Check List **5**(3): 446–459, 2009.
ISSN: 1809-127X

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Amphibians and Reptiles from Reserva Natural Absoluta Cabo Blanco, province of Puntarenas, Costa Rica

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Abstract

A survey of the amphibians and reptiles of *Reserva Natural Absoluta Cabo Blanco* (RNACB), Puntarenas, Costa Rica was conducted from May to August 2003. Thirteen amphibian and 19 reptile species were found within the RNACB boundaries. Twenty-two of these species were not previously recorded from the lower Nicoya Peninsula and for seven, this locality represents the southernmost extension of their range. One additional amphibian and three reptile species are known from the area based on literature review and examination of museum collections. However, interviews with locals indicate that up to nine other reptile species could be present in the reserve. I observed all but one amphibian species at Laguna Balsitas and at least eight species utilize the lagoon for reproduction. The lagoon is also notable for its population of *Kinosternon scorpioides.* This study will provide a baseline for further research in the reserve.

Introduction

The importance of herpetological inventories as a basis for planning conservation and land use strategies, and as a springboard for future research, has been noted by several authors (Raven and Wilson 1992; Silva-Jr and Sites 1995; Sasa and Solórzano 1995). In Costa Rica there is a long history of herpetological inventories, most notably the work by Savage and his students spanning almost 40 years (Scott et al. 1983; Donnelly 1994; Guyer 1994, Guyer and Donnelly 2005, McDiarmid and Savage 2005), and that of Sasa and Solórzano (1995). Despite this long and productive effort, the herpetofauna in many areas around the country remains undocumented. Such is the case with the *Reserva Natural Absoluta Cabo Blanco* (RNACB). Established in 1963, RNACB has the distinction of being Costa Rica's first protected area. As such, it holds an important place in Costa Rican conservation both as an absolute reserve and as a symbol of the country's commitment to conservation. To date however, no formal list of its amphibians and reptiles exists.

This paper presents the results of a three-month inventory of RNACB and provides a preliminary species list of its amphibians and reptiles. I also compare the list of species found inside the reserve to known records of amphibian and reptile species in the Cabo Blanco area. Comments follow regarding the abundance, distribution within the reserve, and natural history of these species. This list is by no means final and is presented as a baseline to build upon and to stimulate future study in the area.

Methods

Study Site

Reserva Natural Absoluta Cabo Blanco, lying at the southern tip of Costa Rica's Nicoya Peninsula (9°34' N, 85°5' W) (Figure 1), comprises 1,270 terrestrial hectares and 1,700 ha of marine area. Known for its marine bird populations, the reserve ranges in elevation from sea level to 359 m (Boza 1984), and is part of the Tempisque Conservation Area. At its creation, 85% of its lands were being used for agriculture or grazing and was deforested. However, over the last 40 years, much of the natural vegetation in the RNACB has regenerated, and today the reserve consists of a mixture of primary and secondary forest. Holdridge's (1967) life zone system classifies RNACB as tropical moist forest and the reserve's mean annual temperature is 27.3 °C (SINAC 2002). Mean yearly rainfall is 2895.4 mm, most of which falls between May and November (*Instituto Meteorológico Nacional: Promedios Mensuales de Datos Climáticos: Estación Cabuya*, 1985). The reserve contains several streams, the two most important being Quebrada San Miguel and Quebrada Cabo Blanco.

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This study focused on three areas within the reserve (Figure 1): *Estación Cabuya* (EC), *Estación Biológica San Miguel* (EBSM) and *Laguna Balsitas* (LB). *Estación Cabuya* (9°35'21" N, 85°5'34.0" W) lies on the eastern side of the reserve and serves as the reserve's administrative center. The lands around the station include open areas, human habitations, beaches and an open, grassy arboretum. Sendero Sueco leaves EC and heads south through the forest for 4 km towards the tip of the peninsula, crossing Quebrada Cabo Blanco twice. Also of interest at EC are the roads leading to the station from the North that contain ephemeral pools housed in tire ruts and depressions. Estación Biológica San Miguel (9°34'47.5" N, 85°8'12.6" W), located on the west side of the reserve facing the Pacific Ocean, serves as the main investigative center and consists of a main house, dorm, laboratory and associated buildings. The surrounding area consists of regenerating forest with open sunny areas. EBSM is located next to Quebrada San Miguel and serves as the trailhead to Sendero Maven and Sendero El Barco. Leaving EBSN to the North is a small road to Mal País, which also contained ephemeral pools that provided suitable reproductive habitat for the amphibians in the area. Laguna Balsitas (9°34'50.1" N, 85°7'28.6" W) is an ephemeral lagoon located in the reserve's interior to the west of EBSM along Sendero Central. The lagoon is approximately 40 m X 50 m, filled with high grass and surrounded by forest. A small stream feeds the lagoon, which increased in size continuously throughout this study. On the first visit to the lagoon on 6 June, it was no more than a small puddle surrounded by a larger area of soft mud. By 20 June, it had expanded to a 15 m X 15 m pool. By mid August, the lagoon had grown to an approximate 35 m X 50 m with depths exceeding 2.75 m in some areas.

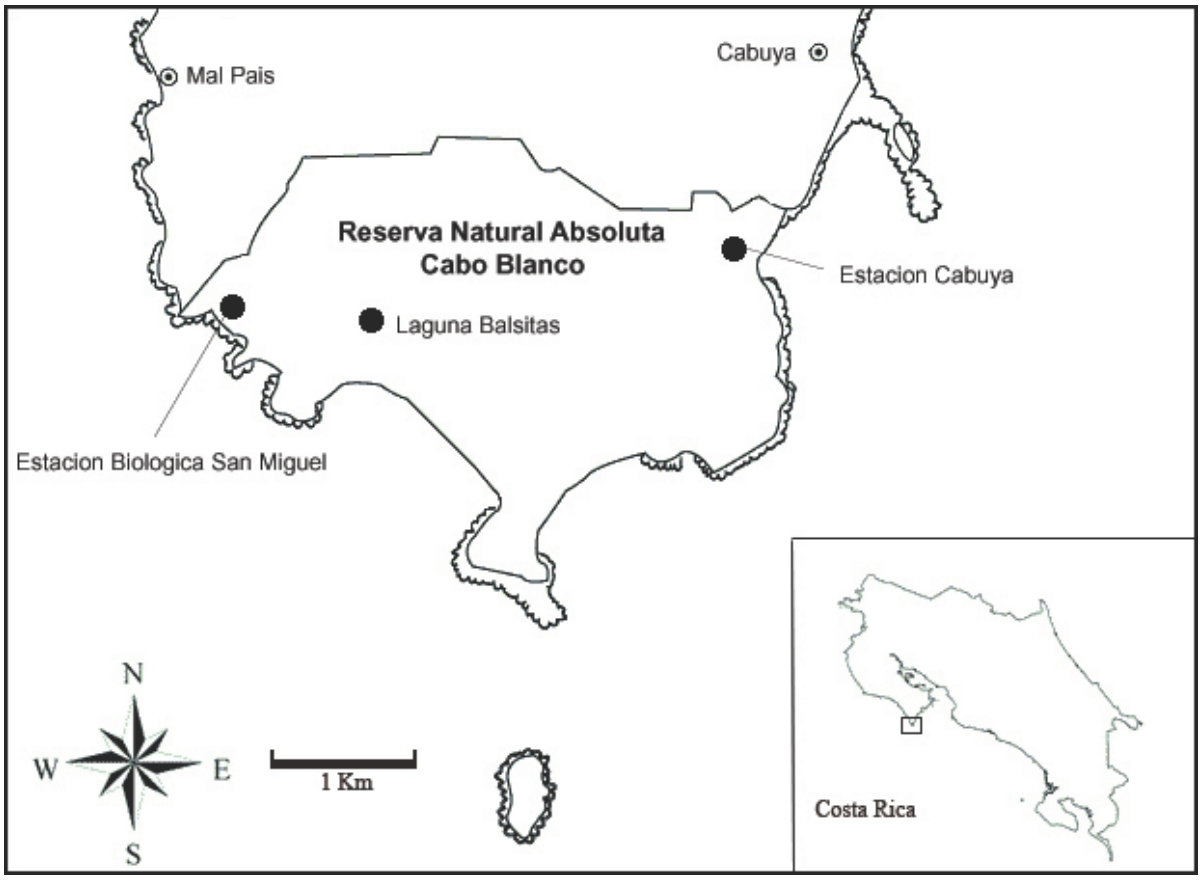

Figure 1. Reserva Natural Absoluta Cabo Blanco, Puntarenas Province, Costa Rica. The three sampling localities within the reserve are denoted by black circles.

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Data Collection
This study took place between 30 May and 17 August 2003, corresponding to the rainy season in the area. I used drift fence arrays and visual encounter surveys (VES) to sample amphibians and reptiles. Three drift fence arrays, two near the EBSM and one at LB, were constructed following Corn (1994). Array arms were 15 m in length and constructed using polystyrene as described by Malone and Laurencio (2004). I constructed all of the arrays in a "Y" formation. For the two EBSM arrays, 20-liter buckets were sunk at the end of each arm and in the middle of the array, and a 22.9 cm. X 44.5 cm. Gee Minnow Trap was placed on either side of each arm at the midway point, for a total of ten traps per array. At Laguna Balsitas, the array was set up in a similar fashion, but with two double and one triple length arms (Figure 2). This "super-Y" configuration contained eight buckets and 14 funnel traps for a total of 22 traps. Once opened, arrays were checked daily. Drift fence array capture data were analyzed by dividing total captures by the total number of trap nights.

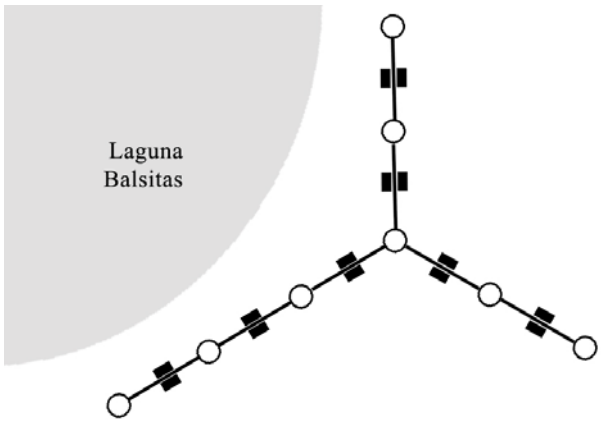

Figure 2. Diagram of "super-Y" array located at Laguna Balsitas in Reserva Natural Absoluta Cabo Blanco, Puntarenas Province, Costa Rica. Hollow circles represent 20-liter buckets, black rectangles represent funnel traps and straight lines represent 15 m polystyrene arms. Figure is not drawn to scale.

Visual encounter surveys (Crump and Scott 1994) were conducted at all three sites. Groups of one to six individuals searched a given area and each amphibian and reptile observed was recorded. Time spent searching was also recorded. Since the VES had varying numbers of participants and varying search duration, all VES data were transformed to encounters/person hour. Additionally, some species were collected opportunistically. Voucher specimens for each species were collected and have been deposited at the Museum of Zoology at the University of Costa Rica (UCR). Tissue samples were also collected from each species and deposited in the frozen tissue collection at Texas State University, San Marcos, Texas, USA. This inventory was conducted under MINAE *Resolución* # 168-2003-OFAU.

Results
Species Composition and Distribution
Overall, 425 individuals comprising 33 species were documented for RNACB including 13 frog, two turtle, nine lizard and nine snake species (Appendix 1). Drift fence arrays were open for 543 trap nights, yielding 127 captures. I captured six frog, three lizard and one snake species in the arrays. *Ameiva undulata* (20 captures) was the most captured lizard species during the study, accounting for 15.7 % of the total captures (Appendix 2). Only two individuals of one snake species, *Coniophanes piceivittis*, were captured, both in the lagoon array.

The two arrays near EBSM captured only 13 individuals of two species (*A. undulata* and *Anolis cupreus*), whereas the array at the lagoon captured 10 species and 114 individuals, or 89.9 % of all captures. Explosive breeding events (23 June 2003, 14-15 August 2003) led to captures of large numbers of two frog species, *Hypopachus variolosus* (46 captures) and *Trachycephalus venulosus* (32 captures), accounting for 61.4 % of all captures (Appendix 2).

A total of 201.5 person-hours was spent conducting diurnal and nocturnal visual encounter surveys. *Craugastor fitzingeri* (92 observations) and *Anolis cupreus* (31 observations) were found at all three sites and in all areas of the reserve. Other lizards encountered often in open, sunny areas were *Ctenosaura similis*, *Ameiva undulata* and *Sceloporus variabilis*. Only two snake species, *Leptophis mexicanus* and *Trimorphodon quadruplex,* were encountered more than twice. All three *L. mexicanus* were in the same tree,

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whereas the *T. quadruplex* were found at three separate localities.

During the survey, the majority of the documented species accumulated rapidly as evidenced by the species accumulation curve (Figure 3). Seventeen species were found within three days, and the rate of accumulation slowed considerably after a week After 14 days, only 0.26 species/day were added to the collection, and the rate of accumulation decreased to 0.13 species/day by the end of the study. Although the rate of addition of new species was decreasing, the curve did not reach an asymptotic value.

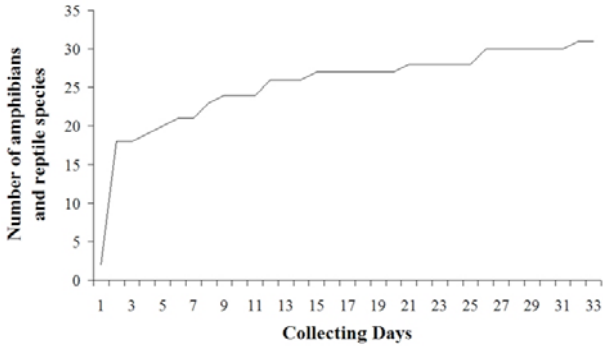

Figure 3. Rate of amphibian and reptile species accumulation at Reserva Natural Absoluta Cabo Blanco, Puntarenas Province, Costa Rica.

Table 1. Amphibian calling activity at Laguna Balsitas, Reserva Natural Absoluta Cabo Blanco, Puntarenas Province, Costa Rica.

Date	Full chorus	Sporadically Calling	Present but not calling
7 June, 2003		*A. callidryas* *L. poecilochilus* *L. savagei*	*D. microcephalus* *S. baudinii* *T. venulosus*
20 June, 2003	*D. microcephalus*	*A. callidryas* *L. poecilochilus* *L. savagei*	*L. forreri* *O. coccifer* *S. baudinii* *T. venulosus*
23 June, 2003 (after heavy rain)	*A. callidryas* *D. microcephalus* *H. variolosus* *S. boulengeri* *S. baudinii* *T. venulosus*	*L. poecilochilus* *L. savagei*	
2 August, 2003	*D. microcephalus*	*A. callidryas* *L. poecilochilus* *S. boulengeri*	*O. coccifer* *T. venulosus*
17 August, 2003	*D. microcephalus*	*A. callidryas* *L. poecilochilus* *S. boulengeri*	*H. variolosus* *O. coccifer* *L. poecilochilus* *L. forreri* *T. venulosus*

Time of Activity

From the 32 terrestrial species documented at RNACB 40.1 % were diurnal, 50 % nocturnal, and 9.4 % were active day and night (Appendix 1). Trends in activity periods were tied to taxonomic group. All amphibian species were nocturnal, with one, *C. fitzingeri*, also being active in late afternoons. The turtle species, *Kinosternon scorpioides*, was active day and night. Iguanids, skinks and teiids were diurnal, as was the gecko, *Gonatodes albogularis*. However, *Phyllodactylus tuberculosus,* was nocturnal. The snakes *C. piceivittis*, *L. mexicanus* and *Leptodeira annulata*, all of which feed on anurans, were nocturnal. The remaining six snake species were diurnal except for *B. constrictor*, which is active day and night.

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Amphibian Reproduction

Reproductive activity of anurans was observed at all three sites and for all species except *Ollotis coccifer*, *Rhinella marina* and *Lithobates forreri*. *Craugastor fitzingeri*, a direct developing species, was seen and heard calling throughout the entire reserve.

At EC, reproductive activity centered around the ephemeral pools found near the station and in the adjacent roads and pastures. *Leptodactylus fragilis*, *Smilisca baudinii*, and *Dendropsophus microcephalus* were observed calling in chorus in these pools, and two *Agalychnis callidryas* males were seen calling from a banana plant on the side of the road leading from EC to the town of Cabuya. Two other species, *Hypopachus variolosus* and *Ollotis coccifer* were seen at the ephemeral pools, but were not heard calling at these sites and no egg masses or tadpoles of these species were found.

At EBSM, reproductive activity was restricted to several pools in a stagnant branch of Quebrada Sam Miguel and the small ephemeral pools in the road to Mal País, north of the station. In the stream pools, we found *Agalychnis callidryas* tadpoles of various sizes, presumably from different clutches. Additionally, we observed four egg masses and four calling adult males in the vegetation overhanging the pools. On several occasions *Smilisca baudinii* were heard calling along the trail to Mal País and tadpoles were found in several tire-rut pools. *Leptodactylus poecilochilus* and *L. fragilis* were also heard calling along this trail.

The majority of amphibian reproductive activity took place at LB. All documented amphibian species except *L. fragilis* were found there, and eight used the lagoon as a breeding site. Different species utilized the lagoon at different times (Table 1). In early June, when the lagoon was muddy, the foam nesting *L. savagei* and *L. poecilochilus* called from the ground and *A. callidryas* from the trees surrounding the lagoon. Egg masses from the latter were found on leaves overhanging the as of yet dry land. Other species were present, but not calling. By 20 June, the lagoon had expanded to 15 m X 15 m and was several cm deep. With water present, *D. microcephalus* began calling and depositing eggs on the tall grass near the surface of the water. *Lithobates forreri* and *Ollotis coccifer* were found in the lagoon area, but reproduction was not documented for either species.

A downpour of 44 mm on 23 June triggered the season's first explosive breeding event. That night there was a deafening chorus of *Smilisca baudinii*, *Trachycephalus venulosus*, *and Hypopachus variolosus*. Also calling in full chorus were, *D. microcephalus*, *A. callidryas* and *Leptodactylus poecilochilus*. By 02:00 h, the large chorus of *T. venulosus* and *S. baudinii* had ended; however, *H. variolosus* and *D. microcephalus* were still in full chorus and had now been joined by *Scinax boulengeri*, and *L. poecilochilus*.

Following the rain event of 23 June until the study ended on 17 August, the calling pattern at LB was: *D. microcephalus* calling in full chorus each night and *A. callidryas*, *S. boulengeri* and *L. poecilochilus* calling sporadically. *Hypopachus variolosus* and *T. venulosus* only called on two other nights, each time after very heavy rain.

Kinosternon scorpioides

Twenty *Kinosternon scorpioides* were collected in the area of the lagoon during the study. Turtles were first noticed on 7 June, in the muddy area of what was to be the lagoon. They were captured from that date forward, first in the mud pit, then in the shallow water and finally along the edge of the filled lagoon. Data taken are summarized in Table 2 and described in the species account below.

Species Accounts

Species accounts are provided below. They include distribution (EC = *Estación Cabuya*, EBSM = *Estación Biológica San Miguel*, LB = *Laguna Balsitas*) and natural history notes.

Frogs

Agalychnis callidryas (EC, EBSM, LB)

Previously known only from the LB, this species was present at all three study sites. Near EC, two individuals were calling on a banana plant on the side of the road. At two stagnant pools at EBSM, several males were heard calling, and four males

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and two females were found along with four egg masses and tadpoles from several clutches. The population surrounding the lagoon was large with several dozen males calling each night and dozens of egg masses found on the vegetation surrounding the lagoon.

Craugastor fitzingeri (EC, EBSM, LB)
The only ubiquitous amphibian species in the reserve, individuals were heard and seen in all areas. Ninety-two individuals were found during VES and an additional six were captured in the drift fence arrays.

Dendropsophus microcephalus (EC, LB)
This species was found along roadside pools at EC and in LB where it called persistently nightly and seasonally. Eleven individuals were observed during the VES and a full chorus called continually once the lagoon filled. Calling continued nightly for the duration of this study.

Hypopachus variolosus (EC, LB)
One individual was found near a roadside pool near EC. I captured 46 individuals in the drift fence array at LB. The majority of these captures occurred on nights following especially heavy rains.

Leptodactylus fragilis (EC, EBSM)
This species was heard calling in low abundance along the road to EC and along the road from EBSM to Mal País. This species was not heard calling in the interior of the reserve.

Leptodactylus savagei (LB)
This species was heard calling on three occasions from LB before it filled with water. On 7 June and 20 June, one individual was heard calling all night. On 23 June, three individuals called from the lagoon floor.

Leptodactylus poecilochilus (EBSM, LB)
This species was heard calling along the road from the EBSM to Mal País and at LB. At the lagoon, this species called nightly, from burrows under mats of tall grass as the lagoon filled, and in lesser numbers once the lagoon was full. This species was not encountered at EC.

Lithobates forreri (LB)
This species was also found only at LB. Individuals were occasionally seen under a large gourd tree next to the lagoon and in the lagoon itself but none were heard calling. It is possible that this species does not call until later in the rainy season when the lagoon is at maximum capacity.

Ollotis coccifer (EC, LB)
Ten individuals were captured in the LB array and an additional 6 were observed during the VES. Some were observed in roadside pools near EC and others were seen around LB. This species was not heard calling.

Rhinella marina (EC, EBSM)
Only three individuals were observed, all around human habitations. None was heard calling within the reserve.

Scinax boulengeri (LB)
This species was found in the vegetation surrounding the lagoon. Individuals were also observed during the 23 June explosive breeding event. Calling in this species commenced later in the night once *S. baudinii* and *T. venulosus* stopped calling.

Smilisca baudinii (EC, EBSM, LB)
The most common hylid in the reserve, this species was found at all three localities. At EC and EBSM, males called in the trees along the roads and tadpoles were present in tire rut pools. At LB, individuals were common in trees surrounding the lagoon and hundreds were present at the 23 June explosive breeding event. Afterward, they did not call in great numbers at the lagoon.

Trachycephalus venulosus (LB)
This species was observed in and around LB, and was seen and heard calling sporadically in the trees surrounding the lagoon. Two explosive reproductive events were documented, on 23 June and 14 August following heavy rains. Interestingly, the second calling bout occurred in broad daylight, in full sun and an air temperature of 37 °C. Calling started before 09:50 h and continued until 11:25 h.

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Turtles

Kinosternon scorpioides (LB)

The only terrestrial turtle species observed at RNACB, this species was abundant but only encountered at LB. Turtles were found partially buried in the mud only before the lagoon filled. As the lagoon filled, additional individuals were seen swimming in the water. Twenty individuals (13 males, 7 females) were captured by hand opportunistically, measured, marked then released. Measurements taken include curved and straight carapace length and width, straight plastron length and width, and mass. Marking was accomplished by notching marginal scutes. There were no recaptures. Males on average weighed less and were longer but thinner than females, but none of the differences were statistically significant (Table 2).

Lepidochelys olivacea (Beach)

One dead individual was found washed up on the beach in front of the EBSM dorm.

Table 2. Mean ± SD of seven morphological parameters for *Kinosternon scorpioides* found at Laguna Balsitas, *Reserva Natural Absoluta Cabo Blanco*, Puntarenas Province, Costa Rica. All length and width measures are in mm.

Variable	Male (N=13)	Female (N=7)	Total (N=20)	t-statistic	p-value
Straight carapace length	140.2 ± 8.28	135.0 ± 4.20	138.4 ± 7.43	1.5321	0.143
Curved carapace length	166.0 ± 10.10	160.0 ± 7.09	164.0 ± 9.35	1.2988	0.211
Straight carapace width	94.8 ± 4.85	96.2 ± 3.37	95.3 ± 4.34	-0.6450	0.527
Curved carapace width	150.0 ± 6.75	154.0 ± 6.99	152.0 ± 6.89	-1.1483	0.267
Plastron length	128.7 ± 8.16	126.0 ± 7.59	127.7 ± 7.88	0.8163	0.425
Plastron width	73.3 ± 3.47	72.0 ± 2.75	72.8 ± 3.22	0.8422	0.411
Mass (g)	425 ± 51.3	434 ± 36.5	428 ± 45.8	-0.3725	0.714

Lizards

Ameiva undulata (EC, EBSM, LB)

This teiid was found at all three sites within the reserve. It was abundant along open sunny areas of the trails, at beach margins and near habitations where they actively foraged.

Anolis cupreus (EC, EBSM, LB)

The only species of anole found in reserve, *A. cupreus* was common and I found both adults and juveniles at all three sites.

Basiliscus basiliscus (EC)

A single large male was observed on Sendero Sueco near EC, approximately 20 m up a tree. No other individuals were observed.

Ctenosaura similis (EC, EBSM, LB)

A common lizard in the reserve, *C. similis* was found on the edges of the trails and along the beaches. Juveniles were found near the station buildings and at LB. On 16 August, an adult female was observed capturing and consuming an adult *Sceloporus variabilis*.

Gonatodes albogularis (EC, EBSM)

Several individuals were seen on the buildings and surrounding trees at EC. Additionally, one individual was found at the EBSM. It was found on equipment in the laboratory, therefore it is possible it could have been brought in from elsewhere. No other individuals were observed during this study.

Mabuya unimarginata (EC, EBSM)

Two individuals of this species were observed: one on a tree in the arboretum next to EC, and a second on a fence post along the trail from EBSM to Mal País.

Phyllodactylus tuberculosus (EC, EBSM)

This gecko species was found on buildings at both EC and EBSM. No individuals of the two introduced geckos (*Hemidactylus frenatus* and *H. garnotii*) were found.

Sceloporus squamosus (EC)

Dr. James R. Dixon observed individuals of this species along the beach margin at Estación

Cabuya (pers comm.). No individuals were captured during this study.

Sceloporus variabilis (EC, EBSM)
One of the more common species, this lizard was found in open sunny areas, along trails, around habitations and on the beach. Hatchlings of this species were seen during the later part of my time at RNACB.

Snakes
Boa constrictor (EBSM)
One individual was found dead on the trail from the EBSM to Mal País. The cause of death was unknown, but the snake was severely emaciated (SVL = 1766 mm, Mass = 1775 g). A second individual was observed by a park guard near the dorm at EBSM, but was not captured.

Coniophanes piceivittis (LB)
Two individuals were captured in the funnel traps of Array 3, located adjacent to LB. Both were captured on the lagoon side of the array. It is possible that they were foraging for frogs when they were trapped.

Leptodeira annulata (LB)
Two individuals were found along the Sendero Central south of Laguna Balsitas. The first was a juvenile found coiled in the branches of a fallen tree, the second an adult found on the ground near the beach.

Leptodrymus pulcherrimus (EBSM)
The lone individual of this species captured was found crawling out from under the EBSM main house.

Leptophis mexicanus (LB)
Three juveniles were found on branches of the same tree on the edge of Laguna Balsitas. It is possible that the individuals were seeking prey on the tree. *Leptophis* are known predators of hylid frogs (Savage 2002) and several *A. callidryas* adults were found on the tree where the snakes were collected.

Mastigodryas melanolomus (EC, EBSM)
I encountered two individuals of this species. I captured an individual near EC on Sendero Danes and observed another near the lab at EBSM.

Oxybelis fulgidus (EBSM)
This species was not directly observed during this study. It was identified from a photograph provided by Dr. Erin S. Lindquist. The snake had been photographed outside of the laboratory at EBSM.

Tantilla armillata (EBSM)
A single hatchling (SVL = 98 mm) was found on a tree stump outside of the laboratory at EBSM.

Trimorphodon quadruplex (EBSM)
Three individuals were found, at or near EBSM making this species the most encountered snake.

Discussion
As the first collecting effort of any magnitude at the RNACB and in the lower Nicoya Peninsula, this study takes a first step in identifying the distribution of amphibians and reptiles in the region. Based on the maps of Savage (2002), of the 32 species observed, 22 were collected for the first time on the lower Nicoya Peninsula. Additionally, the RNACB locality represents the southernmost extension of the range for seven of those 22 species (*P. tuberculosus, S. variabilis, A. undulata, C. piceivittis, L. mexicanus, O. fulgidus,* and *T. quadruplex*).

How complete is the inventory at RNACB? While the flattened shape of the species accumulation curve suggests a majority of the amphibian and reptile species present at RNACB were detected, the lack of asymptote indicates additional species, remain to be detected. Lack of prior collecting effort in the region made it difficult to assess what species may be present, but that I did not collect. A review of the range maps in Savage (2002) revealed few historical collecting localities on the Nicoya peninsula, nor were there records of additional species in the Museum of Zoology at the University of Costa Rica. Only 15 species were previously collected in the vicinity of the reserve, and all but four of those were documented in this study (Table 3). The relatively flat accumulation curve indicates substantial effort would be needed to detect these species. Using the accumulation rate of 0.125 species/day, it would take an additional 40 days to find the five undetected species known to occur in the vicinity.

Traditional local knowledge may give insight into encounter probabilities of rare species (Berkes 1999; Laird 2002), and completeness of herpetological inventories. I interviewed Don Carlos, Costa Rica's first park guard (*Guardaparque*), who has worked in the reserve since its creation in 1963. Don Carlos identified ten species from photographs, mostly snakes, that I did not collect (Table 3). Interestingly, some were very rarely encountered; for example, only one individual of the easy to identify *Crotalus mimus* was seen in 42 years. Hence, encountering rare species may take a great amount of additional effort.

Table 3. Species not encountered in this study that have been documented or are possible for *Reserva Natural Absoluta Cabo Blanco*, Puntarenas Province, Costa Rica. Documentation includes literature review and interviews with long time RNACB personnel.

Species	Literature	Visual	Source
Amphibians			
Ollotis luetkeni	X		Savage 2002
Reptiles			
Rhinoclemmys pulcherrima	X		Savage 2002
Gymnopthalmus speciosus	X		Savage 2002
Iguana iguana		X	Don Carlos
Clelia clelia		X	Don Carlos
Drymobius margaritiferus			Don Carlos
Imantodes sp.		X	Don Carlos
Oxybelis aeneus		X	Don Carlos
Senticolis triaspis	X		Savage 2002
Spilotes pullatus		X	Don Carlos
Micrurus nigrocinctus		X	Don Carlos
Crotalus mimus		X	Don Carlos
Porthidium ophryomegas		X	Don Carlos

As a whole, the reserve's species assemblage is similar to those of the nearby dry forest sites to the north, for example *Parque Nacional Santa Rosa* (PNSR). However, species richness was lower in RNACB than in PNSR. The RNACB has 45 species likely to be present (using our data combined with traditional knowledge and museum records), compared to 78 at PNSR (Sasa and Solórzano 1995). The difference in species richness is due to both the presence of more species at SRNP from families shared between the two sites (e. g. Colubridae), as well as the presence of seven additional families at PNSR. These include Caeciliidae, Rhinophrynidae, Corytophanidae, Leptotyphlopidae, Loxocemidae, Elapidae, and Crocodylidae (Sasa and Solórzano 1995). I realize however, that these observed differences may be due in part to my limited sampling effort. This is especially true in snakes, which are difficult to detect. Continued sampling at RNACB will most likely decrease the difference in species richness between these two sites as well as increase the number of families shared between the two.

Palo Verde National Park, located on the mainland at the base of the Nicoya Peninsula, has 38 species verified with voucher specimens at the Natural History at the University of Costa Rica. This number however, undoubtedly underestimates the number of species present in the park, making comparisons difficult. This lack of documented species at Palo Verde and indeed along the entire Nicoya Peninsula precludes identification of a gradient in species richness that could be attributed to peninsula effects (Simpson 1964; Seib 1980; Busack and Hedges 1984; Means and Simberloff, 1987).

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Available oviposition sites and rainfall dictated amphibian reproduction at RNACB. Reproductive activity at Cabuya and EBSM were limited to ephemeral pools and one temporary river pool and only the direct developing *Craugastor fitzingeri* called throughout the reserve. The majority of the reproductive activity however, occurred at Laguna Balsitas. Not surprisingly, the anuran community at LB separated their reproductive activities in space and time. Much of the observed reproductive activity was consistent with published accounts. Foam nesting leptodactylid frogs are known to call as temporary bodies of water fill (Savage 2002). Three species (*Smilisca baudinii*, *Trachycephalus venulosus, Hypopachus variolosus*) observed in explosive breeding events have been associated with these events (Duellman 2001; Savage 2002). Furthermore, the toad *O. coccifer,* which was not heard calling, has been documented to not call for months after arriving at a breeding site (Savage 2002).

Little information exists on anuran reproductive communities in Costa Rica. One exception is the study by Donnelly and Guyer (1994) on hylid reproduction at *La Selva*. Although *La Selva* is on the Caribbean versant and contains a different anuran assemblage, notable similarities exist. As was the case at *La Selva*, *A. callidryas* called from higher perches than other species and deposited eggs over dry land in anticipation of water. The explosive breeders at both LB and *La Selva* were most common early in the wet season and like *La Selva*, LB had two species of prolonged breeders, though in the case of LB *D. microcephalus* and not *D. ebraccatus* joined *A. callidryas* as one of these species. Additionally, Donnelly and Guyer (1994) documented anuran predation by several colubrid snakes at *La Selva*. While no predation was directly observed but the author al LB, the presence of the frog eating snakes *Leptophis mexicanus* and *Leptodeira annulata* suggests that predation is occurring upon *A. callidryas* and other hylid species present at the lagoon. A longer study of anuran reproduction at Laguna Balsitas is needed to make rigorous comparisons, but utilizing observations made in this study, one can hypothesize that, like La Selva, RNACB has seasonal anuran reproduction, and that habitat use, phenology, reproductive strategy, and predation play a role in structuring the anuran community.

The aggregation of *K. scorpioides* at the filling lagoon is consistent with behavior at other sites in Costa Rica (Acuña Mesén 1990; Acuña Mesén 1998). Interestingly though, *K. scorpioides* at RNACB are smaller than elsewhere in the country (Table 2). Acuña Mesen (1992) provides the following range for SCL (95-185 mm; $\bar{x}$ = 156.9 mm) and CCL (134-210 mm; $\bar{x}$ = 184.9 mm) for *K. scorpioides* in Costa Rica. Additionally, morphometric data including SCL, CCL and mass are available for three Costa Rican *K. scorpioides* populations (Acuña Mesén 1990; Acuña Mesén 1992; Marquez 1995). The Cabo Blanco population is smaller in mean size (SCL, CCL and/or weight), than all other Costa Rican populations and the national means. This holds for the population as a whole as well as males and females separately.

In addition to providing a list of herps for RNACB, this study provides a baseline for future biodiversity assessments that include herpetofauna on the Nicoya Peninsula. Continual accrual of biodiversity information will enable us to better understand species distributions and provide raw material for hypothesis testing about the biogeography of Mesoamerican herpetofauna. Furthermore, it demonstrates the importance of Cabo Blanco as a site for future studies of anuran reproduction, chelonian communities, and the dynamics of neotropical amphibian and reptile communities.

Acknowledgements
Many thanks to Laura Laurencio, Dr. James R. Dixon, Mary Dixon, David LaFever and Kristen Millenbach for their assistance in the field. I thank the staff of the *Ministerio del Ambiente y Energía and the Reserva Natural Absoluta Cabo Blanc*o for their logistic support, information, and permission to work in such a beautiful area. I thank Dalia Edelman for her continued hospitality and support. A special thank you to the park system volunteers, who not only

helped us with this study, but also gave of their time to help support Costa Rica's national parks system. Thanks to L. A. Fitzgerald, J. R. Dixon and R. A. Wharton for their helpful reviews of this manuscript.

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Received July 2007
Accepted April 2009
Published online August 2009

Appendix 1. Amphibians and Reptiles in Reserva Natural Absoluta Cabo Blanco, Puntarenas Province, Costa Rica. Habitat categories: Aqu = aquatic, Arb = arboreal, Bld = manmade structures, Fos = fossorial, Mar = marine, Ter = Terrestrial, Rip = riparian. Diel activity categories: D = diurnal, N = nocturnal, C = crepuscular, ? = unknown.

Taxon	Site			Habitat	Diel Activity
	Cabuya	San Miguel	Lagoon		
AMPHIBIANS					
ANURA (13 species)					
Bufonidae (2)					
Ollotis coccifer	X		X	Ter	N
Rhinella marina	X	X	X	Ter	N
Leptodactylidae (4)					
Craugastor fitzingeri	X	X	X	Ter	D/N
Leptodactylus fragilis	X	X**		Ter	N
Leptodactylus poecilochilus		X	X	Ter	N
Leptodactylus savagei			X	Ter	N
Hylidae (5)					
Agalychnis callidryas	X	X	X	Arb	N
Dendropsophus microcephalus	X		X	Arb	N
Scinax boulengeri			X	Arb	N
Smilisca baudinii	X	X	X	Arb	N
Trachycephalus venulosus			X	Arb	N
Microhylidae (1)					
Hypopachus variolosus	X		X	Fos, Ter	N
Ranidae (1)					
Lithobates forreri			X	Aqu	N
REPTILES					
TESTUDINATA (2 species)					
Cheloniidae (1)					
Lepidochelys olivacea		X		Mar	?
Kinosternidae (1)					
Kinosternon scorpioides			X	Aqu, Ter	D/N

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Taxon	Site			Habitat	Diel Activity
	Cabuya	San Miguel	Lagoon		
LACERTILIA (9 species)					
Corytophanidae (1)					
Basiliscus basiliscus	X*			Arb	D
Iguanidae (1)					
Ctenosaura similis	X	X	X	Ter, Arb	D
Phrynosomatidae (2)					
Sceloporus squamosus		X*		Ter	D
Sceloporus variabilis	X	X		Ter, Arb	D
Polychrotidae (1)					
Anolis cupreus	X	X	X	Arb	D
Gekkonidae (2)					
Gonatodes albogularis	X	X		Arb, Bld	D
Phyllodactylus tuberculosus	X	X		Bld	N
Scincidae (1)					
Mabuya unimarginata	X	X		Arb	D
Teiidae (1)					
Ameiva undulata	X	X	X	Ter	D
SERPENTES (9 species)					
Boidae (1)					
Boa constrictor		X		Ter, Arb	D/N
Colubridae (8)					
Coniophanes piceivittis			X	Ter?	N?
Leptodeira annulata			X	Arb	N
Leptodrymus pulcherrimus		X		Ter?	D
Leptophis mexicanus			X	Arb	N
Mastigodryas melanolomus	X	X*		Ter	D
Oxybelis fulgidus		X***		Arb	D
Tantilla armillata		X		Ter	D
Trimorphodon quadruplex		X		Ter	D

*=Seen but not vouchered; **=Heard but not vouchered; ***=ID from photo

Appendix 2. Drift fence array and visual encounter survey capture rates and percentages by species from Reserva Natural Absoluta Cabo Blanco, Puntarenas Province, Costa Rica. Voucher specimens: URC 19688 - 19755 and 19760 - 19792.

Species	Drift Fence Arrays		Visual Encounter Surveys	
	Number Captured	% of total captures	Number Observed	% of total observed
AMPHIBIANS	**101**	**79.53**	**198**	**66.44**
Anura	**101**	**79.53**	**198**	**66.44**
Ollotis coccifer	10	7.87	6	2.01
Rhinella marina	0	0	1	0.34
Craugastor fitzingeri	6	4.72	92	30.87
Leptodactylus fragilis	0	0	3	1.01

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Species	Drift Fence Arrays		Visual Encounter Surveys	
	Number Captured	% of total captures	Number Observed	% of total observed
Leptodactylus savagei	0	0	1	0.34
Leptodactylus poecilochilus	6	4.72	23	7.72
Agalychnis callidryas	0	0	19	6.38
Dendropsophus microcephalus	0	0	11	3.69
Scinax boulengeri	0	0	12	4.03
Smilisca baudinii	1	0.79	14	4.70
Trachycephalus venulosus	32	25.20	7	2.35
Hypopachus variolosus	46	36.22	4	1.34
Lithobates forreri	0	0	5	1.68
REPTILES	**26**	**20.47**	**100**	**33.56**
Turtles	**0**	**0**	**12**	**4.03**
Kinosternon scorpioides	0	0	12	4.03
Lizards	**24**	**18.90**	**82**	**27.52**
Basiliscus basiliscus	0	0	1	0.34
Ctenosaura similis	1	0.79	20	6.71
Sceloporus variabilis	0	0	19	6.38
Anolis cupreus	3	2.36	31	10.40
Gonatodes albogularis	0	0	1	0.34
Phyllodactylus tuberculosus	0	0	0	0
Mabuya unimarginata	0	0	2	0.67
Ameiva undulata	20	15.75	8	2.68
Snakes	**2**	**1.57**	**6**	**2.01**
Boa constrictor	0	0	0	0
Coniophanes piceivittis	2	1.57	0	0
Leptodeira annulata	0	0	2	0.67
Leptodrymus pulcherrimus	0	0	0	0
Leptophis mexicanus	0	0	3	1.01
Mastigodryas melanolomus	0	0	1	0.34
Oxybelis fulgidus	0	0	0	0
Tantilla armillata	0	0	0	0
Trimorphodon quadruplex	0	0	0	0