

Documenting Manatee (*Trichechus manatus manatus*) Presence at Turneffe Atoll, Belize, Central America and its Conservation Significance

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ABSTRACT.— Belize in Central America supports one of the largest populations of endangered Antillean manatees in the Caribbean. In 2012, a country-wide survey resulted in the highest count ever recorded (507 manatees). Manatee use of atolls has only been documented at Turneffe Atoll in Belize. Manatees in Belize, including those that use Turneffe, have been shown to be impacted by human activities including habitat degradation, entanglement in fishing gear, poaching, and watercraft. The atoll itself faces threats to its diversity and productivity. In 2002, the Oceanic Society began monitoring manatees on Turneffe to document numbers, distribution, and seasonality of use to facilitate the atoll's designation as a protected area. Since 2002, 52 sightings of manatees have been recorded at Turneffe, including cow/calf pairs, indicating it is an important part of the resource network used by the manatees. Protecting the atoll should be a priority for all working to protect manatees and Belize's natural resources.

KEYWORDS.—Antillean manatee, Belize, Turneffe Atoll, aerial surveys, protected areas

West Indian manatees (Antillean subspecies, *Trichechus manatus manatus*) have been documented throughout the Wider Caribbean in at least twenty counties or territories in the region. However, their abundance is low, their distribution is patchy, and human impacts to the species in some of their range is considerable (Quintana-Rizzo and Reynolds 2010). Manatee populations in the Caribbean are either unknown or thought to be stable or declining (Quintana-Rizzo and Reynolds 2010, Deutsch et al. 2007). Under the Convention for the Protection and Development of the Marine Environment of the Wider Caribbean (Cartagena Convention) adopted in 1983 by governments of the region, Antillean manatees were identified as one of the region's priority protected species (Quintana-Rizzo and Reynolds 2010).

Belize in Central America is believed to support one of the largest populations of

endangered (Appendix I of CITES 2003) Antillean manatees in the Caribbean (Morales-Vela et al. 2000, O'Shea and Salisbury 1991). In 2012, a country-wide survey was conducted by the Belizean Coastal Zone Management Authority and Institute, a statutory body within the Ministry of Forestry, Fisheries and Sustainable Development which resulted in the highest count ever recorded for Belize. Five-hundred and seven manatees were sighted on the survey, with 10% being recorded as calves. Although these numbers do not represent an abundance estimate because an unknown proportion of manatees are missed by observers during the survey, they do represent a minimum count of manatees in Belizean waters on the day of the survey (Pollock and Kendall 1987, Lefebvre et al. 1995). The total estimated number of manatees inhabiting Belizean waters is believed to range from about 300 to 900 individuals (Quintana and Reynolds 2010; Auil 2004), but exact estimates of abundance are not currently available.

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Although manatees are found throughout the Caribbean, manatee use of atolls has only been documented at one, Turneffe Atoll in Belize (Morales-Vela et al. 2000). Turneffe is located approximately 50 km off the coast of Belize (Fig. 1), and is the largest of three Belizean atolls. On November 22, 2012, legislation was signed by Belize's Minister of Forestry, Fisheries and Sustainable Development that established the Turneffe Atoll Marine Reserve, the largest (over 325,000 acres) marine protected area in Belize. Prior to this designation, Turneffe Atoll had no management structure in place, and had long been highlighted as a gap in Belize's National Protected Areas System (Turneffe Atoll Marine Reserve Management Plan 2012-2017).

Turneffe, comprised of approximately 200 sand or mangrove covered oceanic cayes, extends 48.2 km in length and 16.1 km in width, and covers an overall area of 525 km² (Gischler and Hudson 1998). The atoll is encircled by fringing and patch reefs; 22% of its total area is covered by land that surrounds three central lagoons (<8m in depth; Spalding et al. 2001) (Fig. 1). Several other IUCN classified threatened species also inhabit Turneffe including the American crocodile (*Crocodylus acutus*), hawksbill turtle (*Eretmochelys imbricata*), roseate tern (*Sterna dougallii*), and the Nassau grouper (*Epinephelus striatus*). In addition, the atoll provides year-round habitat to a small population of coastal bottlenose dolphins (*Tursiops truncatus*) (Dick and Hines 2011, Campbell et al. 2002, and Grigg and Markowitz 1997).

The first aerial surveys to evaluate manatee populations in Belize were conducted in 1977 ($n=5$ flights; Bengston and Magor 1979); 101 manatees were sighted. Other manatee surveys of the Belizean mainland were conducted by O'Shea and Salisbury in 1991, and by Auil in 1997 and from 1999–2002. However, aerial surveys of Turneffe were not conducted until January and May of 1994, and January of 1995 ($n=3$, 11 manatee sighted at Turneffe; Morales-Vela et al. 2000) and later by Auil in 1997, as part of a country-wide survey to document manatees (O'Shea and Salisbury 1991; Auil 1998). In 2002, the Oceanic Society (OS)

began opportunistically monitoring manatees on Turneffe by both boat and aircraft to document numbers, distribution, and seasonality of use to help facilitate the atoll's designation as a protected area. From 2002 to 2012, 52 sightings of manatees have been recorded by OS at Turneffe including cow/calf pairs (Fig. 1). During the 2012 country-wide survey a record 14 manatees (13 adults and 1 calf) were counted at Turneffe on that day. During the survey manatees were seen traveling between the Drowned Cayes, an area recognized as important to manatees (LaCommare et al. 2008), and the atoll. Satellite telemetry tracking data also has provided evidence of movement between the Drowned Cayes and Turneffe (Auil et al. 2007) and between Turneffe and the mainland (pers. comm. J. Powell). Distribution of manatees at Turneffe indicates that the passages along the western side, particularly near Douglas lagoon, are used to access the atoll. The creeks and shoreline areas in the southern part of Central Lagoon, Southern Lagoon, and Long Bogue (Fig. 1) appear to be important manatee habitat, and sightings were common in the northern-most part of the atoll. These surveys are the only assessments of manatee use of the atoll that have been conducted on a regular basis, and provide the only data currently available to resource managers to inform conservation actions concerning manatees on Turneffe.

Belizean manatees, including those that use Turneffe, have been shown to be impacted by human activities including habitat degradation, entanglement in fishing nets, poaching, and watercraft (Auil 1998). The atoll itself faces several threats to its diversity and productivity including: (1) unsustainable fishing, (2) mangrove clearing, (3) overdevelopment, and (4) dredging. Tourism currently accounts for about 20% of Belize's Gross Domestic Product and much of Belize's tourism is geared towards coastal activities including diving, snorkeling, fishing and boating. As Belize's dependence on tourism grows and its use of coastal regions increases, balancing economic growth and tourism in places like Turneffe will be important to achieving sustainability. Data from surveys

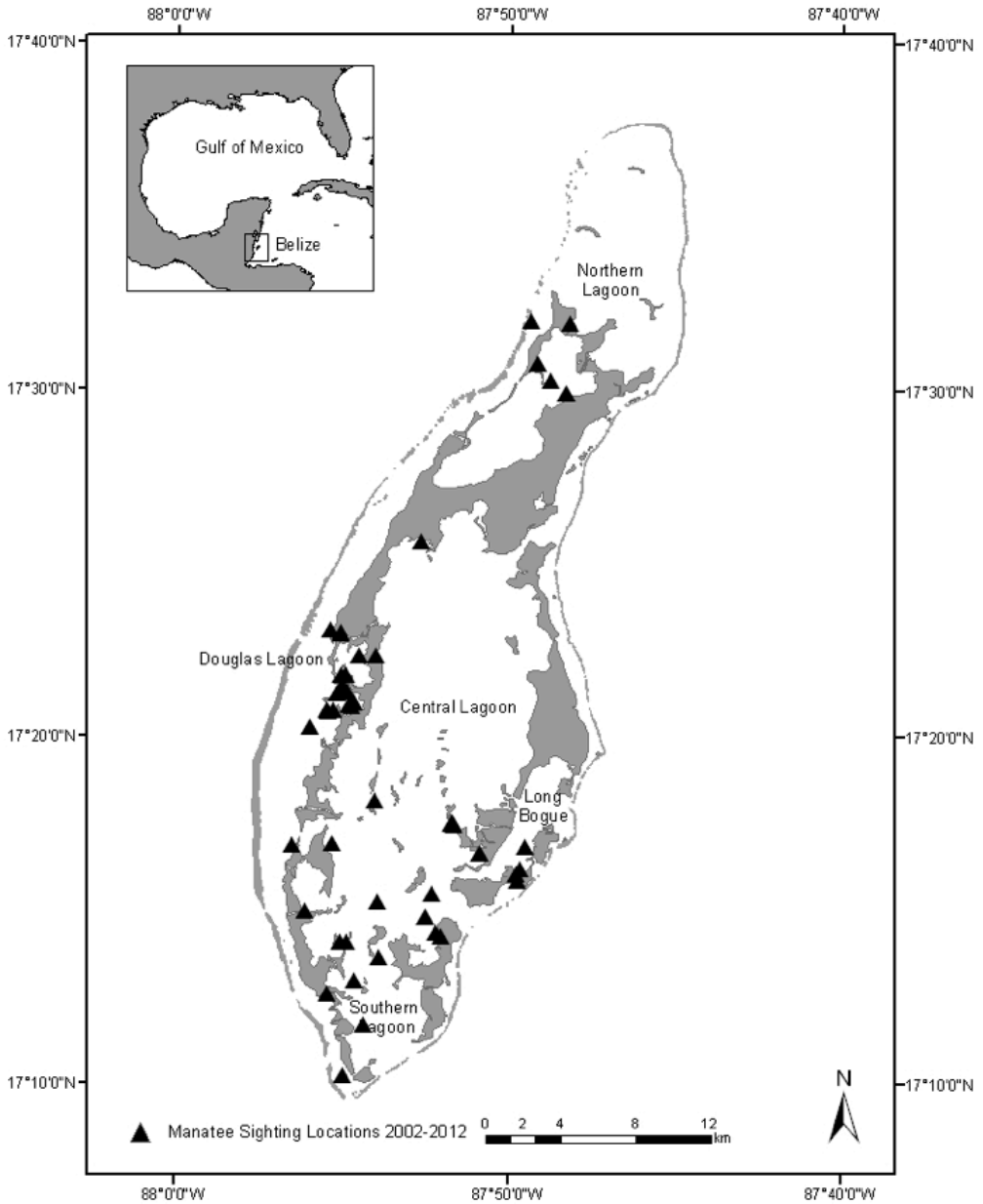


FIG. 1. Location of manatee sightings on Turneffe Atoll, Belize from 2002 to 2012.

demonstrate that Turneffe is an important and consistently used habitat for endangered Antillean manatees in Belize. To protect the atoll and the variety of species it supports, including manatees, effective management strategies should be considered and adopted as appropriate, including those, that for example: establish regulations for boat use and speeds (and zone signage in high use areas); mark boating corridors; implement fishing regulations to limit the use of entangling equipment; and establish special use areas or no entry sanctuaries and protection zones for critical habitat. These management actions have been implemented in the State of Florida (USA) for many years, and have assisted in the recovery of the Florida manatee (*Trichechus manatus latirostris*), another sub-species of the West Indian manatee (Calleson and Frohlich 2007, USFWS 2001). In addition, impacts of climate change on the atoll and its species should be considered, and appropriate adaption measures to address changes should begin to be developed.

The establishment of Turneffe Atoll as a marine reserve was an important first step to protecting the unique natural resources of the atoll and its wildlife species, including manatees. However, to improve manatee protection measures, more information is needed, including robust statistical estimates of manatee abundance, fine-scale habitat use and distribution around the atoll. On a broader scale, the relationship and contribution of Turneffe manatees to manatee populations in Mexico and the larger Central American region is also important. In 1991 O'Shea considered Belize to be one of the last strongholds for manatees in the Caribbean mainly due to its high quality habitat and low levels of human related mortality (O'Shea and Salisbury 1991). Protecting habitat and limiting mortality are integral to maintaining that status. We compiled and reviewed evidence that demonstrates that Turneffe Atoll is an important part of the resource network used by the manatees of Belize. Therefore, protecting its resources and the animals that use it should be a priority for all working to protect manatees, and Belize's natural resources.

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LITERATURE CITED

- Auil, N. 1998. Belize Manatee Recovery Plan. Sustainable development and management of biologically diverse coastal resources, Belize project no. BZE/92/G31. UNEP. 67pp.
- Auil, N. E. 2004. Abundance and distribution trends of the West Indian Manatee in the coastal zone of Belize: Implications for conservation. Master's Thesis, Texas A&M University.
- Auil, N. E., J. A. Powell, R. K. Bonde, K. Andrewin and J. Galves. 2007. Belize Conservation Programme 10 year summary to Liz Claiborne Art Ortenberg Foundation. New York: Wildlife Trust.
- Bengston, J. L. and D. Magor. 1979. A survey of manatees in Belize. *Journal of Mammalogy* 60:230-232.
- Calleson, C. S. and R. K. Frohlich. 2007. Slower boats speeds reduce risk to manatees. *Endangered Species Research* 3:295-304, doi:10.3354/esr00056.
- Campbell, G. S., B. A. Bilgre and R. H. Defran. 2002. Bottlenose dolphins (*Tursiops truncatus*) in Turneffe Atoll, Belize: occurrence, site fidelity, group size, and abundance. *Aquatic Mammals* 28:170-180.
- Dick, D. M. and E. M. Hines. 2011. Using distance sampling techniques to estimate bottlenose dolphin (*Tursiops truncatus*) abundance at Turneffe Atoll, Belize. *Marine Mammal Science* 27:606-621, <http://dx.doi.org/10.1111/j.1748-7692.2010.00435.x>.
- Deutsch, C. J., C. Self-Sullivan and A. Mignucci-Giannoni. 2007. *Trichechus manatus*. In: *IUCN 2007. 2007 IUCN Red List of Threatened Species*. Retrieved September 2007 from www.iucnredlist.org.
- Gischler, E. and J. H. Hudson. 1998. Holocene development of three isolated carbonate platforms, Belize, Central America. *Marine Geology* 144:333-347.

- Grigg, E. and H. Markowitz. 1997. Habitat use by bottlenose dolphins (*Tursiops truncatus*) at Turneffe Atoll, Belize. *Aquatic Mammals* 23:163-170.
- LaCommare, K. S, C. Self-Sullivan and S. Brault. 2008. Distribution and habitat use of Antillean manatees (*Trichechus manatus manatus*) in the Drowned Cayes area of Belize, Central America. *Aquatic Mammals* 34:35-43.
- Lefebvre, L., B. Ackerman, K. Portier and K. Pollock. 1995. Aerial survey as a technique for estimating trends in manatee population size – problems and prospects. In *Population Biology of the Florida Manatee*, eds. T. O’Shea, B. Ackerman and H. Percival, National Biological Service Information and Technology Report 1. U.S. Department of the Interior.
- Morales-Vela B., D. Olivera-Gomez, J. E. Reynolds III and G. B. Rathbun. 2000. Distribution and habitat use by manatees (*Trichechus manatus manatus*) in Belize and Chetumal Bay, Mexico. *Biological Conservation* 95:67-75.
- O’Shea, T. J. and C. A. Salisbury. 1991. Belize, a last stronghold for manatees in the Caribbean. *Oryx* 25: 156-164.
- Pollock, K. and W. Kendall. 1987. Visibility bias in aerial surveys: A review of estimation procedures. *Journal of Wildlife Management* 51:502–510.
- Quintana-Rizzo, E. and J. Reynolds III. 2010. Regional management plan for the West Indian manatee (*Trichechus manatus*). *CEP Technical Report 48*. Caribbean Environment Programme, United Nations Environment Programme, Gosier, Guadeloupe, France.
- Spalding M., C. Ravilious and E. P. Green. 2001. *World atlas of coral reefs*. Prepared at the UNEP World Conservation Monitoring Center. Berkeley: University of California Press.
- Turneffe Atoll Marine Reserve Management Plan 2012-2017. 2012. <http://www.turneffeatoll.org/app/webroot/userfiles/66/File/Final%20Turneffe%20Atoll%20Management%20Plan%2014%2009%2012%20Fisheries%20Edited.pdf>.
- U. S. Fish and Wildlife Service. 2001. Florida Manatee Recovery Plan (*Trichechus manatus latirostris*), Third Revision. U.S. Fish and Wildlife Service. Atlanta, Georgia, USA.