Effect of Habitat Degradation on the Health and Conservation of Painted Turtles (*Chrysemys picta*) and Slider Turtles (*Trachemys scripta)*.

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Abstract

The aim of this project is to determine how terrestrial habitat degradation impacts the health of painted turtles (*Chrysemys picta*) and slider turtles (*Trachemys scripta)*. We will trap turtles in wetlands surrounded by either degraded or intact terrestrial habitats to test whether differences in morphological and physiological health indicators are associated with habitat quality and can function as biomonitors for habitat quality. We predict that terrestrial habitat degradation acts as a persistent stressor, reducing the overall health of aquatic turtles.

Background

Reptiles are experiencing declines that are similar in geographic scope and severity to those experienced by amphibians. Many factors such as environmental pollution, global climate change, introduced invasive species, disease, and unsustainable harvesting contribute to these declines. As with amphibians, habitat degradation is the primary cause of reptile declines (Gibbons et al. 2000 and Lovich 1995). Some of the most heavily degraded and threatened habitats worldwide are wetlands, and within the last 200 years, over 53% of the original wetlands in the United States have been destroyed due to human development (Dahl 1990). Although regulations have been established to protect the remaining wetlands, these regulations typically only protect aquatic habitats and not the terrestrial land surrounding them (Semlitsch and Bodie 2003). Maintaining terrestrial habitat adjacent to wetlands is essential, however, for many aquatic reptiles to complete their life cycles and to maintain viable populations (Gibbons 1970, 2003 Wygoda 1979, Graham 1995, Joyal et al. 2001, Burke and Gibbons 1995, Semlitsch and Bodie 2003, and Steen and Gibbs 2004).

Aquatic turtles make excellent models for studying the effects of terrestrial habitat degradation because of their dependence on terrestrial habitat adjacent to wetlands for movement corridors, nesting, hibernation, and aestivation (Buhlmann 1995, Buhlmann and Gibbons 2001, Burke et al. 1993, Joyal et al. 2001, and Gibbons 2003) and their habit of basking in the open. Some aquatic turtles may travel long distances (Buhlmann and Gibbons 2001 and Joyal et al. 2001) and spend a greater proportion of each year in terrestrial habitat rather than in the wetland itself (Buhlmann and Gibbons 2001). Turtles are also ”keystone species” in aquatic ecosystems, in that they act as dispersers for plants, contribute to environmental diversity, and often comprise a significant portion of the biomass in wetlands. Unfortunately, over half of the native turtle species in the United States require conservation action (Lovich 1995), and the primary cause of their decline is habitat degradation. In turtles, terrestrial habitat degradation has been linked to abnormal population structures, and population declines (Marchand and Litvaitis 2004, Steen and Gibbs 2004, Aresco 2005, Dodd 1990, Gibbons et al. 2000). The sub-lethal impacts that terrestrial habitat degradation have on turtle health, however, remain unstudied.

Sub-lethal impacts can have important conservation implications if they affect the survival and reproduction of animal populations. Sub-lethal impacts have been shown to physiologically increase stress (Creel et al. 2002, Hopkins et al. 1997, Moore et al. 2005, Norris et al. 1999, Wasser et al. 1997, Marra and Holberton 1998) reduce reproduction (Kitaysky et al. 1999, morphologically reduce growth (Elsey et al. 1990), increase debilitating deformities (Hopkins et al. 2000), and behaviorally alter activity, diet, and competitive interactions (Hopkins et al 2000, Glennemeier and Denver 2001) in vertebrates. Turtles can be susceptible to many sub-lethal impacts due to complex life history traits. Since turtles are long-lived and have delayed maturity, sub-lethal impacts can accumulate over many years. However, these same life-history traits mean that long-term studies are required to monitor turtle population dynamics (Lovich 1995). Using morphological, physiological, and pathological indicators of stress may be useful to conservation biologists as quick biomonitors to identify sub-lethal impacts in potentially threatened populations (Wingfield et al. 1997, Creel et al. 1997), monitor re-introductions (Wingfield et al. 1997), devise and evaluate management strategies (Wasser et al. 1997, Homan et al., 2003ab, and Creel et al. 2002, and Elsey et al. 1990) and assess wetland quality (Homan et al. 2003).

Objectives

Determine the impacts of terrestrial habitat degradation on turtle health by examining the physiological stress levels, parasitism, and body condition in turtles.

Stress/Corticosterone

Chronic exposure to sub-lethal stressors can have profound impacts on the physiology of organisms. In recent years, conservation biologists have used the stress response as a biomonitor for identifying sub-lethal impacts (Homan 2003b; Wasser et al. 1997), assessing population health (Wingfield et al. 1997) and predicting the survival of individuals in stressed populations (Romero and Wikelski 2001). Baseline and stress induced patterns of glucocorticoid release can indicate the sensitivity of the hypothalamic-pituitary-adrenal (HPA) axis, and the ability of an organism to respond to stress. Additionally, glucocorticoids can be obtained easily with minimal harm to the animal and provide information in a short period of time, compared to behavioral studies (Homan et al. 2003).

Corticosterone is the primary glucocorticoid in reptiles (Greenberg and Wingfield 1987), and is usually rapidly released into the bloodstream from adrenal tissue in response to a variety of stressful environmental stimuli such as storms and predation. Increases in corticosterone promote behavioral and physiological changes that help the animal survive stressful conditions, and can have beneficial short-term effects such as increased foraging, temporary suppression of reproduction, and increased glucose production. However, under conditions of chronic stress, corticosterone can cause detrimental effects including inhibited reproduction, decreased growth, immunosuppression, phenotypic asymmetry, and death (Wingfield et al 1997; Guillette et al 1995).

Anthropogenic activity and alterations to natural habitat can act as stressors, resulting in elevated glucocorticoid concentrations. For example, anthropogenic alterations to natural habitat such as paved roads surrounding a salamander breeding pool (Homan et al 2003b), deforestation of owl habitat (Wasser et al 1997), heavy metal pollution in streams inhabited by trout (Norris et al. 1997), and coal waste pollution in ponds inhabited by toads (Hopkins et al. 1997) all resulted in increased glucocorticoid levels in the animals studied. Additionally, human activities such as snowmobiling, and ecotourism have been found to be stressful to elk and wolves (Creel et al 2002), and to neotropical birds (Mullner et al. 2004).

Parasites

Parasites can also act as biomonitors to identify sub-lethal impacts in stressed populations (Lafferty 1997, Lafferty and Holt 2003) and have been successfully used to examine the effect of degradation in aquatic and terrestrial habitats (reviewed by Lafferty 1997). In most studies, parasite prevalence (the percentage of hosts infected with a given parasite), and intensity (the number of parasites of a given species per infected host), is examined among hosts between a small number of control and impacted sites (Lafferty 1997). Using parasites as biomonitors can be difficult, however, due to the varied array of affects that stress can have on host-parasite dynamics, making predictions on how parasites will respond to environmental degradation difficult (Lafferty and Holt 2003).

Stressful situations often stimulate the release of corticosteroids that regulate the immune system in vertebrates (Guillette et al. 1995, Wingfield et al. 1997). Immune systems are costly to maintain and, in stressed animals, energy normally used for immune defense may be diverted to coping with the stressor, resulting in immunosuppression. Stressed individuals should, therefore, be more susceptible to infection (Scott 1988, Holmes 1996, Lafferty and Holt 2003) resulting in higher parasite prevalence and/or intensity. However, both the environmental stressor and parasitic infection can affect an individual's fitness (the ability to survive and reproduce), and alter host density (Lafferty and Holt 2003). Stressors that reduce host density should reduce parasite prevalence and transmission due to reduced contact rates between hosts (Lafferty and Holt 2003, Lafferty and Gerber 2002). Additionally, stressors (such as pollution) can have a direct negative impact on the parasites, and not the hosts, reducing parasitism (Lafferty and Holt 2003, Lafferty 1997).

Despite varied stressor-host-parasite interactions, parasites have been used successfully in a variety of vertebrate groups to assess environmental quality (reviewed by Lafferty 1997). Few studies, however, have adequately examined the effect of habitat degradation on parasitism in turtles. One study found that turtles from an industrial site had higher parasite loads than conspecifics from an agricultural site (de Campos Brites and Rantin 2004). No data was available, however, to compare parasite loads between polluted and unpolluted areas, so the ultimate effect of anthropogenic influence is uncertain. When altered and natural habitats have been compared, turtles from altered agriculture ponds had lower parasite loads than the turtles from natural ponds, presumably, from the high levels of insecticides used in agriculture. Additionally, turtles from ponds receiving thermal effluent had lower parasite prevalence than natural ponds, possibly from the parasites being unable to survive in the high water temperatures (Bourque and Esch 1974, Esch et al. 1979a).

Aquatic turtles, are hosts to a great diversity of micro- and macroparasites (Telford 1984). Since we are unwilling to sacrifice all the turtles in this study, we will only be examining hemoparasite and ectoparasite prevalence.

Coccidian parasites, especially hemogregarines (*Haemogregarina sp*.) are the most common intracellular blood parasites in turtles (Mader 1996, Siddall and Desser 1991, Telford 1984) and can be found in all families of freshwater turtles throughout the world (Telford 1984). In lizards (genus: Lacerta), *Haemogregarina* sp. have been known to affect life-history traits (Sorci et al. 1996), and physiological parameters of its host (Oppliger et al. 1996, and Oppliger and Clobert 1997), however, they are not thought to be pathogenic in turtles (de Campos Brites and Rantin 2004, Telford 1984). Hemoflagellates, such as *Trypanosoma* sp. are another common hemoparasite in turtles and not thought to be pathogenic in their natural hosts (Telford 1984 and Woo 1969).

Hematophagus leeches (*Placobdella* sp.) are known vectors for both *Haemograegarina* sp. (Mader 1996, Siddal and Desser 1992, Telford 1984) and *Trypanosma* sp. (Telford 1984), and can transmit the parasites between turtles (Barnard and Upton 1994, and Telford 1984). Leeches are the most common parasite in freshwater turtles (Light and Siddall 1999), and have been known to cause anemia in their hosts (Mader 1996). Additionally, they can be a significant component of macroinvertebrate diversity in freshwater systems, and have served as indicators of environmental stress (Grantham and Hann 1994).

Hypothesis

The goal of this project is was to determine the effects of terrestrial habitat degradation on the health status and conservation of painted turtles (*Chrysemys picta*) and slider turtles (*Trachemys scripta)* using a combination of field studies and endocrinological laboratory analyses. We propose that terrestrial habitat degradation acts as a persistent stressor, causing sub-lethal impacts in aquatic turtles. To test this hypothesis we measured baseline (unstressed) and stress induced concentrations of corticosterone, and ecto- and hemo-parasite prevalence and intensity as biomonitors of turtle health. This study predicts that terrestrial habitat degradation and human recreation will be associated with reductions in turtle physiological health. The hypothesis will be supported if turtles from wetland sites demonstrating high degrees of terrestrial habitat degradation and human activity exhibit elevated baseline corticosterone concentrations, no increase in corticosterone levels 30-minutes after capture, and increased hemoparasite and ectoparasite prevalence and intensity compared to turtles living in wetlands with well-preserved terrestrial habitats. These responses may be useful as quick biomonitors in identifying sub-lethal impacts in potentially threatened populations, and monitoring wetland quality. This research will be a model for investigating impacts on highly threatened turtle species. The results of this study will have significant implications for the management of chelonian populations, and for wetland management and conservation in general.

Methods

Study Animals

Both the painted turtle (*Chrysemys picta),* and the slider turtle (*Trachemys scripta)* are two of the most widely studied, and distributed turtles in the United States. Both species are diurnal and prefer slow-moving, quiet waters with soft bottoms. An abundance of aquatic vegetation and suitable basking sites are preferred. In Illinois, both species hibernate and do not become active in the spring until water temperatures reach 10°C for slider turtles, and 14°C for painted turtles.

In both species, males are sexually dimorphic from females and display elongated foreclaws and anal openings posterior to the carapacial ridge. We will designate male and female painted turtles as sexually mature if their plastron lengths exceed 70 mm and 97 mm, respectively (Ernst et al. 1994). Slider turtles will be designated as mature if male plastron lengths exceed 100 mm and female plastron lengths exceed 160 mm (Gibbons and Greene 1990).

Field Protocol

To examine the effects of terrestrial degradation on turtle health, fifty-seven ponds surrounded by varying levels of terrestrial habitat degradation within 125 m of the pond edge were chosen based on analysis of aerial photographs and field visits.

Turtles were trapped from May through September 2005, and encompass both to breeding and post-breeding seasons. Turtles were sampled and submitted to a capture stress protocol. All turtles will be notched on the marginal scutes of the carapace to indicate previous capture (Cagle 1939).

Capture Stress Protocol and Blood Collection

The actual time turtles spend in the trap will be unknown (up to 24 hours), however, trapping has not been found to be an acutely stressful event and has not been associated with increased hormone levels (Cash et al. 1997; Licht et al. 1985). The first blood sample will be obtained within 3 minutes of capture (researcher touching the trap). Changes in corticosterone concentrations can be detected as early as 3 minutes from time of disturbance, so samples taken within 3 minutes should represent baseline corticosterone concentrations. A second sample will be collected at 30 minutes, to determine the corticosterone response to the capture (Wingfield et al 1997; Cash et al. 1997; Homan et al. 2003). An increase in corticosterone concentration between the two blood draws in undegraded habitats (see below) will further validate the assumption that the time spent in the trap (before handling) is not an acutely stressful event. A total of 2,160 blood samples will be collected from 1,080 turtles.

All blood will be collected from the subcarapacial sinus using disposable 25-gauge needles and tuberculin syringes, and placed in heparinized Capiject tubes. Blood smears will be made from the first blood sample to evaluate hemoparasite prevalence. The blood samples will then be placed on ice and centrifuged within 8 hours. Plasma will be decanted, placed in microcentrifuge tubes, and stored in liquid nitrogen until transferred to a -80° freezer. The red blood cells will be preserved in lysis buffer and stored at -80° for other uses. The protocol is approved by the University of Illinois Institutional Animal Care and Use Committee.

Radioimmunoassay of Corticosterone

All plasma samples will be analyzed by radioimmunoassay (RIA) for corticosterone concentration by Rebecca Holberton at the University of Maine, in a collaborative effort. This project will only be charged for the cost of antibody purchases.

Parasite Prevalence

Leeches will be counted for each turtle, and blood smears, created from the first blood sample, will be stained using the Wright-Giemsa method. From each smear, we will scan 5,000 cells to determine hemoparasite prevalence and intensity. Prevalence is defined as the % of hosts infected with at least one parasite, and intensity is defined as the average number of parasites per infected host.

Other standard measurements

Turtles will be weighed using a digital scale (to the nearest 0.01g), and measured for carapace length, and plastron lengths (to the nearest 0.01mm) using aluminum calipers. Body condition scores will be calculated based on the residuals of a regression of total body length and the cubed root of body mass (Cash et al. 1997).

Results

General

From 25 May to 22 September 2005, 57 open water ponds were sampled from central and southern Illinois. Baited hoop traps captured a total of 522 individual turtles from 8 species at 44 of the ponds. Only a single individual was captured from two species: the river cooter (*Pseudemys concinna),* and the false map turtle (*Geographica pseudogeographica*). The most common turtle captured was the red-eared slider turtle (*T. scripta)* followed by painted turtles (*C. picta),* snapping turtles (*C. serpentina),* common musk turtle (*S. odoratus),* and finally, spiny softshell turtles (*A. spinifera)*. One Florida cooter (*Pseudemys floridana*) and one false map turtle (*G. pseudogeographica)* were found in the Arboretum Pond south of the University of Illinois and were likely released pets (Table 1).

Thesis project

A total of 222 paired plasma samples (baseline and acute corticosterone response samples) from T. scripta, and 91 paired samples from C. picta were sent to Dr. Rebecca Holberton at the University of Maine for corticosterone analysis. We are still awaiting results so no data is currently available.

A total of 433 turtles from five species were examined for ecto-parasites (leeches). We are currently writing these results up for publication and I have included a copy of the manuscript (still in preparation).

Blood smears are still being examined for hemoparasites. Approximately 400 blood smears from individual turtles will be used to examine the impacts of habitat degradation on turtle parasitism. No data is currently available.

Digital orthophoto quadrangles (DOQs) from the ISGS website and digital land cover maps from the Illinois Department of Agriculture are being used to examine the habitat use surrounding each pond. I am currently digitizing ponds and working with the ATLAS center on campus for help with GIS technology. No data is currently available.

Side project

Additionally, I used information from captured turtles from the summer of 2005 for a side project examining secondary sexual character (SSC) development in *T. scripta*. We have submitted one manuscript to the scientific journal Copeia and it is going to review. I have attached a copy of this submitted manuscript. A second manuscript on this side project is also in preparation and the R. Weldon Larimore support will likewise be acknowledged.

Larimore Property/Jordan Creek

Six ponds at the Larimore property, and two sections of Jordan Creek were trapped for turtles during the summer of 2005 (Picture 1 and 2). Additionally, minnow traps were set in Jordan Creek to survey for mudpuppies (*Necturus maculatus*), a species known to occur in that location. No turtles or mudpuppies were recovered from Jordan Creek (see Tables 2 and 3). A total of 30 individuals from three species of turtles were captured from the Larimore property (see Tables 4.1, 4.2, and 4.3)

Discussion

This discussion will only include information on the Larimore property and Jordan Creek. All other available data is included in manuscript form.

Jordan Creek

Although no turtles were captured in Jordan Creek, I believe that turtle do utilize the creek. Two fishermen reported to me that they saw what is likely to be a common snapping turtle and a spiny softshell turtle in the creek during preceding years. Additionally, one hatchling painted turtle was found in the spring of 2005 alongside the creek bank. I do not have a good explanation for why turtles were not captured in Jordan Creek despite over 1100 trap hours of effort. My only thought is that during drought years (like that of 2005), the creek water level may have decreased enough to encourage resident turtles to either aestivate or migrate to another water source. This was seen in other turtles in Illinois during the drought conditions in 2005 (Banning et al. 2006).

No mudpuppies were captured from Jordan Creek. Mudpuppies have been observed in the creek (Larimore, personal communication). I only concentrated our mudpuppy survey in the forested sections of the creek after communication with Dr. Chris Phillips.

Larimore Property

Turtles at the Larimore property showed a distinct preference for certain ponds. Turtles were captured only from the Cabin Pond, Pond 2, and Pond 4. Turtles were visually encountered, however, in the Entrance Pond, and one turtle was seen basking in Pond 1. No turtles were ever seen in Ponds 3, 4, 5, or 6. Because turtles were not seen in Ponds 5 and 6, I did not trap them.

Pond 4 had the highest density of turtles. This was surprising because it was the smallest pond surveyed. One reason for the high density of turtles may be from food availability. Adult slider and painted turtles feed primarily on vegetation (Ernst et al. 1994), and throughout the year, Pond 4 was covered in duckweed, a characteristic that no other pond shared. Additionally, none of the other ponds had much submergant vegetation. Fecal examinations from two painted turtles taken from Pond 4, however, suggest that the turtles were also consuming water beetles. Because most vegetation is digested in the gut, we were unable to determine how much of the turtles diet was from duckweed.

The painted turtle was the only species with recapture data. Ten of the turtles were recaptured in the same pond as their initial capture. Two turtles, however, were found to have migrated to a different pond. Turtle 1L-8L was a male originally captured in Cabin Pond on 6/2/05. On 7/17/05, however, he was found in Pond 4. Additionally, turtle 1L-9L, a female originally captured on 6/2/05 in Pond 2, was captured on 7/18/05 in Pond 4. This provides evidence that turtles migrate among the pond complexes. Migration in males can be due to mate searching, or to locate a new site with more food resources or water (Ernst 1994). Female migrations, can be for similar reasons, or also from nesting (Ernst 1994). This female, however, was not gravid during her initial encounter.

Overall, encouraging the growth of more aquatic vegetation might help encourage a larger number of turtles to remain in the ponds.

Species	No. individuals	No. recaptures
A. spinifera	20	0
C. serpentina	60	2
C. picta	99	26
G. pseudogeographica	2	0
P. concinna	1	0
P. floridana	1	0
S. odoratus	26	0
T. scripta	313	7
Total	522	35

Table 1. Number of individuals captured throughout the 2005 season.

	Set	Removed	# Traps used	Total Trap Hours	Days/Trap	*C. serpentina*	*C. picta*	*T. scripta*
Larimore Property								
Entrance Pond	6/1/05	6/7/05	1	146	6	0	0	0
Cabin Pond	6/1/05	6/13/05	2	588	12	0	8	1
	6/17/05	6/27/05	2	432	9	0	1	0
	7/15/05	7/19/05	3	313	4	0	0	0
	9/16/05	9/22/05	3	432	6	1	5	0
Pond 1	6/1/05	6/11/05	1	245	10	0	0	0
	7/15/05	7/19/05	2	194	4	0	0	0
	9/16/05	9/22/05	1	142	6	0	0	0
Pond 2	6/1/05	6/11/05	2	445	9	0	2	1
	7/15/05	7/19/05	2	189	4	1	1	0
	9/16/05	9/22/05	2	285	6	0	0	0
Pond 3	9/16/05	9/22/05	1	143	0	0	0	
Pond 4	7/15/05	7/21/05	2	286	6	1	14	0
	9/16/05	9/22/05	2	286	6	0	4	0
			Total	4126	---	3	35	2
Jordan Creek								
Forest	6/12/05	6/26/05	2	671	14	0	0	0
	7/17/05	7/19/05	2	98	2	0	0	0
	9/16/05	9/19/05	2	152	3	0	0	0
Field	6/15/05	6/22/05	1	168	7	0	0	0
	7/17/05	7/19/05	1	48.5	2	0	0	0
	9/16/05	9/17/05	1	26.5	1	0	0	0
			Total	1164	---	0	0	0

Table 2. Turtle trap records from the Larimore Property and Jordan Creek.

Jordan Creek	Set	Removed	# Traps used	Total Trap Hours	Days/Trap	*Necturus maculatus*
Forest	6/22/05	6/26/05	11	1100	4	0
	7/17/05	7/19/05	11	511.5	2	0
			Total	1611.5	---	0

Table 3. Mudpuppy trap records for Jordan Creek.

Chelydra serpentina							
	ID	Sex	DOC	location	Weight	CL	PL
Initial Captures	12L	Unknown	7/22/05	Cabin Pond	106	69	58
	11L-12L	Male	9/21/05	Cabin Pond	---	247	176
	---	Female	6/2/05	Field	---	277	215
	11R	Unknown	7/17/05	Pond 2	1704	189	147
	12R	Unknown	7/16/05	Pond 4	---	193	136

Table 4.1. Individual turtle information. Two turtles were hand captured: one adult female in a field, and the other a juvenile in Cabin Pond.

Chrysemys picta								
	ID	Sex	DOC	Location	Weight	CL	PL	Gravid
Initial Captures	1L-3L	Female	6/2/05	Cabin Pond	630	167	161	Yes
	1L-8L	Male	6/2/05	Cabin Pond	402	150	141	---
	2L-3L	Female	6/6/05	Cabin Pond	688	177	168	Yes
	1L-11L	Female	6/7/05	Cabin Pond	725	183	165	No
	1L-12L	Female	6/7/05	Cabin Pond	603	169	160	No
	2L-8L	Female	6/10/05	Cabin Pond	616	164	159	Yes
	2L-9L	Female	6/10/05	Cabin Pond	681	176	168	Yes
	9L-12R	Male	9/17/05	Cabin Pond	428	160	147	---
	1L-9L	Female	6/2/05	Pond 2	534	167	159	No
	1L	Male	6/2/05	Pond 2	147	106	98	---
	3L-9L	Female	7/16/05	Pond 2	686	180	174	No
	1L-9L	Female	7/16/05	Pond 4	570	169	159	No
	8L-9L	Female	7/16/05	Pond 4	223	117	110	No
	2L-11L	Male	7/16/05	Pond 4	460	160	146	---
	3L-8L	Male	7/16/05	Pond 4	343	144	129	---
	3L-12L	Male	7/16/05	Pond 4	214	120	114	---
	3L-10L	Male	7/16/05	Pond 4	284	137	121	---
	3L-11L	Unknown	7/16/05	Pond 4	98	88	83	---
	12R	Male	7/16/05	Pond 4	430	159	149	---
	8L-10L	Male	7/17/05	Pond 4	331	147	133	---
	8L-11L	Female	7/18/05	Pond 4	783	185	177	No
	8L-12L	Male	7/20/05	Pond 4	308	139	130	---
	10L-11L	Female	9/18/05	Pond 4	696	179	173	No
Recaptures	1L-11L	Female	6/10/05	Cabin Pond	726	183	165	No
	1L-12L	Female	6/27/05	Cabin Pond	684	168	160	No
	1L-3L	Female	9/21/05	Cabin Pond	608	165	162	No
	2L-8L	Female	9/21/05	Cabin Pond	606	168	160	No
	9L-12R	Male	9/21/05	Cabin Pond	431	160	148	---
	1L-11L	Female	9/22/05	Cabin Pond	838	184	167	No
	1L-8L	Male	7/17/05	Pond 4	403	151	145	---
	1L-9L	Female	7/18/05	Pond 4	564	169	159	No
	8L-9L	Female	7/21/05	Pond 4	235		111	No
	8L-10L	Male	9/18/05	Pond 4	306	146	132	---
	3L-12L	Male	9/18/05	Pond 4	213	124	117	---
	2L-11L	Male	9/20/05	Pond 4	447	160	146	---

Table 4.2. Individual turtle information.

Trachemys scripta									
	ID	Sex	DOC	Location	Weight	CL	PL	Gravid	Melanistic
Initial Captures	1L-2L	Male	6/2/05	Cabin Pond	1008	207	192	No	---
	1L-10L	Male	6/2/05	Pond 2	1486	227	209	---	Yes

Table 4.3. Individual turtle information.

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