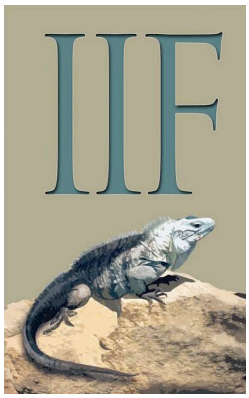

APPLICATION COVER SHEET

Name of Applicant and Organization: Chad E. Montgomery; University of Wisconsin La Crosse
Project Title: Status and Conservation of *Ctenosaura melanosterna* in the Cayos Cochinos Archipelago
Was this project funded in 2005? Yes _____ No _XXX_.
Has your final report been submitted?_____ If no, when can we expect it?

Total cost of this project: 11,000.00 Amount Requested: 5,500.00 Percentage of Total Project: 50%

Name of principal contact: Dr._X Mr.__ Ms.__Chad E. Montgomery
Address:___Department of Biology, University of Wisconsin La Crosse, La Crosse, WI 54601
Phone: (608) 785-6998 Fax: (608) 785-6959 Email: montgome.chad@uwlax.edu

Name(s) of Persons Conducting Program:___Chad E. Montgomery

Species Targeted:__*Ctenosaura melanosterna*_____Country:_____Honduras

Brief Description of Project (goals, outcomes and actions): *Ctenosaura melanosterna* is listed as critically endangered on the IUCN Red List due to a limited geographic range, habitat destruction, and overexploitation. There is currently limited information available concerning the ecology, life history, population size, or genetic structure of this species. My objectives are to 1) increase our understanding of the basic ecology and life history of *C. melanosterna*; 2) determine the population size of *C. melanosterna* on Cayo Pequeño and Cayo Grande; 3) determine the genetic relatedness within and between the Cayo Pequeño and Cayo Grande populations; and 4) determine the life stage specific effects of poaching on *C. melanosterna* by comparing the protected Cayo Pequeño population to the susceptible Cayo Grande population. The outcome of this project will be a long term management plan developed in cooperation with the Honduran Coral Reef Foundation and Operacion Wallacea to ensure protection of *C. melanosterna* within the Cayos Cochinos Archipelago. The management plan will also have direct implications for the Rio Aguan Valley population of *Ctenosaura melanosterna*.

Time Frame of Project (from/to):___1-January-2007 to 31-December-2007
Other Confirmed Funding Sources:__Honduran Coral Reef Foundation and Operacion Wallacea
Other Organizations/Partnership(s) Involved: Honduran Coral Reef Foundation and Operacion Wallacea
I understand that a report of significant outcomes to date is due within one year of receipt of funds, or before I apply for any additional funds. I understand and agree that award recipients, including the name of this organization and project information may be released and publicized.

Signature_____ Printed Name__Chad E. Montgomery

Title__Assistant Professor_____ Date___17-October-2006

Project Summary:

Ctenosaura melanosterna is endemic to Honduras and restricted to the Valle de Aguan region and to the islands of Cayo Pequeño and Cayo Grande. *Ctenosaura melanosterna* is imperiled due to its limited geographic range, increased fragmentation and habitat destruction, and continued overharvesting of eggs and adults. Because of the detrimental impact of these factors on population of this species, *C. melanosterna* has been categorized as critically endangered according to the IUCN Red List. There is currently a lack of information available concerning all aspects of the species' biology. Therefore, I propose to study the ecology, demography, population size, and genetic relatedness of *Ctenosaura melanosterna* on Cayo Pequeño and Cayo Grande to gather information necessary for the development of a management plan for the species.

Project Introduction:

Iguanids throughout Central America and the Caribbean are rapidly declining due to anthropogenic factors including habitat destruction and the exploitation of eggs and adults for food. *Ctenosaura melanosterna*, the black-chested spinytail iguana, is one species that exemplifies this decline and is increasingly vulnerable due to its limited geographic distribution (Wilson and McCranie, 2004). Due to a small geographic range and declining, fragmented populations *C. melanosterna* is categorized as critically endangered on the IUCN Red List. *Ctenosaura melanosterna* is endemic to Honduras and is known from just two localities, the Cayos Cochinos Archipelago off the north coast of Honduras and the Valle de Aguan region on the north-central mainland. *C. melanosterna* has been classified as one of the top four most ecologically vulnerable reptile species in Honduras (Wilson and McCranie, 2004). Little information is available concerning population size trends or even basic ecology of the species, however there is evidence demonstrating that the population within the Rio Aguan Valley continues to be heavily hunted, and is nearing extirpation (Reynoso et. al., 2006).

Within the Cayos Cochinos Archipelago, *C. melanosterna* exists on Cayo Cochino Pequeño and Cayo Cochino Grande. Both islands are now within the Cayos Cochinos Archipelago Natural Marine Reserve (CCANMR) operated by the Honduran Coral Reef Foundation (HCRF). The population on Cayo Cochino Pequeño is protected by the presence of an HCRF research establishment; however, the population on Cayo Cochino Grande, although legally protected, remains susceptible to poaching due to limited presence of the HCRF on the island, leaving this population of *C. melanosterna* increasingly vulnerable. The vulnerability of the Cayo Grande population is increased due to the affinity of the species for human settlements, making them more susceptible to poaching. Exploitation and habitat destruction on Cayo Cochino Grande leaves the population on Cayo Cochino Pequeño as the only stable representation of this species.

Since the description of *C. melanosterna* as a separate and distinct species from *C. palearis* (Buckley and Axtell, 1997), little ecological information on the species has been collected. According to the IUCN Red List, information on the ecology, population size and trends, and management of the species is needed (Kohler, 2004). Some information, however, about the ecology of *C. melanosterna* on Cayo Pequeño is available (Wilson and Cruz Diaz, 1993; Shaw, 2005; Reed et. al, 2005). *Ctenosaura melanosterna* appears to reach high densities on Cayo Pequeño and is the most common lizard observed (Shaw, 2005). It is known to inhabit palm groves, rocky promontories, hill forest, and wind scrub (Wilson and Cruz Diaz, 1993; Shaw, 2005) and have an affinity for human settlements (Wilson and Cruz Diaz, 1993). *C. melanosterna* appears to be more arboreal than other species of the genus, however juvenile lizards are reported to more terrestrial than adults (Shaw, 2005). Ctenosaurs on Cayo Pequeño are omnivorous, and take full advantage of food discarded from the research station kitchen (pers. observ). Away from the kitchen, lizards have been observed feeding on leaves and likely consume land crabs opportunistically (pers. observ). The only known natural predator of these lizards on the islands is *Boa constrictor*, which is known to feed on lizards of all life stage classes except eggs (pers. observ; Reed et al., 2005).

During the establishment of the CCANMR the HCRF established a management plan for the entire reserve. One of the objectives of the HCRF management plan is to determine the effects of the local Garifuna community and continued development on the natural resources of the reserve. As part of that plan, the HCRF is interested in the effects of hunting on the iguanas within the reserve. The HCRF is, therefore, supporting our project by providing local travel (including boats), lodging, meals, personnel, and logistical support.

Cayo Pequeño and Cayo Grande are similar in all biotic and abiotic characteristics. The only major difference between the two islands is the human presence on Cayo Grande. Therefore, a comparison of the populations from the two islands presents a unique opportunity for determining the effects of harvesting on the population status and demography of *C. melanosterna*. Ascertaining the functional population size and the life stage specific effects of hunting are critical for establishing the minimum viable population (MVP) and subsequent maximum sustainable harvest (MSH). MVP and MSH are critical for developing management guidelines for *C. melanosterna* in the reserve and are directly applicable to the Rio Aguan Valley population.

The objectives of the proposed study are to 1) increase our understanding of the basic ecology and life history of *C. melanosterna*; 2) determine the population size of *C. melanosterna* on Cayo Pequeño and Cayo Grande; 3) determine the intra- and inter-population relatedness of the two Cayos populations; and 4) determine the life stage specific effects of poaching on *C. melanosterna* by comparing the protected Cayo Pequeño population to the susceptible Cayo Grande population. To accomplish our objectives, we will examine the population status, demography, and recruitment of *C. melanosterna* in the Cayos Cochinos Archipelago using visual encounter surveys and mark recapture techniques. Our results will have important implications for determining management strategies for the conservation of *C. melanosterna* in the Cayos Cochinos, as well as the Rio Aguan Valley.

Methods:

Study Site—The Cayos Cochinos are a group of small islands approximately 17 km north of the town of Nueva Armenia, Atlántida, Honduras and part of the Bay Islands department of Honduras (McCranie et al. 2005). The archipelago consists of two main islands and several smaller cays, with a total land area of 2.28 km^2 (Davidson 1979). The largest of the two main islands, Cayo Cochino Grande, is approximately 1.55 km^2 in area and the smaller of the two main islands, Cayo Cochino Pequeño is approximately 0.64 km^2 (Davidson 1979). Cayo Cochino Grande has a small permanent population of Garifuna residents in the village of East End, as well as a small resort catering to SCUBA divers. Cayo Cochino Pequeño is uninhabited with the exception of a small research station run by the Honduran Coral Reef Foundation (HCRF). "Hill forest," dominated mainly by tropical lowland oak (*Quercus oleoides*), and "wind swept forest" dominated by windswept lowland oak, prostrate sea grapes, or a mixture of the two, are the primary habitats of the two islands (Wilson and Cruz Diaz, 1993).

Mark Recapture—Lizards will be captured in the field using a combination of noosing, box traps, and pitfall traps. Nooses will be made from modified collapsible fishing poles with 10lb test fishing line as the noose. Twenty box traps will placed in a pseudorandom fashion to cover all available habitat types throughout the study site, baited with meat scraps and fruit, and checked daily. In addition, ten pitfall arrays will be placed throughout the available habitat. Each pitfall array will consist of a ten meter drift fence constructed of landscape fencing (0.5 m tall) with a 7.5 liter bucket on each end. Pitfall traps will be monitored daily throughout the study.

Data Collection—All lizards captured will be processed in the field and released immediately. At the site of capture I will record date, time, ambient temperature, cloacal temperature, and location (UTM coordinates using a Garmin GPS II Plus (Garmin Intl., Olathe, KS)). I will measure whole body mass, snout-vent length (SVL), and tail length (TL). I will measure mass to the nearest gram using a Pesola sping scale or an electronic balance and length to the nearest centimeter (error rate ± 1.0% of total length) using a measuring tape. In addition, I will record sex (by cloacal probing), reproductive condition (by palpation), and stage class (adult, juvenile, or young of the year). Each lizard will be permanently marked by injection of a small (11mm X 2.1mm) polymer-encased microchip (passive integrated transponder (PIT tag); AVID, Inc (Norco, CA)) intraperitoneally in the left lateral abdominal region. PIT-tagging provides unique individual identification without significantly affecting the health or behavior of the animal and has been shown to be more effective than other marking techniques (Camper and Dixon, 1986). Each lizard will also be marked by painting, using non-toxic paint, the lizard identification number on the left and right lateral surface of the body for temporary identification, so that

an individual is not recaptured shortly after initial capture. Subsequent recapture and measurement will provide movement, growth and survivorship data. In addition to marking and measuring, a blood sample (0.4 ml) will be taken from the subcaudal vein for DNA microsatellite analysis.

Population Estimate—To estimate the population size on each island I will set up a series of 10 visual transects on each island. Transects will be 100 m long and marked every 10 meters. Each transect will be walked every other day (with time of day randomized) throughout the course of the study. When a ctenosaur is observed, I will record time, date, position along transect, distance from transect, stage class, and sex. At the end of the study I will estimate the population size for each stage class and sex based on the average number of individuals observed within the searchable area of each transect in a particular habitat. I will determine the searchable area by multiplying the length of the transect by the average distance a ctenosaur was observed from the transect line. By extrapolating those values for total area of each habitat type on each island I will be able to determine the population size of each life stage class for each island. By comparing the population sizes between the two islands I will be able to determine the life stage class specific effects of poaching.

Population Genetics—I will collect a blood sample from each individual captured that will be used for DNA analysis. I will store blood samples in 100% ethanol in a refrigerator until time of extraction. I will use a standard DNA extraction kit (Qiagen DNeasy) following a 12 hour proteinase K digestion to isolate DNA. I will test published *C. hemilopha* microsatellite primers (Blazquez et al., 2006) to determine if they are informative in *C. melanosterna*. In addition, I will develop microsatellite primers using the protocol of Blazquez et al. (2006). Due to the invaluable work being conducted by S. A. Pasachnik on the relatedness of *C. melanosterna*, *C. bakeri*, *C. oedirhina*, *C. similis*, and *C. palearis* a genomic library will already be available for *C. melanosterna*. The availability of the partial genomic library for *C. melanosterna* will greatly reduce the time and money needed to complete this project. Based on the results of microsatellite analysis of individuals from the two populations I will be able to determine intra- and inter-population genetic variation. Comparison of intra-population genetic variation between the two populations will provide evidence of the effects of poaching on the Cayo Grande population. I will also be able to determine if a reduction in population size has occurred on Cayo Grande, and if so how long ago, using the model constructed by Garza and Williamson (2001).

Projected Outcomes:

The results of the proposed research will include at least three peer reviewed publications discussing the natural history, population size, genetic relatedness, and the effects of poaching on *C. melanosterna* in the Cayos Cochinos Archipelago. The more important result, however, will be a management plan for the conservation of *C. melanosterna* within the Cayos Cochinos Archipelago.

There is currently little to no information available about the life history and ecology of *C. melanosterna*, although that information is needed for the species (Kohler, 2004). Therefore, data collected during this project will be the first broad scale natural history study of any population of this species. Data gathered on the natural history and demography of the species will be invaluable for establishing a recovery plan for the highly imperiled Rio Aguan Valley population. Natural history data will also be helpful in the captive management of *C. melanosterna* at the Centro Regional de Educacion Ambiental (Arenal, Honduras; Reynoso et al., 2006).

Currently the only estimate of the total population size for *C. melanosterna* is fewer than 2,500 adults (Kohler, 2004), although no basis for the estimate is provided. A reliable population estimate from two of the three known localities of *C. melanosterna* is necessary for assessing the species and is invaluable for determining the overall status of the species (Kohler, 2004). Population estimates will provide necessary information for determining the effects of overexploitation on the demography of the species. Overexploitation of adults and eggs is a major factor contributing to the extirpation of the species from some localities.

The inter- and intra-population genetic relatedness of the species is unknown. Determining the genetic relatedness of different populations will provide valuable information needed for the conservation and management of the species. In addition, genetic analysis may provide evidence of the origin of the Cayos

Cochinos populations of *C. melanosterna*. Currently it is unknown whether those populations are the result of introductions or natural range expansions.

A management plan should be the priority for any conservation effort. Based on the results of the proposed research I will be able to construct a management plan in cooperation with the HCRF and Operation Wallacea that will ensure the protection and sustainability of *C. melanosterna* in the Cayos Cochinos Archipelago into the foreseeable future. The management plan will also be valuable and directly applicable to *C. melanosterna* conservation and management efforts in the Valle de Aguan region.

Project Schedule:

The field aspects of the proposed project will be initiated 20-December-2006 and continue through 31-December-2007. The field project will be broken up into a two week trip in December, 2006; a 3 month trip during the summer (June – August) 2007; and a final two week trip in December, 2007. During the field component of the project all of the tissue samples will be collected and the natural history data and population estimate data will be collected. The laboratory (microsatellite analysis) component of the project will continue through May, 2008 to allow enough time to process all of the tissue samples including those collected on the final field trip in December, 2007.

Literature Cited:

Blázquez, M.C., R. Rodríguez Estrella, and A. Munguía Vega. 2006. Characterization of 10 microsatellite loci in the spiny-tailed iguana *Ctenosaura hemilopha*. Molecular Ecology Notes 6:753-755.

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Budget for IIF Proposal:

BUDGET ITEM & METHOD OF CALCULATION	PROJECT COMPONENT	AMOUNT REQUESTED FROM IIF	AMOUNT IN - KIND	AMOUNT FROM OTHER FUNDING SOURCE(S)	TOTAL
Labor					
Included in HCRF Personnel Salary	Drift Fence and Pitfall Trap Construction				
Travel					
2 roundtrip flights (2 X $900 =$1800)				$1800	$1800
Boat Travel (2 trips from mainland to Cayo Pequeno @ $100) (20 trips between islands @ $25)				$700	$700
Room and Board (120 days at $25/day = $2250)				$3000	$3000
Equipment & Supplies					
PIT tags (500 @ $5)	Mark recapture study	$2500			$2500
Other					
DNA isolation and PCR (500 samples @ $6)	Genetic relatedness study	$3000			$3000
TOTAL PROJECT BUDGET					11,000
TOTAL REQUESTED FROM IIF					5,500
OTHER FUNDING SUPPORT					5,500

Budget Narrative

Transportation

Air Travel: (to be paid by Operacion Wallacea)	
2 roundtrip flights from U.S. to La Ceiba, Honduras 2 tickets @ 900.00 ea	1,800.00
Boat Travel: (to be paid by HCRF)	
2 roundtrip rides from mainland to Cayo Pequeno @ $100/trip	700.00
20 trips between islands @ $25/trip	
Room and Board on islands: (to be paid by HCRF and Operacion Wallacea)	
Room and 3 meals a day for 120 days @ $25	3,000.00

Equipment & Supplies

PIT Tags:	
500 AVID Pit tags @ $5 each	2,500.00
500 DNA Isolation and PCR reactions @ $6 each	3,000.00

Other Sources of Support: funding, logistical and technical. Are matching funds available and have they been applied for?

The Honduran Coral Reef Foundation will provide local travel, room and board, personnel, and logistical support. Operacion Wallacea will provide international travel, room and board, and logistical support.

Chad Edward Montgomery

October, 2006

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Education:

Ph.D. in Biological Sciences May, 2005; University of Arkansas, Fayetteville. "Bioenergetic and ecological correlates of foraging mode in the copperhead, *Agkistrodon contortrix*, and the timber rattlesnake, *Crotalus horridus*, in northwest Arkansas."

Masters of Arts in Biology (Thesis) May, 1998; University of Northern Colorado, Greeley. "Natural history of the Texas horned lizard, *Phrynosoma cornutum*, in southeastern Colorado with notes on clinal variation throughout its range."

Bachelor of Science in Biology May, 1995; Northeast Missouri State University (now known as Truman State University), Kirksville, Missouri.

Teaching Experience:

06/06-Present Assistant Professor of Biology, University of Wisconsin La Crosse.

01/06-05/06 Instructor for Zoology 408-Herpetology, Zoology 410-Conservation Biology, Southern Illinois University

07/04-Present Dissertation Supervisor for Operation Wallacea Honduras Program in Cayos Cochinos, supervising undergraduates conducting research

09/04-12/04 Teaching Assistant for Biology 4230L-Comparative Physiology Lab, University of Arkansas

08/03-05/04 Teaching Assistant for Zoology 2441L-Human Anatomy Lab, University of Arkansas

Research Experience:

04/05-05/06 Postdoctoral research associate examining the effects of high elevation tropical amphibian decline on a snake community. Southern Illinois University, Carbondale

08/99-12/04 Research assistant examining energy allocation of the timber rattlesnake, *Crotalus horridus*, in northwest Arkansas. University of Arkansas, Fayetteville

Publications:

Reed, R.N., S.M. Boback, **C.E. Montgomery**, S. Green, Z. Stephens, and D. Watson. Ecology and conservation of an exploited insular-endemic population of *Boa constrictor* (Squamata: Boidae) in the Cayos Cochinos, Honduras. In: Biology of the Boas and Pythons. R.W. Henderson, R. Powell, G.W. Schuett, and M.E. Douglas eds., Eagle Mountain Publishing. In Press.

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Whiles, M., K. Lips, C. Pringle, S.S. Kilham, R.J. Bixby, R. Brenes, S. Connelly, J.C. Colon Gaud, M. Hunte-Brown, A.D. Huryn, **C.E. Montgomery**, and S. Peterson. 2006. The consequences of amphibian population declines to the structure and function of neotropical stream ecosystems. *Frontiers in Ecology and Evolution*, 4(1):27-34.

Presentations:

Montgomery, C.E.* and K.L. Lips. 2006. Effects of amphibian decline on a mid-elevation snake community. Ecological Society of America. Memphis, TN.

Montgomery, C.E.* and K.L. Lips. 2006. Ontogenetic shift in sleeping perch in *Oxybelis brevirostris*. Midwestern Ecology and Evolution Conference. St. Louis, MO.

Montgomery, C.E.*, H. Shaw, S.M. Boback, and R.N. Reed. 2006. The reptiles and amphibian of Cayos Cochinos Pequeño, Honduras. Southeastern Ecology and Evolution Conference. Tuscaloosa, AL.

Reed, R.N., S.M. Boback, and **C.E. Montgomery***. 2005. Ecology and conservation of insular *Boa constrictor* in the Cayos Cochinos, Honduras. Joint Meeting of Ichthyologists and Herpetologists. Tampa, FL.

Published Natural History Reports:

Frazier, J.A., **C.E. Montgomery**, S.M. Boback, and R.N. Reed. In Press. *Coniophanes imperialis* (Black–striped Snake) Diet. *Herpetological Review*.

Montgomery, C.E., E.J. Griffith Rodriguez, H.L. Ross, C.A. Jaramillo, and K.R. Lips. In press. *Urotheca decipiens* (Collared Glasstail Snake). Diet. *Herpetological Review*.

Frazier, J.A., **C.E. Montgomery**, and K.R. Lips. In press. *Sibon nebulatus* (Common Snaileater). Maximum size. *Herpetological Review*.

Reed, R.N., S. Green, S.M. Boback, and **C.E. Montgomery**. 2006. *Ctenosaura melanosterna* (Black-chested Ctenosaur). Attempted predation. *Herpetological Review* 37(1):84.

Published Geographic Distribution Reports:

Frazier, J.A., **C.E. Montgomery**, S.M. Boback, and R.N. Reed. In Press. *Leptophis mexicanus* (Mexican Vinesnake). *Herpetological Review*.

Boback, S.M., **C.E. Montgomery**, R.N. Reed, and S. Green. In Press. *Oxybelis aeneus* (Brown Vinesnake). *Herpetological Review*.

Boback, S.M., **C.E. Montgomery**, R.N. Reed, and S. Green. In Press. *Kinosternon leucostomum* (Mud Turtle). *Herpetological Review*.