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THE BASS TAPEWORM, PROTEOCEPHALUS AMBLOPLITIS, IN MICHIGAN BASS HATCHERIES AND REARING PONDS, WITH SUGGESTIONS FOR ITS CONTROL

by

Leonard N. Allison

Introduction

The bass tapeworm, *Proteocephalus ambloplitis*, occurs in four important game fish in Michigan; the largemouth bass, smallmouth bass, rock bass and bluegill. The first two named species harbor both the adult and larval tapeworm while the latter two species become infected only with the larvae and act as transfer hosts. Little or no damage to the transfer hosts has been reported but serious damage to the reproductive organs of large- and smallmouth bass is an established fact.

From a fish-cultural viewpoint, damage to the reproductive organs results in reduced fish production, and cases of complete sterilization of hatchery brood stock are on record. The larvae of this tapeworm do not encyst but wander around in the tissues of the internal organs. This frequently causes the internal organs of the host to "bunch" together into an indistinquishable mass, and they often become stained with a brown pigment.

From the fishermen's viewpoint, "wormy" fish are undesirable as food and many of the bass that fishermen bring home never reach the frying pan but are thrown away because they harbor a heavy infestation of the bass tapeworm larvae.

The present investigation was undertaken to determine the status of the bass tapeworm in bass hatcheries and rearing ponds in Michigan and to formulate, if possible, methods of control.

The lifecycle of the bass tapeworm may be summarized as follows:

(Read clockwise)

Large or adult bass (large- or smallmouth) (final host)
Carries adult tapeworm in small intestine

End segments of tapeworm, merely sacs of eggs, voided by bass, spray out the eggs as they settle thru the water.

Eggs eaten by certain copepods. (First intermediate host). If eggs are not eaten between 36 and 48 hours, they die.

Eggs hatch in gut of copepod and larvae (procercoids) burrow into body cavity and remain dormant until ---

Infected copepod is eaten by a small bass, any one of the sunfish family, perch or northern pike. (Second intermediate host). Larva (procercoid) burrows thru gut of fish into body cavity and internal organs (liver, testes and ovary). Is now called plerocercoid larva and continues to migrate in tissues, causing scar tissue to form adhesions and destroying eggs in the ovary.

Infected fish eaten by large- or smallmouth bass. Plerocercoid larva attaches to lining of small intestine and develops into an adult tapeworm.

A more complete account of the life history, importance to bass culture and control methods may be found in the Institute for Fisheries Research Report No. 714. The report just mentioned describes methods of control applied successfully in other states.

HILLSDALE REARING PONDS

July 3rd, 1942

These ponds were founded in December, 1933. Mr. James Scully has been superintendent continuously to September, 1942.

Species of fish:

Largemouth bass fry.
Bluegills.

Water Supply:

Water for the six ponds (total area of 42 acres) is obtained from several springs and from drainage of the surrounding hills. No chemical analysis was made.

Examination of fish:

Largemouth bass fry:

No. examined --------- 15
No. positive --------- 5

Disease problems: (as reported by Mr. James Scully)

None.

Comments:

The present stock of bass fry were collected from Bear, Wilson and Cub Lakes in Hillsdale County and were undoubtedly infected when collected. Had the fry been collected immediately after they left the nest and before they began to feed this infection could have been avoided.

These ponds are ideal for the rearing of bass free of the bass tapeworm provided the ponds are stocked with uninfected fry.
The ponds are dry from December to March every year.

ADRIAN REARING PONDS

July 3rd, 1942

Operation of these ponds began in 1925 and they are tended by local people.

Species of fish:

Largemouth bass, adults and fry.
Bluegills, adults and fry.

Water Supply:

Derived from spring two miles above ponds. The stream flows by the septic tank of the County Farm before emptying into the ponds. A heavy brown algae was in evidence at this time in many places in the bass pond.

A chemical analysis was not made.

Examination of fish:

Largemouth bass fry:

No. examined ---- 16
No. positive ---- 0

Largemouth bass adults:

Inaccessible --- not examined.

Disease problems: (as reported by local people)

None to date.

Comments:

The largemouth bass came from Hillsdale Rearing Ponds and are held in the same pond as the adults. The bass came originally from Cub Lake, Hillsdale County. The fact that no tapeworms were demonstrated here could be due to several conditions; (1) the presence of uninfected adults, (2) the absence of the intermediate host, (in both 1 and 2, the fry must have been collected before they ate infected copepods) and (3) examination of an insufficient number of fry to expose a light infection.

Bass could be reared here without danger of infection if they are uninfected when stocked. If the intermediate host is absent (more plankton samples should be taken to be sure it is absent) the fry may be safely held with infected adult bass. If the intermediate host is present, only uninfected adult bass should be held in the same pond with the fry.

WOLF LAKE STATE FISH HATCHERY

July 4th, 1942

Development of this hatchery began in 1928. Mr. Jay G. Marks has been superintendent continuously to date.

Species of fish:

Largemouth bass, adults and fry.
Smallmouth bass, adults and fry.
Bluegills, adults and fry.
Brook trout, adults and fry.
Brown trout, adults and fry.
Rainbow trout, adults and fry.
(See diagram for allocation of fish in ponds).

Water Supply:

Water is supplied by three springs and by pumping from Wolf Lake. The chemistry of the water is as follows:

#1 spring
Air 68° F.; water 59° F.

O_2 ----	10.0 ppm
CO_2 ----	0.0 ppm
ph-th ----	0.0 ppm
MO ----	180.0 ppm
pH ----	8.0

#2 spring
Air 64° F.; water 64° F.

O_2 ----	4.5 ppm
CO_2 ----	4.0 ppm
ph-th ----	0.0 ppm
MO ----	154.0 ppm
pH ----	7.6

#3 spring
Air 68° F.; water 56° F.

O_2 ----	9.0 ppm
CO_2 ----	0.0 ppm
ph-th ----	0.0 ppm
MO ----	130.0 ppm
pH ----	9.0

Wolf Lake at pump house.
Air 68° F.; water 72° F.

O_2 ----	8.4 ppm
CO_2 ----	0.0 ppm
ph-th ----	0.0 ppm
MO ----	150.0 ppm
pH ----	8.2

See diagram for circulation of water.

Examination of fish:

Fry:

Pond #10. Largemouth fry from Wolf Lake, Van Buren Co.

No. examined ---- 20
No. positive ---- 0

Pond #16. Largemouth fry from Muskrat Lake, Van Buren Co.

No. examined ---- 20
No. positive ---- 17

Pond #18. Smallmouth fry from Pond #19, Wolf Lake breeders.

No. examined ---- 22
No. positive ---- 9

Pond #23. Smallmouth fry from Lydell Hatchery.

No. examined ---- 20
No. positive ---- 7

Adults:

Pond #13. Largemouth bass, Wolf Lake Stock.

No. examined ---- 1 female.
Many larvae present; no adult tapeworms found.

Pond #14. Largemouth bass, Wolf Lake Stock.

No. examined ---- 1 female, 1 male.
Heavy infestation with larvae; no adult tapeworms found.

Pond #19. Smallmouth bass, Wolf Lake Stock.

No. examined ---- 2 females.
Heavy infestation with larvae; no adult tapeworms found.

Wolf Lake Fish:

Smallmouth bass:

2 males examined; heavy infestation with larvae, several adult tapeworms found.

Largemouth bass:

1 male, 1 female; heavy infestation with larvae, several adult tapeworms found.

Yellow perch:

1 examined ---- larvae present.

Pumpkinseed sunfish:

2 examined ---- larvae present.

Bluegill:

2 examined ---- larvae present.

Rock bass:

1 examined ---- larvae present.

Disease problems: (as reported by J. G. Marks)

No major problems.
Salt treatment, external and internal, successful.
No prophylaxis.

Comments:

In the examination of fish from various ponds (not all ponds were examined), pond #10 (largemouth fry from Wolf Lake) was the only one in which no infections were found among a random sample of 20 fry. Although the sample was too small to permit definite conclusions, it will be noted that the fry were obtained from Wolf Lake which does support a population of heavily infected fish. Apparently, the fry were transferred before acquiring an infection. From the diagram of the allocation of bass and the circulation of water, it will also be noted that water is supplied to pond #10 from #1 spring through a 16" log pipe from the hatchery building as well as through ponds #4, #5, #7 and #11. The latter ponds contain no bass. Water from Wolf Lake is pumped into pond #6 and dispensed from there. Although water from pond #6 may pass through pond #11 into pond #10, it is probable that most of it goes into ponds #12 and #15 since pond #10 is amply supplied by #1 spring. Thus the possibility of pond #10 being infected by water from Wolf Lake would be slight. It is unfortunate that fry from pond #21 were not examined because this is the only pond containing bass fry that has no connection with water from Wolf Lake.

The bass tapeworm could be eliminated from Wolf Lake Hatchery by certain adjustments in management practices. Wolf Lake, which serves as one source of water supply, contains fish that are very heavily infected with the bass tapeworm and infected copepods, the first intermediate host of the bass tapeworm, could easily be carried into the hatchery in this water. In order to free this water of infected copepods, a sand filter would have to be installed. Water from the three springs needs no such treatment as the springs do not contain bass that might carry the infection.

Although infected, the breeder bass now present in the hatchery could be used for propagation, provided that certain precautions were observed. First, to prevent the spread of the infected intermediate host, they should be held only in ponds that empty either directly into Wolf Lake or into other series of ponds that contain no bass or bluegills. Second, the fry should be removed from the spawning ponds before they begin to feed to lessen the possibility of infection. Some uninfected fry should be held for future use as breeders.

Bass fry could be collected from lakes and be brought into the ponds, provided they were taken before they had begun to feed. Fry older than this should not be brought into the hatchery unless held in such ponds that empty into ponds containing infected brood stock bass or empty directly into Wolf Lake. If examination reveals the presence of the bass tapeworm in the fry, these fry should be planted only in lakes where the infection is known to be heavy.

In a discussion with Mr. Jay Marks it was decided that, for the present time, and until a sand filter can be established for the water from Wolf Lake, the management would remain as before except that bass fry would be taken before they began to feed in all cases and uninfected fry would be used to stock pond #21. The Almena ponds would also be stocked with uninfected fry and as many as possible of these fry would be wintered at Wolf Lake Hatchery in ponds 20, 21, 2, 3, 4, and 5, provided a check in the fall shows they are uninfected. These bass would be reared for use as uninfected breeders.

All bass ponds at the hatchery, except #20, #21, #22, #23, and outlying ponds are dried down in winter. #20, #21, #22, and #23 are used as winter holding ponds for bass and bluegills.

ALMENA PONDS.

The station at Almena consists of five ponds for bass in series and eight raceways for trout, all supplied with water from Haden Creek, which is a small stream containing no black bass.

The chemistry of Haden Creek water at the reservoir pond is as follows:

Air 73° F.; water 64° F.

O_2	----	8.4 ppm
CO_2	----	0.4 ppm
ph-th	----	0.0 ppm
MO	----	162.0 ppm
pH	----	7.4

Examination of fish:

#1	No. examined ----	20
	No. positive ----	0
#2	No. examined ----	10
	No. positive ----	0
#4	No. examined ----	20
	No. positive ----	20
#5	No. examined ----	20
	No. positive ----	18

Smallmouth fry from Lydell Hatchery in ponds #1 and #2 apparently were transferred before they had acquired an infection with bass tapeworm larvae, and since the stream supplying the ponds contains no bass, they did not become infected. The largemouth fry from Muskrat Lake, Van Buren Co., may have been infected before they were removed from the lake, or they may have acquired the tapeworm larvae through infected copepods carried to them from pond #3 which contains largemouth breeders. However, specimens of the adult largemough bass in pond #3 could not be collected for examination at this time. Specimens were to be collected for examination when the ponds were drained in the fall. If it is necessary to hold infected breeders here, they should be held only in the tail pond of the series (#5).

CRUM PONDS

This station consists of two ponds in series supplied from the stream connecting Gull Lake, Kalamazoo Co. with the Kalamazoo River. There are several small lakes between the ponds and Gull Lake. Gull Lake, the small lakes and stream all contain both large and smallmouth bass. Both rearing ponds contain smallmouth bass from Wolf Lake Hatchery. The chemistry of the water was not taken.

Examination of fish:

Pond #1 --- could not collect.

Pond #2 --- No. examined --- 20
No. positive --- 5

Comments:

Since the stream supplying the ponds contains adult bass and the lakes drained by the stream also contain bass, an infection from such fish could easily be carried into the ponds. The only method of eliminating the possibility of infection would be the installation of a sand filter at the head of the ponds.

KIBBEE POND

Not visited. It is a small pond supplied by springs and containing smallmouth fry from pond #19, Wolf Lake Hatchery. Kibbee Pond would be ideal for the rearing of uninfected bass, provided it were stocked with uninfected fry.

BENTON HARBOR FISH HATCHERY

July 5th, 1942

Mr. H. L. Thompson was the superintendent until September, 1942, when Mr. James Scully took over.

Species of fish:

Walleyed pike, fry.
Largemouth bass, adults and fry.
Brook trout.
Brown trout.
Rainbow trout.

See diagram for distribution.

Water Supply:

Blue Creek:

Only a part of this stream is necessary to supply four trout ponds in series. The chemical analysis taken at the head of the ponds is as follows:

Air 75° F.; Water 64° F.

O_2	----	7.9 ppm
CO_2	----	2.0 ppm
ph-th	----	0.0 ppm
MO	----	172.0 ppm
pH	----	8.0

Makers Creek:

Supplies one trout pond and two connected largemouth bass ponds. Entire volume of stream is used, and hatchery ponds are arranged in series. The chemical analysis taken at the head of the pond is as follows:

Air 75° F.; water 68° F.

O_2	----	11.4 ppm
CO_2	----	0.0 ppm
ph-th	----	4.0 ppm
MO	----	169.0 ppm
pH	----	8.2

Webber's Creek:

Supplies one bass pond and one walleyed pike pond connected in series. Entire volume of stream used. The chemical analysis is as follows:

Air 75° F.; water 64° F.

O_2	----	7.5 ppm
CO_2	----	0.0 ppm
ph-th	----	0.0 ppm
MO	----	123.0 ppm
pH	----	8.2

See diagram for circulation of water.

Examination of fish:

Adults:

Largemouth bass

1 male ---- one larvae, no adults.

Fry:

Largemouth bass- (Originally from Paw Paw Lake, Berrien Co.)

No. examined ---- 20
No. positive ---- 20

Disease problems: (as reported by Mr. Harold Thompson)

Bass --- none

Trout --- Ithchyophthirius successfully treated with NaCl and swift water. Fin rot occurs occasionally during higher water temperatures. Gill lice successfully treated with lysol (1/1000) for three minutes.

Prophylaxis:

One tablespoon full of NaCl per quart of feed given every Monday.
Fish are not fed on Sunday, to rest them.
Lysol is used for tools.

Comments:

Largemouth bass spawn in the ponds supplied by Webber's Creek and Maker's Creek and are not removed from the ponds. This procedure gives the bass

tapeworm opportunity to be transferred to the fry, provided the proper intermediate host is present. The largemouth bass breeders in this hatchery should be held and bred in what is now the pond containing walleyed pike and supplied with water from Webber's Creek. The fry should be collected as soon as possible after hatching and transferred to the upper pond of the Webber's Creek series and to the ponds of the Maker's Creek series. The lower pond of the Maker's Creek series should be used only for rearing because the low water temperature retards the spawning.

In a conference with Mr. James Scully, it was decided that the present management practices would continue until uninfected breeder bass could be obtained because the limited number of ponds makes it necessary to hold breeders and fry together.

STATE FISH HATCHERY

Hastings, Michigan

July 7th, 1942

John Brass, Superintendent, from 1930 to 1942.

Robert Fortney, present Superintendent.

Species of fish:

Bluegills, adults and fry.
Largemouth bass, adults and fry.
Smallmouth bass, adults and fry.

See diagram for allocation of fish in ponds.

Water Supply:

The water is taken directly from West Creek. Circulation of the water through the ponds is in series. (See diagram).

Chemical analysis of water from West Creek taken from pond #3:

Air 64° F.; water 58° F.

O_2	----	8.6 ppm
CO_2	----	0.0 ppm
ph-th	----	0.0 ppm
MO	----	214.0 ppm
pH	----	8.2

Examination of fish for bass tapeworm:

Adults:

Pond #2. Smallmouth bass:

Two females --- larvae and adults in both (very heavy).

Pond #3. Smallmouth bass:

One male and one female --- larvae and adults in both (very heavy).

Fry:

Pond #1. Smallmouth bass:

No. examined --- 20
No. positive --- 20

Pond #7. Smallmouth bass:

No. examined --- 20
No. positive --- 7

Pond #8. Smallmouth bass:

No. examined --- 20
No. positive --- 1

Pond #9. Largemouth bass:

No. examined --- 20
No. positive --- 1

Disease problems: (as reported by Ira Schultz)

None.
No prophylaxis

Comments:

The adult bass examined carried a very heavy infestation of the bass tapeworm, both larvae and adults. Since the fry also were found to contain larvae, the intermediate copepod host is present. Infected breeders could be held at the hatchery without danger of infecting other hatchery fish by holding them in ponds #1, #10, #11 and #12. The fry should be removed from these ponds immediately following hatching and placed in rearing ponds. The ponds which now contain the infected adult bass should be dried down for the winter to eliminate the intermediate copepod host. It is unfortunate that the water supply for the ponds enters through pond #3 which contains infected bass.

Breeders are held over winter in pond #3 at the present time. If hatchery conditions are such that they must be over-wintered in pond #3, they should be removed to breeding ponds early in the spring. The spawning ponds should be at the end of the series, #1, #10, #11, and #12. The fry should be removed from the spawning ponds before they begin to feed. No adult bass should be held at any time in ponds higher in the series than those containing fry.

Mr. Robert Fortney has moved the breeder bass into pond #1 since this study was made. He plans to keep them there and transfer the fry to ponds high in the series before they have had opportunity to feed in the spawning pond. A considerable number (exact number to be determined at a later date) will be reared to adults for use as uninfected breeders.

BATES' PONDS:

These ponds are stocked with largemouth bass fry from Clear, Carter, Taggert and Gurnsey Lakes. No fish collection was made here but a sample is to be sent in for examination when the fish are planted.

The water is derived from a large spring. The chemical analysis of the water is as follows:

Air 68° F.; Water 50° F.

O_2 ----	6.0 ppm
CO_2 ----	8.0 ppm
ph-th ----	0.0 ppm
MO ----	200.0 ppm
pH ----	7.6

Comments:

These ponds would be ideal for the rearing of large- and smallmouth bass provided they were dried down during winter and stocked with uninfected fry in the spring.

COOK'S PONDS:

These ponds are stocked with largemouth fry from Clear, Carter, Taggert and Gurnsey Lakes. The water is supplied by a small stream.

The chemical analysis of the water is as follows:

Air 66° F.; Water 69° F.

O_2 -----	11.5 ppm
CO_2 -----	0.0 ppm
ph-th -----	6.0 ppm
MO -----	160.0 ppm
pH -----	8.3

Examination of fish:

Largemouth bass fry:

No. examined ----	20
No. positive ----	3

Comments:

Bass uninfected with the bass tapeworm could be reared here provided uninfected fry were stocked. Drying down during winter would aid in eliminating copepod hosts to minimize transfer of the tapeworm if infected fish did get in.

LYDELL STATE FISH HATCHERY

Comstock Park,

Michigan

July 8th, 1942

Claude Lydell is the present superintendent.

Species of fish:

Large- and smallmouth bass, adults and fry.
Bluegills, adults and fry.
Walleyed pike, fry
Golden shiners, fry
Top minnows, fry
See diagram for allocation of fish in ponds.

Water Supply:

The water is taken directly from Mill Creek and Strawberry Creek, in which dams have been constructed. Circulation of the water through the ponds is in series (See diagram). Chemical analysis of Strawberry Creek water at the trough in the hatchery:

O_2	----	8.0 ppm
CO_2	----	3.0 ppm
ph-th	----	0.0 ppm
MO	----	185.0 ppm
pH	----	8.4

Chemical analysis of Mill Creek water taken from pond #2:

O_2	----	10.3 ppm
CO_2	----	0.0 ppm
ph-th	----	6.0 ppm
MO	----	188.0 ppm
pH	----	8.2

Examination of fish:

Adults:

Pond #2. Smallmouth bass:

Two females and one male -- larvae and adults in all.

Pond #7. Smallmouth bass:

Three females -- larvae and adults in all.

Island. Smallmouth bass:

Three males -- only larvae found.

Pond #9. Smallmouth bass:

Two males -- larvae and adults in both (very heavy).

Pond #6. Bluegills:

Five adults -- 2 with larvae, 3 negative.

Fry:

Pond #1. Largemouth:

No. examined ---- 20
No. positive ---- 0

Pond #7. Smallmouth:

No. examined ---- 20
No. positive ---- 0

Pond #9. Smallmouth:

No. examined ---- 20
No. positive ---- 0

Pond #12. Smallmouth:

No. examined ---- 10
No. positive ---- 0

Pond #13. Largemouth:

No. examined ---- 3
No. positive ---- 0

Pond #17. Smallmouth:

No. examined ---- 20
No. positive ---- 0

Pond #21. Largemouth:

No. examined ---- 20
No. positive ---- 0

Island. Smallmouth:

No. examined ---- 12
No. positive ---- 11

Pond #4. Largemouth:

No. examined ---- 21
No. positive ---- 2

Disease Problems: (as reported by Claude Lydell)

None, no prophylaxis.

Comments:

Random samples of 20 bass fry each from ponds #1 and #21, and 10 bass fry from #12 were negative for the bass tapeworm. The water supply to pond #21 is taken directly from Mill Creek and Strawberry Creek; that to pond #1 comes directly from the reservoir cistern containing water from Mill and Strawberry Creeks. This indicated that, although bass may be present in Strawberry and Mill Creeks, either they are not infected or the intermediate host is not present. In either case, the water supply is not bringing an infection into the ponds. Although pond #12 is one of a series of ponds of which two, #7 and #9, are heavily infected, it is separated from the nearest infected pond by pond #11. In addition, it also receives water from pond #10 which contains no fish, acting only as a settling pond for water from the lower dam in Mill Creek.

Although infected, the present stock of bass breeders could be used in the rearing of uninfected bass fry provided the designated spawning ponds do not empty into a series of ponds intended for fry, and provided that the fry were removed from the spawning ponds immediately following hatching. Ponds #5, #6, Island, #8, #10, #16 and #17 would be suitable for infected adult bass. The outlet from pond #8, however, should empty into Mill Creek below the intake to pond #10 to prevent possible infection of ponds #11, #12, #13, #14 and #15. A number of uninfected fry should be held and reared to adults for the purpose of replacing the present infected breeders.

In a conference with Mr. Claude Lydell it was decided to modify the recommendations for management until uninfected adult bass could be secured for breeding. Ponds #18, #19, #20 and #21 will be used to rear uninfected bass fry. A considerable number (to be determined at a later date) will be reared to adults for use as uninfected breeders.

HOLLAND FISH AND GAME CLUB REARING PONDS

Zeeland, Michigan

Species of fish:

Smallmouth fry from Lydell Hatchery.
Largemouth fry from Half Moon Lake, Muskegon Co.
Bluegill fry.

Water Supply:

Entire supply from one small stream which supports no large fish of any kind.

The three ponds are arranged in series.

Fish examination:

Smallmouth fry:

No. examined ---- 6
No. positive ---- 0

Largemouth fry:

No. examined ---- 12
No. positive ---- 7

Comments:

These ponds are safe to use for the rearing of bass free of the bass tapeworm, provided only uninfected fry are admitted. The largemouth fry from Half Moon Lake, were undoubtedly infected before they were put into the pond.

RICHMOND PARK POND, Grand Rapids.

Species of fish:

Largemouth bass and fry.

Water Supply:

Water is supplied by a spring creek containing no large bass.
A sample of fish will be sent at a later date.

Comments:

Since breeders remain in the pond throughout the year, the life cycle of the bass tapeworm will be kept intact, unless the intermediate host is

absent. An examination of the fry will reveal the presence or absence of the intermediate host; if the fry are infected the intermediate host is present.

BELMONT PONDS (3 ponds, 2 smallmouth fry, 1 largemouth fry)

These ponds are supplied by a small stream originating at springs about one mile distant. The stream contains a small number of brook trout but no adult bass. The chemical analysis is as follows:

Air 74° F.; Water 77° F.

O_2 ----	12.3 ppm
CO_2 ----	0.0 ppm
ph-th ----	10.0 ppm
MO ----	130.0 ppm
pH ----	8.6

Examination of fish:

Smallmouth bass:

No. examined ---- 20
No. positive ---- 0

Largemouth bass:

No. examined ---- 20
No. positive ---- 0

Comments:

Uninfected fry can be reared in these ponds without danger of becoming infected.

WEBBER POND, Ionia Co.

7 N- 5 W- Sec. 33

(Not visited)

The Grand River serves as the water supply for this pond.
The pond contains smallmouth bass fry from Lydell Hatchery.
A sample of these fish was sent in for examination when the pond was drained.

Smallmouth bass from Lydell Fish Hatchery were planted in the Grand River several years ago. It is possible that these fish were infected; if so, they would contaminate the rearing pond, provided the proper intermediate host is present.

Fish examination:

Smallmouth bass:

No. examined ---- 8
No. positive ---- 0

BELDING POND, Belding, Michigan.

Species of fish:

Largemouth fry from Richmond Park Pond.

Water Supply:

Drainage from the surrounding land supplied the necessary water. We were unable to seine this pond and fish samples were sent for examination when the pond was drained in the fall.

Fish Examination:

Largemouth bass:

No. examined ---- 3
No. positive ---- 0

Comments:

This pond is ideal for the rearing of bass, provided uninfected fry are stocked.

GREENVILLE PONDS, Greenville, Michigan.

(Not visited).

Fish were sent in for examination when the ponds were drained in the fall.

Fish examination:

Largemouth bass:

No. examined ---- 14
No. positive ---- 0

HARRISVILLE FISH HATCHERY

July 15th, 1942

Floyd Potts is the present superintendent.

Species of fish:

Smallmouth bass, adults and fry.
Rainbow trout, fingerlings.
Brook trout, fingerlings.

Water Supply:

The water is taken from the sawmill pond in Mill Creek above the hatchery and piped underground through twelve-inch pipe to the hatchery. It is dispersed to the ponds from a central reservoir. Mill Creek has a pond of about 30 acres and one of about 1½ acres one mile above the hatchery. Trout are present in Mill Creek but no smallmouth bass have been observed. The temperature at the hatchery may reach 71° F. in summer. The air temperature on date of examination was 74° F. and the temperature of the water in the hatchery tanks was 58° F. The highest temperature in the hatchery in July, 1941 was 69° F. and the lowest was 55° F. The chemical analysis of the water taken at the dam at the upper end of the hatchery property is as follows:

Air 74° F.; water 65° F.

O_2	----	9.0 ppm
CO_2	----	0.0 ppm
ph-th	----	0.0 ppm
MO	----	170.0 ppm
pH	----	8.0

Examination of fish:

Adults:

Pond #2. Smallmouth bass:

2 females, 1 male -- allwith a small number of larvae; none with adult tapeworms.

Fry:

Pond #3. Smallmouth bass:

No. examined ---- 20
No. positive ---- 0

Pond #5. Smallmouth bass:

No. examined ---- 20
No. positive ---- 0

Pond #7. Smallmouth bass:

No. examined ---- 20
No. positive ---- 0

Disease problems: (as reported by Floyd Potts)

Brown trout fingerlings:

Develop white spot if kept in raceways. A strong current of water was successfully used to clean it up. Fin rot results when they are kept in the hatchery tanks. Various treatments for fin rot have been used in the past two years with little effect. Formalin, as recommended by Dr. F. Fish, copper sulphate and potassium permanganate of unknown concentrations have been used. Fin rot was present on July 15th, 1942, and was treated with a solution of 1/2000 $CuSO_4$ for one minute. The loss dropped from 8,481 on July 15th, to 377 on July 27th.

Rainbow trout fingerlings:

Not affected by fin rot when kept in the hatchery tanks. The most difficulty with rainbow fingerlings has been with the diet. The growth is irregular. Octomitus was suspected this year and they were successfully treated with granulated potassium iodine and iodine (approximately 1 to 1) administered with the diet.

Comments:

Adult bass, unless known to be free of infection with the bass tapeworm, should be held and bred in the terminal ponds of a series and the fry should be removed at the earliest possible moment. In so doing, the upper ponds of the series could be kept free of infection and the fry would have a minimum chance of becoming infected while in the same ponds with the adult bass.

DRAYTON PLAINS HATCHERY

June, 1942

Bass fry are obtained from Lydell Hatchery, Wolf Lake Hatchery and Hillsdale Rearing Ponds, Cass, Crooked and Leggets Lakes in Oakland County and the Clinton River near Drayton Plains Hatchery.

Water Supply:

The water for the ponds is taken from the Clinton River and each pond has a separate inlet from the river.

Examination of fish:

Smallmouth bass fry:

From Wolf Lake Hatchery:

No. examined ---- 12
No. positive ---- 11

From Lydell Hatchery:

No. examined ---- 12
No. positive ---- 6

Largemouth bass fry:

From Leggett's Lake:

No. examined ---- 15
No. positive ---- 0

Comments:

The Clinton River from which the water supply is derived contains adult bass. It is not known whether these bass are infected with the bass tapeworm but, if they are infected, the river would serve as a natural reservoir for the parasite, pouring a continual stream of infection into the ponds. The infection could be eliminated from the water supply only by passing the water through sand filters before turning it into the ponds.

No fish were examined from the Fenton or Ortonville ponds. These ponds would be suitable for rearing uninfected fry, provided they were stocked with uninfected fish, because both ponds are fed by small streams in which no adult bass are found.

U. S. FISH AND WILDLIFE SERVICE STATION

Northville, Michigan

June 23, 1942

Mr. E. R. Widmyer is superintendent.

Species of fish:

Rainbow trout
Brook trout
Brown trout
Bluegills, adults and fry
Largemouth bass, adults and fry
Smallmouth bass, adults and fry

Water Supply:

The water supply for the bass and bluegill ponds is taken directly from the West Branch Rouge River (see diagram). Pond O drains into pond P and pond N drains into pond Q; the remaining ponds, L, M, A, K, and R are isolated from all other ponds by individual inlets and drains.

Water for trout is taken from a spring pond.

Examination of fish:

Largemouth fry:

No. examined ---- 16
No. positive ---- 0

Smallmouth fry:

No. examined ---- 16
No. positive ---- 0

Largemouth adults:

Not examined.

Smallmouth adults:

Examined September 20, 1941

No. examined ---- 15
No. positive ---- 15
11 with larvae only, and 5 with adults and larvae.

Disease problems: (as reported by E. R. Widmyer)

Rainbow trout occasionally become infected with Octomitis.
Calomel is used successfully to control this disease.
No prophylaxis.
Brushes, scaps, etc., for trout troughs are kept in a small trough of potassium permanganate (1 oz. to 2 qts. of water) which is made up fresh each week.

Trout eggs:

Brook trout eggs are obtained from E. Orland, Maine and Leadville, Colorado. One shipment from Maine this year was prematurely hatched. Brown trout eggs were from Paris Hatchery this year. They were hatched and sent to Indiana.

Rainbow trout eggs are obtained from Manchester, Iowa.
All eggs developed with very little loss this year, except one shipment of brook trout eggs from E. Orland, Maine.

Comments:

Since the West Branch River supplies water for the ponds, bass and sunfish from it should be examined for the bass tapeworm. If this parasite is present, sand filters should be established to prevent infected intermediate hosts from entering the ponds.

The layout of the supply lines to the ponds would permit infected brook stock to be easily held in any pond, except ponds N and O, which drain into pond P and Q, respectively. Likewise, fry and fingerlings could be held in any pond not containing infected brood stock, provided brook stock were not held in ponds N and O.

In managing infected brood stock to prevent infection of the off-spring, the fry should be removed from the pond containing infected brood stock before they begin to feed. If they are removed from the infected pond before they begin to feed, they will have no opportunity to eat an infected intermediate host.

A program for the coming year was worked out with Mr. Widmyer in which, until uninfected brood stock can be obtained, smallmouth bass fry are to be removed from the spawning ponds before they have fed, and held in ponds N and O. A sample of at least 50 fish from each pond are to be examined for infection before the remainder are planted. Largemouth bass will be managed as usual in any of the remaining ponds.

CONCLUSIONS

The bass tapeworm, Proteocephalus ambloplitis, was found to be firmly established in all of the bass hatcheries in Michigan that were completely investigated. This parasite can be controlled, in most hatcheries, by certain modifications of management practices. The following practices should be strictly adhered to:

1. Spawning ponds should always be located at the lower end of the series of ponds containing bass or bluegill fry, to prevent infected copepods from being carried throughout the hatchery.

2. Bass fry should always be removed from the spawning ponds before they begin to feed, so that they will have no opportunity to eat an infected copepod.

3. Rearing ponds should always be located higher in the series of ponds than the spawning and brood stock ponds.

Even when uninfected brood stock is available, these practices should be followed as precautionary measures in case the brood stock accidentally becomes infected.

Donald L. McKernan described in the Progressive Fish-Culturist #50, 1940, a method of eliminating adult tapeworms from trout. He treated with a diet of 2% kamala (a drug used to eliminate worms from man) for one week. Such a treatment should be tried on brood stock bass.

At Drayton Plains Hatchery, the water supply is derived directly from the Clinton River. Although bass from this river have not been examined for the tapeworm, they probably are infected because bass from Drayton Plains Hatchery have been planted in it and were probably infected when planted. The only means to control the bass tapeworm here is to pass all of the water intended for the bass and bluegill ponds through a sand filter to remove all infected copepods.

The water supply at Wolf Lake Hatchery is derived, in part, from Wolf Lake, which is heavily infected with the bass tapeworm. Water from Wolf Lake must be passed through a sand filter before it can be used to rear bass free of this parasite.

At Lydell Hatchery, this study indicated that bass that might be in Mill and Strawberry Creeks probably are not infected. A careful check should be made, however, before definite conclusions are drawn.

The present study indicated that bass fry can be collected from infected lakes and reared without becoming infected, provided they are collected at the right time. However, if the fry have had the opportunity to feed on infected copepods in the lake before the are collected, they will be infected. Here, as in spawning ponds with brook stock, the fry should be collected before they have eaten, and be reared in ponds having an uninfected water supply.

It is admitted that a large percentage, of the natural waters of Michigan are infected with the bass tapeworm and that in all probability it cannot be completely wiped out. However, for many years infected bass and bluegills have been planted in these natural waters, bringing in new infections to add to those already present. The first step, then, in the control of the bass tapeworm in natural waters is to rear uninfected fish and discontinue the practice of building up the infection by planting infected fish.

INSTITUTE FOR FISHERIES RESEARCH

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