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Technique

Biomedical health assessments of the Florida manatee in Crystal River - providing opportunities for training during the capture, handling, and processing of this endangered aquatic mammal

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Abstract

Federal and state researchers have been involved in manatee (*Trichechus manatus*) biomedical health assessment programs for a couple of decades. These benchmark studies have provided a foundation for the development of consistent capture, handling, and processing techniques and protocols. Biologists have implemented training and encouraged multi-agency participation whenever possible to ensure reliable data acquisition, recording, sample collection, publication integrity, and meeting rigorous archival standards. Under a U.S. Fish and Wildlife Service wildlife research permit granted to the U.S. Geological Survey (USGS) Sirenia Project, federal biologists and collaborators are allowed to conduct research studies on wild and captive manatees detailing various aspects of their biology. Therefore, researchers with the project have been collaborating on numerous studies over the last several years. One extensive study, initiated in 2006 has focused on health and fitness of the winter manatee population located in Crystal River, Florida. During those health assessments, capture, handling, and work-up training has been afforded to many of the participants. That study has successfully captured and handled 123 manatees. The data gathered have provided baseline information on manatee health, reproductive status, and nutritional condition. This research initiative addresses concerns and priorities outlined in the Florida Manatee Recovery Plan. The assessment teams strive to continue this collaborative effort to help advance our understanding of health -related issues confronting manatees throughout their range and interlacing these findings with surrogate species concepts. [JMATE. 2012;5(2):17-28]

Key words: Trichechus manatus latirostris, wildlife, marine mammal, recovery, research, data acquisition, sample collection

Introduction

Health and welfare of the wild manatee populations in Florida is of concern for managers dealing with species recovery. The Florida manatee (*Trichechus manatus latirostris*) is a flagship species and is currently listed as endangered at the federal and state levels; however it is subjected to limitations in habitat and water quality throughout its range. Scientists at the USGS, Southeast Ecological Science Center (SESC) ï Sirenia Project and the Florida Fish and Wildlife Conservation Commission (FWC) have been conducting manatee captures at selected sites in Florida for many years. Recently, additional sites have been utilized in order to broaden the scope of the project. One of these sites is located in Crystal River, Florida and is the winter home to over 600 wild manatees. This area encompasses the Crystal River National Wildlife Refuge, where a flourishing ecotourism industry supports observation and swimming with manatees outside the extensive no-entry sanctuary network. This human activity, coupled with other environmental pressures such as a shrinking habitat due to development and a growing regional manatee population, makes Crystal River a unique study area. These pilot studies have incorporated a large research team consisting of several biologists and veterinarians in order to conduct field examinations of wild, free-ranging manatees. This team has aided in facilitating collaborative projects within the broad scope of scientific research between several partners. Collaborations exist with the USGS, FWC, the University of Florida (UF) College of Veterinary Medicine, Oceanographic Environmental Research Society (OERS), and various governmental, non-profit, and educational agencies.

The concept of use of wildlife as sentinel species has been introduced for marine mammals (2,7,8,16), and more particularly the manatee (1). Though not high in the food chain, manatees are thought to be good indicators of water quality and possibly indicators of diseases in the environment, especially those zoonotic diseases of interest to human health. Recent analyses of seroprevalence titer levels in wild manatees and use of genetics for pathogen detection studies have identified possible disease exposure in Florida manatees (4,9,13,15). Contaminant levels have also been

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identified in manatees from Florida (12,17). Many additional studies focused primarily on biomarkers are currently underway to look at fine-scale detection processes for determining health and fitness (18).

Biomedical examination and clinical tools are an integral part of our arsenal to better understand manatee populations as a whole. Researchers and managers should continue to take advantage of this science to ensure that data are available and used in a meaningful way. The capture team personnel offer years of experience and expertise in manatee capture techniques, animal handling, clinical medicine applications, and understanding life history parameters, as well as assisting with sample collection for future collaborative studies and data interpretation. Through these efforts, researchers will gain insight into the basic and fundamental concepts of biology, health, and disease confronting the manatee in Florida. This insight will then be translated into information that can be used for interpretation during adaptive management processes for future implementation.

One of the objectives of acquiring manatee medical and biological information is to provide an opportunity to train researchers, scientists, and veterinarians in several aspects of wildlife health assessment. During this study, teams were organized in such a way as to mentor and offer training specific to out-of-water animal handling, vital sign monitoring, drawing blood samples, performing surgical implantation of identifying chips and biopsies, utilizing ultrasonography and thermography, collection of morphometric data, and handling and processing of biomedical samples. The training approach consisted of four components: (1) initial observation of the specific procedure, (2) assisting with the procedure, (3) performing the procedure, and (4) training someone else on how to do the procedure. As all procedures were monitored by experienced personnel, these levels of involvement helped ensure that all procedures were performed in a safe, consistent, and reliable manner.

Materials & Methods

Net capture and handling of manatees ï Wild manatees were targeted for capture in Crystal River, Florida (28° 53ô28òN, 82°35ô50òW) in the cooler months of October and February when the greatest number of manatees are available for capture. Selection of capture dates were based on mornings with the lowest tides, when access to exposed beaches along the shoreline was more opportune. The site for capture was chosen because manatees commonly travel along the shoreline when moving about the bay. The capture site is also distant from the boundaries of the no-entry sanctuary areas scattered throughout the bay. FWC-lead capture teams and other researchers caught manatees in a net deployed from a specialized boat (Figure 1). Once the net encircled the manatee, the net was then collapsed onto shore, where the target animal was restrained by animal handlers on the exposed beach at low tide (Figure 2). The manatee capture boat used for this study was 24 feet in length, with the outboard engine mounted in the forward third of the vessel affording a flat, open deck work area aft, and a stern with a removable transom. The level, open stern, at the surface of the water, allowed for easy deployment of the net off the boat and also provided an efficient way for a captured manatee to be loaded up onto the deck of the vessel for transportation. The net utilized for this study was 400 feet in length, 30 feet deep, with a 3òx3ò square mesh constructed of number 60 green nylon twine. Football floats, placed approximately every 18ò along the top of the net, provided buoyancy. The lower end of the net was laced with heavy lead core line keeping it in contact with the substrate. This configuration allowed the net to drape from the surface through the water column to the

Figure 1: Specialized net boat used to deploy nets to catch manatees. Reproduced with permission USGS.

Figure 2: Capture beach at Crystal River. Reproduced with permission USGS.

Figure 3: Manatee captured with a net for health assessment. Reproduced with permission USGS.

substrate thereby effectively closing off any potential exit points for the targeted manatee.

Generally, lone transient manatees were selected based on their size and behavior as they swam along the shore into the capture area. A team of experienced spotters sighted the manatees from both a bridge that spanned the waterway and a support boat, visually tracking their movements and relaying information on manatee size, count, and position by way of radios to the waiting capture team. Once the manatee was within the capture area, the capture boat captain drove the boat out from shore and encircled the manatee while deploying net off the back of the boat. Once the net was completely deployed around the target manatee, the beach team, in a coordinated effort, collapsed the net onto the shoreline where the pursed manatee was pulled up onto the beach (Figure 3). Manatees often struggled during this part of the operation, so the team used caution to get the manatee restrained using human weight as rapidly as possible. The manatee was then safely removed from the net, secured into a stretcher, and placed onto a second capture boat for transport to the processing beach area. Prior to the transport, the beach team conducted an initial assessment of the restrained manatee to confirm that the animal was healthy then proceeded to the processing beach. If multiple manatees were captured during an event, each one was removed individually from the net and transported separately to the processing beach area.

Biomedical examination ï After capture each manatee was placed on closed cell foam pads and monitored for vital signs, including the monitoring of oral temperature, heart rate, and respiration (THR). Information was recorded on THR evaluation data sheets during the entire time the manatee was out-of-water. Vital sign monitoring provided on-site clinical assessment and was conducted by veterinarians and experienced biologists (Figure 4). Capnography and oximetry readings were collected with each respiration. Prescriptive oxygen and medications were available for medical management of the animal if necessary. A blood sample was collected

Figure 4: Medical research team conducting various procedures on a wild Florida manatee in Crystal River. Reproduced with permission USGS.

Figure 5: Blood is drawn from each manatee from the medial aspect of the pectoral flipper. Reproduced with permission USGS.

from the medial aspect of the flipper with a Vacutainer® system extension set (BD Co., Franklin Lake, NJ, USA) from the brachial vascular plexus bundle (Figure 5) and processed on site for submission to clinical pathology laboratories for analyses (11). General analyte values were obtained with an i-STAT® CG4+ cartridge, which included pH, PCO_2, HCO_3, TCO_2, base excess, PO_2, sO_2, and lactate (Abbott Co, Princeton, NJ,USA). Additional samples of serum and plasma were processed and archived for future analyses looking specifically at immunology, seroprevalence screening, contaminants, endocrine stressors, genetics, and microbiology. The manatee was checked for previously implanted passive integrated transponder (PIT) tags. If no tags were present two tags were surgically implanted over each shoulder in accordance with established PIT tagging protocols (19). Subcutaneous blubber measurements were recorded at three sites along the dorsum using an ultrasound following well established protocols (14). These data were then entered on appropriate data sheets. General biological samples were also collected, including, but not limited to, urine, feces, milk, tear film, and if present dermatological lesions. Skin biopsies may have also been collected for stable isotope and genetic analyses.

Radio Tagging – Manatees that met radio tagging criteria (individuals identified for a specific USGS study) were opportunistically fitted with tracking devices and monitored after release by field biologists. The manatees were fitted with a non-invasive belt placed around the peduncle, just cranial to the fluke. The floating transmitters were attached to the belt with a stiff nylon tether approximately 1.5m in length. Transmitters utilized both VHF and UHF signaling capabilities as has been previously described in detail (3,5,6). If manatees were selected for radio tag monitoring, the benefit of follow-up captures and health assessments could be realized and initiated at a later date, which were often dependent on the target animal's behavior and location.

Morphometrics and weight data – Overall morphometrics were collected and recorded for each individual manatee. Size class categories, as measured by straight-line length, were defined as follows: calf <235cm, juvenile 235-264cm, adult >264cm. After complete health processing the manatee was weighed using a suspended stretcher under a modified weighing arch with an electric winch (Figure 6). After the weight was obtained, the manatee was then placed onto the

Figure 6: An arch is used to weigh the suspended manatee before release back into the wild. Reproduced with permission OERS.

transport boat oriented head first towards the bow in preparation for release. Releases of manatees with tail-first entry off the stern of capture boats, has proven to be a much safer procedure than land-based releases. The manatee was marked on the head with an orange cattle grease marker (temporarily used for short-term identification to help avoid possible recapture). Then the manatee was taken by boat out to deeper water (approximately 2.2 meters or greater) near the original capture location under the direction of the capture coordinator. The manatee was released off the stern of the boat tail first with use of the stretcher.

Results

All manatees examined were considered healthy by appearance and based on individual monitoring there was seldom concern for their well-being. In some cases, when ambient air temperature was very low, manatees were provided a thermal blanket covering their body and placed into a tent where a space heater was used to keep the area warm. When the animal exhibited significant breath holding, another form of mitigation was employed, consisting of inducing respiration by pouring a small amount of water over the closed nostrils. Mentation was actively monitored by the team to determine reflex response and alertness. Manatees generally maintained heart rates within normal ranges (10,20). Female manatees thought to be pregnant were placed on extra closed cell foam pads and additional support was placed along their flanks around the abdomen. In those cases of suspected pregnancy, examinations were expedited and weights not taken for fear of applying additional pressure around to the abdomen during lifting.

Manatee captures and health assessments have been successfully conducted in Crystal River, Florida during 2006 through 2012. To date one hundred and twenty-three manatees have been handled by the experienced team. These captures were conducted during the winter month seasons from October through February (Table 1 by year). Only one radio tagged and monitored manatee was recaptured in June outside of this window. One hundred and twenty-three (76 males, 47 females) manatee captures have been conducted (addendum-Table 2). Three manatees were recaptures, one caught twice and one caught three times. Out of water holding time varied among individuals. Average holding time was 61.5 minutes, ranging from 48 to 100 minutes. Holding time generally increased with the size of the target individual and/or the number of complex procedures that were performed by the team. For example, the longest holding time was 100 minutes and this was for individuals where electrocardiography was performed in addition to the baseline procedures. This procedure alone added 20 minutes extra holding time. Holding time was also increased in cases when cow/calf pairs (n=5) were captured together. It was standard practice to release these pairs together to ensure that they did not become separated after return to the wild. This required that one of the individuals ready for release had to wait until the other was finished. Pregnant females, especially in the third trimester, were usually

	Calf	Juvenile	Adult	Totals
2006	0,0	1,0	1,0	2,0
2007	3,3	2,1	7,4	12,8
2008	2,4	6,0	9,4	17,8
2009	2,3	2,2	8,4	12,9
2010	3,1	4,2	4,3	11,6
2011	1,2	8,3	5,6	14,11
2012	1,1	2,1	5,3	8,5
Totals	12,14	25,9	39,24	76,47

Table 1: Table of 123 manatees caught in Crystal River, Florida by year, age class, and sex (male,female).

processed more rapidly and weights were not always determined in these cases in order to get these individuals back into the water as soon as possible.

The age group classifications constituted calves (n=26), juveniles (n=34), and adults (n=63) using existing criteria. However, only 5 of the classified 26 calves were captured with their mothers. As the selection process for catching manatees utilized spotters with information about other manatees in the area, these smaller manatees were considered lone individuals with no maternal association. Additionally, a lone young 175cm long female manatee was rescued tidally exposed with two other adult male manatees. The mother was not in the entrapment area at the time of capture. This small manatee was successfully released and visually monitored, where it likely joined its mother in the nearby aggregation of manatees. This finding is in support of trends over time of smaller individuals being independently weaned from the mothers before they obtain a length of >235cm. Analyses of morphometric data (total length versus total weight) resulted in separate regression lines, with females being heavier than males as body length increased (Figure 7). This is generally reflected in an increase of girth, as adult female manatees have different nutritional demands encumbered during pregnancy and the following burdens of lactation during calf dependency. Sexual maturity in

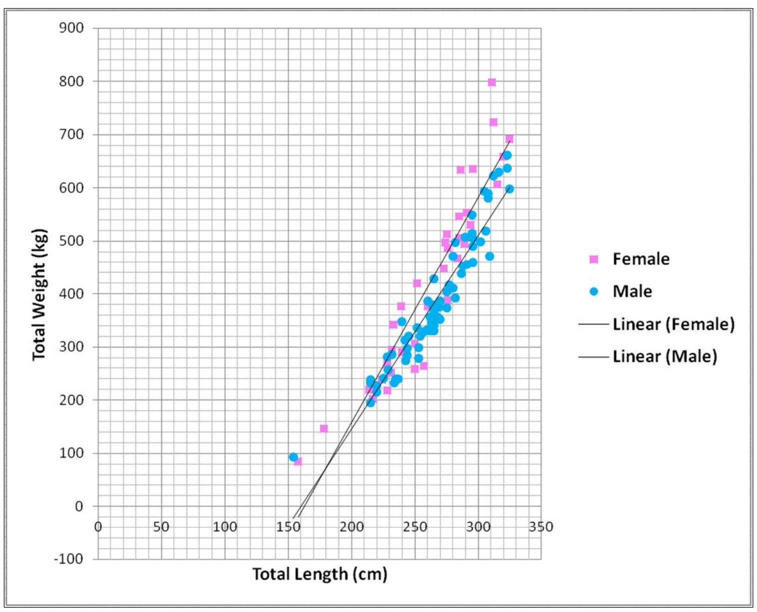

Figure 7: Total straight–line length measurement (cm) and total weight (kg) plotted for male (blue circles, n=66) and female (pink squares, n=39) Florida manatees from Crystal River.

in Florida manatees is reached at around 265cm in total straight-line length.

In the field blood analyte monitoring was accomplished using i-STAT instrumentation and the collection of vital signs. Ranges of lactic acid and CO_2 in expired breaths allowed clinicians to assess stress and prescribe O_2 if warranted. Vital signs were also monitored to ensure that they fell within normal ranges. Normal range for heart rate was considered between 40 to 80 beats per minute, oral temperature between 30°C and 36°C, and respirations between 3 and 7 breaths every five minutes (20). Oxygen was offered at each breath and all activities were recorded on data sheets. Manatees were kept calm while out-of-water and offered shade from the sun, warmth during exceedingly cold days, and periodically doused with water to prevent the skin from drying out.

Once out of the water, manatees generally calmed down when gentle force was applied to the dorsal surface of the body by experienced handlers. The animals were held in ventral recumbency, and care was taken to ensure that they did not roll over onto their back, where their tail could sweep up and injure the crew. After the manatee was stabilized and triaged by the experienced on-site medical team, the target manatee was then manipulated with broad, long pulling straps positioned under the body and caudal to the pectoral flippers as well as at a point caudal to the mid-body at a level cranial to the anus. Leverage techniques were used to place the manatee on top of a stretcher. The manatee could then be lifted by the handlers and loaded onto another manatee capture boat to be transported a short distance to the second beach where a clinical research team was prepared to process and perform a detailed physical examination. Upon arrival the manatee was placed on a foam pad, provided shade from direct sunlight, and its surface sprayed with water on warm days, or covered with a thermal blanket providing insulation during cold weather. Average holding time for each manatee was targeted for less than one hour, during which each individual was monitored for vital signs and possible distress. If issues of stress were detected the assessment was terminated early and the target animal returned to the water as soon as possible. Additionally, issues encountered during collection of oral temperature, heart rate, and respiration assessment were mitigated as necessary (11).

Discussion

The future for manatees in Florida will be quite different than what they have experienced during the last half of a century. With the Endangered Species Preservation Act of 1966, the Marine Mammal Protection Act of 1972, and the Endangered Species Act of 1973, manatees have been provided ample protection in the United States. With that protection, and the advent of artificial power plants in the mid 20^{th} century, manatee populations in Florida appear to have increased. However, due in part to power plant closures during the next half century, manatees will not have the available warm water they have become acclimated to for so many years. Warm water is necessary for their survival, and deprived of it, manatees will need to make adjustments in their winter migrations and site fidelity patterns if we expect them to survive cold winters. Resource managers are striving to make adjustments to ensure a warm water network exists and is available for manatees. With the loss of warm water discharges from power plants, and more limited access to artificial sources of warm water available to manatees, locations containing natural, artesian springs will become very important to the viability of the population of manatees in Florida. Mitigation is currently underway to address this problem. With continued population growth of the manatee in Crystal River, there will be greater demands on the available habitat that will likely be reflected in carrying capacity issues for manatees in the years to come. This study is one of the first in Florida to incorporate established base-line information of manatee population health and nutrition standards using physiological parameters. This information will be very important when making comparisons in body condition indices with manatees captured in the future. Manatees may be utilized as surrogate species to broaden our knowledge of complex habitat and ecological conditions.

Capture coordination and logistics are very important. For the continued success of this program in Crystal River a team approach and structure that required the assignment of specific duties for team members was utilized. This structure included detailed assignment of tasks to team leaders. These team leaders are as follows:

Project Leader, is in charge of the logistics and operation of the program. Assigns the field ID number for the target manatee. Ensures that all conditions of the research permits issued for the live capture of wild manatees are met. Acts as liaison with law enforcement officers, and is public relations representative with media representatives and the citizenry.

Capture Coordinator, is the primary person responsible for the capture operation and can include the following duties: operation of the capture boat, net deployment and expedient retrieval, and the safety and well-being of the target manatee and capture crew. Works closely with manatee spotters (in other boats and on-land) that are in charge of sighting potential manatees for capture. Generally, all manatee spotters are to report directly to the Capture Coordinator. This position is often tasked with coordination of manatee releases as well.

Safety Officer, is responsible for the safety of all individuals in the operation. Coordinates radio use and operation to facilitate communication between the team members. Examines all equipment for safe operation, supervises the use of equipment, and ensures all boating and on-the-water safety requirements are met.

Processing Beach Coordinator, is the individual responsible for coordinating animal handlers and animal manipulation on the processing beach. Coordinates any loading or unloading from the transport boat, animal rolls, transfers, and supervises the operation of the weighing the manatee. This position can be the capture coordinator if only one manatee is being captured at a time.

Chief Veterinarian, supervises the clinical team on the processing beach and calculates the most efficient and effective method for performance of all necessary medical procedures and is the veterinarian of record for the captured manatee. Administers or supervises the administration of medications if warranted.

Data Acquisition Coordinator, is the individual responsible for recording and maintaining all records pertaining to the manatee capture. Ensures that all data sheets are completed and that photo-documentation is thorough and complete. Approval from this person is required before the target manatee is released.

Sample Processing Coordinator, supervises a team of researchers who are responsible for in-field processing of biomedical samples. Maintains accurate inventories and monitors specimen labeling, curation, and storage.

Along with the defined roles for specific duties of the team leaders, certain physical techniques have been incorporated into the health assessment that will be useful for other researchers involved in other manatee captures. These techniques involved rolling and positioning the manatee with flat straps, obtaining weights, ensuring consistency in data collection techniques, establishment of protocols, safe deployment of nets, experience and familiarity with the use of nets, and specific knowledge of manatee behavior and their unique biology.

As these studies are important for manatee conservation, adaption of manatee assessment and capture techniques should be implemented widely. Similar studies could be integrated into innovative research venues throughout the range on sirenians. Capture and monitoring studies on manatee health have been conducted in Belize since 1997, where 155 manatees have been captured 269 times over the last 15 years (Sea to Shore Alliance files). The value of that study, illustrates the significance of long-term health assessment in assisting with management of an imperiled species such as the manatee. Additional health assessment studies are being conducted on manatees in Brazil, Mexico, Puerto Rico, and Cuba, as well as on dugongs in Australia.

Performing a health assessment on wild manatees is expensive and challenging, but the benefits of acquiring scientific data and training local biologists are proven. Nurturing similar training programs in other countries inhabited by threatened and endangered manatees will ensure better baseline scientific information to assist managers in making informed conservation-oriented decisions. Study of these bellwether species will assist conservation programs throughout the global range of sirenians.

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Addendum Table 2 (pages 26-28)

ID #	Date	Hold Time	Sex	TL - SL	TL - CL	WT (kg)	WT (lb)
CCR-06-01	17-Nov-06	77	Male	265	280	368	811
CCR-06-02	17-Nov-06	65	Male	246	260	ND	ND
CCR-07-01	4-Jan-07	48	Female	240	257	290	640
CCR-07-02	4-Jan-07	44	Female	324	358	ND	ND
CCR-07-03	4-Jan-07	60	Male	295	315	514	1132
CCR-07-04	4-Jan-07	43	Male	323	340	637	1404
CCR-07-05	5-Jan-07	57	Male	269	283	375	828
CCR-07-06	5-Jan-07	49	Male	215	234	233	514
CCR-07-07	5-Jan-07	41	Male	229	247	257	566
CCR-07-08	5-Jan-07	45	Male	288	306	453	998
CCR-07-09	16-Feb-07	49	Female	295	313	ND	ND
CCR-07-10	16-Feb-07	56	Male	237	252	240	528
CCR-07-11	16-Feb-07	69	Male	225	239	241	532
CCR-07-12	18-Jun-07	85	Male	265	283	331	730
CCR-07-13	10-Dec-07	57	Male	308	331	590	1300
CCR-07-14	10-Dec-07	72	Male	270	287	352	775
CCR-07-15	10-Dec-07	58	Male	254	276	320	705
CCR-07-16	10-Dec-07	57	Female	294	316	530	1170
CCR-07-17	10-Dec-07	57	Female	158	172	84	185
CCR-07-18	11-Dec-07	60	Female	228	240	218	480
CCR-07-19	11-Dec-07	53	Female	228	249	263	580
CCR-07-20	11-Dec-07	51	Female	291	310	553	1220
CCR-08-01	22-Jan-08	55	Male	252	272	336	740
CCR-08-02	22-Jan-08	49	Male	290	309	508	1100
CCR-08-03	22-Jan-08	41	Male	228	252	282	620
CCR-08-04	22-Jan-08	49	Male	264	286	379	835
CCR-08-05	22-Jan-08	73	Male	296	316	490	1080
CCR-08-06	23-Jan-08	60	Male	323	340	662	1460
CCR-08-07	23-Jan-08	40	Male	258	280	ND	ND
CCR-08-08	23-Jan-08	28	Female	289	309	ND	ND
CCR-08-09	23-Jan-08	46	Female	273	296	449	990
CCR-08-10	6-Feb-08	83	Male	232	255	286	630
CCR-08-11	6-Feb-08	65	Male	305	320	ND	ND
CCR-08-12	6-Feb-08	97	Male	296	312	506	1115
CCR-08-13	6-Feb-08	57	Male	270	289	386	850
CCR-08-14	7-Feb-08	67	Female	276	296	388	855
CCR-08-15	7-Feb-08	67	Female	178	199	147	325
CCR-08-16	7-Feb-08	55	Female	219	241	229	505
CCR-08-17	7-Feb-08	40	Male	245	259	320	705
CCR-08-18	11-Dec-08	56	Male	277	292	417	920
CCR-08-19	12-Dec-08	75	Female	224	232	238	525
CCR-08-20	12-Dec-08	55	Male	295	320	549	1210
CCR-08-21	12-Dec-08	85	Male	309	320	472	1040
CCR-08-22	12-Dec-08	74	Female	276	299	488	1075
CCR-08-23	12-Dec-08	45	Male	260	277	ND	ND
CCR-08-24	12-Dec-08	46	Male	253	ND	ND	ND
CCR-08-25	12-Dec-08	52	Female	175	193	ND	ND
CCR-09-01	12-Jan-09	71	Male	220	233	227	500
CCR-09-02	12-Jan-09	77	Male	265	287	428	945

Addendum Table 2 (pages 26-28)

ID #	Date	Hold Time	Sex	TL - SL	TL - CL	WT (kg)	WT (lb)
CCR-09-03	12-Jan-09	78	Male	295	313	508	1120
CCR-09-04	12-Jan-09	88	Female	320	342	658	1450
CCR-09-05	12-Jan-09	72	Male	305	320	594	1310
CCR-09-06	11-Feb-09	61	Female	285	305	506	1115
CCR-09-07	11-Feb-09	55	Male	263	283	347	765
CCR-09-08	11-Feb-09	51	Female	228	250	272	600
CCR-09-09	11-Feb-09	68	Male	275	291	374	825
CCR-09-10	11-Feb-09	62	Female	260	279	376	830
CCR-09-11	3-Dec-09	53	Male	220	232	215	475
CCR-09-12	3-Dec-09	83	Female	215	230	231	510
CCR-09-13	3-Dec-09	83	Female	293	315	508	1120
CCR-09-14	3-Dec-09	53	Male	280	293	411	905
CCR-09-15	3-Dec-09	66	Male	282	298	392	865
CCR-09-16	3-Dec-09	57	Female	231	244	252	555
CCR-09-17	4-Dec-09	52	Female	240	265	ND	ND
CCR-09-18	4-Dec-09	65	Female	315	333	606	1335
CCR-09-19	4-Dec-09	60	Male	291	303	456	1005
CCR-09-20	4-Dec-09	62	Male	280	295	472	1040
CCR-09-21	4-Dec-09	51	Male	253	262	279	615
CCR-10-01	11-Feb-10	72	Female	252	268	ND	ND
CCR-10-02	11-Feb-10	69	Male	242	259	313	690
CCR-10-03	11-Feb-10	65	Male	260	280	334	735
CCR-10-04	11-Feb-10	55	Male	243	260	274	605
CCR-10-05	11-Feb-10	53	Female	250	269	306	675
CCR-10-06	21-Oct-10	85	Female	286	316	634	1398
CCR-10-07	21-Oct-10	85	Male	154	162	93	205
CCR-10-08	21-Oct-10	56	Female	233	260	342	755
CCR-10-09	7-Dec-10	59	Male	262	282	331	730
CCR-10-10	7-Dec-10	65	Male	215	235	238	525
CCR-10-11	7-Dec-10	59	Female	337	350	ND	ND
CCR-10-12	7-Dec-10	61	Male	268	283	356	785
CCR-10-13	7-Dec-10	66	Male	302	320	499	1100
CCR-10-14	8-Dec-10	60	Male	296	310	460	1015
CCR-10-15	8-Dec-10	57	Female	285	303	547	1205
CCR-10-16	8-Dec-10	47	Male	265	281	340	750
CCR-10-17	8-Dec-10	67	Female	296	325	635	1400
CCR-10-18	8-Dec-10	67	Male	215	224	195	430
CCR-11-01	1-Feb-11	29	Male	253	269	299	660
CCR-11-02	1-Feb-11	58	Male	275	291	404	890
CCR-11-03	1-Feb-11	59	Male	257	273	329	725
CCR-11-04	1-Feb-11	60	Male	235	250	240	530
CCR-11-05	1-Feb-11	66	Male	262	276	356	785
CCR-11-06	1-Feb-11	64	Male	308	335	581	1280
CCR-11-07	1-Feb-11	75	Female	312	339	723	1595
CCR-11-08	2-Feb-11	60	Male	292	303	ND	ND
CCR-11-09	2-Feb-11	42	Male	253	275	ND	ND
CCR-11-10	2-Feb-11	39	Male	263	278	ND	ND
CCR-11-11	2-Feb-11	39	Male	267	277	ND	ND
CCR-11-12	2-Feb-11	39	Male	262	285	ND	ND

Addendum Table 2 (pages 26-28)

ID #	Date	Hold Time	Sex	TL - SL	TL - CL	WT (kg)	WT (lb)
CCR-11-13	2-Feb-11	55	Female	321	340	ND	ND
CCR-11-14	9-Nov-11	68	Male	306	326	519	1144
CCR-11-15	9-Nov-11	63	Female	257	282	264	802
CCR-11-16	9-Nov-11	69	Female	275	302	513	1132
CCR-11-17	10-Nov-11	100	Female	232	251	295	650
CCR-11-18	10-Nov-11	100	Female	274	304	498	1099
CCR-11-19	10-Nov-11	72	Female	252	272	420	926
CCR-11-20	10-Nov-11	70	Male	260	276	386	851
CCR-11-21	10-Nov-11	70	Female	339	360	ND	ND
CCR-11-22	7-Dec-11	69	Female	325	350	692	1526
CCR-11-23	7-Dec-11	53	Female	239	265	377	832
CCR-11-24	7-Dec-11	49	Male	244	256	298	656
CCR-11-25	7-Dec-11	52	Female	217	228	203	448
CCR-12-01	24-Jan-12	62	Female	311	352	798	1760
CCR-12-02	24-Jan-12	94	Female	289	312	494	1090
CCR-12-03	24-Jan-12	80	Female	214	232	220	486
CCR-12-04	24-Jan-12	56	Female	250	256	259	572
CCR-12-05	24-Jan-12	66	Male	316	342	630	1390
CCR-12-06	24-Jan-12	59	Male	287	303	438	966
CCR-12-07	25-Jan-12	58	Male	244	259	284	626
CCR-12-08	25-Jan-12	67	Female	284	306	467	1030
CCR-12-09	25-Jan-12	70	Male	312	225	622	1372
CCR-12-10	25-Jan-12	53	Male	234	245	233	514
CCR-12-11	25-Jan-12	66	Male	240	261	348	767
CCR-12-12	25-Jan-12	69	Male	282	317	497	1096
CCR-12-13	25-Jan-12	74	Male	325	351	598	1318

Table 2: List of 123 manatees captured in Crystal River, Florida from 2006 through January 2012. Includes field assigned ID#, capture date, holding time (min), sex, total length (cm for straight-line and curvilinear), and body weight (kilograms and pounds). ND designates not determined.