIA

*Centrovarium lobotes	Metacercaria in musculature
†Clinostomum marginatum	Cercaria in snail, Helisoma; metacercaria in fish as yellow grub; adult in mouth and esophagus of heron
Diplostomum spathaceum	Cercaria in snail; metacercaria in eye of fish; adult in birds
D. sp.	Metacercaria in eye of fish; adult in birds
Echinochasmus donaldsoni	Cercaria in snail; metacercaria in gills; adult in grebe
Euparyphium melis	Cercaria in snail; metacercaria in nares and cloaca; adult in mink
Posthodiplostomum minimum minimum	Adult in birds
*Rhipidocotyle sp.	Metacercaria in fins
Tetracotyle sp.	Metacercaria in mesenteries and kidney; adult in birds

CESTOIDEA

Bothriocephalus claviceps	Procercoid in copepods; plerocercoid sometimes in small fish; adult in intestine
B. cuspidatus	Procercoid in copepods; plerocercoids sometimes in small fish; adults in intestine
*B. sp.	Pyloric caeca, intestine
*Cestoda gen. sp. metacestode	Encysted in musculature, mesenteries, viscera, free in intestine
Corallobothrium fimbriatum	Procercoid in Cyclops; plerocercoid, Notropis blennius
C. parafimbriatum	Procercoid in copepod; plerocercoid in copepod or fish; adult in intestine
C. parvum	Procercoid in Cyclops; plerocercoid in Glaridichthys talcatus
C. perplexus	Plerocercoids in Hyborhynchus, Roccus, Ictalurus
*C. sp.	Intestine
Corallotaenia minutia	Procercoid in copepod; plerocercoid in copepod or fish; adult in intestine
Haplobothrium globuliforme	Procercoid in Cyclops; plerocercoid encysted in liver of Amia calva; adult in intestine
Proteocephalus ambloplitis	Procercoid in haemocoel of crustacea; plerocercoid in mesenteries of small fish
*P. pearsi	Intestine

NEMATODA

Camallanus oxycephalus	Larvae in copepod; adult in intestine shows red from anus
*Capillaria sp.	Intestine, stomach
†Contracaecum sp.	Adult in mesenteries and liver of fish
*Cucullanellus cotylophora	Intestine

Dacnitoides cotylophora	Intestine
*Dichelyne robustus	Intestine
*Dioctophyma renale	Larvae in viscera, mesenteries, muscle
Metabronema prevosti	Larvae in mayfly nymphs
*Rhabdochona cascadilla	Intestine
*R. sp.	Intestine
Spinitectus carolini	Larvae in mayfly larvae; adult in stomach and intestine
S. gracilis	Larvae in mayfly larvae; adult stomach and intestine
Spiroxys contorta	Larvae in Odonata nymphs, adult in turtles and fish
S. sp.	First host Cyclops; mesenteries of fish and amphibia, dragonfly nymphs

ACANTHOCEPHALA

Acanthocephalus sp.	Larvae in amphipods; no second host; adult in intestine
Leptorhynchoides thecatum	Larvae in amphipod, if less than 30 days may also be in small fish
*Metechinorhynchus salmonis	Intestine
Neoechinorhynchus rutili	Larvae in crustacea and fish
Pomphorhynchus bulbocolli	Larvae in amphipod; second intermediate host small fish, may be in this fish

OLIGOCHAETA

Illinobdella moorei	Not available
I. sp.	Not available
*Myzobdella moorei	Fins
Piscicolaria sp.	Not available

CRUSTACEA

Achtheres pimelodi	Not available
Argulus americanus	Not available
A. appendiculosus	Not available
Ergasilus caeruleus	Not available
E. megaceros	Nasal fossae
*E. sp.	Gills
E. versicolor	Not available

Ictalurus melas - *Black bullhead*

PROTOZOA

Ciliata

Ambiphrya ameiuri	Gills

Myxosporida

Henneguya exilis	Gills, gut, skin, gall bladder
H. gurleyi	Base of spine
H. limatula	Gall bladder
Myxidium macrocapsulare	Gall bladder

MONOGENEA

Cleidodiscus floridanus	Gills
*C. pricei	Gills
Gyrodactylus fairporti	Fins

DIGENEA

Acetodextra ameiuri	Metacercaria in liver of stonecat; adult in ovary and air bladder
Allocreadium ictaluri	Cercaria in clam, limpet; metacercaria in arthropods, clams; adult in intestine

Alloglossidium corti	Intestine
A. sp.	Metacercaria dragonfly nymphs; adult in intestine
Azygia angusticauda	Intestine, stomach
A. longa	Cercaria in snail; metacercaria may be in carrier fish or host fish; adult in intestine, stomach
Bucephaloides pusillus	Cercaria in clam; metacercaria fish; adult in intestine
Centrovarium lobotes	Metacercaria fish flesh; adult in stomach and intestine
Crepidostomum cornutum	Cercaria in clam; metacercaria in crayfish
C. ictaluri	Metacercaria in mayfly nymphs
C. sp.	Cercaria in clam; metacercaria in insect nymphs
Glossidium geminum	Intestine
*Leuceruthrus micropteri	Stomach
*Megalogonia ictaluri	Intestine
Microphallus opacus	Metacercaria in crayfish
Phyllodistomum americanun	Cercaria in clam; metacercaria in sporocyst in clam, arthropods; adult in urinary bladder
P. sp.	Cercaria in clam; metacercaria in sporocysts in clam, arthropods
P. staffordi	Cercaria in clam; metacercaria in sporocysts in clam, arthropods; adult in urinary bladder

DIGENEA METACERCARIA

†Clinostomum marginatum	Cercaria in snail, Helisoma; metacercaria in fish as yellow grub; adult in mouth and esophagus of heron
Diplostomulum flexicaudum	Unencysted in lens; adult in birds
D. of Hysteromorpha	Cercaria in snail; large metacercaria in muscle

Macroderoides spinifera	Cercaria in snail, Helisoma; metacercaria in muscle of fish; adult in intestine
Ribeiroia ondatra	Cercaria in snail, Helisoma; metacercaria in laterial line of fish; adult in muskrats, ospreys, hawks
Sellacotyle mustelae	Metacercaria in flesh and mesenteries; adult in intestine of mammals
CESTOIDEA	
Corallobothrium fimbriatum	Procercoid in Cyclops; plerocercoid in Notropis blennius
C. giganateum	Procercoid in copepods; plerocercoid in small fish
C. sp.	Procercoid in copepods; plerocercoid in small fish; adult in intestine
*Proteocephalus ambloplitis	Plerocercoids encysted in viscera
NEMATODA	
Camallanus oxycephalus	Larvae in copepod; adult in intestine, shows red from anus
†Contracaecum spiculigerum	Intestine and mesentery
*Cucullanellus cotylophora	Intestine
Dacnitoides cotylophora	Intestine
Spinitectus carolini	Larvae in mayfly larvae; adult in stomach and intestine
S. gracilis	Larvae in mayfly larvae; adult in stomach and intestine
Spiroxys sp.	First host Cyclops; mesenteries of fish and amphibia, dragonly nymphs, snails

ACANTHOCEPHALA	
Acanthocephalus parksidei	Larvae in amphipod; midgut of this fish
Leptorhynchoides thecatum	Larvae in amphipod; if less than 30 days may also be in small fish
Neoechinorhynchus rutili	Larvae in crustacea and fish
Pomphorhynchus bulbocolli	Larvae in amphipod; second intermediate host is this fish
OLIGOCHAETA	
Illinobdella moorei	Not available
I. sp.	Not available
*Piscicola punctata	Body surface, gills
Piscicolaria sp.	Not available
CRUSTACEA	
Achtheres ambloplitis	Gills
A. pimelodi	Not available
†Argulus appendiculosus	Not available
A. biramosus	Not available
*A. catostomi	Fins
A. sp.	Gills
Ergasilus caeruleus	Not available
E. elegans	Not available
E. megaceros	Nasal fossae
E. sp.	Not available
E. versicolor	Not available
Lernaea sp.	Not available
L. variabilis	Larvae on gills

Ictalurus natalis - *Yellow bullhead*

MONOGENEA

Cleidodiscus floridanus	Gills

DIGENEA

Acetodextra ameiuri	Metacercaria in Noturus (stonecat); adult in ova next to swim bladder, ova passed during spawning
Alloglossidium corti	Cercaria in snail; metacercaria in dragonfly nymphs; adult in intestine
Azygia angusticauda	Cercaria in snail, snail eaten; metacercaria in small fish
Centrovarium lobotes	Cercaria in snail; metacercaria in fish muscle; adult in stomach and intestine
Crepidostomum cooperi	Cercaria in clam; metacercaria in aquatic insects, crustacea; adult in birds
C. cornutum	Cercaria in clam; metacercaria in crayfish
C. ictaluri	Cercaria in clam; metacercaria in mayfly nymphs, Gammarus
Glossidium geminum	Not available
Macroderoides spinifera	Cercaria in snail; metacercaria in muscle of fish, tadpoles; adult in intestine
Phyllodistomum staffordi	Cercaria in clam; metacercaria in sporocysts in clam, arthropods

DIGENEA METACERCARIA

Clinostomum marginatum	Cercaria in snail, Helisoma; metacercaria in fish as yellow grub; adult in mouth and esophagus of heron
Diplostomulum sp.	Cercaria in snail; larvae metacercaria in muscle; adult in herons and other birds

Posthodiplostomum minimum (Neascus of)	Metacercaria in fish; adult in herons and other birds
CESTOIDEA	
Corallobothrium fimbriatum	Procercoid in Cyclops; plerocercoid in Notropis
Proteocephalus ambloplitis	Procercoid in copepods; plerocercoid in viscera
P. pearsi	Procercoid in copepods; plerocercoid in yellow bullhead
P. sp.	Procercoid in copepods; plerocercoid in many fish
NEMATODA	
Camallanus sp.	Larvae in copepods and other crustacea; adult in stomach and intestine
Contracaecum spiculigerum	Larvae in fish; adult in cormorants, mergansers, gulls, pelicans
C. sp.	Larvae in fish; adult in birds
Spinitectus carolini	Larvae in mayfly larvae
S. gracilis	Larvae in mayfly larvae
S. sp.	Larvae in mayfly larvae
Spiroxys sp.	Larvae in mesenteries of fish, amphibia, dragonfly nymphs, snails, (Cyclops experimentally)
ACANTHOCEPHALA	
Leptorhynchoides thecatum	Larvae in amphipods, if less than 30 days also may be in mesenteries of fish
Neoechinorhynchus rutili	Larvae in crustacea; some have second intermediate host
Pomphorhynchus bulbocolli	Larvae in amphipod; second host small fish

OLIGOCHAETA	
Piscicolaria sp.	Not available
CRUSTACEA	
Achtheres pimelodi	Not available
Ergasilus versicolor	Not available

Ictalurus furcatus - *Blue catfish*

DIGENEA	
Allocreadium ictaluri	Cercaria in clam; metacercaria arthropods, clams; progenesis sometimes in clams
DIGENEA METACERCARIA	
†Diplostomulum scheuringi	Vitreous humor
†Neascus sp.	Muscle
CRUSTACEA	
Ergasilus versicolor	Not available

ESOCIDAE

Esox lucius - *Northern pike*

FUNGI	
†Branchiomyces demigrans	Gills
PROTOZOA	
Ciliata	
†Trichodina sp.	Not available
Myxosporida	
Henneguya schizura	Eye muscle, sclera, choroid
Myxidium lieberkuehni	Urinary bladder
MONOGENA	
*Gyrodactyloidea gen. sp.	Gills, skin
Tetraonchus monenteron	Gills
Urocleidus mimus	Gills
DIGENEA	
Azygia angusticauda	Cercaria in snail; adult in stomach or intestine
A. longa	Cercaria in snail, eaten; metacercaria in host fish or carrier fish; adult in host fish
A. sebago	Cercaria in snail, eaten; metacercaria in host fish or carrier fish; adult in host fish
A. sp.	Cercaria in snail, eaten; metacercaria in host fish or carrier fish; adult in host fish
Bucephaloides pusillus	Cercaria in clam; metacercaria in fish; adult in intestine
Centrovarium lobotes	Metacercaria in fish muscle; adult in stomach and intestine
Crepdiostomum cooperi	Cercaria in clam; metacercaria in insect or crustacea

Macroderoides flavus	Cercaria in snail; metacercaria in fish and tadpoles; adult in intestine
Maritrema obstipum	Adult in intestine, normally in birds, accidentally in fish
Microphallus opacus	Metacercaria in crayfish; adult in intestine and urinary bladder
Phyllodistomum americanum	Cercaria in clam; metacercaria in arthropod, sporocysts in clam; adult in urinary bladder
P. folium	Cercaria in clam; metacercaria in arthropod, sporocysts in clam; adult in urinary bladder
Rhipidocotyle papillosum	Cercaria in clam; metacercaria in fish; adult in stomach and intestine

DIGENEA METACERCARIA

Clinostomum marginatum	Cercaria in Helisoma; metacercaria as yellow grub; adult in intestine, stomach of heron
Diplostomulum scheuringi	Cercaria in snail, Helisoma; metacercaria in vitreous chamber and brain of fish and newts
*D. sp.	Eye, brain, pharynx
†Neascus sp.	Metacercaria in integument, fins, flesh, eye socket, cranial cavity, mesentery and peritoneum
Neascus of Crassiphiala bulboglossa	Cercaria in snail, Helisoma; metacercaria black spot, skin cysts; final host, kingfisher
Posthodiplostomum minimum	Metacercaria in liver, mesenteries; adult in birds
Tetracotyle sp.	Metacercaria in mesenteries; adult in birds
Uvulifer ambloplitis	Cercaria in snail, Helisoma; metacercaria in skin; adult in kingfisher

CESTOIDEA	
Bothriocephalus claviceps	Procercoid in copepod; plerocercoid may be in small fish; adult in intestine
†*B. cuspidatus	Pyloric caeca, intestine
†Diphyllobothrium latum	Procercoid in copepod; plerocercoid fish; adult in bears, dogs, man
*D. sp.	Plerocercoid in viscera, musculature, body cavity, blood vessels of heart
Proteocephalus perplexus	Plerocercoids in Hyborhynchus; Notatus, Roccus, Ictalurus
P. pinguis	Procercoid in copepods; plerocercoid in fish
†P. sp.	Intestine
†Triaenophorus crassus	Procercoid in copepods; plerocercoid in forage fish; adult in intestine
T. nodulosus	Procercoid in copepods; plerocercoid in forage fish; adult in intestine
*T. sp.	Adult in intestine
NEMATODA	
Camallanus oxycephalus	Larvae in copepods; adult red from anus of fish
†Contracaecum brachyurum	Larvae in stomach, intestine; adult in fish eating fish, birds, mammals
Haplonema sp.	Larvae in Cottus
Philometra transulucida	Larvae in copepods; adult in fish tissue
Raphidascaris acus	Larvae small fish
R. canadense	Larvae in small fish, minnows, perch; adult in teleosts
*R. sp.	Liver and digestive tract
Spinitectus carolini	Larvae in mayfly larvae; adult in stomach or intestine

Spinitectus gracilis	Larvae in mayfly larvae; adult in stomach or intestine
Spiroxys sp.	First intermediate host, Cyclops; larvae in mesenteries of fish, amphibia, dragonfly nymphs and smail
*Thynnascaris brachyura	Intestine

ACANTHOCEPHALA

Leptorhynchoides thecatus	Larvae in amphipods; less than 30 days larvae may also be in fish; adult in intestine
Metechinorhynchus salmonis	Intestine
Neoechinorhynchus cylindratum	Larvae in crustacea and fish
N. rutili	Larvae in crustacea and fish
N. tenellum	Larvae in crustacea and fish
Pomphorhynchus bulbocolli	Larvae in amphipod, small fish

OLIGOCHAETA

Illinobdella moorei	Not available
I. sp.	Fins
*Mollibdella grandis	Body surface
Placobdella parasitica	Not available

CRUSTACEA

Argulus biramosus	Not available
Ergasilus sp.	Gills
Lernaea cyprinacaea	Flesh and fins

Esox masquinongy - *Muskellunge*

PROTOZOA

Myxosporida

Henneguya acuta	Gills
Myxobolus dentium	Cyst base of teeth, mouth

MONOGENEA	
*Gyrodactyloides gen. sp.	Gills, skin
*Tetraonchus loftusi	Gills
DIGENEA	
Azygia angusticauda	Cercaria in snail, snail eaten by host fish, small fish may act as carriers; adult in intestine
*A. longa	Intestine, stomach
Cestrahelmins laruei	Intestine
Cryptogonimus chyli	Metacercaria in fish muscle; adult gastrointestinal
Macroderoides spinifera	Cercaria in snail, Helisoma; metacercaria in fish and tadpoles; adult in intestine
Phyllodistomum staffordi	Cercaria in clam; metacercaria sporocyst, arthropods; adult in urinary bladder
DIGENEA METACERCARIA	
Clinostomum marginatum	Cercaria in Helisoma; metacercaria as yellow grub; adult in intestine, stomach of heron
Diplostomulum flexicaudum	Cercaria in snail; metacercaria in fish; adult in birds
D. scheuringi	Cercaria in snail, Helisoma; metacercaria in vitreous chamber and brain of fish and newts
*D. spathaceum indistinctum	Eye
*D. sp.	Eye, brain, pharynx
Neascus of Crassiphiala bulboglossa	Cercaria in snail, Helisoma; metacercaria as black spot, skin cysts; adult in kingfisher
CESTOIDEA	
Proteocephalus pinguis	Procercoid in copepods; plerocercoid in fish

Triaenophorus crassus	Plerocercoids in Coregonus, Lota lota, Oncorhynchus nerka, Percopsis omiscomaycus, Petromyzon marinus, Prosopium sp., Salvelinus namaycush, Stenodus leucichthys, Thymallus signifer (muscle); adult in Esox sp.
T. nodulosus	Plerocercoids in viscera of Catostomus sp., Coregonus sp., Cottus cognatus, Esox sp., Micropterus sp., Moxostoma sp., Notropis sp., Perca flavescens, Poxomis nigromaculatus, Salvelinus fontinalis, Thymallus signifer
NEMATODA	
Camallanus oxycephalus	Larvae in copepod; red nematode from anus
Contracaecum brachyurum	Larvae in stomach and intestine; adult in fish eating fish, birds, mammals
Metabronema salvelini	Larvae in mayfly nymphs
Philometra sp.	Larvae in copepods; adult in fish tissue
Raphidascaris canadense	Larvae in liver of minnows and perch; adult in teleosts
Spinitectus carolini	Larvae in mayfly larvae; adult in stomach and intestine
S. gracilis	Larvae in mayfly larvae; adult in stomach and intestine
Spiroxys sp.	First host Cyclops; larvae in mesenteries of fish and amphibia, dragonfly nymphs, snails
*Thynnascaris brachyura	Intestine
ACANTHOCEPHALA	
Leptorhynchoides thecatum	Larvae in amphipod, if less than 30 days may be in small fish
Metechinorhynchus salmonis	Intestine
Neoechinorhynchus cylindratum	Larvae in crustacea and fish, larvae in this fish; adult in this fish

Neoechinorhynchus rutili	Larvae in crustacea and fish
N. tenellus	Larvae in small crustacea, some have second intermediate host; adult in intestine
Pomphorhynchus bulbocolli	Larvae in amphipod, small fish
OLIGOCHAETA	
Illinobdella moorei	Not available
I. sp.	Not available
Placobdella parasitica	Not available
CRUSTACEA	
Argulus americanus	Not available
Ergasilus caeruleus	Not available

ANGUILLIDAE

Anguilla rostrata - *American eel*

PROTOZOA	
Coccidia	
Eimeria anguillae	Epithelium of anterior gut
Myxosporida	
*Myxidium zealandicum	Gills, kidney cysts
Myxobolus sp.	Not available
DIGENEA	
Azygia acuminata	Cercaria in snail; metacercaria may be in small fish; adult in stomach, intestine
A. longa	Cercaria in snail; metacercaria may be in small fish or host fish; adult in stomach, intestine
*Bunodera luciopercae	Adult in intestine
Centrovarium lobotes	Cercaria in snail; metacercaria in muscle of fish; adult in stomach and intestine
Crepidostomum brevivitellatum	Cercaria in clam; metacercaria in aquatic insects, crustacea
C. cornutum	Cercaria in clam; metacercaria in aquatic insects and crustacea
Deropristis inflata	Cercaria in Bittium; metacercaria in Nereis; adult in intestine
Microphallus opacus	Metacercaria in crayfish; adult in stomach and intestine
DIGENEA METACERCARIA	
Diplostomulum flexicaudum	Cercaria in snail; metacercaria in lens of eye; adult in gulls
Diplostomum spathaceum indistinctum	Metacercaria in eye

Posthodiplostomum minimum (Neascus of)	Metacercaria in fish; adult in herons and other birds
CESTOIDEA	
Bothriocephalus claviceps	Procercoid in copepods; plerocercoid sometimes in small fish
Proteocephalus macrocephalus	Procercoid in crustacea; plerocercoid in small fish
P. sp.	Plerocercoid in fish
NEMATODA	
Contracaecum spiculigerum	Larvae in fish; adult in piscivorous fish, birds and mammals
*Paraquimperia aditum	Adult in intestine
*Thynnascaris brachyura	Adult in intestine
ACANTHOCEPHALA	
Echinorhynchus clavaeceps	Larvae in amphipods; adult in intestine
Leptorhynchoides thecatum	Larvae in amphipod, if less than 30 days may also be in mesenteries of fish
Neoechinorhynchus cylindratum	Larvae in small crustacea; some have second intermediate host
CRUSTACEA	
Argulus laticauda	Not available
Ergasilus caeruleus	Gills
Lernaea cyprinacaea	Head in musculature

GADIDAE

Lota lota - *Burbot*

PROTOZOA	
Ciliata	
Trichodina sp.	Urinary bladder
Myxosporida	
Myxidium lieberkuhni	Urinary bladder
Myxobolus sp.	Gills
DIGENEA	
Azygia angusticauda	Intestine and stomach
A. longa	Cercaria in snail, eaten; metacercaria in host and carrier fish; adult in intestine and stomach
Crepidostomum farionis	Cercaria in clam; metacercaria in mayfly nymphs or Gammarus
C. sp.	Cercaria in clam; metacercaria in insect or crustacea
*Microphallidae gen. sp.	Not available
DIGENEA METACERCARIA	
Clinostomum marginata	Cercaria in snail, Helisoma; metacercaria in fish as yellow grub; adult in mouth, esophagus of heron
Diplostomulum scheuringi	Cercaria in snail, Helisoma; metacercaria in vitreous chamber and brain of fish and newts
*Neascus sp.	Metacercaria in mesenteries, gills, skin
Tetracotyle sp.	Metacercaria in mesenteries; adult in birds

CESTOIDEA	
*Bothriocephalus sp.	Adult in pyloric caeca, intestine
Diphyllobothrium latum	Procercoid in copepods; plerocercoid in fish; adult in bear, dogs, man
D. sp.	Not available
Eubothrium crassum	Procercoid in copepods; no second host required; adult in intestine
E. rugosum	Procercoid in copepods; no second host required; adult in intestine
*Proteocephalus pearsi	Adult in intestine
*P. sp.	Adult in intestine, pyloric caeca
*Triaenophorus crassus	Adult in intestine
T. nodulosus	Procercoid in copepods; plerocercoid in liver
NEMATODA	
Camallanus oxycephalus	Larvae in copepods, possibly other crustacea; adult in intestine
Capillaria bakeri	Intestine
Contracaecum brachyurum	Intestine
*Cucullanellus cotylophora	Intestine
Dichelyne cotylophora	Intestine
Haplonema hamulatum	Stomach
Hepaticola bakeri	Intestine
Rhabdochona cascadilla	Some larvae develop in mayflies; adult in intestine
*Skrjabinocapillaria bakeri	Intestine
Spinitectus carolini	Larvae in mayfly larvae; adult in stomach and intestine
S. gracilis	Larvae in mayfly larvae; adult in intestine
*Thynnascaris brachyura	Intestine

ACANTHOCEPHALA	
Acanthocephalus parksidei	Larvae in amphipods; no second intermediate host required
Echinorhynchus leidyi	Larvae in amphipods
E. salmonis	Larvae in amphipods; second intermediate host, Osmerus
Leptorhynchoides thecatum	Larvae in amphipod, if less than 30 days, second host may be small fish
*Metechinorhynchus leidyi	Intestine and stomach
Neoechinorhynchus cylindratum	Larvae in crustacea and fish
N. rutili	Larvae in crustacea and fish
Pomphorhynchus bulbocolli	Larvae in amphipod; second intermediate host small fish
OLIGOCHAETA	
*Cystobranchus verrilli	Opercular region
Piscicola milneri	Not available
P. punctata	Fins
CRUSTACEA	
Achtheres ambloplitis	Not available
Ergasilus caeruleus	Not available
*E. celestis	Gills
E. osburni	Gills

PERCOPSIDAE

Percopsis omiscomaycus - *Trout perch*

PROTOZOA	
Ciliata	
Trichodina sp.	Gills
Myxosporida	
*Myxobolus sp.	Not available
Myxosoma procerum	Gills
MONOGENEA	
*Cleidodiscus baldwini	Gills
C. sp.	Gills
*Gryodactyloidea gen. sp.	Gills, skin
Gryodactylus sp.	Gills
DIGENEA	
Bucephalus sp.	Cercaria in clam; metacercaria in fish; adult in intestine of this fish
Crepidostomum isostomum	Cercaria in clam; metacercaria in aquatic insects, crustacea; adult in intestine
DIGENEA METACERCARIA	
Centrovarium lobotes	Metacercaria in cyst in flesh
Clinostomum marginatum	Cercaria in snail, Helisoma; metacercaria in fish as yellow grub; adult in mouth, esophagus of heron
*Cotylurus communis	Metacercaria in mesenteries, liver
Diplostomulum flexicaudum	Cercaria in snail; metacercaria in eye; adult in gulls

Diplostomulum scheuringi	Cercaria in snail, Helisoma; metacercaria in vitreous chamber of fish and newts
*D. sp.	Metacercaria eye, brain, pharynx
*D. spathaceum	Metacercaria in vitreous humor, lens
*D. spathaceum indistinctum	Metacercaria in eye
*Neascus sp.	Metacercaria in mesenteries, gills, skin
*Posthodiplostomum minimum	Metacercaria in mesenteries, liver, kidney
Tetracotyle communis	Metacercaria in liver, mesenteries; adult in gulls
T. diminuta	Metacercaria encysted pericardial cavity and adipose tissue behind eye; adult reared in unfed chicks
*T. intermedia	Metacercaria in heart, mesenteries
*T. sp.	Metacercaria in heart, pericardium, mesenteries, kidney, musculature
CESTOIDEA	
Bothriocephalus claviceps	Procercoid in copepod; plerocercoid sometimes in small fish; adult in intestine
*B. cuspidatus	Adult in pyloric caeca, intestine
B. formosus	Procercoid in copepod; plerocercoid sometimes in small fish; adult in intestine
*Proteocephalus pearsei	Adult in intestine
*Triaenophorus nodulosus	Plerocercoid in liver, viscera
*T. sp.	Plerocercoid in this fish; adult in this fish in intestine
T. stizostedionis	Procercoid in copepods; plerocercoid in liver
NEMATODA	
*Camallanus oxycephalus	Adult in intestine, shows red at vent

Contracaecum brachyurum	Adult in stomach and intestine of fish eating fish, birds, mammals
Dacnitoides cotylophora	Adult in intestine
*Rhabdochona cascadilla	Intestine
Spinitectus gracilis	Larvae in mayfly larvae; adult in stomach and intestine
*Thynnascaris brachyura	Intestine
ACANTHOCEPHALA	
Echinorhynchus salmonis	Larvae in amphipod, second intermediate host, Osmerus mordax
Leptorhynchoides thecatum	Larvae in amphipod; if less than 30 days second intermediate host may be small fish
*Metechinorhynchus salmonis	Intestine
*Neoechinorhynchus sp.	Intestine
Pomphorhynchus bulbocolli	Larvae in amphipod; small fish; larvae also in this fish
OLIGOCHAETA	
Illinobdella sp.	Not available
CRUSTACEA	
*Argulus sp.	External surface
A. versicolor	Fins
Ergasilus caeruleus	Gills

APHREDODERIDAE

Aphredoderus sayanus - *Pirate perch*

DIGENEA

Crepidostomum sp.	Cercaria in clam; metacercaria in insect, crustacea
Phyllodistomum pearsii	Cercaria in clam; metacercaria in sporocysts in clam, arthropods; adult in urinary bladder

DIGENEA METACERCARIA

Clinostomum marginatum	Cercaria in snail, Helisoma; metacercaria in fish as yellow grub; adult in mouth, esophagus of heron

PERCICHTHYIDAE

Morone chrysops - *White bass*

PROTOZOA	
Ciliata	
*Ichthyophthirius multifiliis	Skin, fins, gills
*Trichodina sp.	Gills, urinary bladder, ureters
*Trichophrya sp.	Gills
MONOGENEA	
*Gyrodactyloidea gen. sp.	Gills, skin
Urocleidus chrysops	Not available
U. mimus	Not available
DIGENEA	
Allacanthochasmus artus	Metacercaria in fish; adult in intestine
*A. varius	Digestive tract
Azygia acuminata	Cercaria in snail, eaten; metacercaria in host or small fish; adult in stomach or intestine
Bucephalus sp.	Cercaria in clam; metacercaria in fish; adult in caeca
Crepidostomum cooperi	Cercaria in clam; metacercaria in insects and crustacea
Leuceruthrus micropteri	Adult in mouth and stomach
*L. sp.	Digestive tract
DIGENEA METACERCARIA	
Clinostomum marginatum	Cercaria in snail; Helisoma; metacercaria in fish as yellow grub; adult in mouth, esophagus of heron

Diplostomulum scheuringi	Cercaria in snail, Helisoma; metacercaria in vitreous chamber, eye, brain of mice, newts and fish
*D. sp.	Metacercaria in eye, brain, pharynx
Neascus of Posthodiplostomum minimum centrarchi	Cercaria in snail, Physa; metacercaria encysted in kidney, liver, pericardium and spleen, 4 years in fish at 12°C; adult in herons, loons, chicks
*N. sp.	Metacercaria in mesenteries, gills, skin
CESTOIDEA	
*Bothriocephalus cuspidatus	Adult in pyloric caeca, intestine
*Proteocephalus ambloplitis	Plerocercoid in this fish; adult in intestine
P. pearsei	Procercoid in copepod; plerocercoid in small fish
*Triaenophorus nodulosus	Adult in intestine
NEMATODA	
*Camallanus oxycephalus	Intestine
*Cucullanellus cotylophora	Intestine
Dacnitoides cotylophora	Intestine
*Rhabdochona sp.	Intestine
Spinitectus carolini	Larvae in mayfly larvae; adult in stomach or intestine
S. gracilis	Larvae in mayfly larvae; adult in stomach or intestine
ACANTHOCEPHALA	
Leptorhynchoides thecatum	Larvae in amphipod, if less than 30 days second host may be small fish
Neoechinorhynchus cylindratum	Larvae in crustacea and fish

CRUSTACEA

Argulus appendiculosus	Not available
A. stizostethi	Not available
Ergasilus centrarchidarum	Not available
E. versicolor	Not available

Morone saxatilis - *Striped bass*

ACANTHOCEPHALA

Leptorhynchoides thecatum	Larvae in amphipods, if less than 30 days may be found in mesenteries of fish

CENTRARCHIDAE

Micropterus salmoides - *Largemouth bass*

PROTOZOA	
Flagellata	
*Spironucleus sp.	Intestine
Ciliata	
Suctoria	
Trichophyra piscium	Gills
"True ciliates"	
*Apiosoma sp.	Fins, gills, skin
Chilodonella sp.	Gills
*Ichthyophthirius multifiliis	Skin, fins, gills
*Trichodina sp.	Gills, urinary bladder, ureters
Trichodinella myakkae	Gills
Myxosporida	
Chloromyxum trijugum	Gall bladder
Myxobolus inornatus	In flesh
Coccidia	
Eimeria micropteri	Anterior gut epithelium
MONOGENEA	
Acolpenteron ureteroecetes	Ureters and bladder
Actinocleidus fusiformis	Gills
A. mizellei	Gills
Clavunculus unguis	Not available
Cleidodiscus helicus	Gills
*Gyrodactyloidea gen. sp.	Gills, skin
Gyrodactylus macrochiri	Gills and fins

*Syncleithrium fusiformis	Gills
*Urocleidus dispar	Gills
U. furcatus	Gills
*U. helicis	Gills
U. principalis	Gills
*U. sp.	Gills
DIGENEA	
*Azygia angusticauda	Adult in intestine, stomach
A. sp.	Cercaria in snail, snail eaten; metacercaria in fish or small fish may act as carriers; adult in host fish
Bunodera luciopercae	Cercaria in clam; metacercaria in mayfly nymphs, crustacea, copepods, crayfish; adult in intestine and caeca
B. sacculata	Cercaria in clam; metacercaria in mayfly nymphs, crustacea, copepods, crayfish; adult in intestine and caeca
†Caecincola parvulus	Metacercaria in Lepomis; adult in caeca and intestine
Crepidostomum cornutum	Cercaria in clam; metacercaria in crayfish
C. ictaluri	Cercaria in clam; metacercaria in aquatic insects, crustacea
Cryptogonimus chyli	Metacercaria fish flesh; adult gastrointestinal
Leuceruthrus micropteri	Adult in stomach
*Microphallus opacus	Adult in intestine
Phyllodistomum pearsii	Cercaria in clam; metacercaria in sporocyst, arthropod, insect larvae; adult in urinary bladder
Rhipidocotyle papillosum	Cercaria in clam; metacercaria in fish; adult in caeca of fish
Sanguinicola huronis	Cercaria in snail; adult in blood vessel

DIGENEA METACERCARIA	
Clinostomum marginatum	Cercaria in snail, Helisoma; metacercaria in fish as yellow grub; adult in mouth, esophagus of heron
Diplostomulum scheuringi	Cercaria in snail, Helisoma; metacercaria in vitreous chamber and brain of fish, newts, mouse
*D. sp.	Metacercaria in eye, brain, pharynx
†*Neascus sp.	Metacercaria in mesenteries, gills, skin
*Posthodiplostomum minimum	Metacercaria in mesenteries, liver, kidney
*P. minimum centrarchi	Metacercaria in liver
*Tetracotyle sp.	Metacercaria in heart, pericardium, mesenteries, kidney, musculature
CESTOIDEA	
Bothriocephalus claviceps	Procercoid in copepods; plerocercoid sometimes in small fish; adult in intestine
*Corallobothrium sp.	Not available
*Dilepis sp. cysticercus	Not available
*D. unilateralis cysticercus	Not available
Eubothrium crassum	Procercoids and plerocercoids in copepods; adult in intestine of fish
Ligula intestinalis	Procercoid in copepods; plerocercoid in body cavity of fish; adult in fish eating birds
†Proteocephalus ambloplitis	Procercoids in copepods; plerocercoid in ovary and spleen
P. fluviatilis	Procercoids in copepods; plerocercoid in small fish
*P. pearsei	Not available

NEMATODA	
*Camallanus oxycephalus	
C. sp.	Larvae in copepods, other crustacea
Capillaria catenata	Gut, liver, urinary bladder of vertebrates
†Contracaecum brachyurum	Adult in fish eating fish, birds, mammals in stomach and intestine
*Cucullanellus cotylophora	Not available
Dacnitoides cotylophora	Intestine
*Dioctophyma sp.	Not available
Philometra cylindracea	Larvae in copepods; adult in tissue
P. nodulosa	Larvae in copepods; adult in tissue
Rhabdochona cascadilla	Larvae in mayflies; adult in intestine
Spinitectus carolini	Larvae in mayfly larvae; adult in stomach and intestine
S. gracilis	Larvae in mayfly larvae; adult in stomach and intestine
Spiroxys sp.	First host Cyclops; larvae in mesenteries of fish, amphibia, dragonfly nymphs
*Thynnascaris brachyura	
ACANTHOCEPHALA	
Acanthocephalus parksidei	Larvae in amphipods
†Echinorhynchus salmonis	Larvae in amphipod; second host, Osmerus
†Leptorhynchoides thecatum	Larvae in amphipod and mesenteries of young fish; adult in intestines
*Metechinorhynchus salmonis	Not available
†Neoechinorhynchus cylindratum	Larvae in crustacea; larvae and adult in mesenteries

Neoechinorhynchus rutili	Larvae in crustacea and fish
†Pomphorhynchus bulbocolli	Larvae in amphipod and small fish; both larvae and adult in mesenteries

OLIGOCHAETA

Illinobdella moorei	Not available
*Placobdella montifera	Not available

CRUSTACEA

Achtheres micropteri	Not available
Argulus appendiculosus	Not available
Ergasilus caeruleus	Not available
E. centrarchidarum	Not available
E. nigratus	Not available
E. sp.	Not available
Lernaea cyprinacaea	Not available

Micropterus dolomieui - *Smallmouth bass*

PROTOZOA

Ciliata

Chilodonella dentatus	Gills
*Ichthyophthirius multifiliis	Skin, fins, gills

Coccidia

Eimeria micropteri	Epithelium of anterior gut

Myxosporida

Myxidium sp.	Gall bladder
Myxobolus kostiri	Subcutaneous
M. osburni	Mesenteries and peritoneum
Trophozoites	Gall bladder

MONOGENEA

Acolpenteron ureteroecetes	Ureters and bladder
Actinocleidus fusiformis	Gills
A. mizellei	Gills
Cleidodiscus banghami	Gills
C. glenorensis	Gills
*C. sp.	Gills
Dactylogyrus extensus	Gills
*Gyrodactyloidea gen. sp.	Gills, skin
Gyrodactylus macrochiri	Fins
*Syncleithrium fusiformis	Gills
Urocleidus dispar	Gills
U. ferox	Gills
U. furcatus	Gills
U. principalis	Gills

DIGENEA

Asymphylodora amnicolae	Cercaria in snail, Amnicola; metacercaria may undergo progenesis in snail; adult in intestine
Azygia angusticauda	Adult in intestine and stomach
A. longa	Cercaria in snail, eaten; metacercaria in host fish or carrier; adult in intestine and stomach
Bucephaloides pusillus	Cercaria in clam; metacercaria in fish; adult in intestine of fish
Caecincola parvulus	Metacercaria beneath skin; adult in intestine
Centrovarium lobotes	Metacercaria in fish muscle; adult in intestine or stomach of fish

Crepidostomum cooperi	Cercaria in clam; metacercaria in insects, crustacea
C. cornutum	Cercaria in clam; metacercaria in crayfish
Cryptogonimus chyli	Metacercaria in fish muscle; adult in intestine or stomach of fish
Leuceruthrus micropteri	Adult in stomach
*Lissorchis sp.	Not available
*Microphallidae gen. sp.	Not available
Microphallus opacus	Metacercaria in crayfish; adult in intestine
Neochasmus umbelus	Adult in intestine
Rhipidocotyle papillosum	Cercaria in clam; metacercaria in fish; adult in caeca
R. septpapillata	Cercaria in clam; metacercaria in fish; adult in caeca
Sanguinicola huronis	Cercaria in snail; adult in blood vessels

DIGENEA METACERCARIA

*Clinostomum complanatum	Metacercaria in gills, musculature
C. marginatum	Cercaria in snail, Helisoma; metacercaria in fish as yellow grub; adult in stomach, esophagus of heron
*C. sp.	Metacercaria in musculature, viscera
Diplostomulum scheuringi	Cercaria in snail, Helisoma; metacercaria in vitreous chamber and brain of fish, newts
*D. spathaceum	Metacercaria vitreous humor, lens
*D. sp.	Metacercaria eye, brain, pharynx
*Neascus sp.	Metacercaria in mesenteries, gills, skin
*Posthodiplostomum minimum	Metacercaria in mesenteries, liver, kidney

Ribeiroia ondatrae	Cercaria in snail, Helisoma; metacercaria in lateral line of fish; adult in osprey, hawks, muskrats
Tetracotyle sp.	Metacercaria in mesenteries; adult in birds
Uvulifer ambloplitis	Cercaria in snail, Helisoma; metacercaria in skin, fins; adult in kingfisher

CESTOIDEA

†Bothriocephalus claviceps	Procercoid in copepods; plerocercoid sometimes in small fish; adult in pyloric caeca and intestine
†B. cuspidatus	Procercoid in copepods; plerocercoid sometimes in small fish; adult in pyloric caeca and intestine
*B. sp.	Pyloric caeca, intestine
†Ligula intestinalis	Procercoid in copepod; plerocercoid in body cavity; adult in fish eating birds
†Proteocephalus ambloplitis	Procercoids in copepods; plerocercoid in ovary, body cavity; adult in intestine
P. fluviatilis	Procercoids in copepods; plerocercoid in ovary of this fish or in small fish; adult in fish
P. microcephalus	Procercoids in copepods; plerocercoid in ovary of this fish or in small fish; adult in fish
*P. pearsei	Adult in intestine
P. stizostethi	Procercoids in copepods; plerocercoid in ovary of this fish or in small fish; adult in fish
*Triaenophorus nodulosus	Plerocercoid in this fish; adult in intestine of this fish
*T. sp.	Plerocercoid in this fish; adult in intestine of this fish

NEMATODA	
Agamonema sp.	Larvae in fish, in liver, mesenteries
Camallanus oxycephalus	Larvae in copepods, other crustacea; adult in intestine shows red from vent
Capillaria catenata	Gut, liver urinary bladder of vertebrates
*C. sp.	Adult in intestine, stomach
Contracaecum brachyurum	Adult in fish eating birds, fish, mammals
C. sp.	Adult in intestine
*Cucullanellus cotylophora	Adult in intestine
Dacnitoides cotylophora	Intestine
*Nematoda gen. sp.	Larvae or adult in viscera, musculature, mesenteries, intestine, stomach
*Philometra sp.	Larvae in copepod; adult in body cavity, intestine
Rhabdochona cascadilla	Larvae in mayfly; adult in intestine
Spinitectus carolini	Larvae in mayfly larvae; adult in stomach and intestine
*S. gracilis	Intestine
Spiroxys sp.	First host Cyclops, second intermediate hosts, mesenteries of fish and amphibia, dragonfly nymphs, snails
*Thynnascaris brachyura	Intestine
ACANTHOCEPHALA	
Echinorhynchus leidyi	Larvae in amphipod; second host, Osmerus
Leptorhynchoides thecatum	Larvae in amphipod, if less than 30 days small fish may be second host
*Metechinorhynchus salmonis	Intestine

Neoechinorhynchus cylindratum	Larvae in crustacea and fish
N. rutili	Larvae in crustacea and fish
Pomphorhynchus bulbocolli	Larvae in amphipod or this fish; second host, small fish

OLIGOCHAETA

*Illinobdella alba	Body surface
*I. elongata	Body surface
I. moorei	Not available
*I. sp.	Fins
*Piscicola punctata	Body surface, gills
Piscicolaria sp.	Not available
Placobdella montifera	Not available

CRUSTACEA

Achtheres ambloplitis	Not available
A. micropteri	Not available
Ergasilus caeruleus	Not available
E. centrarchidarum	Not available
E. sp.	Not available
*Lernaeidae gen. sp.	Partially embedded in flesh

Lepomis cyanellus - *Green sunfish*

PROTOZOA

Myxosporida

Chloromyxum trijugum	Gall bladder

MONOGENEA

Cleidodiscus sp.	Not available
Haplocleidus furcatus	Not available

DIGENEA	
Asymphylodora amnicolae	Cercaria in snail; metacercaria in snail, may undergo progenesis
Bucephaloides pusillus	Cercaria in clam; metacercaria in fish; adult in fish intestine
Crepidostomum cooperi	Cercaria in clam; metacercaria in aquatic insects, crustacea; adult in fish
C. cornutum	Cercaria in clam; metacercaria in crayfish; adult in fish
DIGENEA METACERCARIA	
Cryptogonimus chyli	Metacercaria in fish flesh
Diplostomulum scheuringi	Cercaria in snail; metacercaria in vitreous chamber of eye, brain of fish
Neascus of Uvulifer ambloplitis	Cercaria in snail, Helisoma; metacercaria in fish as a black spot; adult in kingfisher
Posthodiplostomum minimum centrachi (Neascus of)	Cercaria in snail, Physa; metacercaria in kidney, liver, pericardium, spleen; adult in heron and other birds
Psilostomum ondatrae	Metacercaria in lateral line of fish
CESTOIDEA	
Bothriocephalus claviceps	Procercoid in copepods; plerocercoid sometimes in small fish
B. cuspidatus	Procercoid in copepods; plerocercoid sometimes in small fish
B. sp.	Plerocercoid in this fish
Proteocephalus ambloplitis	Plerocercoid in this fish
P. pearsei	Procercoid in copepods; plerocercoid in this fish
NEMATODA	
Camallanus oxycephalus	Larvae in copepods, crustacea; adult in intestine, shows red from vent

Contracaecum spiculigerum	Larvae in fish; adult in comorants, gulls, mergansers, pelicans
C. sp.	Larvae in fish; adult in fish
Dacnitoides cotylophora	Not available
Spinitectus carolini	Larvae in mayfly; adult in stomach and intestine of fish
S. gracilis	Larvae in mayfly; adult in stomach and intestine of fish
Spiroxys sp.	First host Cyclops; larvae in mesenteries of fish, dragonfly nymphs, snails

ACANTHOCEPHALA

Acanthocephalus parksidei	Larvae in amphipods; no second intermediate host
Leptorhynchoides thecatum	Larvae in amphipod, if less than 30 days may encyst in mesenteries of fish
Neoechinorhynchus cylindratum	Larvae in small crustacea; some have second intermediate host
N. sp.	Larvae in small crustacea; some have no second intermediate host

OLIGOCHAETA

Piscicola punctata	Not available

CRUSTACEA

Ergasilus caeruleus	Not available
E. centrarchidarum	Not available
Lernaea cyprinacaea	Not available

Lepomis gibbosus - *Pumpkinseed*

PROTOZOA

Ciliata

Trichodina sp.	Not available

Myxosporida	
Chloromyxum gibbosum	Gall bladder
Myxobilatus ohioensis	Ureters, urinary bladder
Myxobolus dechtiari	Gills
M. gibbosus	Connective tissue of gill arches
M. magnaspherus	Parietal peritoneum of kidney
M. osburni	Mesenteries and peritoneum, gall bladder, pancreas
M. sp.	Connective tissue
M. uvuliferis	In cyst wall of metacercaria of the trematode, Uvulifer ambloplitis
MONOGENEA	
Actinocleidus fergusoni	Gills
A. gibbosus	Gills
*A. incus	Gills
A. oculatus	Gills
A. recurvatus	Gills
*A. scapularis	Gills
*A. sigmoideus	Gills
Cleidodiscus robustus	Gills
Gyrodactylus avalonia	Fins
G. macrochiri	Gills, fins
Haplocleidus dispar	Gills
H. furcatus	Gills
Urocleidus acer	Gills
U. attennatus	Gills
*U. dispar	Gills
U. ferox	Gills

*Urocleidus megalonchus	Gills
*U. procax	Gills
U. similis	Gills

DIGENEA

*Allocreadium sp.	Intestine
Asymphylodora amnicolae	Cercaria in snail, Amnicola; metacercaria in snail, progenesis in snail in some cases; adult in intestine
Azygia angusticauda	Cercaria in snail, snail eaten; metacercaria in host fish or small carrier fish; adult in intestine
A. longa	Cercaria in snail; metacercaria in host or carrier fish; adult in intestine or stomach
Bunodera sacculata	Cercaria in clam; metacercaria in copepods, crustacea, crayfish; adult in intestine and caeca
*B. sacculata	Intestine
Crepidostomum cooperi	Cercaria in clam; metacercaria in insect, crustacea
C. cornutum	Cercaria in clam; metacercaria in crayfish
C. farionis	Cercaria in clam; metacercaria in mayfly nymphs, Gammarus
C. sp.	Cercaria in clam; metacercaria in aquatic insects, crustacea; adult in fish in pyloric caeca
Cryptogonimus chyli	Metacercaria in fish muscle; adult in gastrointestinal
*Homalometron armatum	Intestine
Phyllodistomum pearsii	Cercaria in clam; metacercaria in sporocyst in clam, arthropod; adult in urinary bladder
Proterometra dickermani	Cercaria in snail; complete life cycle in snails, Gonio basis, eaten by fish

Proterometra macrostoma	Cercaria in snail, complete life cycle in snail; adult in esophagus of fish
Rhipidocotyle septpapillata	Cercaria in clam; metacercaria in fish; adult in stomach and intestine
DIGENEA METACERCARIA	
Apophallus brevis	Cercaria in snail; metacercaria in capsule of bone, caudal fin, operculum; adult in gulls, loons, muskrats
*A. venustus	Metacercaria in musculature
Caecincola parvulus	Metacercaria in this fish beneath skin; adult in stomach, intestine of this fish
Clinostomum marginatum	Cercaria in snail, Helisoma; metacercaria in fish as yellow grub; adult in mouth, esophagus of heron
Diplostomulum scheuringi	Cercaria in snail, Helisoma; metacercaria in vitreous chamber and brain of fish, newts
*D. spathaceum huronense	Metacercaria in eye
*D. sp.	Metacercaria in eye, brain, pharynx
D. of Diplostomum huronense	Snail not known; metacercaria in lens and vitreous chamber; adult in gulls
Echinochasmus donaldsoni	Cercaria in snail; metacercaria in gills; adult in grebes
Euparyphium melis	Cercaria in snail; metacercaria in nares and cloaca of this fish; adult in minks
*Heterophyidae gen. sp.	Metacercaria in skin, gills, musculature
*Neascus sp.	Metacercaria in mesenteries, gills, skin
N. of Posthodiplostomum minimum	Metacercaria in kidney, liver, spleen and pericardium; adult in heron and other birds

Opisthorchis tonkae	Cercaria in snail, Amnicola; metacercaria in fish; adult in bile duct, gall bladder
Petasiger nitidus	Cercaria in snail, Helisoma, eaten; metacercaria in fish; adult in intestine
*Posthodiplostomum cuticola	Metacercaria in mesenteries, kidney, liver
P. minimum centrarchi	Cercaria in snail; metacercaria in liver, kidney; adult in loons, herons
Ribeiroia ondatrae	Cercaria in snail; metacercaria in lateral line of this fish; adult in muskrats, ospreys, hawks
Tetracotyle sp.	Metacercaria in air bladder, kidney, muscle in this fish
Uvulifer ambloplitis	Cercaria in snail; metacercaria in striated muscle, dorsal and caudal fins; adult in kingfisher

CESTOIDEA

Bothriocephalus claviceps	Procercoid in copepod; plerocercoid in small fish; adult in intestine
B. cuspidatus	Procercoid in copepod; plerocercoid in small fish; adult in intestine
*B. sp.	Adult in pyloric caeca, intestine
*Dilepididae gen. sp.	Larvae encysted liver, mesenteries
*Diphyllobothrium sp.	Plerocercoid in viscera, musculature, body cavity, blood vessels of heart
*Hymenolepis sp.	Plerocercoid encysted body cavity, liver
Proteocephalus ambloplitis	Procercoid in copepods; plerocercoid in small fish; adult in liver and mesenteries
*P. fluviatilis	Adult in intestine
*P. pearsei	Adult in intestine
P. stizostethi	Procercoid in crustacea; plerocercoid in small fish

Triaenophorus nodulosus	Procercoid in copepods; plerocercoid in small fish; adult in liver
NEMATODA	
Ascaris angulata	Adult in intestine
Camallanus oxycephalus	Larvae in copepod; adult in intestine, shows red from vent
Capillaria catenata	Gut, liver, urinary bladder of vertebrates
Contracaecum sp.	Larvae in liver of fish; adult in fish eating birds, fish, mammals
Dacnitoides cotylophora	Intestine
Dichelyne sp.	Parasites of teleosts; larvae in this fish
Eustrongylides sp.	Larvae in muscle cyst, ovary of fish, red; adult in proventriculus of fish eating birds
Oxyuridea sp.	Not available
*Philometra sp.	Body cavity, intestine
*Rhabdochona sp.	Adult in intestine
Spinitectus carolini	Larvae in mayfly larvae; adult in stomach and intestine
S. gracilis	Larvae in mayfly larvae; adult in stomach and intestine
Spiroxys sp.	Larvae in mesenteries of fish, amphibia, dragonfly nymphs and snails
*Thynnascaris brachyura	Adult in intestine
ACANTHOCEPHALA	
Echinorhynchus salmonis	Larvae in amphipod; second intermediate host, Osmerus
Leptorhynchoides thecatum	Larvae in amphipod, if less than 30 days small fish may be second intermediate host

*Metechinorhynchus salmonis	Adult in intestine
Neoechinorhynchus cylindratum	Larvae in crustacea and fish
Pomphorhynchus bulbocolli	Larvae in amphipod, small fish second intermediate host

OLIGOCHAETA

illinobdella moorei	Not available
I. sp.	Not available
*Myzobdella moorei	Fins
*Piscicola punctata	Body surface, gills
*Placobdella montifera	Body surface
P. parasitica	Not available

CRUSTACEA

Achtheres ambloplitis	Not available
Ergasilus caeruleus	Not available
E. centrarchidarum	Not available
E. sp.	Not available
Lernaea cyprinacaea	Not available
L. dolabrodes	Not available
L. pomotidis	Not available
L. variabilis	Not available

Lepomis macrochirus - *Bluegill*

PROTOZOA

Flagellata	
Bodomonas concava	Gills
Ciliata	
†Gyrodactylus sp.	Not available
Scyphidia (Ambiphrya) ameiuri	Gills

Trichodina discoidea	Gills
T. sp.	Not available
Myxosporida	
Chloromyxum trijugum	Gall bladder
Myxidium macrocapsulare	Gall bladder
Myxobolus osburni	Gall bladder
Trophozoites	Gall bladder
MONOGENEA	
Actinocleidus bakeri	Gills
A. fergusoni	Gills
A. gibbosus	Gills
A. oculatus	Gills
A. unguis	Gills
Cleidodiscus robustus	Gills
C. sp.	Not available
C. venardi	Gills
*Gyrodactyloidea gen. sp.	Gills, skin
Gyrodactylus macrochiri	Gills and fins
Haplocleidus dispar	Not available
H. furcatus	Not available
Lyrodiscus longibasus	Fins and body
L. seminolensis	Fins, body
L. sp.	Not available
Urocleidus dispar	Gills
U. ferox	Gills
DIGENEA	
Asymphylodora amnicolae	Cercaria in snail; metacercaria in snail, progenesis in snail

Azygia acuminata	Cercaria in snail, snail eaten; metacercaria in small host fish or carrier fish; adult in host fish
A. angusticauda	Cercaria in snail, snail eaten; metacercaria in small host fish or carrier fish; adult in host fish
A. sebago	Cercaria in snail, snail eaten; metacercaria in small host fish or carrier fish; adult in host fish
*Bunodera luciopercae	Adult in intestine
Crepidostomum cooperi	Cercaria in clam; metacercaria in aquatic insects, crustacea; adult in fish
C. cornutum	Cercaria in clam; metacercaria in crayfish; adult in fish
C. sp.	Cercaria in clam; metacercaria in crayfish; adult in fish
Cryptogonimus chyli	Metacercaria in flesh of fish; adult in fish
Microphallus opacus	Metacercaria in crayfish; adult in intestine and urinary bladder
Proterometra dickermani	Cercaria in snail, Goniobasis; metacercaria in snail with progenesis in snail
P. macrostoma	Cercaria in snail, Goniobasis; metacercaria in snail with progenesis in snail
Rhipidocotyle papillosum	Cercaria in clam; metacercaria in fish; adult in intestine and caeca of fish

DIGENEA METACERCARIA

Bolbophorus confusus of Diplostomulum	Cercaria in snail; metacercaria in fish; adult in pelican
†Clinostomum marginatum	Cercaria in snail; metacercaria in fish as yellow grub; adult in heron in mouth, esophagus
†Diplostomulum scheuringi	Metacercaria in vitreous humor, not encysted

Diplostomulum spathaceum	Cercaria in snail; metacercaria in fish in lens of eye; adult in gulls
†Echinochasmus donaldsoni	Cercaria in snail; metacercaria in fish in gills; adult in grebe
Euparyphium melis	Cercaria in snail; metacercaria in nares and cloaca of fish; adult in mink
†Neascus ambloplitis of Uvulifer ambloplitis	Cercaria in snail, Helisoma; metacercaria in fish as black spot; adult in kingfisher
†Neascus of Posthodiplostomum minimum centrarchi	Cercaria in snail, Helisoma; metacercaria in kidney, liver, pericardium, spleen of fish; adult in herons, loons
Petasiger nitidus	Cercaria in snail, snail eaten by fish; metacercaria in fish; adult experimentally in canaries
†*Posthodiplostomum minimum	Metacercaria in mesenteries, liver, kidney
†P. minimum centrarchi	Encysted in mesenteries and viscera
Psilostomum ondatrae	Metacercaria in lateral line of fish
*Tetracotyle sp.	Metacercaria in heart, pericardium, mesenteries, kidney, musculature

CESTOIDEA

Bothriocephalus claviceps	Procercoid in copepods; plerocercoid sometimes in small fish
†B. cuspidatus	Plerocercoid in this fish
B. sp.	Plerocercoid in this fish
Proteocephalus ambloplitis	Plerocercoid in this fish
P. pearsei	Procercoid in copepod; plerocercoid in this fish
P. stizostethi	Procercoid in copepod; plerocercoid in this fish
Triaenophorus nodulosus	Procercoid in copepod; plerocercoid in this fish

NEMATODA	
Camallanus oxycephalus	Larvae in copepod, crustacea; adult in intestine of fish, shows red from vent
C. sp.	Larvae in copepod, crustacea
Capillaria catenata	Adult in intestine
Contracaecum sp.	Not available
†C. spiculigerum	Larvae in fish; adult in cormorants, mergansers, gulls, pelicans
*Cucullanellus cotylophora	Adult in intestine
Dichelyne sp.	Larvae in fish
*Nematoda gen. sp.	Viscera, musculature, mesenteries, intestine, stomach
*Rhabdochona sp.	Adult in intestine
Spinitectus carolini	Larvae in mayfly; adult in stomach and intestine of fish
S. gracilis	Larvae in mayfly; adult in stomach and intestine
Spiroxys sp.	First host Cyclops; larvae in mesenteries of dragonfly nymphs, fish, snails
ACANTHOCEPHALA	
Acanthocephalus parksidei	Larvae in amphipods; no second intermediate host
Leptorhynchoides thecatum	Larvae in amphipod, if less than 30 days to mesenteries of fish, a second intermediate host
Neoechinorhynchus cylindratum	Larvae in small crustacea; some have second host
Pomphorhynchus bulbocolli	Larvae in amphipod; second intermediate host, small fish
OLIGOCHAETA	
Illinobdella moorei	Not available

Illinobdella sp.	Not available
*Piscicola punctata	Body surface, gills
Placobdella parasitica	Not available
CRUSTACEA	
Achtheres micropteri	Not available
Argulus americanus	Not available
†A. sp.	Not available
Ergasilus caeruleus	Not available
E. centrarchidarum	Not available
E. versicolor	Not available
Lernaea cyprinacaea	Flesh and fins
L. dolabrodes	Not available
L. pomotidis	Not available
L. variabilis	Not available

Ambloplites rupestris - *Rock bass*

PROTOZOA	
Ciliata	
*Apiosoma sp.	Fins, gills, skin
Myxosporida	
Myxobolus sp.	Intestinal wall
MONOGENEA	
Cleidodiscus alatus	Not available
C. chautauquaensis	Gills
C. glenorensis	Gills
C. sp.	Not available
C. stentor	Gills
Gyrodactylus goerani	Fins

Gyrodactylus sp.	Gills
Lyrodiscus minimus	Fins
L. rupestris	Nasal cavities, fins, skin
*Urocelidus alatus	Gills, skin, fins
U. chautauquaensis	Not available

DIGENEA

Alloglossidium corti	Metacercaria in dragonfly nymphs; adult in intestine
Azygia angusticauda	Adult in stomach or intestine
A. longa	Cercaria in snail, eaten; metacercaria in host or carrier fish; adult in stomach or intestine of this fish
Bucephalus elegans	Cercaria in clam; metacercaria in fish; adult in caeca of fish
*Bunodera luciopercae	Adult in intestine
Caecincola parvulus	Cercaria in snail, Amnicola; metacercaria in Lepomis; adult in gastrocaecal, intestinal
Crepidostomum cooperi	Cercaria in clam; metacercaria in insects and crustacea
C. cornutum	Cercaria in clam; metacercaria in crayfish
C. lintoni	Not available
*Leuceruthrus micropteri	Adult in stomach
Microphallus opacus	Metacercaria in crayfish
Phyllodistomum sp.	Cercaria in clam; metacercaria in sporocysts in clam or arthropods
Protenteron diaphanum	Adult in intestine
Proterometra macrostoma	Life cycle in snail; adult in esophagus of fish

DIGENEA METACERCARIA

Centrovarium lobotes	Cercaria in snail; metacercaria in fish muscle

†Clinostomum marginatum	Cercaria in snail, Helisoma; metacercaria in fish as yellow grub; adult in mouth, esophagus of herons
Cryptogonimus chyli	Metacercaria in flesh of this fish
Diplostomulum scheuringi	Cercaria in snail, Helisoma; metacercaria in vitreous chamber of fish, newts, mouse
*D. spathaceum	Metacercaria in vitreous humor, lens
*D. sp.	Metacercaria in eye, brain, pharynx
Euparyphium melis	Cercaria in snail; metacercaria in nares and cloaca of this fish adult in mink
*Neascus sp.	Metacercaria in mesenteries, gills, skin
Petasiger nitidus	Cercaria in snail, Helisoma, eaten by fish; metacercaria in this fish esophagus; adult experimentally in canaries
*Posthodiplostomum minimum	Metacercaria in mesenteries, liver, kidney
P. minimum centrarchi	Metacercaria in kidney, liver pericardium of fish
Rhipidocotyle papillosa	Cercaria in clam; metacercaria in fish; adult in intestine and caeca
Ribeiroia ondatrae	Cercaria in snail, Helisoma; metacercaria in lateral line of this fish; adult in hawks, ospreys, muskrats
Tetracotyle sp.	Metacercaria in mesenteries of this fish
Uvulifer ambloplitis	Cercaria in snail; metacercaria in skin; adult in kingfisher

CESTOIDEA

Bothriocephalus claviceps	Procercoid in copepods; plerocercoid in small fish; adult in intestine

Bothriocephalus cuspidatus	Procercoid in copepods; plerocercoid in small fish; adult in intestine
*Corallobothrium sp.	Adult in intestine
*Ligula intestinalis	Plerocercoid in body cavity
Proteocephalus ambloplitis	Plerocercoid in liver and mesenteries; adult in intestine
*P. pearsei	Adult in intestine
P. perplexus	Plerocercoids in Hyborhynchus, Roccus, Ictalurus

NEMATODA

Ascaris labiata	Adult in intestine of fish
A. lucii	Adult in intestine of fish
Camallanus oxycephalus	Larvae in copepods; adult in intestine, shows red from vent
Capillaria catenata	Adult in gut, liver or urinary bladder of vertebrates
Contracaecum brachyurum	Adult in stomach and intestine of fish eating fish, birds, mammals
*C. sp.	Intestine, stomach, viscera, mesenteries, musculature
*Cucullanellus cotylophora	Adult in intestine
Dacnitoides cotylophora	Not available
Rhabdochona cascadilla	Larvae in mayfly; adult in intestine
Spinitectus carolini	Larvae in mayfly larvae; adult in intestine
S. gracilis	Larvae in mayfly larvae; adult in intestine
Spiroxys sp.	First intermediate host Cyclops; Larvae in mesenteries of fish and amphibia, dragonfly nymphs, snails
*Thominx catenata	Adult in intestine
*Thynnascaris brachyura	Larvae in liver, mesenteries; adult in intestine of this fish

ACANTHOCEPHALA	
Acanthocephalus lateralis	Larvae in Asellus and Gammarus
Echinorhynchus salmonis	Larvae in amphipod; fish Osmerus as second intermediate host
Leptorhynchoides thecatum	Larvae in amphipods; if less than 30 days fish may be second intermediate host
*Metechinorhynchus salmonis	Intestine
Neoechinorhynchus cylindratum	Larvae in crustacea; some have fish as second host; larvae may be in this fish
N. rutili	Larvae in crustacea and fish
Pomphorhynchus bulbocolli	Larvae in amphipod; small fish second intermediate host, may be this fish
P. rocci	Larvae in amphipod; second host, small fish
OLIGOCHAETA	
Illinobdella sp.	Not available
*Myzobdella moorei	Fins
*Piscicola punctata	Body surface, gills
Piscicolaria sp.	Not available
CRUSTACEA	
*Achtheres ambloplitis	Gills
*A. micropteri	Gills, mouth
Argulus biramosus	Not available
*Ergasilus caeruleus	Gills
*E. centrarchidarum	Gills
E. elegans	Not available
*E. sp.	Gills
†Lernaea cruciata	Skin

Pomoxis spp. - *Crappie*

PROTOZOA	
Ciliata	
Trichodina sp.	Gills
Myxosporida	
Chloromyxum trijugum	Gall bladder
Myxobolus discrepans	Gills
M. iowensis	Gills
M. intestinalis	Intestinal wall
M. okobojiensis	Intestine
M. osburni	Gall bladder
M. sparoidis	Gall bladder and intestine
M. sp.	Not available
MONOGENEA	
Cleidodiscus adspectus	Not available
C. capax	Gills
C. longus	Gills
C. sp.	Not available
C. stentor	Gills
C. uniformis	Gills
C. vancleavei	Gills
*Gyrodactyloidea gen. sp.	Gills, skin
Lyrodiscus longibasus	Fins, body
L. sp.	Not available
DIGENEA	
Azygia angusticauda	Adult in stomach and intestine
Caecincola parvulus	Cercaria in snail, Amnicola; metacercaria in Lepomis; adult gastrocaecal, intestinal

Crepidostomum cooperi	Cercaria in clam; metacercaria in insect and crustacea
C. cornutum	Cercaria in clam; metacercaria in crayfish
Cryptogonimus chyli	Metacercaria in fish flesh; adult gastrointestinal
Proterometra macrostoma	Life cycle in snail; adult in esophagus
DIGENEA METACERCARIA	
Clinostomum marginatum	Cercaria in snail, Helisoma; metacercaria in fish as yellow grub; adult in mouth, esophagus of herons
Diplostomulum scheuringi	Cercaria in snail, Helisoma; metacercaria in vitreous chamber, brain of fish and mice
*D. sp.	Metacercaria in eye, brain, pharynx of fish
Neascus sp.	Metacercaria in skin of fish
Neascus of Posthodiplostomum minimum centrarchi	Cercaria in snail, Physa; metacercaria encyst in kidney, liver, pericardium, spleen, longevity 4 years in fish @ 12°C; adult in herons, loons, unfed chicks
*Posthodiplostomum minimum	Metacercaria in mesenteries, liver, kidney of fish
Tetracotyle sp.	Metacercaria in mesenteries of fish
CESTOIDEA	
Bothriocephalus sp.	Procercoid in copepods; plerocercoid sometimes in small fish; adult in intestine
Proteocephalus ambloplitis	Procercoid in crustacea; plerocercoid encysted in liver of this fish
P. pearsei	Procercoid in copepods and other crustacea; adult in intestine of fish

NEMATODA

*Camallanus oxycephalus	Adult in intestine, shows red from vent
Capillaria catenata	Larvae in gut, liver, urinary bladder of vertebrates
†Contracaecum spiculigerum	Coiled in viscera
Dacnitoides cotylophora	Adult in intestine
Spinitectus carolini	Larvae in mayfly larvae; adult in stomach and intestine
S. gracilis	Larvae in mayfly larvae; adult in stomach and intestine
Spiroxys sp.	First host Cyclops; larvae in mesenteries of fish and amphibia, dragonfly nymphs, snails

ACANTHOCEPHALA

Leptorhynchoides thecatum	Larvae in amphipod; if less than 30 days small fish may be second intermediate host
Neoechinorhynchus cylindratum	Larvae in crustacea and fish
Pomphorhynchus bulbocolli	Larvae in amphipod; small fish second intermediate host

CRUSTACEA

Argulus appendiculosus	Not available
A. biramosus	Not available
Ergasilus caeruleus	Not available
E. centrarchidarum	Not available

Lepomis gulosus - *Warmouth*

PROTOZOA

*Ciliata

Trichodina sp.	Gills, urinary bladder, ureters

Myxosporida	
*Chloromyxum gibbosum	Gall bladder
*Myxobilatus ohioensis	Ureters, urinary bladder
*Myxobolus dechtiari	Cysts in gills
*M. magnaspherus	Cysts in parietal peritoneum of kidney
*M. osburni	Cysts, mesenteries and pancreas
*M. sp.	Gills, mesenteries, viscera, skin
*M. uvuliferis	Found in fibrous capsule of the trematode metacercaria of Uvulifer ambloplitis
MONOGENEA	
Actinocleidus fergusoni	Gills
*A. gibbosus	Gills
*A. incus	Gills
*A. oculatus	Gills
*A. recurvatus	Gills
*A. scapularis	Gills
*A. sigmoideus	Gills
*Cleidodiscus robustus	Gills
*Gyrodactylidae gen. sp.	Gills
*Gyrodactyloidea gen. sp.	Gills, skin
*Gyrodactylus avalonia	Gills, fins
*G. macrochiri	Gills, fins
*Urocleidus acer	Gills
*U. attenuatus	Gills
*U. dispar	Gills
*U. ferox	Gills
*U. megalonchus	Gills

*Urocleidus procax	Gills
*U. similis	Gills
DIGENEA	
*Allocreadium sp.	Intestine
Alloglossidium corti	Cercaria in snail, Helisoma; metacercaria in dragonfly nymphs
*Azygia angusticauda	Intestine and stomach
*Bundoderina sacculata	Intestine
Crepidostomum cooperi	Cercaria in clam; metacercaria in aquatic insects, mayfly nymphs or crustacea; adult in fish
C. cornutum	Cercaria in clam; metacercaria in crayfish; adult in fish
*C. sp.	Intestine, gall baldder
*Homalometron armatum	Intestine
*Proterometra macrostoma	Esophagus
DIGENEA METACERCARIA	
*Apophallus brevis	Skin, fins, gills, musculature
Ascocotyle tenuicollis	Metacercaria in this fish; adult in herons
Clinostomum marginatum	Cercaria in snail, Helisoma; metacercaria in fish as yellow grub; adult in mouth, esophagus of heron, other birds
*Cryptogonimus chyli	Musculature
*Diplostomulum scheuringi	Cercaria in snail, Helisoma; metacercaria in vitreous chamber of fish, newts, also encysts in mice
*D. spathaceum huronense	Eye
*D. sp.	Eye, brain, pharynx
*Heterophyidae gen. sp.	Skin, gills, musculature

*Neascus sp.	Mesenteries, gills, skin
*N. of Posthodiplostomum minimum	Metacercaria in this fish; adult in heron, other birds
*N. of Uvulifer ambloplitis	Cercaria in snail, Helisoma; metacercaria in fish as black spot; adult in kingfisher
*Posthodiplostomum cuticola	Mesenteries, kidney, liver
*P. minimum	Mesenteries, kidney, liver
*P. minimum centrarchi	Liver
*Tetracotyle sp.	Heart, pericardium, mesenteries, kidney, musculature
*Uvulifer ambloplitis	Skin, musculature, gills, fins

CESTOIDEA

Bothriocephalus claviceps	Procercoid in copepods; plerocercoid sometimes in small fish; adult in fish
*B. sp.	Pyloric caeca, intestine
*Dilepididae gen. sp.	Plerocercoid in liver and mesenteries
*Diphyllobothrium sp.	Plerocercoid in viscera, musculature, body cavity, blood vessels of heart
*Hymenolepis sp.	Plerocercoid in body cavity, liver
Proteocephalus ambloplitis	Procercoid in copepods; plerocercoid in fish; adult in fish
*P. fluviatilis	Intestine
*P. pearsei	Intestine
*Triaenophorus nodulosus	Plerocercoid in liver, viscera

NEMATODA

Camallanus oxycephalus	Larvae in copepods and other crustacea; adult in intestine, shows red from vent
C. sp.	Larvae in fish

*Contracaecum sp.	Intestine, stomach, viscera, mesenteries, musculature
C. spiculigerum	Larvae in this fish; adult in fish eating birds
*Eustrongylides sp.	Larvae in viscera, musculature, body cavity, ovary
*Philometra sp.	Body cavity, intestine
*Rhabdochona sp.	Intestine
Spinitectus carolini	Larvae in mayfly larvae; adult in stomach and intestine of fish
*S. gracilis	Intestine
*Spiroxys sp.	Viscera, mesenteries, digestive tract
*Thynnascaris brachyura	Intestine
ACANTHOCEPHALA	
Acanthocephala thecatum	Larvae in amphipods; if less than 30 days may encyst in fish which act as second intermediate host; adult in caeca
Leptorhynchoides thecatum	Larvae in amphipod; if less than 30 days, small fish may be second intermediate host
*Metechinorhynchus salmonis	Intestine
Neoechinorhynchus cylindratum	Larvae in small crustacea and in this fish
Pomphorhynchus bulbocolli	Larvae in amphipod; second intermediate host, fish
OLIGOCHAETA	
Illinobdella moorei	Not available
I. sp.	Not available
*Myzobdella moorei	Fins
*Piscicola punctata	Body surface, gills
*Placobdella montifera	Body surface

CRUSTACEA	
*Achtheres ambloplitis	Gills
A. micropteri	Not available
Argulus flavescens	Not available
Ergasilus caeruleus	Not available
E. centrarchidarum	Not available
E. sp.	Gills
E. versicolor	Not available
*Lernaea cyprinacaea	Embedded in musculature, body protruding

Centrarchus macropterus - *Flier*

DIGENEA	
Phyllodistomum pearsii	Cercaria in clam; metacercaria in sporocyst in clam, arthropod; adult in urinary bladder
DIGENEA METACERCARIA	
Clinostomum marginatum	Cercaria in snail, Helisoma; metacercaria in fish as yellow grub; adult in mouth, esophagus of heron
Diplostomulum scheuringi	Metacercaria in vitreous chamber of eye of fish, newt, mouse
ACANTHOCEPHALA	
Neoechinorhynchus cylindratum	Larvae in small crustacea; some species have second intermediate host
CRUSTACEA	
Ergasilus caeruleus	Not available

PERCIDAE

Stizostedion canadense - *Sauger*

MONOGENEA

Cleidodiscus aculeatus	Gills
Gyrodactylus mizellei	Not available
*Urocleidus aculeatus	Gills

DIGENEA

Bucephalus pusillus	Cercaria in clam; metacercaria in fish; adult in intestine of this fish
Centrovarium lobotes	Metacercaria in fish muscle; adult in stomach and intestine
Phyllodistomum superbum	Cercaria in clam; metacercaria in sporocysts in clam or arthropods; adult in ureters of this fish
*Prosorhynchoides pusilla	Adult in stomach, pyloric caeca, intestine

DIGENEA METACERCARIA

Clinostomum marginatus	Cercaria in snail, Helisoma; metacercaria in fish muscle; adult in heron
Diplostomulum sp.	Cercaria in snails; metacercaria in this fish; adult in herons, gulls, cormorants, fish
Neascus sp.	Metacercaria in skin
†Tetracotyle communis	Metacercaria in mesenteries and pericardium of fish; adult in birds
Tetracotyle of Cotylurus communis	Metacercaria encysted in pericardial cavity of fish

CESTOIDEA

Bothriocephalus claviceps	Procercoid in copepods; plerocercoid sometimes in small fish

†Bothriocephalus cuspidatus	Procercoid in copepods; plerocercoid in small fish sometimes; adult in caeca and intestine
Diphyllobothrium latum	Procercoid in copepods; plerocercoid in this fish
Proteocephalus ambloplitis	Procercoid in copepods; plerocercoid in small fish; adult in mesenteries of this fish
P. luciopercae	Procercoid in haemocoel of crustacea; plerocercoid in small fish
P. stizostethi	Procercoid in haemocoel of crustacea; plerocercoid in small fish
Triaenophorus nodulosus	Procercoid in copepod; plerocercoid in small fish; adult in liver and mesenteries of this fish
T. sp.	Procercoid in copepods; plerocercoid in small fish; adult in intestine of this fish

NEMATODA

Camallanus oxycephalus	Larvae copepods, other crustacea; adult in intestine, shows red from vent
Contracaecum brachyurum	Adult in intestine
Eustrongylides sp.	Larvae in cysts in body cavity; adult in glands of proventriculus of fish eating birds
*Thynnascaris brachyura	Larvae in liver, mesenteries of this fish; adult in intestine of this fish

ACANTHOCEPHALA

Echinorhynchus salmonis	Larvae in amphipods; second intermediate host, Osmerus mordax
Metechinorhynchus salmonis	Adult in intestine
Neoechinorhynchus cylindratum	Larvae in small crustacea, Ostracod?; fish, second host

*Neoechinorhynchus sp.	Adult in intestine
N. tenellus	Larvae in small crustacea; some have second intermediate host; adult in intestine

OLIGOCHAETA

Illinobdella moorei	Fins
*Myzobdella moorei	Fins
Piscicola punctata	Not available

CRUSTACEA

Argulus appendiculosus	Fins
A. biramosus	Not available
A. stizostethi	Not available
Ergasilus caeruleus	Gills
E. centrarchidarum	Not available
Lernaea cruciata	Not available
L. variabilis	Not available
Lerneocerca sp.	Not available

Stizostedion vitreum vitreum - *Walleye*

PROTOZOA

Ciliata

Carchesium sp.	On eggs
†Ichthyophthirius multifiliis	Not available

Myxosporida

Myxobilatus asymmetricus	Urinary bladder

MONOGENEA

Cleidodiscus aculeatus	Not available
*C. sp.	Gills

*Gyrodactyloidea gen. sp.	Gills
Gyrodactylus mizellei	Not available
G. schmidti	Not available
*Urocleidus aculeatus	Gills
DIGENEA	
Azygia acuminata	Cercaria in snail, eaten; metacercaria in host or small carrier fish; adult in stomach or intestine
A. angusticauda	Cercaria in snail; adult in stomach and intestine
*Azygia sp.	Not available
Bucephaloides ozakii	Cercaria in clam; metacercaria in fish; adult in gut
Bunodera sacculata	Cercaria in clam; metacercaria in copepod, crayfish, crustacea; adult in intestine and caeca
*Bunoderina sacculata	Adult in intestine
Centrovarium lobotes	Metacercaria in fish flesh; adult in stomach and intestine
Crepidostomum sp.	Cercaria in clam; metacercaria in insect, crustacea
Phyllodistomum superbum	Cercaria in clam; metacercaria in sporocysts in clam or arthropods; adult in ureters
*Prosorhynchoides pusilla	Adult in stomach, pyloric caeca, intestine
Sanguinicola occidentalis	Cercaria in snail; no second host; adult in blood vessel
DIGENEA METACERCARIA	
*Clinostomum complanatum	Metacercaria in musculature
C. marginatum	Cercaria in snail, Helisoma; metacercaria in fish as yellow grub; adult in mouth, esophagus of heron

*Clinostomum sp.	Metacercaria in musculature, viscera
*Cotylurus communis	Metacercaria in mesenteries, liver
Diplostomulum scheuringi	Cercaria in snail, Helisoma; metacercaria in vitreous chamber of eye of fish and newts
†*D. sp.	Metacercaria in eye, brain, pharynx
†*Neascus sp.	Metacercaria in mesenteries, gills, skin
N. of Crassiphiala bulboglossa	Cercaria in snail, Helisoma; metacercaria in fish as black spot skin cysts; adult in kingfisher
*Posthodiplostomum minimum	Metacercaria in mesenteries, liver, kidney
Tetracotyle of Cotylurus communis	Metacercaria in pericardial cavity of fish; adult in the gull, Larus argentatus

CESTOIDEA

Bothriocephalus claviceps	Procercoid in copepod; plerocercoid small fish sometimes; adult in intestine
†B. cuspidatus	Procercoid in copepod; plerocercoid small fish sometimes; adult in intestine
†Diphyllobothrium latum	Procercoid in copepod; plerocercoid in fish musculature; adult in bear, dogs, man
*D. sp.	Plerocercoid in viscera, musculature, body cavity, blood vessels of heart in this fish
†Proteocephalus ambloplitis	Procercoid in crustacea; plerocercoid in mesenteries and liver
†P. fluviatilis	Procercoid in crustacea; plerocercoid in mesenteries and liver
P. luciopercae	Procercoids in copepods; plerocercoid in small fish
P. macrocephalus	Procercoid in copepods; plerocercoid in small fish

*Proteocephalus pearsei	Adult in intestine
†*P. pinguis	Adult in intestine
*P. sp.	Adult in intestine, pyloric caeca
†P. stizostethi	Procercoid in copepods; plerocercoid in small fish
Triaenophorus crassus	Plerocercoid in viscera of Catostomus spp., Coregonus spp., Cottus cognatus, Esox spp., Eucalia inconstans, Roccus chrysops, Lepomis spp., Micropterus spp., Moxostoma spp., Notropis spp., Perca flavescens, Pomoxis nigromaculatus, Salvelinus fontinalis, Thymallus signifer; adult in intestine of this fish
*T. nodulosus	Intestine
*T. sp.	Plerocercoid in musculature, liver, viscera
T. stizostedionis	Procercoid in Cyclops; plerocercoid in viscera of Percopsis omiscomaycus; adult in intestine of this fish

NEMATODA

†*Camallanus oxycephalus	Adult in intestine, shows red from vent
Capillaria catenata	Gut, liver, urinary bladder of vertebrates
Contracaecum brachyurum	Adult in stomach and intestine of fish eating birds, fish, mammals
†C. spiculigerum	Adult in stomach and intestine of fish eating birds, fish, mammals
†C. sp.	Adult in stomach and intestine of fish eating birds, fish, mammals
*Cucullanellus cotylophora	Adult in intestine
Dacnitoides cotylophora	Adult in intestine of fish
Eustrongylides sp.	Larvae encyst in muscles of this fish; adult in glands of proventriculus of birds

Philometra cylindracea	Larvae in copepods; adult in fish tissue
*Raphidascaris acus	Adult in intestine
*R. sp.	Adult in liver, digestive tract
Spinitectus carolini	Larvae in mayfly larvae; adult in stomach and intestine of fish
S. gracilis	Larvae in mayfly larvae; adult in stomach and intestine of fish
*S. sp.	Adult in digestive tract
*Thynnascaris brachyura	Adult in intestine
ACANTHOCEPHALA	
Echinorhynchus salmonis	Larvae in amphipods; second intermediate host, Osmerus
*Leptorhynchoides thecatus	Larvae in amphipods; if less than 30 days a small fish may be second intermediate host; larvae may be encysted in mesenteries of this fish; adult in intestine of this fish
Metechinorhynchus salmonis	Adult in intestine
*M. sp.	Adult in intestine
*Neoechinorhynchus crassus	Adult in intestine
†N. cylindratum	Larvae in crustacea and fish
*N. sp.	Adult in intestine
†N. tenellum	Larvae in crustacea and fish
Pomphorhynchus bulbocolli	Larvae in amphipod; small fish as second host
*P. sp.	Adult in digestive tract
OLIGOCHAETA	
Illinobdella moorei	Not available
*Macrobdella decora	Body surface
*Myzobdella moorei	Fins

†Myzobdella sp.	Not available
*Percymoorensis marmorata	Body surface
*Piscicola punctata	Body surface, gills
†Placobdella pediculata	Not available
CRUSTACEA	
†Argulus appendiculosus	Not available
A. biramosus	Not available
A. canadensis	Not available
†A. sp.	Not available
A. stizostethi	Not available
A. versicolor	Not available
†Ergasilus caeruleus	Gills
E. centrarchidarum	Not available
E. luciopercarum	Not available
†*E. sp.	Gills

Perca flavescens - *Yellow perch*

FUNGI	
Ichthyosporidium sp.	Internal organs
PROTOZOA	
Flagellata	
*Spironucleus sp.	Intestine
*Trypanosoma percae var canadensis	Blood
T. sp.	Blood
Ciliata	
Balantidium sp.	Intestine
Ichthyophthirius multifiliis	Body, gills
Trichodina sp.	Ureters

Coccidia	
*Eimeria laureleus	Intestine
*E. tedlai	Intestine
Myxosporida	
Henneguya doori	Gills
H. percae	Gills
*H. sp.	Gills
Myxidium percae	Subdermal
M. umbri	Renal tubules
Myxobilatus wisconsinensis	Urinary bladder
Myxobolus percae	Base of pectoral fin
Myxosoma neurophila	Brain
M. scleroperca	Sclerotic cartilage
MONOGENEA	
Cleidodiscus adspectus	Gills
C. sp.	Gills
*Gyrodactylidae gen. sp.	Gills
*Gyrodactyloidea gen. sp.	Gills, skin
Gyrodactylus freemani	Fins
Urocleidus adspectus	Gills
DIGENEA	
Asymphylodora amnicolae	Cercaria in snail, Amnicola; metacercaria progenesis in snail; adult in intestine
Azygia angusticauda	Adult in intestine and stomach
A. longa	Cercaria in snail, eaten; metacercaria in host fish or small carrier fish; adult in intestine and stomach
A. sp.	Cercaria in snail, eaten; metacercaria in small carrier fish

	or host fish; adult in host fish
Bucephaloides pusillus	Cercaria in clam; metacercaria in fish; adult in intestine of fish
Bucephalus elegans	Cercaria in clam; metacercaria in fish; adult in intestine of fish
Bunodera luciopercae	Cercaria in clam; metacercaria in crustacea, copepods and crayfish; adult in intestine and caeca
B. sacculata	Cercaria in clam; metacercaria in Cladocera, crayfish; adult in intestine
Centrovarium lobotes	Metacercaria in fish muscle; adult gastrointestinal
Crepidostomum cooperi	Cercaria in clam; metacercaria in insect or crustacea
C. farionis	Cercaria in clam; metacercaria in mayfly nymphs and Gammarus; adult in gall bladder
Cryptogonimus chyli	Metacercaria in fish muscle; adult gastrointestinal
*Leuceruthrus sp.	Adult in digestive tract
*Microphallidae gen. sp.	Not available
Microphallus opacus	Metacercaria in crayfish
Phyllodistomum americanum	Cercaria in clam; metacercaria in arthropods, sporocyst in clam; adult in urinary bladder
P. superbum	Cercaria in clam; metacercaria in sporocysts in clam, arthropods; adult in urinary bladder, ureters
Sanguinicola occidentalis	Cercaria in snail; no second host; adult in blood vessel
DIGENEA METACERCARIA	
Apophallus brevis	Metacercaria in skin, fins, gills, musculature

Apophallus itascensis	Metacercaria in muscle of fish shaped like balloon tire; adult unknown
*A. venustus	Metacercaria in musculature
*Clinostomum complanatum	Metacercaria in gills, musculature
†C. marginatum	Cercaria in snail, Helisoma; metacercaria in fish as yellow grub; adult in mouth, esophagus of heron
*C. sp.	Metacercaria in musculature, viscera
Crassiphiala bulboglossa	Metacercaria in fins, integument of this fish as black spot; adult in kingfisher
Diplostomulum flexicaudum	Cercaria in snail; metacercaria in lens of fish; adult in gulls, other birds
D. scheuringi	Cercaria in snail, Helisoma; metacercaria in vitreous chamber and brain of fish and newts
D. of Diplostomum huronense	Snail not known; metacercaria in lens and vitreous chamber; adult in gulls
Diplostomum adamsi	Cercaria in snail, Lymnaea; metacercaria in periphery of retina of fish; adult experimentally in gull
*D. spathaceum huronense	Metacercaria in eye
*D. sp.	Metacercaria in eye
Echinochasmus donaldsoni	Cercaria in snail; metacercaria in gills; adult in grebes
Euparyphium melis	Cercaria in snail; metacercaria in nares and cloaca of fish; adult in mink
*Metorchis conjunctus	Metacercaria in musculature
Neascus ellipticus	Metacercaria as non-pigmented muscle cyst
N. longicallis	Metacercaria as pigmented cyst in skin

Neascus pyriformis	Metacercaria as pigmented cyst in skin
†N. sp.	Metacercaria in fins, flesh, integument, eye socket, cranial cavity, mesentery, peritoneum of gut of this fish
N. of Crassiphiala bulboglossa	Cercaria in snail, Helisoma; metacercaria in fish as black spot skin cysts; adult in kingfisher
Ornithodiplostomum ptychocheilus	Cercaria in snail, Physa; adult in some ducks
Petasiger nitidus	Cercaria in Helisoma, eaten; metacercaria in fish; adult in intestine of this fish
*Posthodiplostomum minimum	Metacercaria in mesenteries, liver, kidney
*P. minimum centrarchi	Metacercaria in liver
*Rhipidocotyle papillosa	Metacercaria in musculature
Ribeiroia ondatrae	Cercaria in snail, Helisoma; metacercaria in lateral line of this fish; adult in osprey, hawks, muskrats
Tetracotyle diminuta	Metacercaria encysted in pericardial cavity and adipose tissue behind eye; adult reared in unfed chicks
*T. intermedia	Metacercaria in heart, mesenteries
†T. sp.	Metacercaria in mesenteries of fish; adult in birds
†*Uvulifer ambloplitis	Metacercaria in skin, musculature, fins, gills
CESTOIDEA	
Bothriocephalus cuspidatus	Procercoid in copepod; plerocercoid in small fish sometimes; adult in intestine
*B. sp.	Adult in pyloric caeca, intestine
*Corallobothrium sp.	Adult in intestine

Cyathocephalus truncatus	Procercoid in amphipod; plerocercoid in small fish; adult in pyloric caeca
Diphyllobothrium latum	Procercoid in copepod; plerocercoid in fish; adult in bear, dogs, man
Ligula intestinalis	Procercoid in copepod; plerocercoid in fish; adult in fish eating birds
Proteocephalus ambloplitis	Procercoid in crustacea; plerocercoid in small fish and mesenteries of this fish
P. pearsei	Procercoid in copepods; plerocercoids in many fish
P. pinguis	Procercoid in copepods; plerocercoids in fish
*Schistocephalus solidus	Plerocercoid in body cavity
Triaenophorus nodulosus	Procercoid in copepod; plerocercoid in forage fish and this fish; adult in Esox lucius
*T. sp.	Plerocercoid in musculature, liver, viscera
NEMATODA	
Camallanus oxycephalus	Larvae in copepod; adult in intestine, shows red from vent
*C. sp.	Not available
Capillaria catenata	Gut, liver, urinary bladder of vertebrates
†*Contracaecum sp.	Intestine, stomach, viscera, mesenteries, musculature
C. spiculigerum	Larvae in fish; adult in cormorants, mergansers, gulls, pelicans
*Cucullanellus cotylophora	Adult in intestine
Dacnitoides cotylophora	Adult in intestine
Dichelyne cotylophora	Adult in intestine

Eustrongylides sp.	Larvae in fish as cysts attached to viscera
Philometra cylindracea	Larvae in copepods; adult in fish tissue
P. sp.	Larvae in copepods; adult in fish tissue
Rhabdochona cascadilla	Larvae probably in Hyallela (amphipod); adult in intestine
*R. ovifilamenta	Adult in intestine
R. sp.	Larvae in aquatic insects
*Raphidascaris sp.	Adult in liver, digestive tract
Spinitectus carolini	Larvae in mayfly larvae; adult in stomach and intestine
S. gracilis	Larvae in mayfly larvae; adult in stomach and intestine
*S. sp.	Adult in digestive tract
*Spiroxys contortus	Larvae in intestinal serosa of fish
S. sp.	First host Cyclops; larvae in mesenteries of fish and amphibia, dragonfly nymphs, snails

ACANTHOCEPHALA

*Acanthocephalus jacksoni	Adult in intestine
A. lateralis	Larvae in Asellus and Gammarus
Echinorhynchus leidyi	Larvae in amphipods
E. salmonis	Larvae in amphipods; second intermediate host, Osmerus
Leptorhynchoides thecatum	Larvae in amphipod; if less than 30 days, small fish may be second intermediate host
*Metechinorhynchus salmonis	Adult in intestine
Neoechinorhynchus cylindratum	Larvae in crustacea and fish; adult in intestine
*N. pungitius	Adult in stomach, intestine

Neoechinorhynchus rutili	Larvae in crustacea and fish; adult in intestine
*N. sp.	Intestine
Pomphorhynchus bulbocolli	Larvae in amphipod, small fish and this fish
OLIGOCHAETA	
Actinobdella sp.	Not available
*Illinobdella alba	Body surface
I. moorei	Not available
I. sp.	Fins
*Myzobdella moorei	Fins
Piscicolaria sp.	Not available
*Piscicola punctata	Body surface, gills
*P. sp.	Body surface
*Placobdella parasitica	Body surface
CRUSTACEA	
Argulus appendiculosus	Not available
A. biramosus	Not available
A. canadensis	Fins
*A. stizostethi	Body surface, fins
Ergasilus caeruleus	Gills
*E. centrarchidarum	Gills
E. confusus	Not available
*E. luciopercarum	Gills
*E. sp.	Gills
ARTHROPODA	
*Hydrachna sp.	Larvae on gills
Hydrozetes sp.	Gills, nonparasitic

SCIAENIDAE

Aplodinotus grunniens - *Freshwater drum*

PROTOZOA	
Ciliata	
Ichthyophthirius multifiliis	Not available
Myxosporida	
Myxidium macrocapsulare	Gall bladder
Myxobilatus caudalis	Urinary bladder
MONOGENEA	
Cotylogaster occidentalis	Intestine
Lintaxine cokeri	Gills
Microcotyle eriensis	Gills
M. spinicirrus	Gills
DIGENEA	
*Bunodera luciopercae	Intestine
Centrovarium lobotes	Metacercaria in fish muscle; adult in stomach and small intestine
*Crepidostomum sp.	Intestine, gall bladder
*Homalometron armatum	Intestine
H. grunniens	Metacercaria in clams; adult in intestine
Microcreadium parvum	Cercaria in snail; adult in intestine
Phyllodistomum fausti	Cercaria in clam; metacercaria in sporocysts in clam, arthropods; adult in urinary bladder
P. sp.	Cercaria in clam; metacercaria in sporocysts in clams or arthropods

Sanguinicola sp.	Cercaria in snail; adult in blood vessels
DIGENEA METACERCARIA	
Clinostomum marginatum	Cercaria in snail, Helisoma; metacercaria in fish as yellow grub; adult in mouth, esophagus of heron
*Neascus sp.	Metacercaria in mesenteries, gills, skin
*Tetracotyle sp.	Metacercaria in heart, pericardium, mesenteries, kidney, musculature
CESTOIDEA	
Bothriocephalus claviceps	Intestine
B. cuspidatus	Pyloric caeca, intestine
Proteocephalus pearsei	Intestine
NEMATODA	
Camallanus oxycephalus	Larvae in copepods; adult intestine seen as red from anus
*Cucullanellus cotylophora	Intestine
Cystidicola serratus	Intestine
*Philometra cylindracea	Peritoneum, body cavity
P. sp.	Larvae in copepods; adult in fish tissue
Spinitectus gracilis	Larvae in mayfly larvae; adult in stomach and intestine
ACANTHOCEPHALA	
Leptorhynchoides thecatum	Larvae in amphipod; if less than 30 days intermediate host may be small fish
Pomphorhynchus bulbocolli	Larvae in amphipod; intermediate host, small fish

OLIGOCHAETA	
Illinobdella sp.	Not available
*Piscicola punctata	Body surface, gills
CRUSTACEA	
Argulus appendiculosus	Fins

COTTIDAE

Myoxocephalus octodecemspinosus - *Longhorn sculpin*

PROTOZOA	
Flagellata	
Trypanosoma sp.	Blood
Coccidia	
Haemogregarina myoxocephali	In blood cells
Myxosporida	
Myxidium myoxocephali	Gall bladder
DIGENEA METACERCARIA	
Clinostomum marginatum	Cercaria in snail, Helisoma; metacercaria in fish as yellow grub; adult in mouth, esophagus of heron
CESTOIDEA	
Eubothrium crassum	Procercoid in copepods; no second host required; adult in intestine of fish

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