

Results of Allen Cays Iguana study (*Cyclura cychlura inornata*)

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ALLEN CAYS

This year was the 30th year of our studies of the Allen Cays iguana in the Bahamas, and it was one of the most extreme years in terms of weather. Although not a single drop of rain fell on us during our ten days of field work in the Exumas in May of 2008, this year the wind blew 15-25 knots the entire time and it rained part or all of every day of our work. The unusually cool and wet conditions reduced lizard activity significantly. As a result, our capture numbers were down this year (see Table 1, below). However, we did capture 198 iguanas (87% of them recaptures) on Leaf Cay, 82 on U Cay (85% recaptures), and 4 on Allen Cay (one skeleton and three recaptures). We have now accumulated at least 6172 iguana captures in the Allen Cays over the past 30 years!

The decline in numbers of large males on the main beach areas of both Leaf and U Cay seems to be continuing (see previous reports). This year we captured only two males >40 cm SVL on each of Leaf and U Cays (e.g., 9 captured on each in 2005). However, the poor weather and lower capture rates this year reduce our confidence that we captured all of the large males. We will re-examine this issue in 2010 (presumably with better weather).

We were discouraged this year to find the recently dead carcass of one of our oldest iguanas on U Cay (#13A). This female was marked when it was a juvenile on my first trip to the Allen Cays in March of 1980. It was subsequently estimated to have been 9.5 years old when first marked. We had recaptured this female 11 different years since 1980, and believe that she was at least 39.5 years old at her death. Despite our low capture numbers this year, our next oldest capture this year was a female from Leaf Cay marked first in 1986 at an estimated age of 7.5 years. We have captured her in 19 different times over the past 23 years, and her estimated age was 30.7 years in May this year. At last capture she appeared to be robust and healthy, hopefully with a long life still ahead.

Table 1. Recapture information by year for Allen Cays iguanas. Abbreviations are caps (captures), recaps (recaptures), and Cum (cumulative). Total number of captures for U Cay is 1913 (492 + 1421) lizards, and for Leaf Cay it is 3476 (1093 + 2383). All trips for 1980 through 2000 were in mid-March. Trips in 2001 and 2002 were in mid-May and mid-June to mid-July. Censuses in 2003-2009 were also in mid-May.

Year	U Cay					Leaf Cay				
	Total caps	Total recaps	% recaps	Cum. # w/ marks	Cum. # recaps	Total caps	Total recaps	% recaps	Cum. # w/ marks	Cum. # recaps
1980	30	0	0	30	0	14	0	0	14	0
1982	43	9	21	64	9	50	3	6	61	3
1983	48	25	52	87	34	51	26	51	86	29
1986	75	37	49	125	71	79	19	24	146	48
1988	111	58	52	178	129	109	59	54	196	107
1990	113	83	74	208	212	136	81	60	251	188
1992	124	89	72	243	301	148	102	69	297	290
1993	34	33	97	244	334	94	73	78	316	363
1994	150	94	63	300	428	204	110	54	410	473
1995	123	106	86	317	534	150	125	83	435	598
1996	113	86	76	344	620	177	126	71	486	724
1998	95	79	83	360	699	205	150	73	541	874
2000	169	124	73	405	823	254	175	69	620	1049
2001 ^a	140	110	79	435	933	284	220	77	679	1274
2001 ^b	40	34	--	441	967	209	89	--	799	1363
2002 ^c	143	118	83	460	1085	350	266	76	880	1629
2002 ^d	37	34	--	463	1118	147	72	--	945	1701
2003 ^e	102	95	93	470	1213	214	204	95	955	1905
2004 ^f	124	112	90	482	1325	376	257	69	1074	2162
2005 ^g	108	96	89	492	1421	246	221	90	1093	2383
2008 ^h	114	94	82	512	1515	289	245	85	1137	2628
2009 ⁱ	81	69	85	524	1584	198	173	87	1162	2801

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- ^a Excludes 1 additional capture on Allen Cay.
- ^b Excludes 6 additional captures (including 1 recapture) on Allen Cay.
- ^c Excludes 6 additional captures (including 3 recaptures) on Allen Cay.
- ^d Excludes 1 additional capture (a recapture) on Allen Cay.
- ^e Excludes 7 additional captures (including 4 recaptures) on Allen Cay.
- ^f Excludes 9 additional captures (including 7 recaptures) on Allen Cay.
- ^g Excludes 6 additional captures (including 5 recaptures) on Allen Cay; and 3 new captures on the second small cay north of Leaf Cay.
- ^h Excludes 3 additional captures (including 1 recapture) on Allen Cay; also includes captures in March by Chuck Knapp.
- ⁱ Excludes 4 additional captures (all recaptures) on Allen Cay; and 1 new capture on the second small cay north of Leaf Cay.

We did observe one case of mortality this year with an apparent cause. Female #55/OB (15.7 years old; SVL ca. 28 cm) was found dead and nearly mummified along the southwest rocks on Leaf Cay. Although nearly completely intact, insects had partially opened the ventral body wall, exposing the contents of her abdomen. The internal organs were mostly gone, but the space was filled with a large piece of marine sponge (ca. 3 cm x 2 cm x 1.5 cm). It appeared as if she had ingested the large sponge, but that it had obstructed her gastrointestinal tract and caused her death. Whether she ingested the sponge during natural foraging at the tide line, or during a tourist feeding frenzy on the nearby landing beach is not certain. We have observed tourists throwing litter and beach wrack toward iguanas to induce them to come to feed. Perhaps in the frenzy she mistakenly ingested the sponge and was unable to pass it.

Iguana sex ratios on at least Leaf Cay are becoming increasingly female biased, presumably because of the disturbing loss of large males, but perhaps because the cool weather altered male behavior. 112 sexable females and 75 sexable males were captured on Leaf Cay (a ratio of 1.49 to 1; significantly different from 1 to 1), and 42 sexable females and 38 sexable males were captured on U Cay (not significantly different from unity). With one exception, tail break frequencies remain quite low for these iguanas (Leaf Cay females, 7.2%; Leaf Cay males, 12.2%; U Cay females, 6.8%; U Cay males, 18.9%). The rate for U Cay males this year and last year (21.4%) is nearly three times that for our previous full census in 2005 (7.0%)! We believe that this is attributable directly or indirectly (e.g., visiting dogs) to human activities on U Cay.

This year we implanted an additional 38 electronic identification (PIT) tags in iguanas, and have now PIT-tagged a total of 778 lizards (Table 2). We had four PIT tag failures this year. However, the failure rate of PIT tags has been quite low over our 15 years of using them, as has been the failure rate of toe clips due to natural toe loss. We will continue to PIT-tag as many subadults and adults as possible each year as funds allow (\$8 per tag), because the redundancy of using both methods simultaneously insures the positive identification of every iguana so marked.

Table 2. Tally of PIT (passive integrated transponder) tags deployed and their success rates for Allen Cays iguanas. Abbreviations are Recaps (recaptured lizards), Cum (cumulative), True tag failures (tags palpable under skin, but no signal), and Other tag failures (tags not palpable and no signal). Data for 2001-09 are for May captures only.

Year	U Cay					Leaf Cay				
	Number newly tagged	Cum total tagged	Recaps with tags	True tag failures	Other tag failures	Number newly tagged	Cum total tagged	Recaps with tags	True tag failures	Other tag failures
1993	5	5	0	--	--	11	11	0	--	--
1994	13	18	3	0	0	3	14	5	0	0
1995	52	70	10	0	0	19	33	8	0	0
1996	56	126	36	0	0	56	89	19	0	1
1998	0	126	57	0	3	77	166	49	1	2
2000	29	155	74	0	1	55	221	80	0	2
2001	24	179	75	0	0	14	235	93	1	2
2002 ^a	6	185	65	0	0	20	255	65	2	0
2003 ^b	14	199	58	0	0	52	307	66	3	1
2004 ^c	15	214	65	0	0	51	358	106	1	0
2005 ^d	10	224	50	0	1	52	410	105	0	1
2008 ^e	32	256	27	0	0	74	484	100	0	2
2009 ^f	8	264	41	0	2	30	514	124	1	1

^a Excludes pit tags placed in 3 iguanas on Allen Cay.

^b Excludes pit tags placed in 5 iguanas on Allen Cay.

^c Excludes pit tags placed in 3 iguanas on Allen Cay; also excludes 7 carcasses (2 on U; 5 on Leaf) still bearing tags.

^d Excludes pit tag placed in 1 iguana on Allen Cay (total now with tags = 15); also excludes 1 of 6 carcasses (on Leaf Cay) still bearing tags.

^e Excludes pit tags placed in 2 iguanas on Allen Cay (total now with tags = 17); also excludes 3 of 9 carcasses still bearing tags.

^f Excludes pit tag placed in one iguana on Allen Cay (total now with tags = 18); also excludes 4 of 6 carcasses still bearing tags.

Finally, on 18 May 2008 we deployed a digital rainfall gauge in the interior of Leaf Cay. The logger was downloaded on 19 May this year, and re-deployed to record for the next year. Total rainfall from 18 May 2008 to 18 May 2009 was 23.65 inches (60.07 cm), in line with our prior speculation that rainfall might average about 25" (63.5 cm) per year in the Allen Cays (Table 3).

Table 3. Monthly rainfall (in inches) recorded in digital logger on Leaf Cay in the Allen Cays from 18 May 2008 to 18 May 2009.

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2008	--	--	--	--	0.34*	1.14	3.03	4.14	5.54	4.08	2.20	1.68
2009	0.84	0.51	0.13	0.00	0.02*							

* partial month only

ALLEN CAY

Poor weather restricted our time on Allen Cay to only half a day on 20 May. We found the mummified carcass of Male #1 (first marked in 2001) who was the resident of the landing beach area. We could detect no foul play in his death, but we are concerned by the abundance of dog feces observed above the beach at this site. The carcass was too odorous to retrieve for Sandra Buckner, but we will retrieve it on a future trip. We also captured three other adult iguanas. Two of them were recaptures from previous trips. The third (a female) bore distinct toe clips (#56) but we have never used that number on Allen Cay. A search of all of our other records from U and Leaf Cay suggests that this is an iguana that we first marked on Leaf Cay in March of 1994 (at an estimated age of 6.5 years) and never saw there again. We do not know if its transport to Allen Cay was natural or human mediated.

FLAT ROCK REEF CAY

Iguanas were introduced by humans to this 5.3 ha cay in about 1996 (see previous reports), and the population has grown rapidly to a current size of about 150 iguanas. Because of inclement weather half of our field team spent a half day (22 May) on Flat Rock Reef Cay (FRRC) and captured only 18 iguanas (including one dead yearling; 50%, or 9 being recaptures).

While on the island in May we excavated the iguana nests that Kirsten Hines and I had identified in July of 2008. We found that the eight nests had contained 33 total eggs and that 26 (79%) of them had hatched successfully. This compares to six nests identified in July of 2007 in which 18 of 24 eggs hatched and emerged (75%), and seven nests identified in July of 2006 in which 24 of 30 eggs hatched and emerged (80%). Tidbit data loggers placed in seven of the eight nests revealed that mean incubation temperature (15 July to 30 September; recorded every 15 minutes) in each were between 30.8 and 32.7°C (mean of means 31.8°C). Nest temperatures were highest in early incubation and on average declined 2-4°C during the 3 month incubation period.

Kirsten Hines returned to FRRC from 14 to 17 July for our fourth and final year of nesting studies there. A last-minute scheduling problem prevented my accompanying her. Although nesting season is typically well finished by those dates, several females were still digging nest burrows. We suspect that unusually cool conditions in May and June may have delayed the

nesting season this year, and we will test that assumption when we download our temperature station data next May. While on FRRC Kirsten captured 22 iguanas (14 recaptures, 8 previously unmarked; Table 4).

She also located three nests. Each was excavated, and the eggs measured and reburied with a digital temperature logger. Mean clutch size in this year's nests was 4.0 (range 3-5), similar to that for nests found there in previous years. We will excavate these in May of 2010 to determine nest success and incubation temperatures. Through July 2009 we have now marked a total of 114 iguanas on FRRC (57 with PIT tags) and tallied 112 recaptures.

Table 4. Recapture information by year for iguanas on Flat Rock Reef Cay.

Sample Year (month)	Total captures	Total recaptures	Percent recaptures	Sex ratio (M/F)	Cumulative # w/ marks	Cumulative # recaptures
2001 (May)	2	0	0	2/0	2	0
2003 (May) ^a	3	0	0	1/2	5	0
2005 (May)	7	0	0	5/2	12	0
2006 (March)	38	5	13	19/13	45	5
2006 (July)	26	13	50	11/14	58	18
2007 (Jun-Jul)	19	14	74	11/8	63	32
2008 (May) ^b	37	19	51	16/14	81	51
2008 (July) ^c	55	38	69	23/27	98	89
2009 (May)	18	9	50	8/6	106	98
2009 (July)	22	14	64	13/9	114	112

^a Includes 1 individual originally marked on Leaf Cay.

^b Excludes 4 carcasses.

^c Excludes 1 carcass.

During field work on FRRC in May 2010, we intend to excavate this year's nests and do one final capture survey in order to calculate annual survivorship, estimates of population size over the past decade, and growth of individuals. We have begun preparing our manuscript comparing growth, reproduction, and demography of the introduced Flat Rock Reef Cay population with our earlier findings on the Leaf and U Cay populations.

BUSH HILL CAY(Acklin's Iguana)

For the seventh year (2002-2009, except 2006) we visited Bush Hill Cay at the northern limit of the Exuma Cays Land and Sea Park to census the introduced population of Acklins iguanas (*Cyclura rileyi*) there. Between light to heavy showers during 48 hours from 23-25 May we captured and processed iguanas as best we could. Because of the weather we caught only 75 iguanas (23 males, 45 females, 6 unsexed, 1 skeleton; 13 new, 61 recaptures). We have now marked a total of 305 iguanas on Bush Hill and recorded 301 total recaptures (Table 5).

This year we also experimented with the use of small Havahart live traps for capturing iguanas deep in the bush. The technique showed promise, especially since the iguanas seem to be becoming increasingly wary of humans. However, of great concern was the fact that we captured a large rat (*Rattus norvegicus*?) in one of the traps during midday under dark overcast conditions. My students have seen small mammals scurrying in the leaf litter on previous trips (and this one), and we had assumed that these were hutia (presumably waifs from Little Wax Cay). However, it is possible that these sightings were also of rats. Nighttime trapping will be necessary to determine the diversity and density of introduced mammals on Bush Hill Cay.

Table 5. Capture information by year for Acklins iguanas introduced to Bush Hill Cay. All trips 2002-2005 were for 24 hours or less in mid-May. The trips in 2007 and 2008 were for 1.5 days in late June and mid-May, respectively. That is 2009 was for 48 hours in mid-May.

Year	Total captures	Total adults ^a	Total juveniles	Total recaptures	Percent recaptures	Cumulative # with marks	Cumulative number recaptures
2002	75	75	0	--		75	--
2003	72	69	3	16	22	131	16
2004 ^b	104	103	1	42	40	194	58
2005	106	105	1	59	56	241	117
2007 ^b	96	93	3	58	60	279	175
2008 ^b	79	73	6	65	82	293	240
2009 ^b	75	68	6	61	81	305	301

^a includes all individuals 20 cm SVL or larger (the size when the juvenile pattern begins to fade)

^b excludes single carcass found

Last year extremely hot and dry weather contributed to lower capture numbers on Bush Hill Cay, and this year's extremely cool, wet weather had the same effect.

All of our Bush Hill Cay data have been forwarded to Dr. Bill Hayes (Loma Linda University) for comparison with his work on *Cyclura rileyi* in its natural range. A copy also has been sent to Sandra Buckner for archival purposes.

FUTURE PLANS

I plan to return to the Allen Cays and Bush Hill Cay with students in May of 2010 for 8-10 days of survey work (year 31 of our project).

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