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# A ~~PARASITE~~ SURVEY OF COMMON FISHES OF THE MISSOURI RIVER

Helminth Parasites of

A Thesis For Honors Recognition Submitted To The Department of Biology

by

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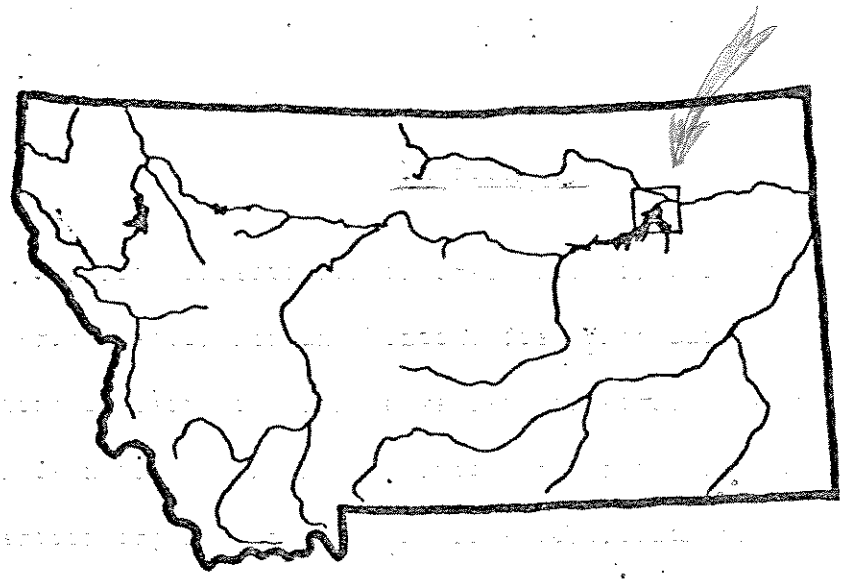
## Introduction

Parasite infestation of freshwater fish is encountered by the fisheries researcher and Montana fishermen alike. Frequently in the routine dressing of fish, a variety of worms or wormlike organisms will be noticed. It is not uncommon for the fisherman to recognize a certain organism repeatedly in a particular species of fish.

No comprehensive parasite surveys have been published on Montana fishes. Some parasite information is available on salmoniform species in western Montana (Benson, 1961; Fox, 1962, 1965; Johnson, 1965; Mitchell, 1968; Canaris and Newell, 1969; Lockard, 1974). Three studies have also been conducted investigating particular parasites (Fox and Olson, 1965; Olson, 1965; Mitchell, 1970). After a careful review of these studies it was apparent that a parasite survey of fishes from the eastern slope and particularly the Missouri River drainage was lacking. Consequently an investigation of fish parasitism in the Missouri River would be original and useful.

This study is a survey of helminth parasites taken from common fish species of the Missouri River. The study site is located in northeast Montana, five kilometers downstream from Fort Peck Dam (see figure 1). Water is released from Fort Peck Reservoir through a hydroelectric plant situated below the dam, and continues downstream as the Missouri River.



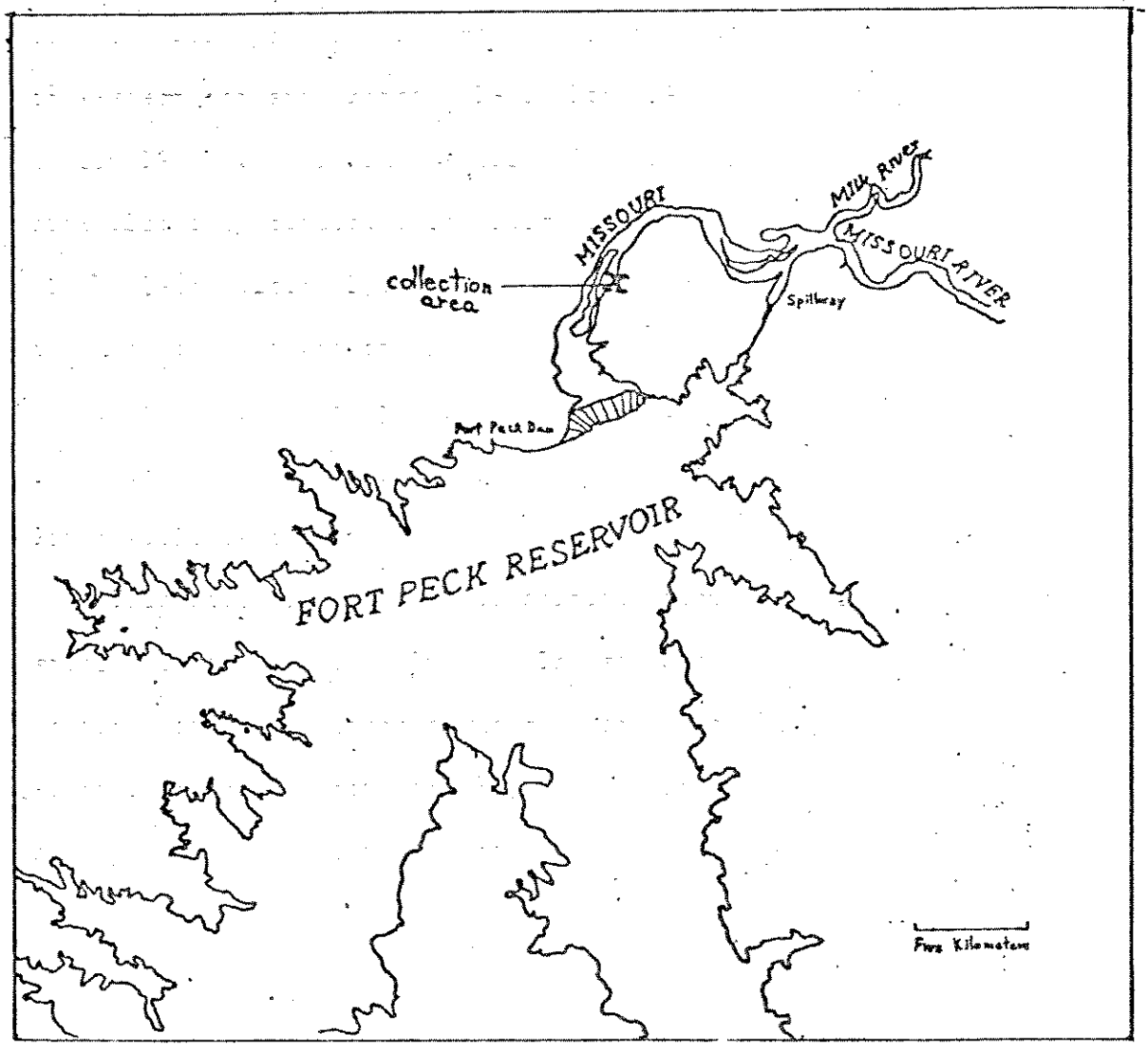



Figure 1. Map Showing The Study Site And Surrounding Area, Fort Peck Reservoir And Missouri River, Montana, 1975. (Map Drawn By Andrew Jordan).

The river at the study site has a slow moving current, is approximately three-fourths of a mile wide, and is bordered on both sides by high banks.

The objectives of this ~~thesis~~ study are:

1. To sample common fish species of the Missouri River below Fort Peck Reservoir, and collect, and preserve, and identify all helminth parasitic organisms ~~associated~~ found with these fish.
2. To examine all parasite collections and whenever possible taxonomically identify individual specimens.
3. To determine host susceptibility to parasitic types.

## Materials and Methods

Fish and parasite collections were made from July 29 to August 26, 1975. All fish were collected by experimental gill net with the exception of two Aplodinotus grunniens (Freshwater drum), one Carpiodes carpio (River carpsucker) and one Cycleptus elongatus (Blue sucker), which were taken by bow and arrow. The ~~nylon~~ gill net was 38.1 meters long by 1.8 meters wide and divided into five panels, each 7.6 meters in length. Successive panels had square mesh sizes of 1.27, 2.54, 3.81, 4.44, and 5.08 centimenters. The bow and arrow was used on one occasion to collect larger fish which swim in shallow water. A fifty pound test bow was used with regular fiberglass fishing arrows. The steel arrow tips were equipped with two barbs.

~~The gill net was set~~ on the river bottom at a depth of 9.4 meters. It was oriented perpendicular to the bank because fish generally tend to follow the shoreline while feeding. The gill net was left in the water from approximately 5 p.m. till 9 a.m. the following morning. All fish were placed in tubs with fresh water and examined that day. The species of fish collected were identified using a standard taxonomic key (Eddy, 1969). I found it best to examine the fish alive or as fresh as possible. Fresh fish are limber, making incisions and probing much easier. In addition, it has been reported that several species of parasites will leave a dead host and seek others (Hoffman, 1967).

Field collections were examined utilizing a three fold approach. First, the external skin and gills were examined by either a hand lens or 40X binocular dissection microscope. Second, the body cavity and mesentaries were examined by hand lens following a midventral incision from the anus to the anterior end of the body cavity. All mesentaries and organ surfaces were examined. Lastly, the digestive tract was examined by an incision opening the alimentary canal from the anus to the middle of the esophagus. The contents were examined in situ by hand lens and/or suspended in water and viewed through a binocular dissection microscope.

All parasitic helminths or helminthlike organisms were picked from their surroundings by a forceps and placed in a 9 mililiter vial containing 10% formalin solution. The vials were stoppered, labeled, and stored for later identification under laboratory conditions. It was often necessary to remove fish tissue with the parasites due to their firmness of attachment. The attachment organ of some parasites is critical for their identification (i.e., Tapeworm scolex).

Standard taxonomic keys were utilized in the identification of parasites. Especially helpful was Hoffman's text dealing with North American fish parasites (Hoffman, 1967). Other texts and journals were also referred to for detailed descriptions of parasites (Hegner, 1946; Cook, 1954; Northcote, 1957; Hugghins, 1959; Jones and Stefanich, 1966). The

40X binocular dissection microscope was used extensively in these identifications with frequent use also of a standard laboratory microscope with 100X and 430X objectives.

## Results

A total of 164 fish representing ten species were collected (see table 1). All fish were examined externally with 6.1% (10/164) showing some degree of external parasitism. Of the 125 fish examined internally, 60.8% (76/125) showed internal parasitism. Overall helminth parasitism thus occured in 52.4% (86/164) of the fish inspected (see table 2).

From the 86 fish parasitized, twelve different genera of parasites were identified. The helminth parasites included representatives of three major types: Cestoda (Tapeworms), Nematoda (Roundworms) and Hirudinea (Leeches). Cestodes were most frequently encountered with 44.8% (56/125) infestation, followed by 8.8% (11/125) Nematoda, and 6.1% (10/164) Hirudinea infestation.

Six of the ten species of fish examined exhibited some type of parasitism. Four of the six parasitized species showed ~~common~~ susceptibility to Cestoda, these included Hiodon alosoides (Goldeye), Stizostedion canadense (Sauger), Scaphirhynchus platorynchus (Shovelnose sturgeon) and Ictiobus bubalus, (Smallmouth buffaloe). Four of the six parasitized species also showed host susceptibility to Nematoda and Hirudinea. Nematodes were collected from Hiodon alosoides, Stizostedion canadense, Scaphirhynchus platorynchus and Ictalarus punctatus (Channel catfish). Hirudines were found on Stizostedion canadense, Ictiobus bubalus, Icta-

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Table 1. Common And Scientific Names, And Number Of Each Species Of Fish Collected From The Missouri River, Montana, 1975.

| Scientific name (Common name) | Number Collected |
|---|---|
| Hiodon alosoides Rafinesque (Goldeye) | 127 |
| Stizostedion canadense Smith (Sauger) | 15 |
| Scaphirhynchus platorynchus Rafinesque (Shovelnose Sturgeon) | 7 |
| Ictiobus bubalus Rafinesque (Smallmouth buffaloe) | 4 |
| Ictalurus punctatus Rafinesque (Channel catfish) | 2 |
| Carpiodes carpio Rafinesque (River carpsucker) | 2 |
| Aplodinotus grunniens Rafinesque (Freshwater drum) | 2 |
| Perca flavescens Mitchill (Yellow perch) | 2 |
| Cyprinus carpio Linnaeus (Carp) | 2 |
| Cycleptus elongatus Lesueur (Blue sucker) | 1 |
| Total | 164 |

Table 2. Incidence Of Infestation For Each Species Of Fish Examined. Percentage Includes All Parasite Types.

| Name | No. infested/No. examined | % infestation |
|---|---|---|
| Hiodon alosoides (Rafinesque) | 64/127 | 50.4 |
| Stizostedion canadense | 9/15 | 60.0 |
| Scaphirhynchus platorynchus | 7/7 | 100.0 |
| Ictiobus bubalus | 3/4 | 75.0 |
| Ictalarus punctatus | 2/2 | 100.0 |
| Aplodinotus grunniens | 1/2 | 50.0 |
| Carpiodes carpio | 0/2 | 0.0 |
| Perca flavescens | 0/2 | 0.0 |
| Cyprinus carpio | 0/2 | 0.0 |
| Cycleptus elongatus | 0/1 | 0.0 |
| Total | 84/164 | 52.4 |

laras punctatus, and Aplodinotus grunniens(Freshwater drum). Two species of fish showed common susceptibility to a particular genus of parasite. The leech Illinobdella was found on 100% (2/2) of the Ictalarus punctatus and 50% (1/2) of the Aplodinotus grunniens. Stizostedion canadense is the only species of fish which showed host susceptibility to all three major types of parasites.

Below is a summary of each species of fish and the parasites found within that species. My identification of parasites was based primarily on gross morphological differences which could be observed with good magnification of the specimen. I found that the taxonomic keys carried these gross morphological differences down to the family and genus for most parasites. In many cases it was not possible to identify the parasite down to its species. The reason is because the taxonomic keys seldom presented detailed descriptions for the distinction of species within a genus. In many cases I offer a "possible species". This is based on previous research in which the same species of parasite was discovered in that species of fish, or on a likeness of a drawing of the parasite.

Also included in each summary are one or two morphological characteristics of the parasites which were particularly helpful in its classification, the percentage of fish infested with that parasite, and the anatomical regions of the fish where the parasites were found.

## SUMMARY

Hiodon alosoides (Goldeye) Total of 127 collected, all examined externally, 90 examined internally.

I. Class: Cestoda
Order: Pseudophyllidea
Family: Amphicotylidae
Genus: Marisopometra sp.

Characteristics: Scolex approximately pyramidal or arrow shaped, neck with or without zone of proliferation

Percentage: 42.2% (38/90)

Region: Intestine

II. Class: Cestoda
Order: Pseudophyllidea
Family: Amphicotylidae
Genus: Eubothrium sp.

Characteristics: Scolex subglobular to elongate, often deformed with simple bothria (longitudinal suctorial grooves)

Neck lacking

Percentage: 6.6% (6/90)

Region: Stomach

III. Class: Cestoda
Order: Pseudophyllidea
Family: Bothriocephalidae
Genus: Bothriocephalus taxomensis. This is a possible species based on J. T. Self finding this parasite in Hiodon alosoides in 1954 (Hoffman, 1967).

Characteristics: Marginal surface of scolex convex or concave

Proglottides campanulate, anapolytic; anterior ones bell or funnel-shaped, posterior ones rectangular.

Percentage: 3.3% (3/90)

Region: Stomach and anus.

IV. Class: Nematoda
Order: Spiruridea
Family: Camallanidae
Genus: Camallanus oxycephalus. This is a possible species based on J. D. Anthony finding this parasite in Hiodon alosoides in 1963 (Hoffman, 1967).

Characteristics: Mouth slitlike; buccal capsule with two lateral chitinous valves

Bright red nematode often seen hanging from anus of fish

Percentage: 1.1% (1/90)

Region: Anus

Stizostedion canadense (Sauger) Total of 15 collected, all examined externally, 13 examined internally.

I. Class: Cestoda
Order: Pseudophyllidea
Family: Triaenophorus stizostedionis. This is a possible species based on R. V. Bangham finding this parasite in Stizostedion vitreum (Walleye pike) in 1955 (Hoffman, 1967).

Characteristics: Scolex with dorsal and ventral pair of trident-shaped hooks on apical disc

Percentage: 7.7% (1/13)

Region: Stomach

II. Class: Hirudinea
Order: Rhynchobdellida
Family: Piscicolidae
Genus: Piscicola punctata. This is a possible species based on J. P. Moore finding this parasite on Stizostedion canadense in 1924 (Hoffman, 1967).

Characteristics: Body at rest cylindrical

Body not clearly divided into anterior and posterior regions

Percentage: 38.5% (5/13)

Region: Floor of mouth (attached)

III. Class: Nematoda
Order: Filariidea
Family: Filarioidea
Genus: Pholometra sp.

Characteristics: Body filiform

Anterior and posterior extremities rounded

Percentage: 7.7% (1/13)

Region: Mesogaster (Mesentary which suspends the stomach)

Scaphirhynchus platorynchus (Shovelnose sturgeon) Total of 7 collected all examined externally and internally.

I. Class: Cestoda
Order: Pseudophyllidea
Family: Bothriocephalidae
Genus: ?

Characteristics: Scolex sometimes spherical club or heart-shaped.

Percentage 100% (7/7)

Region: Small intestine

II. Class: Nematoda
Order: Ascaridea
Family: Ascaroidea
Genus: Ascaris scaphirhynchi. This is a possible species based on A. S. Pearse finding this parasite in Scaphirhynchus platorynchus in 1924 (Hoffman, 1967).

Characteristics: Stout worms

Mouth usually with three lips

Percentage: 100% (7/7)

Region: Stomach

Ictiobus bubalus (Smallmouth buffaloe) Total of 4 collected, all examined externally and internally.

I. Class: Cestoda
Order: Caryophyllidea
Family: Caryophyllaeidae
Genus: Archigetes iowensis. A possible species based on likeness to drawing (Hoffman, 1967).

Characteristics: Scolex with suctorial grooves of different shapes

External segmentation of strobila not distinct

Percentage: 25% (1/4)

Region: Intestine

II. Class: Hirudinea
Order: Rhynchobdellida
Family: Glossiphoniidae
Genus: ?

Characteristics: Body not divided externally into distinct anterior and posterior regions

Body flattened and wider than head

Percentage: 50% (2/4)

Region: Caudal fin

Ictalarus punctatus (Channel catfish) Total of 2 collected, both examined externally and internally.

I. Class: Hirudinea
Order: Rhynchobdellida
Family: Piscicolidae
Genus: Illinobdella sp.

Characteristics: Both suckers much smaller than body diamater
Distinct anterior and posterior body regions

Percentage: 100% (2/2)

Region: Pectoral and pelvic fins

II. Class: Nematoda
Order: Spiruridea
Family: Cucullanidae
Genus: Dacnitoides robusta. A possible species based on similarity of diagram and Bangham finding this parasite in Ictalarus punctatus in 1942 (Hoffman, 1967).

Characteristics: Mouth lips not chitinized

Percentage: 100% (2/2)

Region: Stomach

Aplodinotus grunniens (Freshwater drum) Total of 2 collected, both examined externally and internally.

I. Class: Hirudinea
Order: Rhynchobdellida
Family: Piscicolidae
Genus: Illinobdella sp.

Characteristics: Both suckers much smaller than body diameter,
Distinct anterior and posterior body regions

Percentage: 50% (1/2)

Region: Pectoral fin

## Discussion

My results show the existence of a variety of parasites which infest common fishes of the Missouri River. The river is a productive fisheries area providing a good habitat for many species of fish. This study shows that these fish are being utilized as hosts by many parasite species for the completion of their life cycles.

Hiodon alosoides (Goldeye) were parasitized by the greatest number of different genera with four, with three of these genera being Cestodes. These results point to a marked host susceptibility which Hiodon alosoides has for Cestodes. Fifty-two percent (47/90) of the Hiodon alosoides examined internally carried Cestodes. This species of fish feeds primarily on plankton. Some of the planktonic organisms may be intermediate hosts of Cestode life cycles which would explain this high incidence of Cestode infestation. External parasites weren't detected in any of the Hiodon alosoides. This might be attributed to their surface feeding habits which allows little opportunity for bottom dwelling external parasites to attach.

Stizostedion canadense (Sauger) is the only species of fish in which parasites from all three major types were collected. This species was highly susceptible to Hirudinea (Leeches) with 38.5% (5/13). This was interesting because the Hirudines collected were all attached to the floor of the mouth rather than on the external skin or fins. At first this

phenomenon ~~seemed~~ appeared strange, but after having an opportunity to talk with several fishermen, it seems to be a common occurence. It is possible that Hirudinea are a food source for Stizostedion canadense, and frequently have the opportunity to attach to the mouth floor. Cestoda and Nematoda also parasitized Stizostedion canadense, each with 7.7% (1/13) infestation. Stizostedion canadense has a wide range of feeding habits which covers all strata of the water. This may account for the occurence of the three major types of parasites.

I felt very fortunate to have the chance to examine Scaphirhynchus platorynchus (Shovelnose sturgeon). This is an ancient fish which is moderately common in the Missouri River. Although not commonly caught by fishermen, this species was susceptible to night gill net placement. Heavy infestations of Cestodes (family Bothriocephalidae) and Nematodes (genus Ascaris) were found in the alimentary canal of individual fish. All seven Scaphirhynchus platorynchus were infested with both parasitic types. Although these fish are primarily bottom feeders, they may ingest copepods of the water column as part of their diet. It is known that copepods are intermediate hosts in many Cestode and Nematode life cycles (Hugghins, 1959). Although Scaphirhynchus platorynchus are bottom feeders, they are the only species besides Hiodon alosoides which were free of external parasites. The tough skin and scales of Scaphirhynchus platorynchus may make attachment difficult for external parasites.

Ictiobus bubalus (Smallmouth buffaloe), Ictalarus punctatus (Channel catfish) and Aplodinotus grunniens (Freshwater drum) exhibited a marked susceptibility to Hirudinea (Leeches) with 75% (6/8) infestation. These results would be expected in relation to the feeding habits of these fish. They are large in size and predominently bottom feeders which gives Hirudines the opportunity to attach to the skin and fins.

It is evident from this study that fish parasitism exists in the Missouri River. The results show the kind and diversity of helminth parasitism which exists for some fish species.

The determination of the exact causes of infestation in any species of fish would require in-depth research into the parasite's life cycle and the fish's life history. Improved dissecting and examination techniques, increased knowledge of larval forms, and greater familiarity with parasite morphology would be necessary in such an endeavor. In addition, laboratory facilities adequate for fish study, larger fish samples, and more manpower would be needed to gain greater insight into fish parasitism. There is a great amount of work and research which can and should be done on this topic. This added knowledge would increase our understanding of the condition of Montana fisheries and aid greatly in fisheries management.

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