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THE DIET OF THE MANATEE (*TRICHECHUS MANATUS*) IN PUERTO RICO

The West Indian manatee (*Trichechus manatus*) is considered the most endangered marine mammal in Puerto Rico (Mignucci-Giannoni 1996). The population is protected by the United States Marine Mammal Protection Act, the Endangered Species Act, and by several Commonwealth of Puerto Rico laws (Rathbun *et al.* 1986, Mignucci-Giannoni 1989, USFWS 1995), and its management is mandated and outlined in a federal recovery plan drafted in 1986 (USFWS 1986). Manatees in Puerto Rico inhabit nearshore marine and estuarine areas, with the highest counts occurring on the east and south shores of the island (Powell *et al.* 1981, Rathbun *et al.* 1986). These areas contain extensive seagrass beds, relatively calm waters, and freshwater sources for drinking at river mouths and storm-drain discharges (Powell *et al.* 1981, Rathbun *et al.* 1986).

Manatees feed on a wide variety of plant species (Best 1981), but little is known of their diet in Puerto Rico. Barrett (1935) reported the emergent grasses *Panicum molle* and *P. jumentorum* (Gramineae) and shallow, bottom-growing marine plants as foods of manatees in Puerto Rico, but turtle grass (*Thalassia testudinum*) is the only marine species that has been confirmed as a component of the manatee's diet in Puerto Rico (Randall 1965).

To determine the diet of manatees recovered in Puerto Rico from August 1984 through August 1993, samples of stomach contents were collected at necropsy (Mignucci-Giannoni 1996). A 28–227-g subsample of the contents was removed and preserved in 5% buffered formalin, then prepared and examined following the methodology described in Hurst and Beck (1988). A modified microscope-point technique was used to calculate the frequency of occurrence for the identified items. Each ingesta fragment observed at 100× at 100 designated points on a slide, as seen through an eyepiece grid, was recorded. Five slides were examined per sample. Fragment points per sample were summed and the total percent occurrence for each species was recorded (# points/species/500) (Hurst and Beck 1988).

Samples were available from eight manatees (Table 1), ranging in length from 151 to 329 cm. Four were males and four were females. Five were adults in age categories above 9 yr, while two were subadults and one was a calf less than 1 yr old (Marmontel *et al.* 1996). Animals studied were recovered from the north ($n = 1$), northeast ($n = 2$), east ($n = 2$), south ($n = 2$) and southwest ($n = 1$) shores of Puerto Rico. Seven of the manatees died from human-related causes and one from a natural cause (Mignucci-Giannoni 1996).

Vegetative contents were present in the stomachs of all eight animals, and seagrasses were the dominant component of all ingesta samples. Seagrass root,

Table 1. Percent occurrence of food items in manatees recovered in Puerto Rico.

Catalog number	Date of collection	Locality	Sex	Total length	Age	Food item (%)									
						R	Tt	Sf	Hw	Ma	Ul	Cp	H	A	U
NEPST077	13 Aug 1984	Peñuelas (S shore)	F	151 cm	Calf	15.4	3.6	2.8	59.8	5.0	3.6	0.0	2.4	0.4	7.0
NEPST112	14 Jan 1990	Ceiba (E shore)	F	329 cm	Adult	57.2	1.2	1.6	0.0	29.8	2.0	0.0	0.0	3.2	5.0
NEPST124	04 Oct 1990	Luquillo (NE shore)	F	206 cm	Subadult	62.1	14.9	5.1	0.0	14.0	0.0	0.0	0.0	1.4	2.5
NEPST150	11 Apr 1991	Toa Baja (N shore)	F	210 cm	Subadult	65.6	8.2	0.0	25.0	0.0	0.0	0.0	0.0	0.6	0.6
NEPST186	18 Apr 1992	Ceiba (E shore)	M	294 cm	Adult	52.0	18.8	5.4	11.6	0.0	12.2	0.0	0.0	0.0	0.0
NEPST194	26 Aug 1992	Ponce (S shore)	M	258 cm	Adult	67.4	14.2	6.4	12.0	0.0	0.0	0.0	0.0	0.0	0.0
NEPST202	24 Mar 1993	Fajardo (NE shore)	M	296 cm	Adult	18.4	73.8	7.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NEPST230	28 Aug 1993	Guayanilla (SW shore)	M	273 cm	Adult	73.2	1.0	0.4	22.4	0.0	0.0	1.4	0.0	0.0	1.6

N = north, NE = northeast, E = east, S = south, SW = southwest, M = male, F = female, R = rhizome, Tt = *Thalassia testudinum,* Sf = *Syringodium filiforme,* Hw = *Halodule wrightii,* Ma = mangrove, Ul = *Ulva lactuca,* Cp = *Caulerpa prolifera,* H = hydroids, A = unidentified alga, U = unidentified fragments.

rhizome, stem, and leaf sheath fragments consisted of large storage cells that were not identifiable to species by epidermal characteristics. These fragments were all categorized as rhizome. All eight manatees had ingested seagrass rhizome and *T. testudinum*. Seven manatees had ingested manatee grass (*Syringodium filiforme*), and five samples contained shoal grass (*Halodule wrightii*). The green alga *Ulva lactuca* and mangrove fragments were seen in three samples, but in relatively small amounts. Mangrove identity was based primarily on idioblasts, and bark pieces were observed in the three samples. Unidentified hydroids, the green alga *Caulerpa prolifera*, and ascidians were each observed once, also in relatively small amounts (Table 1). No freshwater species were observed, although elsewhere in their range manatees are known to feed on both marine and freshwater plants (Best 1981).

Although the sample size in this study was small, there is no apparent difference in species consumption by sex or age class. No attempt was made to relate frequency of plant species identified to total volume or weight of contents in each manatee. It is interesting to note that the stomach contents from the calf had the highest occurrence of *H. wrightii*, a common food of manatees in Florida (C. A. Beck, unpublished data) (Table 1). It is not known if this seagrass was purposely selected, or if it simply was more easily accessible to the calf. It is also noteworthy that one adult (NEPST112) had a 57.2% occurrence of rhizome, with little seagrass leaf material observed. This may be an artifact of sampling, as it is unlikely that the manatee would be rooting for rhizome material without also ingesting leaf material.

T. testudinum, *H. wrightii*, and *S. filiforme* are common seagrasses in Puerto Rico (Powell *et al.* 1981, Vicente 1992), and manatee utilization of *T. testudinum* as a food was mentioned by Randall (1965). Vicente (1992) stated that the seavine (*Halophila dicipiens*) may be the most abundant seagrass species in Puerto Rico, yet this species was not observed in the stomach samples examined. *H. dicipiens* is almost always found at greater depths than are *T. testudinum*, *H. wrightii*, and *S. filiforme* (Vicente 1992) and would be less available for grazing by manatees.

Thus, the diet of the manatee in Puerto Rico appears to consist of turtle grass, shoal grass, and manatee grass, with occasional use of mangrove and accidental ingestion of green alga and hydroids. Seagrasses are a dominant component of the manatee diet in Puerto Rico, and manatees inhabiting the waters of Puerto Rico undoubtedly are dependent upon the extensive seagrass beds. Preservation of these seagrass beds is essential for fulfilling the habitat protection task required by the recovery plan for the population and for the continued conservation of the endangered manatee in Puerto Rico.

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