

ANNUAL REPORT

In-water surveys of green turtles (*Chelonia mydas*) at Culebra Archipelago, Puerto Rico

Prepared by

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Introduction

The seagrass beds near the coastal areas of the Culebra Archipelago were designated as Critical Habitat by the U.S. National Marine Fisheries Service (NMFS) for its importance as green turtles' feeding grounds (NMFS, 1998). In-water surveys on these critical habitats were conducted during 1986 to 1989 to obtain information on habitat fidelity, relative abundance, size class composition and growth of the juvenile and sub-adult green turtles found in the area (Collazo *et al.*, 1992). During 1998, José Rivera from US NMFS reinitiated this study for one year survey to evaluate the current status of this aggregation. The information gathered on 1998, combined with the data collected by Collazo *et al.* (1992) strengthen the importance of the area and the proposal for continuing a long-term project to assess trends in this green turtle aggregation and the collection on other important parameters, such as growth rates. The following report is a summary of the activities and results obtained during in-water surveys conducted on June 2000 to June 2001 at the Culebra Archipelago.

Methods and Results

Study-site:

The Culebra Archipelago is located at 30 km from Puerto Rico's east coast (Fig 1). Sea grasses and coral reefs surround the Archipelago, which is composed of more than 9 cays. Three study sites were selected from previous studies. Mosquito and Culebrita have two coves, while Puerto Manglar, only has one (see map). The depth of all sites varies from 8 to 15 meters.

Turtle captures and biometrics:

All work was done from three boats (approximately 15, 17 and 28 feet in length). The method for capturing turtles was adapted from Collazo *et al.* (1992): netting sampling was conducted in several areas located along the eastern coasts of Culebra: (i.e. Mosquito Bay, Puerto Manglar and Culebrita). During the 1998 survey, these locations were the areas of consistently highest turtle densities. Netting was done with a 183 m long, 9.1 m deep net (#12 monofilament line, 9 cm stretch mesh) deployed parallel to shore. Water depth varied depending on site. An average of 8 swimmers (range 7-10) were snorkeling along the net to capture turtles as the turtles encounter the net. Once captured, the turtle was taken to a boat for data collection. Netting for capture and recapture of juveniles green turtles was conducted four times/year (every three months) with an effort range of 12-16 hours of net soaked in the water (3-4 hours of net soaked in the water per session). See Table 1.

Table 1. Dates of surveys at Culebra Archipelago and number of turtles captured.

Date	N ^o of turtles Captured
27-29 Jun 00	22
18-20 Oct 00	22
27 Feb-1 Mar 01	11
26-28 Jun 01	26

Measuring the time spent for each survey session assessed the effort involved with finding and capturing turtles at Culebra Archipelago. Effort assessments were made for all survey sessions during the research period but does not include captures made incidentally. With a net set (total sampling occasions) defined as a unit of effort, the catch per unit effort (CPUE) was calculated for each net set. At Culebrita and Mosquito, nets were set twice and Manglar was set once. All study sites were sampled for three occasions at different times of the day. Table 2 indicates CPUE data for FY 00-01 as presented by Collazo *et al* (1992). However, cautious should be taken when making comparisons, since our data is only for one year, while Collazo *et al* (1992) is for three years. We also presented CPUE data on Table 3 by average and STD for each site. The CPUE in both tables suggests Puerto Manglar site as the highest amount of turtles per net

set, and Mosquito with the least. In the future, we would consider other ways of calculating CPUE data, such as time of net soaked and length of net.

Table 2a. Green turtles captured per net set (total sampling occasions) at Culebra, Puerto Rico, 2000-01. (ordenar en orden ascendente o descendente, pero que haya un orden)

Site	Total captures	Sampling occasions	Catch per net set
Manglar	42	12	3.5
Culebrita	31	18	1.7
Mosquito	8	24	0.33
Total	81		

Table 3. Catch per unit effort (CPUE) at Culebra Archipelago, 2000-01 lo mismo, ordenar en orden por sitio de mayor a menor CPUE.

Site	Total captures	Mean CPUE	STD	SE	Min	Max	Mean captures
Culebrita	31	1.73	0.75	0.43	1.00	2.5	10.33
Manglar	42	3.47	1.12	0.56	2.3	5.0	10.50
Mosquito	8	0.33	0.23	0.12	0.17	0.67	2.0
Total	81						

During FY 00-01 field season a total of 81 green turtles were captured during the net sessions with 56 turtles being captured for the first time. Twelve turtles were recaptures from previous years and the thirteen were recaptures within the FY 00-01. Green turtles ranged in size from 28.1 to 80.15 cm notch-notch straight carapace length (N-N SCL) (See Fig. 2). Turtles in the 30-40 and 50-60 cm SCL size class were most commonly caught; suggesting Culebra Island as a developmental habitat for juvenile and sub-adults green turtles. Two hawksbills were caught in Manglar study site (53.9 cm and 45.0 cm SCL notch-tip).

Turtles were tagged on both flippers with small monel tags prior to release. In addition, juvenile and sub-adult turtles were injected with Passive Integrated Transponder (PIT tags, AVID brand) in their front right flipper muscle (see Appendix I for list of tagged turtles).

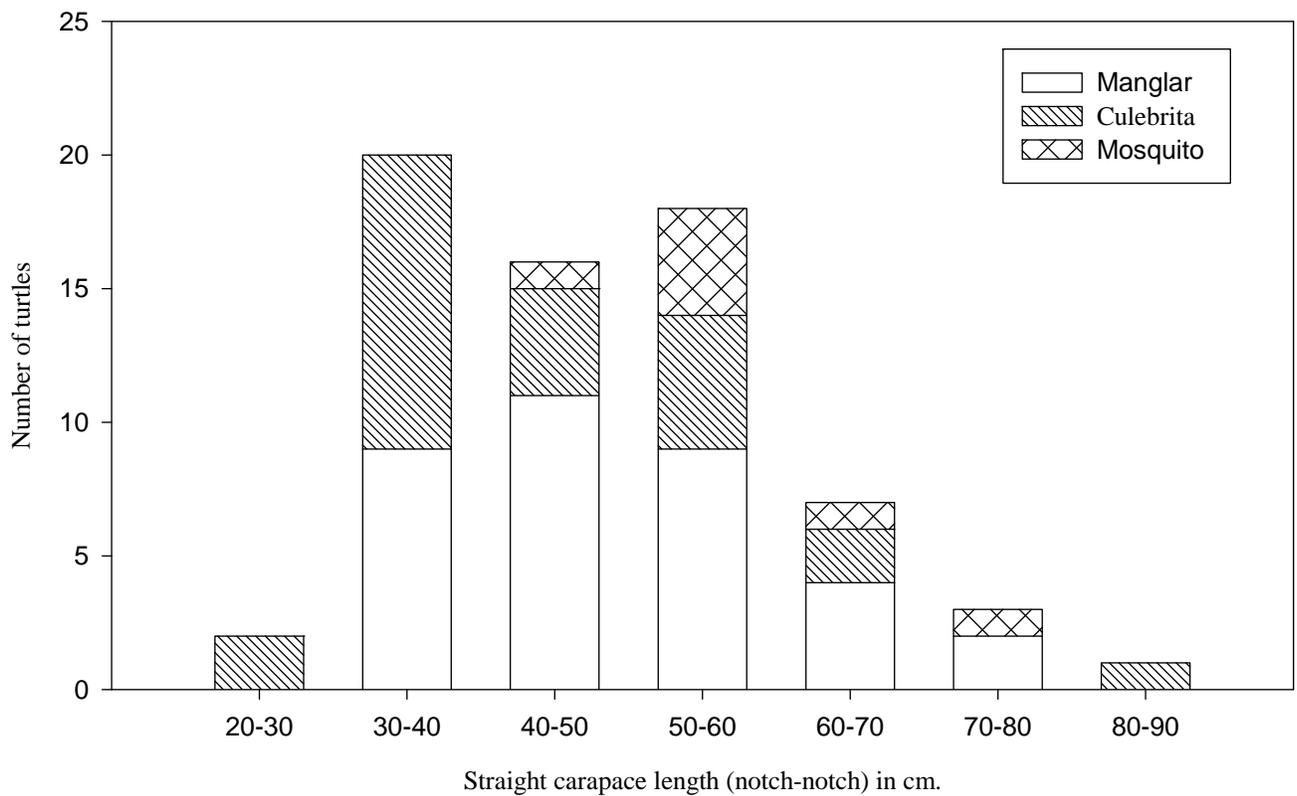
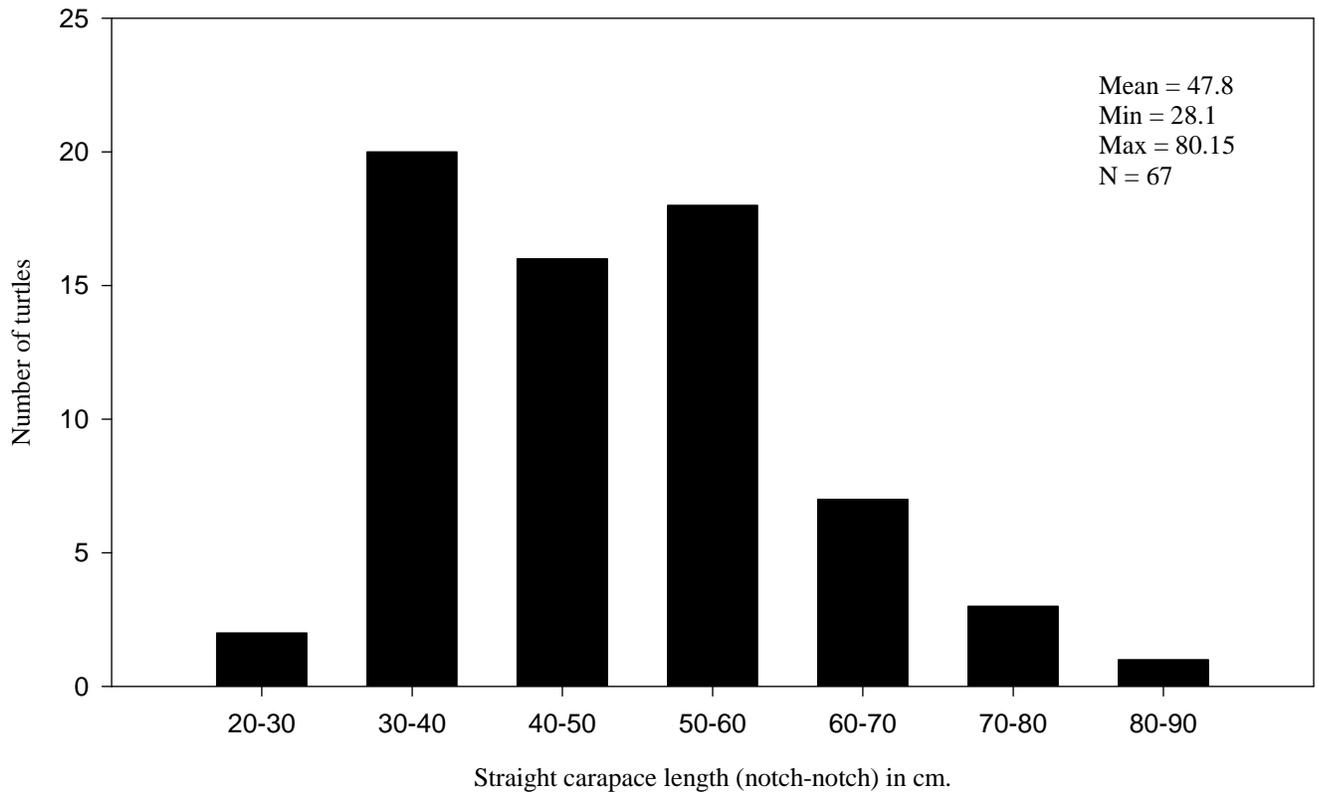


Fig 2. Size distribution of 67 green turtles captured during June 2000-June 2001.

Growth:

Knowledge of turtle growth rates is critical to understanding turtle population dynamics. This information also forms the basis of age to maturity estimates necessary to understand life history stages. Growth data obtained from Collazo *et al* (1992) reported a different pattern than those reported for the Atlantic green turtles. The tagging effort of the fieldwork performed during FY00-01, aimed at juvenile and sub-adult green turtles provided a baseline for growth rates data and would contribute to determine if the discrepancy between the reported growth rates is valid or simply the result of a limited size sample. A total for 17 recaptures yielded growth rate data. Only 8 have growth rate data for intervals greater or equal to 12 months. This was to allow for seasonal changes, which can affect feeding rates and may alter growth rates (Van Dam, 1999). Table 4 summarizes the data for all recaptured animals.

Table 4. Annualized growth rate of turtles recaptured during June 2000-June 2001, at Culebra Island, Puerto Rico. All measurements are straight carapace length (notch to notch) in cm.

Site	L Tag	Date previous measurement	N-N Carapace length	Date latest measurement	N-N Carapace length	Increment	Interval (days)	Annual growth (cm/year)
Culebrita	ppm241	29-Jun-00	51.9	18-Oct-00	53.0	1.09	110	3.62
Culebrita	ppm243	29-Jun-00	51.3	18-Oct-00	52.7	1.43	110	4.76
Culebrita	ppm244	29-Jun-00	55.4	18-Oct-00	55.8	0.76	110	2.52
Manglar	ppm225	28-Jun-00	62.7	18-Oct-00	63.8	1.10	111	3.62
Culebrita	ppm214	27-Jun-00	33.7	19-Oct-00	35.6	1.90	113	6.14
Manglar	ppm209	27-Jun-00	55.7	19-Oct-00	57.0	1.30	113	4.20
Mosquito	ppm372	28-Jun-00	54.8	28-Feb-01	59.1	4.30	246	6.38
Culebrita	xxn824	20-Oct-00	33.3	27-Jun-01	36.7	3.40	250	4.96
Manglar	ppy329	20-Oct-00	67.0	28-Jun-01	71.0	4.00	251	5.82
Manglar	ppm221	28-Jun-00	48.9	28-Jun-01	56.5	7.60	365	7.60
Manglar	ppm208	27-Jun-00	29.8	28-Jun-01	36.9	7.10	366	7.08
Culebrita	ppy354	18-Feb-98	39.5	29-Jun-00	54.6	15.1	861	6.40
Manglar	ppy371	18-Feb-98	54.1	19-Oct-00	65.0	10.9	971	4.10
Mosquito	mnftpy327	18-Aug-97	37.0	27-Jun-00	58.0	21.0	1042	7.36
Manglar	ppm225	18-Aug-97	44.9	28-Jun-00	62.7	17.8	1043	6.23
Manglar	ppy329	19-Aug-97	45.8	20-Oct-00	67.0	21.2	1155	6.70
Culebrita	ppy344	19-Aug-97	48.4	26-Jun-01	63.5	15.1	1404	3.92

Blood sampling:

Blood samples were collected for 29 individuals for both, sex and DNA studies. Ten additional samples were collected for DNA only. Analysis of these materials through genetic profiling may allow us to relate this aggregation of juveniles' green turtles to others among the Caribbean-Atlantic Region. Serum samples would be used for sex determination through testosterone assays. These samples were sent to Dave Owens at University of North Carolina. The results were not available by time this report was written.

Other observations:

-Fibropapillomas

Three green turtles were observed with fibropapillomas tumors at Puerto Manglar. Although in all cases, the tumors were not severe, it was an important documentation since it is the first time that tumors were reported on green turtles at this study site. Turtle PPM209-PPM211 was biopsied and the sample was sent to Dr James Casey at Cornell University for pathological analysis (see Appendix I).

-Home range

Only one turtle moved from one study site to another. Turtle number Mnftpy 327/PPM408 was first captured at Mosquito on August of 1997 and was recaptured three years later (June 2000) at Puerto Manglar. Although the distance from the two sites is not long (approximately 1 km), it was the first and only report of displacement, indicating a limited home range within feeding areas.

-Hawksbills in-water surveys

In addition to the netting sessions, surveys to evaluate the current status of hawksbill turtles at potential feeding grounds in Culebra were conducted. We concentrated our efforts at the Carlos Rosario Marine Reserve, which is located at the northeast side of Culebra mainland. Surveys were conducted using the same methods as in Mona-Monito and Desecheo Islands (see reports). Table 6 summarizes the CPUE for hawksbills in-water surveys at Carlos Rosario Marine

Reserve. A total of 14 hawksbills were captured during 8 hours of in-water surveys. Only two turtles were recaptured. The size range for all turtles captured were 20.5 to 39.2 cm SCL (notch-tip), suggesting the area as a developmental habitat for juvenile hawksbills.

Table 6. CPUE for hawksbill turtles captured at Carlos Rosario Marine Reserve. CPUE was calculated by dividing the number of turtles seen (whether captured or not) by the total time of each survey (hours).

Year	Hours of surveys	Number of hawksbills (captured and seen)	CPUE
1997	1.5	3	2.0
2000	5.5	11	2.0
2001	1	4	4
Total	8	18	2.25

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Appendix I: Comprehensive list of green turtles captured at Culebra Island during June 2000-June 2001.

Site	Date	L-Tag	R-Tag	PIT tag	Capture	N-N SCL
Culebrita I	27-Jun-00	ppm214	ppm217	*040064824	New	33.7
Culebrita I	27-Jun-00	ppm215	ppm216	*0400076265	New	45.8
Manglar	27-Jun-00	mnftpy327	ppm408	114519455A	New	58
Manglar	27-Jun-00	ppm207	ppm210	*040055768	New	47.6
Manglar †	27-Jun-00	ppm209	ppm211	*040075859	New	55.7
Manglar	27-Jun-00	ppm206	ppm212	*040059616	New	59.9
Manglar	27-Jun-00	ppm208	ppm213	*040073819	New	29.8
Manglar	28-Jun-00	ppm237	ppm234	*040100381	New	52.8
Manglar	28-Jun-00	ppm240	ppm236	*040090893	New	48.8
Manglar	28-Jun-00	ppm239	ppm235	*040077632	New	49
Manglar	28-Jun-00	ppm221	ppm227	*040103091	New	48.9
Manglar	28-Jun-00	ppm218	ppm229	*040080560	New	47
Manglar	28-Jun-00	ppm225	ppm226	113735692A	Reca	62.7
Manglar	28-Jun-00	ppm222	ppm230	*040054850	New	41.3
Manglar	28-Jun-00	ppm223	ppm224	113734445A	Reca	68.4
Manglar	28-Jun-00	ppm220	ppm228	*040054595	New	56.6
Mosquito	28-Jun-00	ppm372	ppy380	114624685A	Reca	54.8
Culebrita I	29-Jun-00	ppm241	ppm242	*040102302	New	51.91
Culebrita I	29-Jun-00	ppy354	ppm429	114519234A	Reca	54.58
Culebrita I	29-Jun-00	ppm243	ppm446	*040071876	New	51.26
Culebrita I	29-Jun-00	ppm244	ppy338	113726677A	Reca	55.04
Manglar	29-Jun-00	ppm246	ppm245	*040073622	New	31.92
Culebrita I	18-Oct-00	ppm243	ppm446	*040071876	Reca	52.7
Culebrita I	18-Oct-00	ppm241	ppm242	*040102302	Reca	53
Culebrita I	18-Oct-00	ppm244	ppy338	113726677A	Reca	55.8
Manglar	18-Oct-00	ppm225	ppm226	113735692A	Reca	63.8
Manglar	18-Oct-00	ppm238	ppm233	*040062550	Reca	60.2
Manglar	18-Oct-00	xxn801	xxn802	none	New	31.7
Manglar	18-Oct-00	xxn804	xxn803	none	New	44.2
Manglar	18-Oct-00	ppm208	ppm213	*40073819	Reca	32
Culebrita 2	19-Oct-00	ppm444	xxn808	none	Reca	64.5
Culebrita 1	19-Oct-00	none	xxn807	none	New	34.8
Culebrita 1	19-Oct-00	ppm214	ppm217	*40064824	Reca	35.6
Manglar	19-Oct-00	ppy371	ppy376	114474492A	Reca	65
Manglar	19-Oct-00	ppm209	ppm211	*40075859	Reca	57
Manglar	19-Oct-00	xxn805	xxn806	none	New	42.5
Culebrita 1	20-Oct-00	xxn824	xxn825	none	New	33.3
Culebrita 1	20-Oct-00	xxn810	xxn809	none	New	39.7
Culebrita 1	20-Oct-00	xxn812	xxn811	none	New	39.6
Culebrita 1	20-Oct-00	xxn813	xxn814	none	New	34.3

Site	Date	L-Tag	R-Tag	PIT tag	Capture	N-N SCL
Manglar	20-Oct-00	xxn819	xxn821	none	New	71.43
Manglar	20-Oct-00	ppy329	ppm410	none	Reca	67
Mosquito 2	20-Oct-00	xxn815	xxn816	none	New	42.4
Mosquito 2	20-Oct-00	xxn817	xxn818	none	New	54.1
Manglar	27-Feb-01	ppm262	nnw248	none	New	41.6
Manglar	27-Feb-01	ppm267	nnw247	none	New	31.5
Manglar	27-Feb-01	nnw244	nnw245	none	New	35.9
Manglar	27-Feb-01	ppm263	nnw246	none	New	45.9
Manglar	27-Feb-01	ppm265	ppm292	none	New	46.1
Manglar †	27-Feb-01	ppm263	nnw246	none	New	45.9
Mosquito 1	28-Feb-01	xxn855	xxn854	*41060283	New	56.5
Mosquito 2	28-Feb-01	xxn853	xxn852	*40874274	New	70.4
Mosquito 2	28-Feb-01	ppm372	ppy380	114624685A	Reca	59.1
Mosquito 2	28-Feb-01	nnw243	xxn851	11372165A	Reca	68
Manglar	1-Mar-01	xxn863	xxn862	*41574012	New	50.7
Culebrita 1	26-Jun-01	xxn885	xxn886	*050023571	New	28.1
Culebrita 1	26-Jun-01	xxn889	xxn890	*050076343	New	41.5
Culebrita 1	26-Jun-01	xxn887	xxn888	*050112773	New	43.7
Culebrita 1	26-Jun-01	xxn894	xxn895	*050122345	New	33.8
Culebrita 1	26-Jun-01	xxn881	xxn880	*050307346	New	29.3
Culebrita 1	26-Jun-01	xxn879	xxn878	*050273342	New	55.1
Culebrita 1	26-Jun-01	ppy344	xxn897	113727217A	Reca	63.5
Culebrita 1	26-Jun-01	xxn891	xxn892	*050311358	New	33
Culebrita 1	26-Jun-01	xxn884	xxn882	*050017082	New	33.3
Culebrita 1	26-Jun-01	xxn896	xxn893	*050052862	New	31.6
Manglar	26-Jun-01	xxn876	xxn877	*050302573	New	37.8
Mosquito 2	26-Jun-01	xyp707	xxn898	*050071054	New	51.7
Culebrita 2	27-Jun-01	xyp713	xyp714	*050316555	New	41.3
Culebrita 2	27-Jun-01	xyp711	xyp712	*050117793	New	66.9
Culebrita 1	27-Jun-01	xyp710	xyp708	*050315894	New	36.6
Culebrita 1	27-Jun-01	xxn824	xxn825	*050115840	Reca	36.7
Manglar	27-Jun-01	xyp718	xyp717	*050009775	New	47.2
Manglar	27-Jun-01	xyp715	xyp716	*050071527	New	37.7
Manglar	28-Jun-01	ppy329	ppm410	113723570A	Reca	71
Manglar	28-Jun-01	ppm221	ppm227	*040103091	Reca	56.5
Manglar	28-Jun-01	xyp726	xyp727	*040103091??	Reca	56.9
Manglar	28-Jun-01	xyp719	xyp720	*050027288	New	34.1
Manglar	28-Jun-01	xyp722	xyp721	*050032545	New	39.4
Manglar	28-Jun-01	ppm208	xyp723	*040073819	Reca	36.9
Manglar †	28-Jun-01	xyp725	xyp724	*050289784	New	53.7
Culebrita 1	28-Jun-01	xyp731	xyp730	none	New	80.15

Note: † is to denote those turtles with Fibropapiloma.

