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Helminths of *Rana catesbeiana* in Southern Illinois with a Checklist of Helminths in Bullfrogs of North America

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ABSTRACT

Examination of 31 *Rana catesbeiana* collected from the La-Rue Pine Hills Ecological Area, southern Illinois from September through November, 1990 for helminths revealed *Haematoloechus breviplexus* (12.9%), *Megalodiscus temperatus* (29%), *Gorgodera amplicava* (12.9%), *Gorgoderina attenuata* (2.9%), *Cosmocercoides dukae* (22.6%) and *Camallanus* sp. (3.2%). Two *R. catesbeiana* collected from a small flood pond of the Big Muddy River were infected with *Glypthelmins quieta* (50%), *Gorgoderina attenuata* (50%) and *Cosmocercoides dukae* (50%). Most frogs were infected with a single species; mixed infections included three frogs with two species and two frogs with three species. Total number of all types of parasites was regressed against the size of host frogs and was found to be signficant. This significance resulted from the number of digenetic flukes which was greater in larger frogs and not the number of nematodes. With the exception of *C. dukae* and *G. quieta*, all helminths found in *R. catesbeiana* represent new host records in Illinois.

INTRODUCTION

Little information is available on the helminth parasites of bullfrogs (*Rana catesbeiana*) in Illinois and in particular from bullfrogs in southern Illinois. Beaver (1929) reported *Allassostomoides parvus* from bullfrogs taken northeast of Urbana, Illinois. Walton

(1929) recorded *Cosmocercoides dukae* from bullfrogs in the Mississippi basin, ranging from Wisconsin south to Louisiana, and *Falcaustra catesbeiana* from bullfrogs in Illinois, Oklahoma, and Louisiana. Miller (1930) reported *Glypthelmins quieta* from bullfrogs near Urbana. The present study was conducted to add to our knowledge of the helminths in bullfrogs from southern Illinois. In addition, a checklist of the helminths of bullfrogs in North America is included.

STUDY SITES

Two study sites in southern Illinois, one in Union county and the other in Jackson county, were sampled for bullfrogs. The LaRue-Pine Hills Ecological area occupies nearly 2000 acres in northwest Union County, Illinois (Fig. 1). This federally protcted area comprises a spring-fed bald cypress swamp and limestone bluffs that reach 350 feet above the adjacent swamp. The lowland swamp area is classified as the Austroriparian Division, the northernmost extension of the Gulf Coastal Plain in the Missisippi River drainage basin, and the bluff and rock outcrop regions as the Shawnee Hills Division, which is characterized by fast, clear streams and springs (Smith, 1961).

The other area sampled was a small pond formed by flooding of the Big Muddy River onto a forested lowland 3.2 miles north of Carbondale in east-central Jackson County.

MATERIALS AND METHODS

Thirty-one bullfrogs were collected from the La-Rue Pine Hills Ecological Area from September 5 to November 18, 1990 and two from the small flood pond of the Big Muddy River on October 8, 1990. All frogs were euthanized before their external surface were examined for ectoparasites and their total length (nose to cloaca) measured. They were then dissected and their sex determined. The coelom, heart, lungs, stomach, intestine, liver, gall bladder, and urinary bladder were examined for helminths. Digeneans were fixed in warm AFA with light coverglass pressure, stained in Harris' hematoxylin, dehydrated, cleared in beechwood creosote and mounted in Canada balsam. Nematodes were fixed in hot glycerin-alcohol (nine parts 70% ethanol and one part glycern) and cleared for study in glycerin.

Voucher specimens of helminths were deposited in the United States National Museum Helminthological collection (USNM Helm. Coll.) as numbers 82012-82018.

Voucher specimens of *R. catesbeiana* have been deposited in the herpetological collection of Southern Illinois University at Carbondale and assigned accension numbers H-3830 through H-3850, H-3932 through H-3941, H-3946, and H-3947.

Pearson correlations and ANOVA were conducted only on frogs collected in the LaRue-Pine Hills ecological area (SAS Institute, 1990). Alpha was set at 0.05 for all analyses.

RESULTS

Of the 31 bullfrogs examined from the La-Rue Pine Hills Ecological Area, 19 were infected. A total of 174 helminths including 105 digenetic flukes and 69 nematodes were detected. In addition, 10 larval nematodes were collected from various organs in five frogs. Four species of digeneans were identified: *Haematoloechus breviplexus*,

Megalodiscus temperatus, *Gorgodera amplicava* and *Gorgoderina attenuata*. Other helminths detected included the nematodes *Cosmocercoides dukae* and a single female specimen of *Camallanus* which could not be identified to species. Two bullfrogs collected from a small flood pond of the Big Muddy River were infected with *Glypthelmins quieta*, *Gorgoderina attenuata* and *Cosmocercoides dukae*. Neither monogenetic flukes, tapeworms, nor acanthocephalans were detected in frogs from either locality.

Megalodiscus temperatus had the highest level of prevalence of any of the helminths detected in frogs from the La-Rue Pine Hills Ecological Area (Table 1). The level of prevalence was 50% for each of the three helminths in the two frogs from the flood pond of the Big Muddy River.

Most bullfrogs were infected with a single species of parasite (Table 2; Fig. 2). Three frogs had a parasite mix of two species: one with *H. breviplexus* and *M. temperatus*, one with *M. temperatus* and *G. amplicava*, and one with *M. temperatus* and *C. dukae*. Two frogs exhibited a parasite mix of three species, one with *H. breviplexus*, *M. temperatus* and *C. dukae* and the other with *H. breviplexus*, *M. temperatus* and *Camallanus* sp. (Fig. 2).

The prevalence of helminths in the 19 male and 12 female *R. catesbeiana* from the La-Rue Pine Hills Ecological Area is compared in Table 3. Analyses of variance (ANOVA) were conducted to determine if a significant difference existed between male and female frogs for the total number of parasites present, total number of digenetic flukes, total number of nematodes, and total number of parasite species. The size of male and female bullfrogs did not differ significantly and was not a confounding factor. There was no significant difference between males and females in number of parasites ($F_{1,29}$=1.4219, P>0.2428), size of males and females ($F_{1,29}$=0.0250, P>0.8755), total number of digenetic flukes ($F_{1,29}$=0.0097, P>0.9222), total number of nematodes ($F_{1,29}$=2.5034, P>0.1245), and total number of parasite species ($F_{1,29}$=0.1563, P>0.6955).

The month frogs were collected was tested against the total number of parasites found in the frogs and was found to be significant ($F_{2,28}$=6.5444, P<0.0047). The months were then run against each other to determine which months were significantly different. September was significantly higher in parasite load from October ($F_{1,28}$=8.9626, P<0.0057) and November ($F_{1,28}$=8.8807, P<0.0059). October and November were not significantly different from each other ($F_{1,28}$=0.2386, P>0.6290).

Size of frogs ranged from 65 to 115 mm with a mean of 85.387 mm. The size of frogs were tested against the month of collection and were found not to be significant ($F_{2,28}$=2.2208, P>0.1273).

The total number of all types of parasites collected was regressed against the size of the frog hosts and was found to be significant. This significance was due to the total number of digenetic flukes ($F_{1,28}$=6.4665, P<0.0168)(Fig. 3). The total number of digenetic flukes regressed against the size of the frog hosts was highly significant ($F_{1,29}$=21.567, P<0.0001). In contrast, the total number of nematodes regressed against the size of the frog host was not significant ($F_{1,29}$=2.9846, P>0.0947)(figs. 4 and 5).

DISCUSSION

The specimens identified as *Megalodiscus temperatus* showed variability in the length of the intestinal caeca. Some of the lengths of the intestinal caeca matched the description of *Megalodiscus rankini* by Bravo Hollis (1941). Variability in length of intestinal caeca was dispersed throughout infections of the parasites with no segregation and it is therefore our opinion that all specimens collected were *M. temperatus*. More work on the status of these species is suggested due to the variability in this key character.

With the exceptions of *Glypthelmins quieta* and *Cosmocercoides dukae*, the parasites collected during this study have not been previously reported from bullfrogs in Illinois. Many of the parasites collected have been reported from bullfrogs in states neighboring Illinois (Lank, 1971; Ulmer, 1970; Bennett, 1938; Goodchild,1948; Goodchild, 1950; Jinks and Johnson, 1971). Appendix I is a list of known locality information for helminth parasites of bullfrogs.

The female *Camallanus* sp. (nematode) is the first report of this genus from amphibians in the United States. *Camallanus* sp. have been found in bullfrogs from South Africa and a specimen that died while at the London Zoo (Kung, 1948). The bullfrog at the London Zoo was collected in North America, although Kung did not state the amount of time that it had lived at the London Zoo. The genus is documented from fish in the United States (Petter, 1979) and may be an incidental parasite in amphibians.

Male and female frog hosts were not significantly different in size and were not significantly different for total number of parasites, total number of digenetic flukes, total number of nematodes, or total number of parasite species. This would indcate that none of the parasites found are better adapted to one sex over the other.

Pearson correlations were not significant for frog host sizes compared to total number of parasites, total number of nematodes, or total number of parasite species. Pearson correlations were significant for frog host sizes compared to total number of digenetic flukes. This would indicate that digenetic flukes are better adapted to larger host frogs, and nematodes have no adaptations to one size over any other size. The digenetic flukes adaptation to larger hosts appears not enough to skew the correation of the combination of nematodes and digeneans.

The regression of the total number of parasites plotted on the size of the frog hosts (Fig. 3) shows that smaller and larger frogs harbor significantly more parasites than the middle-sized frogs. The regression of the total number of digenetic flukes plotted on the size of the frog hosts (Fig. 4) shows that there is a significant positive correlation between size of frog host and number of digenetic flukes. Figure 5 shows the regression of the total number of nematodes plotted on the size of the frog host. The regression was not significant, although it may be an indicator of why the significant cubic (x^3) result for the regression of the total number of all parasites plotted on the size of the frog (Fig. 3) occurred.

The month of collection compared to total number of parasites found in the frog hosts was significant. The month of September was significantly higher for number of parasites collected than October and November. A possible reason for the significane of the month of collection may be that a cold period occurred in October. This cold period

may have forced the parasitized frogs into hibernation and the more robust unparasitized frogs to stay active. The size of frogs collected during the three diffrent months of collection were not significantly different.

A longer period of collection with more frog hosts would be valuable to add to the findings of this study. From the results given here, it might be expected that more helminth parasites would be collected during the summer months.

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Table 1. Helminths detected in 31 *Rana catesbeiana* from the La-Rue Pine Hills Ecological Area of southern Illinois.

Parasite	Location in Host	Prevalence	Total # Present	Mean # / Host	Range in Host
Haematoloechus breviplexus	lung	12.9	20	5.0(N=4)	1-8
Megalodiscus temperatus	intestine cloaca	29.0	32	3.6(N=9)	1-11
Gorgodera amplicava	bladder	12.9	46	11.5(N=4)	1-27
Gorgoderina attenuata	bladder	2.9	7	7.0(N=1	-
Cosmocercoides dukae	intestine	22.6	68	9.7(N=7)	1-30
Camallanus sp.	intestine	3.2	1	1.0(N=1)	-
TOTALS		61.3	174		1-30

Table 2. Number of parasitic infections in *Rana catesbeiana* from the LaRue-Pine Hills Ecological Area of southern Illinois.

Infection	Prevalence of Parasitism Sexes Combined (N=31)	Male (N=19)	Female (N=12)
Single Infection	45.2	52.6	33.3
Mixed Infection	16.1	10.5	25.0
Double Infection	9.7	5.3	16.7
Triple Infection	6.4	5.3	8.3
Combined Infections (Single and Mixed)	61.3	63.1	58.3

Table 3. Prevalence of parasitism in male and female *Rana catesbeiana* from LaRue-Pine Hills Ecological Area in southern Illinois.

Parasite	Prevalence of Parasitism Sex of Host Male (N=19)	Female (N=12)
Haematoloechus breviplexus	10.0	16.7
Megalodiscus temperatus	31.6	25.0
Gorgodera amplicava	15.8	8.3
Gorgoderina attenuata	0.0	8.3
Cosmocercoides dukae	21.1	25.0
Camallanus sp.	0.0	8.3

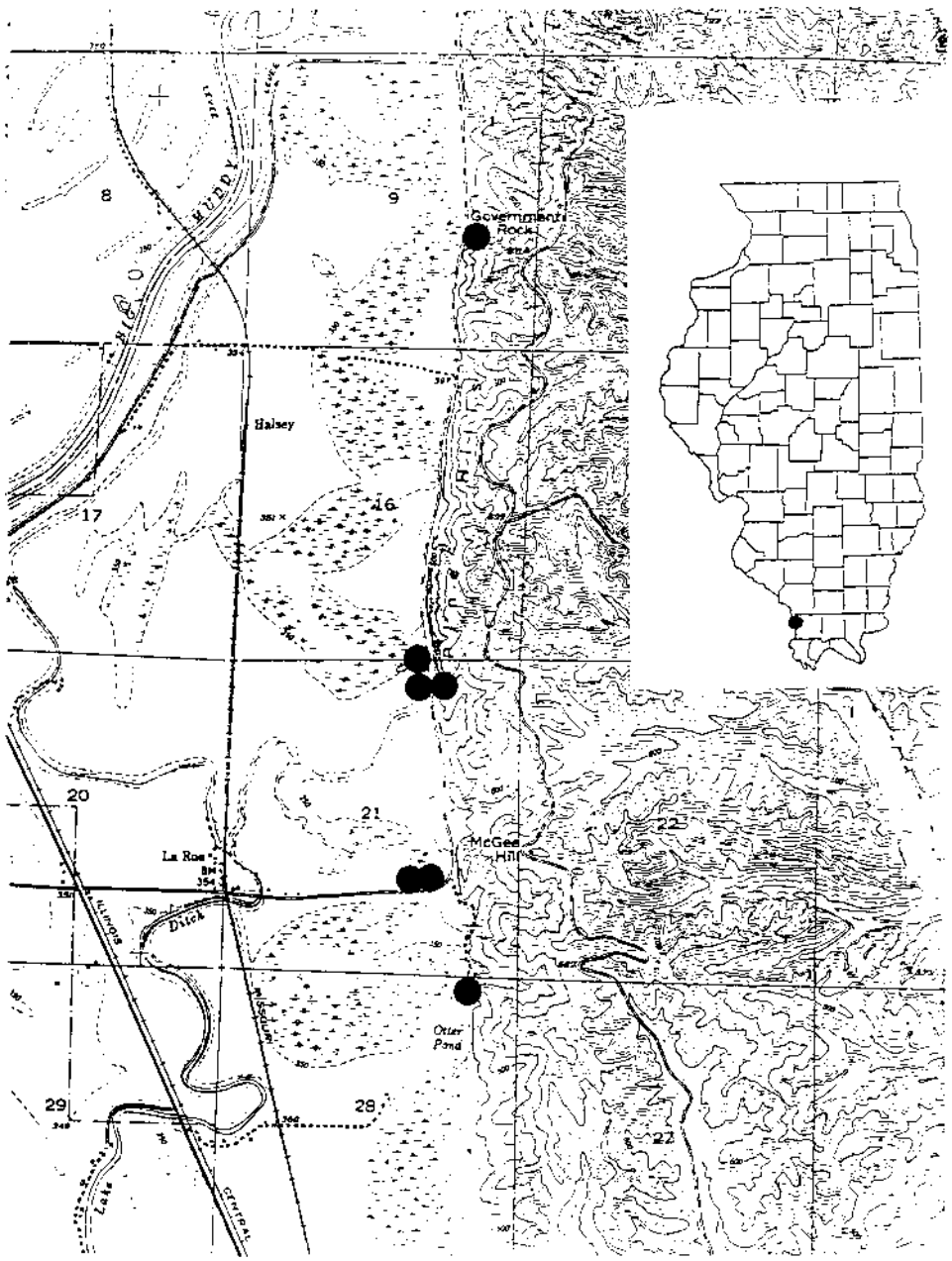

Figure 1. Vicinity of the La-Rue Pine Hills Ecological area, Union County, Illinois (USGS 7.5-minute topographic map, Wolf Lake, Ill.-Mo. quadrangle), showing areas sampled for Rana catesbeiana. Insert map shows the location of Pine Hills within the state of Illinois.

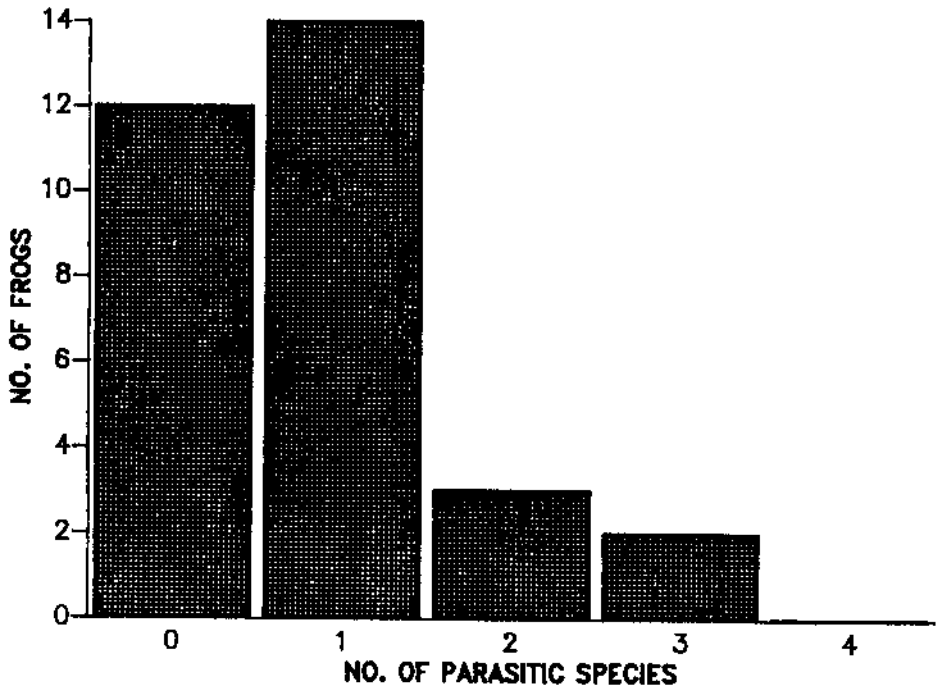

Figure 2. Number of Rana catesbeiana that harbored from 0 to 3 different parasite species.

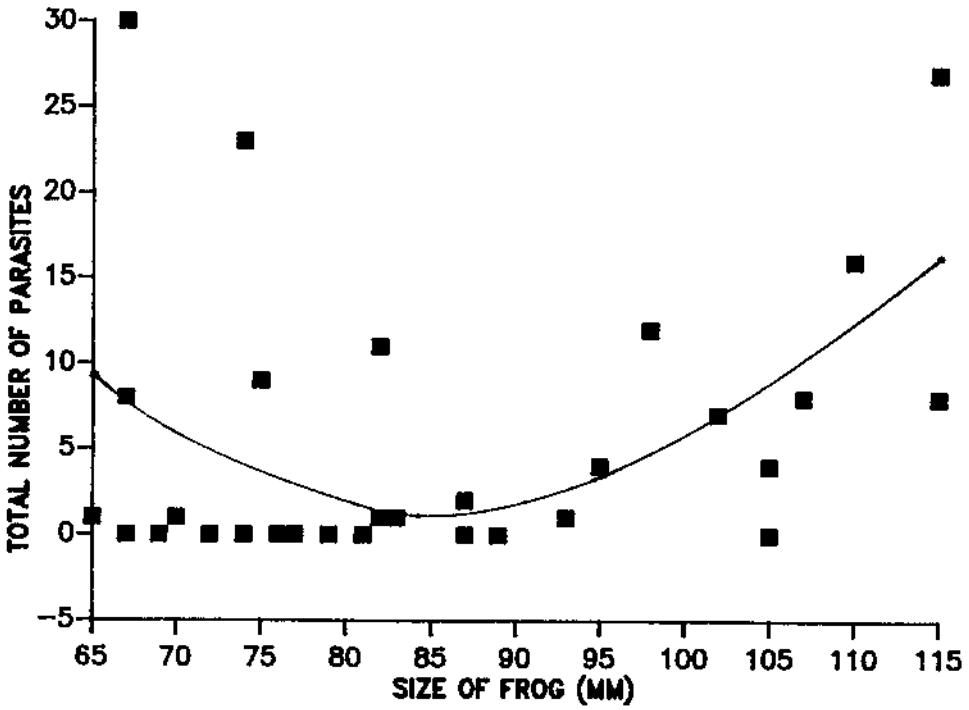

Figure 3. Regression of the total number of parasites collected plotted on the size of the Rana catesbeiana host ($F_{1,28} = 6.4665$, $P<0.0168$).

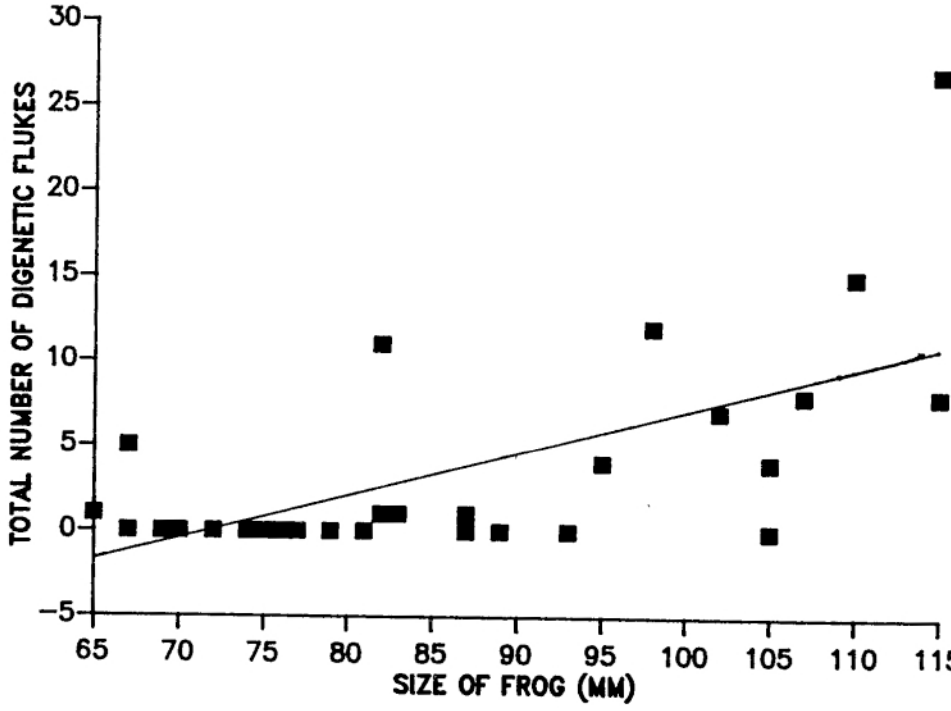

Figure 4. Regression of the total number of digenetic flukes plotted on the size of the Rana catesbeiana host ($F_{1,29} = 21.567$, $P<0.0001$).

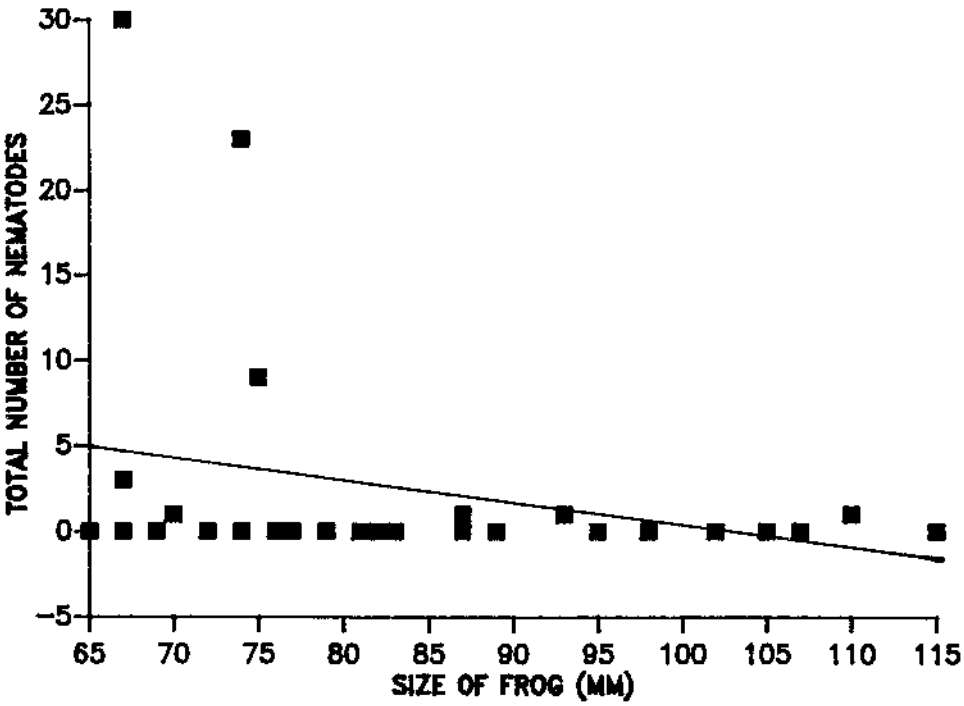

Figure 5. Regression of the total number of nematodes plotted on the size of the Rana catesbeiana host ($F_{1,29} = 2.9846$, $P>0.0947$).

Appendix I: Checklist of the Helminth of Bullfrogs in North America

Helminth		Anatomical Location	Geographic Locality	Reference
NEMATODA				
juvenile nematodes		general	VA	Campbell, 1968
Abbreviata sp.		large intestine	NV	Babero and Golling, 1974
Agamascaris odontocephala		body cavity	NC	Brandt, 1936
Agamonema sp.	cyst	general	NC	Brandt, 1936
Cosmocercoides dukae			MS basin	Walton, 1929
		intestine	NC	Brandt, 1936
		hindgut	MA	Rankin, 1945
			WA,OR,CA	Lehmann, 1965
		colon	VA	Campbell, 1968
			TX	Hollis, 1972
Dioctophyma renale	encap. larvae		Ontario	Mace and Anderson, 1975
Dujardinascaris sp.		body cavity	NC	Brandt, 1936
Eustrongylides wenrichi		muscle,mesentery,eye, mouth,skin,peritoneum,		
		spleen,kidney,liver	LA	Modzelewski and Culley, 1974
	encysted	musculature,stomach	NV	Babero and Golling, 1974
Falcaustra sp.			OK	Kuntz and Self, 1944
Falcaustra catesbianae			IL,OK,LA	Walton, 1929
		intestine	NC	Brandt, 1936
		large intestine	GA	Reiber, et al, 1940
		large intestine	TN	Reiber, 1941
			OK	Kuntz and Self, 1944
			NV	Babero and Golling, 1974
			OH	Ashton and Rabalais, 1978
		rectum	Ontario	Baker, 1986a

Falcaustra inglisi		intestine	Ontario	Anderson, 1964
		small intestine	Ontario	Baker, 1986a
Filaria quadrituberculata	cyst	peritoneum,mesentery	LA	Walton, 1927
Foleyellides sp.			OK	Trowbridge and Hefley, 1934
			OK	Kuntz and Self, 1944
			NJ	Crans, 1969
Foleyellides americana			NJ(exp.)	Benach, 1972
		body cavity	NC	Brandt, 1936
		abd. mesen.,bladder	VA	Campbell, 1968
		body cavity	TX	Hollis, 1972
			OH	Ashton and Rabalais, 1978
Foleyellides flexicauda		mesen.,body cavity	NJ	Schacher and Crans, 1973
			experimental	Benach and Crans, 1973
		blood	NJ	Terwedow and Craig, 1977a
			NJ	Terwedow and Craig, 1977b
Foleyellides ranae	cyst	mesentery	LA	Walton, 1929
		body cavity	NC	Brandt, 1936
Gyrinicola batrachiensis (in tadpoles)			Canada	Adamson, 1980
Hedruris sp.			WA,OR,CA	Lehmann, 1965
Hedruris pendula	imm. female	small intestine	Ontario	Baker, 1986b
Hedruris siredonis			NH	Muzzall and Baker, 1987
Microfilaria sp.		blood	NC	Brandt, 1936
		blood	VA	Campbell, 1968
Oswaldocruzia sp.		intestine	MI	Ridgeway, 1964
Oswaldocruzia pipiens			OK	Trowbridge and Hefley, 1934
		intestine	NC	Brandt, 1936
		small intestine,stomach	VA	Campbell, 1968
Oxysomatium sp.	larvae		OK	Trowbridge and Hefley, 1934
Oxysomatium americana			OK	Trowbridge and Hefley, 1934
		intestine	CA	Ingles, 1936

			TX	Hollis, 1972
Oxysomatium longicaudata		enteron	NC	Brandt, 1936
			IN	Lank,1971
Oxysomatium variabilis		colon	VA	Campbell, 1968
Physaloptera sp.		stomach	NC	Brandt, 1936
Physaloptera ranae	cyst	stomach,intest.wall	IN	Walton, 1931
		stomach	VA	Campbell, 1968
	larval forms		OH	Ashton and Rabalais, 1978
Rhabdias sp.		body cavity	NC	Brandt, 1936
			WA,OR,CA	Lehmann, 1965
Rhabdias ranae		lung	NC	Brandt, 1936
		lung	TX	Morrison, 1966
		lung	OK	Morrison, 1967
		lung	VA	Campbell, 1968
		lung	TX	Hollis, 1972
			OH	Ashton and Rabalais, 1978
Spinitectus sp.			OK	Trowbridge and Hefley, 1934
		stomach	TN	Christian, 1970
Spinitectus gracilis			OK	Kuntz and Self, 1944
Spiroxys sp.		enteron	NC	Brandt, 1936
Strongyluris ranae		large intestine	GA	Reiber, et al, 1940
Anisakinae	immature		OK	Kuntz and Self, 1944
MONOGENEA				
Gyrodactylus sp. (in tadpoles)		epidermis	NJ	Stunkard and Dunihue, 1933a
		epidermis	NJ	Stunkard and Dunihue, 1933b
DIGENEA				
Alaria sp.	mesocercariae	muscle	Toronto	Walters, et al, 1975
Alaria mustelae	mesocercariae		MI	Bosma, 1934

Allassostomoides chelydrae		rectum	NE	Brooks, 1975
			NE	Brooks, 1976
Allassostomoides parvus		colon, cloaca	IL	Beaver, 1929
		cloaca	LA	Bennett, 1938
		rectum	NE	Brooks, 1975
			NE	Brooks, 1976
Auridistomum chelydrae	cyst	body(larvae)	exp.(OK)	Ralph, 1938
Brachycoelium louisianae		small intestine	GA	Parker, 1941
Cephalogonimus americanus		intestine	MA	Rankin, 1945
Clinostomum attenuatum	cyst	peritoneum	OK	Trowbridge and Hefley, 1934
Clinostomum marginatum	metacercariae		KS	Jinks and Johnson, 1971
Cystagora tetracystis	immature	muscles of throat	Canada	Stafford, 1900
	cyst	muscles of throat	Canada	Stafford, 1905
Glypthelmins linguatula			NV	Babero and Golling, 1974
Glypthelmins proxima			NV	Babero and Golling, 1974
Glypthelmins quieta		intestine	Canada	Stafford, 1905
		small&large intest.	IL	Miller, 1930
		intestine	OK	Trowbridge and Hefley, 1934
		digestive tract	exp.	Leigh, 1937
		intestine	Canada, U.S.	Caballero, 1938
		intestine	FL	Manter, 1938
		small intestine	LA	Bennett, 1938
	metacercariae	epithelium	exp.	Leigh and Van Cleave, 1945
				Britt, 1947
		small intestine	OH	Odlaug, 1954
		small intestine	MI	Najarian, 1955
		intestine	WI	Schell, 1962
		small intestine	Cuba	Odening, 1968
		intestine	Can.,US,Mex.	Nasir and Diaz, 1970
		intestine	IA	Ulmer, 1970

		intestine	IN	Lank, 1971
		small intestine	KS	Jinks and Johnson, 1971
			TX	Hollis, 1972
	mature,imm.	small intestine	NV	Babero and Golling, 1974
		small intestine	AR	Rosen and Manis, 1976
			GA,LA,MS	Sullivan, 1976
			NE	Brooks, 1976
			OH	Ashton and Rabalais, 1978
		small intestine	OK,MS	Brooks, 1979
Glypthelmins subtropica		intestine	NC	Brandt, 1936
		intestine	TX	Caballero, 1938
		small intestine	GA	Parker, 1941
		small intestine	TX	Cheng, 1959
		small intestine	VA	Campbell, 1968
		intestine,lung,stomach	U.S.	Nasir and Diaz, 1970
			NV	Babero and Golling, 1974
Gorgodera amplicava		bladder		Bensley, 1897
		bladder	Canada	Stafford, 1903
		bladder	Ontario	Cort, 1912
		bladder	OK	Trowbridge and Hefley, 1934
		bladder	MI	Krull, 1935
		kidney, bladder		Odlaug, 1936
		bladder	NC	Brandt, 1936
	immature	kidney	MA	Odlaug, 1937
		bladder	LA	Bennett, 1938
		bladder	KY,TN	Parker, 1941
	metacercariae		MA	Goodchild, 1945
	young worms	excretory duct	MA	Goodchild, 1945
		bladder,stomach,intestine, cloaca,wolffian duct,		

	oviduct	MA,MO	Goodchild, 1948
	wolffian duct,mesonephroi	MA,MO	Goodchild, 1950
	bladder	LA,MO	Goodchild, 1954
	bladder	LA,MA	Goodchild, 1955
	colon,bladder	VA	Campbell, 1968
	bladder	IN	Lank, 1971
		TX	Hollis, 1972
	bladder	AR	Rosen and Manis, 1976
		NE	Brooks, 1976
		OH	Ashton and Rabalais, 1978
Gorgodera circava	bladder	OK	Guberlet, 1919
	bladder	OK	Guberlet, 1920
	bladder	OK	Guberlet, 1926
	bladder	OK	Trowbridge and Hefley, 1934
Gorgodera cygnoides	bladder	Canada	Stafford, 1900
Gorgodera minima	bladder	IL	Cort, 1912
		TX	Hollis, 1972
	bladder	MS	Brooks, 1979
Gorgodera vivata		Exp.(lab)	Hunt, 1952
Gorgoderina attenuata	bladder	Canada	Stafford, 1903
	bladder	Ontario	Cort, 1912
	kidney,bladder	NC	Brandt, 1936
	kidney	MA	Odlaug, 1937
	bladder	MA	Rankin, 1945
			Britt, 1947
	kidney,ureter	MA	Goodchild, 1950
	bladder	IN	Lank, 1971
	bladder	KS	Jinks and Johnson, 1971
		TX	Hollis, 1972
		NE	Brooks, 1976

		bladder	AR	Rosen and Manis, 1976
		bladder	MS	Brooks, 1979
Gorgoderina bilobata		bladder	GA	Parker, 1941
		bladder	VA	Campbell, 1968
Gorgoderina simplex		bladder		Bensley, 1897
		bladder	Canada	Stafford, 1903
		bladder	Ontario	Cort, 1912
		bladder	MI	Najarian, 1955
			NE	Brooks, 1976
Haematoloechus sp.		lung	LA?	Hunter, 1930
		lung	NC	Brandt, 1936
		lung	TX	Morrison, 1966.
		lung	KS	inks and Johnson, 1971
Haematoloechus breviplexus		lung	Canada	Stafford, 1902
		lung		Cort, 1915
		lung	OK	Trowbridge and Hefley, 1934
		lung	NC	Brandt, 1936
		lung	LA	Bennett, 1938
		lung	TX	Knight, et al, 1965
		lung	VA	Campbell, 1968
		lung	MS	Clark and Longest, 1969
		lung	IN	Lank, 1971
			TX	Hollis, 1972
		lung	NV	Babero and Golling, 1974
		lung	NM	Dronen, 1974
		lung	AR	Rosen and Manis, 1976
		lung	NM	Dronen, 1977
		lung	MS	Brooks, 1979
Haematoloechus buttensis	mature,imm.		NV	Babero and Golling, 1974
Haematoloechus floedae		lung	FL	Manter, 1938

	lung	FL	Loftin, 1960
	lung	TX	Knight, et al, 1965
	larynx	TX	Jacobs and Morrison, 1966
Haematoloechus longiplexus	lung	Canada	Stafford, 1902
	lung		Cort, 1915
	lung	MI	Krull, 1932
	lung	OK	Trowbridge and Hefley, 1934
	lung	NC	Brandt, 1936
	lung	MI	Najarian, 1955
	lung	ID	Waitz, 1961
	lung	ID	Waitz, 1962
	lung	Cuba	Odening, 1968
	lung	MS	Clark and Longest, 1969
	lung	IA	Ulmer, 1970
	lung	IN	Lank, 1971
	lung	NE	Brooks, 1974
		NE	Brooks, 1976
	lung	AR	Rosen and Manis, 1976
	lung	OH	Ashton and Rabalais, 1978
	lung	OK	Brooks, 1979
	lung	CA	Shields, 1987
Haematoloechus medioplexus	lung	IA	Cain and French, 1975
Haematoloechus parviplexus	lung	LA	Bennett, 1938
	lung	NV	Babero and Golling, 1974
	lung	NE	Brooks, 1974
		NE	Brooks, 1976
Haematoloechus variegatus	lung	Canada	Stafford, 1900
Haematoloechus varioplexus	lung	Canada	Stafford, 1902
	lung	VA	Campbell, 1968
Halipegus sp.	eustachian tube	AR	Rosen and Manis, 1976

Halipegus amherstensis		eustachian tube	MA	Rankin, 1944
		mouth,eustachian tube	MA	Rankin, 1945
Halipegus eccentricus		eustachian tube	MI	Thomas, 1939
Halipegus occidualis		mouth	Canada	Stafford, 1905
			NE	Brooks, 1976
Halipegus ovocaudatus		tongue, eustachion tube	Canada	Stafford, 1900
Levinseniella ophidea		large intestine	CA	Nicol, et al, 1985
Loxogenes arcanum	immature	liver	Canada	Stafford, 1900
	cyst	liver	Canada	Stafford, 1905
Loxogenes provitellaria		small intestine	NV	Babero and Golling, 1974
Loxogenoides bicolor		pancreas,liver	NC	Brandt, 1936
	cyst	bile duct,pancreas	GA	Byrd, 1950
		bile duct,pancreas		
		tomach,body cavity	KY	Christensen, 1981
Loxogenoides loborchis		biliary system	GA,KY,NC	Christensen, 1981
Megalodiscus sp.		colon	FL	Loftin, 1960
Megalodiscus ferrissianus		rectum	MI?	Smith, 1953
Megalodiscus intermedius		rectum	LA?	Hunter, 1930
		rectum	NC	Brandt, 1936
		rectum	LA, NC	Bravo Hollis, 1941
Megalodiscus microphagus		small intestine	AR	Rosen and Manis, 1976
Megalodiscus temperatus		rectum	Canada	Stafford, 1905
		intestine(tadpole)	exp.(PA)	Cary, 1909
		rectum		Krull and Price, 1932
		rectum	NC	Brandt, 1936
		intestine	CA	Ingles, 1936
		cloaca	LA	ennett, 1938
		intestine, rectum	MN,CA,Mex.,Canada	Bravo Hollis, 1941
		small intestine	GA,TN	Parker, 1941
		large intestine	MI	Najarian, 1955

		colon	VA	Campbell, 1968
		cloaca	IA	Ulmer, 1970
			TX	Hollis, 1972
			NE	Brooks, 1976
		rectum,small intestine	AR	Rosen and Manis, 1976
			OH	Ashton and Rabalais, 1978
Mesostephanus kentuckiensis	metacercariae		OH	Myer, 1960
Pleurogenoides sp.			WA,OR,CA	Lehmann, 1965
Proterometra albacauda		esophagus,stomach	exp.	Krissinger and Mehra, 1968
Pseudosonsinotrema catesbeianae		duodenum	TN	Christian, 1971
Strigea elegans (in tadpoles)	mesocercariae		U.S.	Miller, et al, 1965a
	mesocercariae		U.S.	Miller, et al, 1965b
	mesocercariae		U.S.	Miller, et al, 1965c
		lung	MI	Esch and Kocan, 1966
CESTODA				
Cylindrotaenia americana		intestine	MA	Rankin, 1945
		small intestine	VA	Campbell, 1968
Ophiotaenia gracilis		small intestine	VA	Jones, et al, 1958
			CO	Buhler, 1968
		intestine	CO	Buhler, 1970
Ophiotaenia magna			OK	Hannum, 1925
	pleroceroid	intestine	OK	Trowbridge and Hefley, 1934
			OK	Kuntz and Self, 1944
			TX	Hollis, 1972
		small intestine	NV	Babero and Golling, 1974
			NE	Brooks, 1976
Ophiotaenia saphena		intestine	NC	Brandt, 1936
Proteocephalus sp.			WA,OR,CA	Lehmann, 1965

			NE	Brooks, 1976
proteocephalid cysts	cysts	general	NC	Brandt, 1936
Spirometra mansonoides	plerocercoid	femoral muscle	LA	Corkum, 1966
ACANTHOCEPHALA				
Centrorhynchus sp.		body cavity	NC	Brandt, 1936
		body cavity	VA	Campbell, 1968
			TX	Hollis, 1972