THE IMPACTS OF NON-NATIVE RAINBOW (*ONCORHYNCHUS MYKISS*) AND BROWN (*SALMO TRUTTA*) TROUT ON THE LIFE CYCLE OF YELLOW PERCH (*PERCA FLAVESCENS*) PARASITES IN MIRROR LAKE

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Abstract. The amphipod *Hyalella azteca* inhabits many freshwater lakes in North America including the oligotrophic Mirror Lake. *H. azteca* serves as a secondary intermediate host for the trematode *Bunodera luciopercae*. The parasite, making its host more prone to predation, is fed on by its definitive host yellow perch (*Perca flavescens*). The life cycle is completed there. The parasites are host specific and will become dormant without the proper host. In addition to the trematode, I observed some amphipods with a red marking. Initially this was thought to be a brightly colored nematode, and was recorded as such. Non-native brown and rainbow trout *Salmo trutta* and *Oncorhynchus mykiss* have been stocked annually into the lake the past 14 years. The impact of the non-native trout on the life cycle of these parasites is investigated. A population of amphipods was sampled from Mirror Lake and gut contents were collected using gastric lavage from trout and perch. The proportion of amphipods parasitized with trematodes and red nematodes was higher than expected in the perch stomach versus the general Mirror Lake population. The results suggest parasitized amphipods are altered and are being preyed upon more frequently by yellow perch. Trout stomach contents only contained a small number of amphipods. Therefore trout likely cause minimal impact on the amphipod population and parasites using them as intermediate hosts. The higher proportion of parasitized amphipods found in the yellow perch's gut demonstrate that parasites may have a significant role in predator-prey relationships and community structure.

INTRODUCTION

Parasites are rarely factored into population dynamics, yet appear to have a significant role (Roberts et al. 2005). A parasitic digenetic trematode such as *B. luciopercae* with multiple hosts has physiological interactions with its secondary host that often increase its transmission rate to the final host. The changes are often beneficial to the parasite and detrimental to the host (Dobson 1988). A series of laboratory studies have shown the detrimental effects to the amphipod host infected with a closely related acanthocephalan parasite. Infected amphipods are hyperactive ignoring fish chemical cues in the water (Dezfuli et al. 2003). The parasitism reverses the amphipods phototropism causing them to go towards the light versus away from it (Bethel and Holmes 1977). The parasite itself is brightly colored making the amphipod more visible (Bakker et al. 1997). Also, it has been shown that amphipods occupy different micro-habitats, and they were found to have a greater overlap in fish habitat (Macneil et al. 2003). All of these characteristics make them more prone to predation. Parasites play a large role in predator-prey interactions on various trophic levels, which may affect population dynamics. The presence of parasites in a population could potentially have a large impact on community structure and energy cycling. The influence of parasitism and exotic species is enough to significantly alter native populations in a given habitat (Dobson 1988).

Muller (1776) identified a larval trematode parasite, *Bunodera luciopercae*, in yellow perch; it was later confirmed to also be in the amphipod, *Hyalella azteca* (Schell 1985). A small crustacean, this amphipod species inhabits the benthic layer in many lakes of North America (Cooper 1965). They serve as a secondary intermediate host to the trematode *B. luciopercae*. Fingernail clams are the first host. The free swimming miracidium infect the gills of fingernail clams and develop there until the cercariae release and swim to infect amphipods (Schell 1985). In the metacercaria stage, the trematode lies dormant until the proper definitive host, a fish, ingests the infected amphipod. In the intestinal tract of the definitive host, the trematode matures and reproduces making more eggs that are egested out and life cycle continues (Ameel 1937). The definitive host for *B. luciopercae* in North American oligotrophic lakes is typically yellow perch, *Perca flavescens* (Esch 1971).

Quantitative evidence is lacking to confirm that fish are more apt to feed on parasitized amphipods in their natural environment (Thomas 1995). Yellow perch in Mirror Lake use the amphipod *Hyalella azteca* as a primary food source (Masza 1973). The non-native trout could be removing the parasitized amphipods lowering the probability of yellow perch feeding on them. The effects of a non-native species on a native parasite life cycle have not been investigated. Since the trout are not a proper host and they are removed regularly from the ecosystem it is considered a dead end to the parasite's life cycle (Dobrovolny 1939). This could create an indirect positive effect on the yellow perch population.

The purpose of this experiment is to investigate the role of the stocked non-native brown and rainbow trout in altering population dynamics of yellow perch, the most prevalent fish species in Mirror Lake. The first objective of this study is to establish that yellow perch are indeed the definitive host for *B. luciopercae* and to see if the yellow perch feed selectively on parasitized amphipods. The second is to see if the non-native trout have a positive impact on the native yellow perch population by feeding on the parasitized amphipods removing them from the lake. Since the trout and yellow perch have high habitat overlap in Mirror Lake they could be in competition for the same food sources, and the trout also may prey on juvenile yellow perch (Masza 1973). The trout could feed rarely on the amphipod population and select for other macro-invertebrates. Therefore, the trout could ultimately have a negative impact on the native perch population.

Research Site

Mirror Lake is located in Grafton County, New Hampshire. This lake is in the foothills of the White Mountains and it is a small (15 ha) oligotrophic lake that is slightly acidic. The maximum depth is 10.9 m with an average depth of 5.57 m. It stratifies in the summer with spring and fall overturns. The bottom of the littoral zone is sandy with some gravel and rocks. The deep part of the lake is covered by organic sediment (Likens 1985). The lake is a nutrient poor environment supporting a limited biodiversity of fish (Masza 1973). The lake contains three small inlets, and one outlet that is controlled by a dam.

MATERIALS AND METHODS

Hyalella azteca were sampled from around Mirror Lake at seven different sites, beginning June 20th and ending August 13th, 2005. At each site samples were taken from depths of 0.5, 1, 2, 3 and 4 meters. Three samples were taken at each depth with a kick net. Beyond the 2 m depth, kick net samples were collected while snorkeling. Anderson's (1959) floatation method was used for separating amphipods from the benthic layer. The amphipods were removed by hand using a plastic disposable pipette, and placed into a separate clear plastic collecting pan with water. The water was decanted into a glass jar through .250 mm mesh to filter out the amphipods. The amphipods were washed off the mesh into 20 mL vials and stored with 70% ethanol for later processing.

In the lab the amphipods were identified using a dissecting scope and dichotomous key (Pennak 1978). They were classified as juvenile or adults based on number of antennal segments and also sexed (Cooper 1965). The parasitized *H. azteca* were separated into another vial of ethanol. The presence of the *Bunodera luciopercae* was indicated by the metacercaria found in the hemoceol of the cleared amphipod (Hazen and Esch 1977). Amphipods were dried using 80% isopropyl alcohol and cleared using oil of wintergreen (Strayer 2005). The cleared amphipods were examined under a compound light microscope at 100x to confirm the presence of the trematode metacercaria. The metacercaria were identified using Schell's key of Trematodes of North America North of Mexico (1985), and personal communication with Dr. Choudhury (2005). Some of the amphipods may also be parasitized with what is believed to be a red nematode. All the amphipods believed to be parasitized with a red nematode evident with a red marking on the amphipod were separated, aged, sexed, and recorded. The presence of one other parasite *Leptorhynchoides thecatus* found in the amphipods was noted.

Angling was the primary means of collecting fish including *Perca flavescens*, *Micropterus dolomieui*, *Salmo trutta*, and *Oncorhynchus mykiss*. This began July 1st and ended August 12th. To increase sample size and to include fish too young to be caught electro-fishing was attempted and was unsuccessful. Mazsa (1973) determined that angling was a proficient method to sample fish older than one year in Mirror Lake. Angling times were mainly at dawn and dusk because these times yielded larger catch rates. Fish were collected from various regions around the lake.

Gastric lavage was used to evacuate the gut contents. If the fish was too small for this process the stomach and digestive tract were cut out to examine the gut contents (Waters et al. 2003). The flushed fish gut contents were concentrated by filtering through a mesh screen. Each gut sample was stored in a separate vial with 70% ethanol. Lengths and weights were recorded for each fish. Fish were weighed using a spring scale. All handling of the fish was done as quickly as possible after catch with the objective of returning the fish to the lake unharmed.

In the lab, *H. azteca* was removed from the gut contents and the presence of the trematode metacercaria parasite was recorded. The stomach and digestive tract was removed from random fish until the adult trematode parasite was found in the intestinal tract to demonstrate the parasite does indeed use the yellow perch as a definitive host. Trout digestive tracts were also examined to demonstrate that they are indeed not being used as a final host for *Bunodera luciopercae*. Each digestive tract was examined fresh with the aid of a dissecting scope 25x to locate the trematode easily (Choudhury 2005). They were identified using Schnells key of Trematodes of North America North of Mexico and personal contact with Dr. Choudhury (2005).

A chi-square test with Yate's correction was used to determine if the difference between the proportion of parasitized amphipods found in gut of *P. flavescens* and in the lake is significantly different. Also, the chi-square test was applied to compare if the proportion of parasitized amphipods found in the trout's gut is significantly different from the proportion parasitized in the lake population. The parasitized amphipod population was analyzed comparing number of parasitized amphipods between age classes and sex to see if there is a significant difference among them.

RESULTS

In Mirror Lake, 280 of the 490 amphipods collected were parasitized with trematode metacercaria. In the yellow perch guts, 245 of the 254 amphipods were parasitized with trematode metacercaria. In both the brown and rainbow trout guts, 14 out of the 17 amphipods were parasitized with trematode metacercaria (Table 1).

A total of 52 yellow perch were caught and 18 of them contained amphipods in their gut contents. The lengths of the perch ranged from 135 mm to 285 mm and had a median of 234.5 mm; the lengths were not normally distributed (Figure 1). Other organisms that appeared to make up a large portion of the diet included odonata niads, fingernail clams, trichoptera larvae, chironomid larvae, diptera larvae, and zooplankton.

There is a significantly higher proportion of parasitized amphipods with the trematode *B. luciopercae* in the yellow perch stomach contents versus the proportion found in Mirror Lake ($\chi^2 = 123$, df = 1, $p < 0.001$) (Table 2). Yellow perch ate more amphipod males and less females than expected if they had consumed them in equal proportion to their population in Mirror Lake ($\chi^2 = 19$, df = 1, $p < 0.001$) (Table 2). Also, yellow perch consumed more amphipod adults and less juveniles than expected if they had consumed them in equal proportion to their population in Mirror Lake ($\chi^2 = 8.43$, df = 1, $p = 0.0037$) (Table 2).

A total of 20 trout were caught and 4 of them contained amphipods in their gut contents. Their lengths ranged from 270 mm to 350 mm and had a median of 303.5 mm; the lengths are normally distributed (Figure 2). A large portion of the diet was made up of chironomid larvae and *Chaoborus* larvae. Other prey found in the trout stomach included finger nail clams, trichoptera larvae, and other diptera larvae.
The results varied when comparing the trout stomach contents with the proportions of amphipods that were infected by *B. luciopercae* and the "red nematode". Examining *B. lucionpercae*, there was no significant difference between the proportion of amphipods parasitized found in the trout's gut versus the proportion found in Mirror Lake (χ^2 = 3.31, df = 1, p = 0.069) (Table 3). However, there is a significantly higher proportion of amphipods with the "red nematode" in the trout's gut versus the proportion found in Mirror Lake (χ^2 = 13.15, df = 1, $p < 0.001$) (Table 3).

A significantly higher proportion of amphipods with the "red nematode" were found in the yellow perch's gut versus the proportion found in Mirror Lake (χ^2 = 102, df = 1, $p < 0.001$) (Table 2). Within the amphipod population collected from the lake there is a higher proportion of males that are infected with the "red nematode" in comparison to females (χ^2 = 6.27, df = 1, p = 0.012) (Table 4). Also, there is a higher proportion of adults infected with the "red nematode" in comparison to juveniles (χ^2 = 34, df = 1, $p < 0.001$) (Table 4).

DISCUSSION

Amphipods infected by *B. luciopercae* seem to be altered in some way that made them more prone to predation by yellow perch. This alteration is suggested by the fact that the proportion of parasitized amphipods found in yellow perch stomachs was higher than the proportion of parasitized amphipods found in Mirror Lake. The results agree with the series of behavioral laboratory studies done previously (Dezfuli et al. 2003, Bethel and Holmes 1977, Bakker et al. 1997, and Macneil et al. 2003), even though in the previous studies the parasitized amphipods were infected with acanthocephalan parasites versus trematode metacercaria. These studies of acanthocephalan parasites demonstrated altered behavior, coloration, micro-habitat, and activity levels in infected amphipods, making them more prone to predation by fish (e.g. Dezfuli et al. 2003). Since the trematode metacercaria are in a dormant cyst stage they do not affect the brain of the amphipod and therefore, are believed to not affect the behavior of the amphipod (Thomas 1995). However, the amphipods were altered in some way, perhaps physically, to make them more prone to predation. Perch are visual predators and opportunist feeders (Langford 1941). Therefore, the results suggest that the infected amphipods were chosen to be fed upon because the parasite made them more prone to predation through some visual cue. Nearly all of the amphipods found in the yellow perch's gut contained parasitized amphipods with trematode metacercaria. Potentially, without the presence of this parasite far fewer amphipods would be prone to predation. Yellow Perch, being a generalist, would switch to another food source that is easier to prey upon. This reinforces the concept that parasites play a large role in predator prey relationships and community structure (Dobson 1988).

The non-native trout did feed on a small number of parasitized amphipods, but amphipods did not constitute a large part of the trout diets. The proportion of parasitized amphipods with trematode metacercaria found in the trout gut was not different from that found in the lake. As a whole, the impact of the non-native trout on the life cycle of *B. luciopercae* is not likely to be significant. Since the removal of parasitized amphipods by non-native trout was minimal, the possibility of the trout having a positive impact on the native perch population seems unlikely. However, as a whole the non-native trout may have an impact on general parasite transmission. I did not account for other hosts and parasites that both trout and yellow perch are eating. Other food sources that make up a larger portion of the trout diet could be carrying parasites that also use yellow perch as their final host. Chironomid larvae and copepods were a significant trout diet item and could be important hosts not focused on in this study. I also observed other parasites, such as acanthocephalans and nematodes, in small mouth bass, trout, and amphipods. The non-native trout may have a positive impact on the perch population by taking into account of all parasites that are host specific to Yellow Perch.

On the other hand, the non-native trout appear to potentially have some negative impact on the perch population by competing for the same food sources and preying on young perch in Mirror Lake. In the summer months the trout were mainly on the bottom of the lake and believed to come in little contact with the amphipods that are found mostly within a 4 meter depth of the lake (Lindeman and Momot 1983). It would be advantageous to study the trout's diet year round in case the trout migrate due to seasonal change and their habitat overlaps more with the amphipods. At these times in the year the trout may have a significant impact on the life cycle of *B. luciopercae* by feeding on amphipods more frequently. Fish bioenergetics modeling (e.g. Hanson et al. 1997) could be used to quantify the impacts of parasitism on amphipod predation and the impacts of the non-native trout on the native yellow perch population.

Dr. Esch (2005) found that amphipods could be co-infected with a red nematode and frequently co-occur with trematode metacercaria. The identification of this "red nematode" has not been confirmed, but has been recorded as such. More adults and males are parasitized with the "red nematode" than expected within the lake population and this follows typical parasite patterns of host exploitation. In spite of this, the red markings do not look like they have a hard smooth cuticle, which is the unique structural part used to identify nematodes (Roberts 2005). Other possibilities for the red mark could be a fungal or bacterial infection, or a scab like structure present in the healing process of an injured amphipod. The "red nematode" is not as prevalent as the trematode metacercaria in the lake population, but there is still a selection for them by both trout and perch demonstrating that they do have a negative impact on the amphipod population.

Adult males are more active and larger, and more likely to be eaten by yellow perch (Cooper 1965), and this is corroborated by my data (Table 2). More adults and males were selected to be eaten by yellow perch and also more than expected adults and males were infected by the "red nematode". This suggests that some mechanism may have evolved in the "red nematode" to be selective within the host species for a certain sex or age class. Other studies that support this theory include Hazen and Esch (1977) that found no juveniles infected with the trematode *Crepidostomum cooperi*. The identification of the "red nematode" is being looked into further. Whatever the "red nematode" is it plays a similar role as the trematode metacercaria in this particular study.

There were few acanthocephalans *Leptorhynchoides thecatus* found in the amphipod population. The reason for this is likely due to the fact that these parasites have much more damaging effects on their hosts (Thomas 1995). This other parasite was using the amphipod as a secondary intermediate host and was found along with the trematode metacercaria. This raises concerns regarding co-infection; one infection could make the amphipod more susceptible to getting infected by another parasite.

Parasites do play a critical role in predator prey interactions and population dynamics between amphipods and yellow perch in this ecosystem. At this point, the role of an exotic trout species and their impacts on the yellow perch population in Mirror Lake, both directly and indirectly, are unclear without more quantitative data. Further investigation is needed to clarify the effects of multiple parasites in one host and the effects of host parasite interactions on community structure as a whole in this ecosystem.

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APPENDIX

TABLE 1. Summary of each amphipod population collected from Mirror Lake and fish stomachs divided into parasitized and un-parasitized amphipod groups.

Location	Un-parasitized Amphipods	Parasitized Amphipods	Total
Lake	210	280	490
Perch Gut	9	245	254
Trout Gut	3	14	17
Total	222	539	761

TABLE 2. The population characteristic of the amphipods found in the yellow perch gut is compared to the population characteristic of amphipods found in Mirror Lake. The comparisons with percentages in each category are made using a chi-square test with Yate's correction.

COMPARISON	PERCENT OF POPULATION IN YELLOW PERCH GUT	PERCENT OF POPULATION IN MIRROR LAKE	CHI-SQUARE VALUE	DEGREES OF FREEDOM	P-VALUE
ADULT AMPHIPODS	37%	29%	8.43	1	0.0037
JUVENILE AMPHIPODS	63%	71%			
MALE	52%	38%	19	1	< 0.001
FEMALES	48%	62%			
PARASITIZED WITH RED NEMATODE	48%	24%	102	1	< 0.001
UN-PARASITIZED	52%	76%			
PARASITIZED WITH *B. LUCIOPERCAE*	96%	57%	123	1	< 0.001
UN-PARASITIZED	4%	43%			

TABLE 3. The population characteristic of the amphipods found in the trout gut is compared to the population characteristic of amphipods found in Mirror Lake. The comparisons with percentages in each category are made using a chi-square test with Yate's correction.

Comparison	Percent of Population in Trout Gut	Percent of Population in Mirror Lake	Chi-Square Value	Degrees of Freedom	P-Value
Parasitized with Red Nematode	65%	24%	13.15	1	< 0.001
Un-parasitized	35%	76%			
Parasitized with *B. lucioperace*	82%	57%	3.31	1	0.069*
Un-parasitized	18%	43%			

TABLE 4. The population characteristic of the un-parasitized amphipods is compared to the amphipod population characteristic that is parasitized with the red nematode, both found in Mirror Lake. The comparisons with percentages in each category are made using a chi-square test with Yate's correction.

Comparison	Un-parasitized in Mirror Lake	Parasitized with Red Nematode in Mirror Lake	Chi-Square Value	Degrees of Freedom	P-Value
Adults	77%	33%	34	1	< 0.001
Juveniles	79%	21%			
Males	73%	27%	6.27	1	0.012
Females	78%	22%			

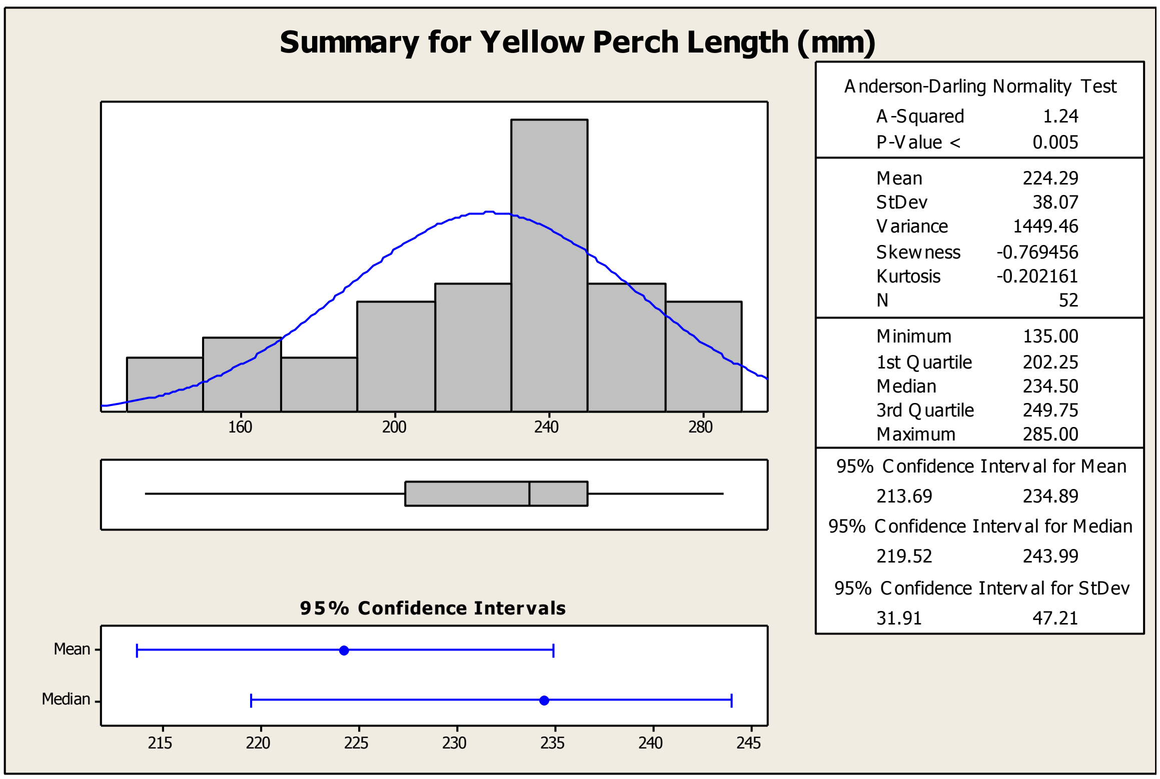

FIGURE 1. A distribution of all the yellow perch lengths caught by angling on Mirror Lake in the summer of 2005.

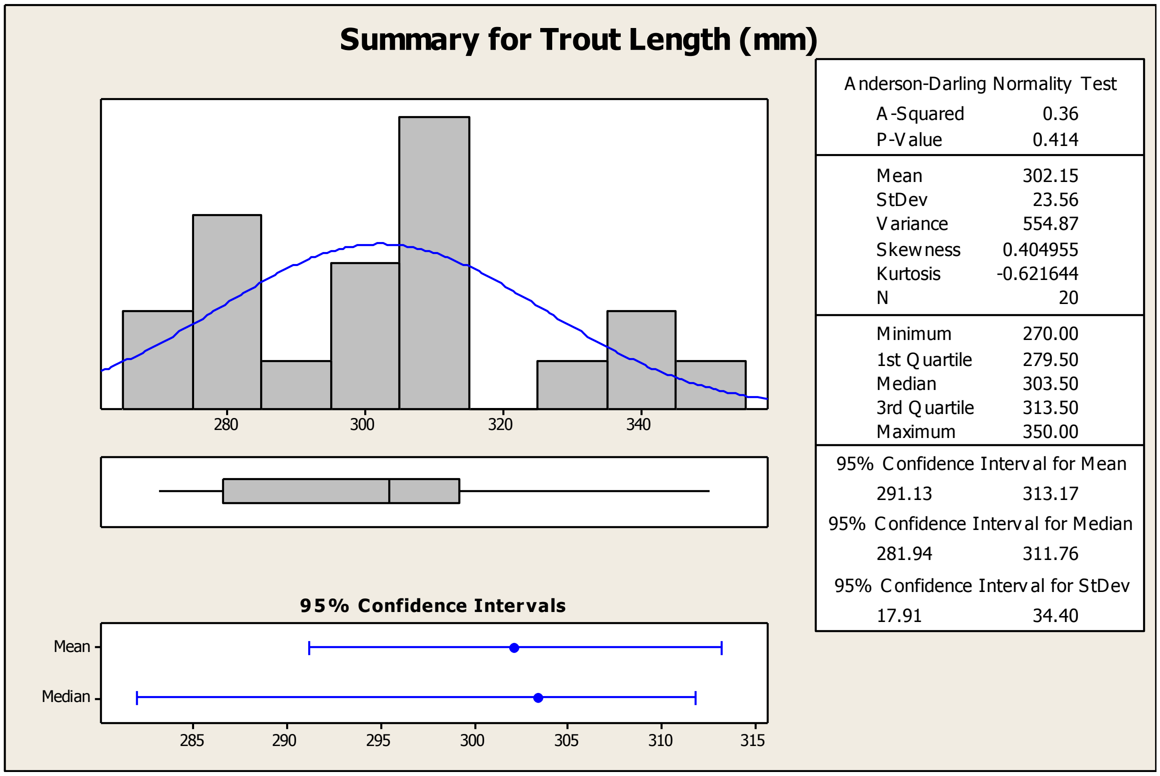

FIGURE 2. A distribution of all the trout lengths caught by angling on Mirror Lake in the summer of 2005.

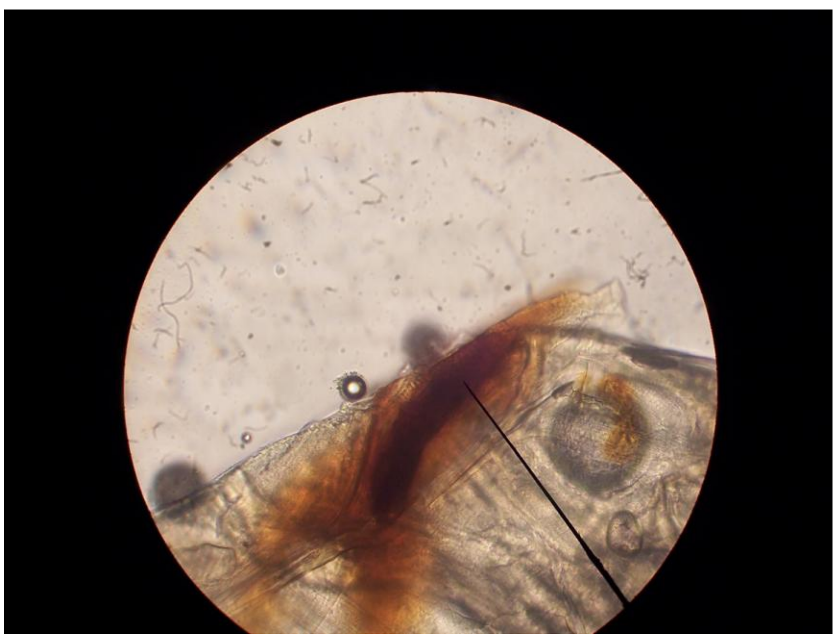

FIGURE 3. A close up of a "red nematode" found in a amphipod that appears to be brightly colored red and in the hemoceol. Magnification 100x.

FIGURE 4. The whole amphipod infected with a "red nematode", this one being on the larger side of the ones found. Magnification 40x.

TABLE 5.

			Fish Data			
Sample #	**Date**	**Species**	**Length (mm)**	**Mass (g)**	**Location**	**Notes**
1	7/1/2005	Yellow Perch	245	140	Hamlets	
2	7/1/2005	Yellow Perch	270	205	Hamlets	NS
3	7/1/2005	Yellow Perch	180	62	Hamlets	
4	7/1/2005	Yellow Perch	225	114	Hamlets	
5	7/1/2005	Yellow Perch	270	205	Hamlets	
6	7/1/2005	SMB	149	45	Hamlets	
7	7/1/2005	SMB	241	167	Hamlets	NS
8	7/1/2005	Yellow Perch	202	92	Hamlets	
9	7/1/2005	Yellow Perch	215	105	Hamlets	
10	7/1/2005	Yellow Perch	246	160	Hamlets	
11	7/1/2005	Yellow Perch	275	190	Hamlets	
12	7/1/2005	Yellow Perch	248	139	Hamlets	
13	7/1/2005	Yellow Perch	245	138	Hamlets	
14	7/1/2005	Yellow Perch	225	136	Hamlets	NS
15	7/4/2005	Yellow Perch	203	100	Hamlets	
16	7/4/2005	Yellow Perch	250	175	Hamlets	
17	7/4/2005	Yellow Perch	199	85	Hamlets	
18	7/4/2005	Rainbow Trout	302	306	Hamlets/Buoy	*

19	7/5/2005	Rainbow Trout	285	229	Hamlets/Buoy	
20	7/5/2005	Rainbow Trout	272	196	Hamlets/Buoy	
21	7/5/2005	Yellow Perch	179	69	Hamlets	
22	7/5/2005	Yellow Perch	161	65	Hamlets	
23	7/6/2005	Rainbow Trout	340	253	Hamlets/Buoy	*
24	7/6/2005	Yellow Perch	242	139	Hamlets/Buoy	*
25	7/6/2005	Yellow Perch	222	122	Hamlets/Buoy	
26	7/6/2005	Yellow Perch	240	139	Hamlets/Buoy	*
27	7/6/2005	Rainbow Trout	270	190	Hamlets/Buoy	*
28	7/6/2005	Yellow Perch	272	172	Hamlets/Buoy	
29	7/6/2005	Yellow Perch	251	152	Hamlets/Buoy	*NS
30	7/6/2005	Yellow Perch	243	129	Hamlets/Buoy	
31	7/8/2005	Rainbow Trout	297	209	Hamlets/Buoy	*
32	7/8/2005	Yellow Perch	262	206	Hamlets/Buoy	*
33	7/8/2005	Yellow Perch	248	164	Hamlets/Buoy	*
34	7/8/2005	Yellow Perch	249	150	Boat Launch	*
35	7/8/2005	Rainbow Trout	279	239	Booie Right	
36	7/8/2005	Rainbow Trout	275	240	Boat Launch	*
37	7/21/2005	Yellow Perch	266	179	Brown House	*
38	7/21/2005	Rainbow Trout	281	209	Booie/Hamlets	*
39	7/21/2005	Yellow Perch	257	161	Boat Launch	
40	7/21/2005	Rainbow Trout	311	273	Boat Launch	*
41	7/23/2005	Rainbow Trout	309	273	Buoy/Rock	*
42	7/23/2005	Rainbow Trout	298	250	Buoy/Rock	*
43	7/23/2005	Yellow Perch	213	105	Rock	*NS
44	7/23/2005	Yellow Perch	237	139	Rock	*
45	7/26/2005	Yellow Perch	233	152	Left Booie	
46	7/26/2005	SMB	209	105	Brown House	
47	7/26/2005	Yellow Perch	142	27	Hamlets	
48	7/26/2005	Yellow Perch	232	121	Hamlets	
49	7/26/2005	Yellow Perch	135	22	Hamlets	
50	7/26/2005	Yellow Perch	206	96	Hamlets	NS
51	7/26/2005	Yellow Perch	208	94	Hamlets	
52	7/26/2005	Yellow Perch	217	105	Hamlets	
53	7/26/2005	Yellow Perch	150	54	Hamlets	
54	7/26/2005	Yellow Perch	233	141	Hamlets	NS
55	7/27/2005	Rainbow Trout	312	291	Boat Launch	*
56	7/27/2005	Yellow Perch	165	258	Hamlets	
57	7/27/2005	Yellow Perch	224	125	Hamlets	
58	7/27/2005	Brown Trout	350	460	Hamlets	
59	7/27/2005	Yellow Perch	285	230	Hamlets	*
60	7/27/2005	Yellow Perch	241	138	Hamlets	
61	7/27/2005	Yellow Perch	149	35	Hamlets	
62	7/27/2005	Rainbow Trout	327	355	NW Inlet	
63	7/27/2005	Yellow Perch	253	161	NW Inlet	*
64	7/31/2005	Yellow Perch	188	85	Dam	
65	7/31/2005	Yellow Perch	202	92	Dam	
66	7/31/2005	Yellow Perch	155	47	Dam	

67	8/3/2005	Brown Trout	306	292	Boat Launch	*
68	8/12/2005	Yellow Perch	236	132	Buoy/Rock	
69	8/12/2005	Brown Trout	335	329	Buoy/Rock	*
70	8/12/2005	Rainbow Trout	314	275	Hamlet/Booie	*
71	8/12/2005	Yellow Perch	242	142	Buoy/Rock	*
72	8/12/2005	Yellow Perch	270	199	Hamlets	
73	8/12/2005	Yellow Perch	257	166	Hamlets	*
74	8/12/2005	Rainbow Trout	305	255	Hamlets	NS
75	8/12/2005	Brown Trout	275	213	NW Inlet	

Key

NS	No Stomach Contents
*	Kept for gut content analysis
SMB	Small Mouth Bass

TABLE 6.

Date	Surface Temps (°C)		Weather
7/1/2005	24.8		Overcast 80
7/4/2005			Breezy, Sunny 75
7/5/2005			Sunny, Calm 75
7/6/2005			light rain, humid, chilly
7/8/2005	23.3		Overcast 80
7/21/2005			Partly Cloudy, calm 55
7/23/2005	25		Partly Cloudy, windy 70
7/26/2005			Sunny, clear
7/27/2005			Overcast, Humid, Calm
7/30/2005	25.7		Electrofishing <3 inch
7/31/2005			Overcast, no wind 70
8/3/2005			Sunny foggy at first
8/9/2005	26		Electrofishing, nothing
8/12/2005			Overcast, cool 65