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A historical review of records of the West Indian manatee and the American crocodile in the Dutch Antilles

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ABSTRACT.—We discuss the significance of two manatee records for the Dutch Windward Islands (Saba, St. Eustatius, St. Maarten) as well as six manatid and one crocodile record for the Dutch Leeward Islands (Aruba, Bonaire, Curaçao). The persistence of the manatee in the Lesser Antilles until the early 17th century suggests that in pre-Columbian times manatees would have also occurred regularly in the Dutch Windward Islands. In pre-Columbian times, suitable habitat for the American crocodile was sufficient in the Dutch Leeward Islands to have supported small resident populations, and habitat for the manatee was possibly also present. Both species have been widely hunted by early humans and we surmise that small, isolated populations of these species could easily have been extirpated on the Dutch Leeward Islands well prior to European colonization. However, two manatee sightings within the last five years, suggest that these islands may somehow still form part of the active range of this rare and elusive species.

KEYWORDS.—*Trichechus manatus, Crocodylus acutus*, manatee, crocodile, Caribbean, Netherlands Antilles, Aruba

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The West Indian manatee, *Trichechus manatus*, is widely distributed throughout the West Indies but has been extirpated throughout much of its range, therewith becoming rare and even endangered in most countries in which it still occurs. The species is typically associated with estuarine and seagrass habitat, and where available shows a strong preference for freshwater (Lefebvre et al. 1989; Ortíz 2001; Morales-Vela et al. 2003). Archeological finds indicate that the species was widely used by the pre-Columbian inhabitants of the region (McKillop 1985; Mercado 1990; Riviera and Rodríguez 1991; Scudder 1991; UNEP 1995). Nevertheless, remains of the manatee are surprisingly rare in Amerindian midden deposits, possibly because they were butchered at shore and only the meat was carried back to the home site (Newsom and Wing 2004). There may also have been taboos imposed on their hunting and consumption. Keeping in mind that ritual artifacts, such as the vomitic spatulas used in the ritual of the *cohoba,* were usually made out of manatee bones by the Tainos from the Greater Antilles, the manatee might have been considered a 'special' animal within the Amerindian cultural taxonomy. During the colonial era the species was hunted for its fine meat, oil, bone and leather (Husar 1978).

The American crocodile, *Crocodylus acutus*, is a large estuarine predator that likewise has a wide distribution within the Caribbean basin. This species depends on fresh and/or brackish water for osmoregulation (Mazotti et al. 1988) but is capable of traversing large stretches of open sea to colonise oceanic islands in the region.

We here review and discuss several manatee and one crocodile record for the Dutch Antillean islands that comprise two island groups separated by about 900 km of open sea (Fig. 1). The records are further F1 discussed with reference to historical use of the animals by the inhabitants of the region.

The islands of Saba, St. Eustatius and St. Martin lie in the Lesser Antilles east of the British Virgin Islands and are typically re-

FIG. 1. Map of the Caribbean showing the islands for which manatid (■) and crocodile (▲) records are presented.

ferred to as the Dutch Windward Islands. In contrast, the islands typically referred to as the Dutch Leeward Islands (Aruba, Bonaire and Curaçao) lie in the southern Caribbean, between 30 and 70 km off the east coast of Venezuela. Of these, only Aruba lies on the South American continental shelf while Bonaire and Curaçao are oceanic islands separated from Venezuela by more than 1000 m of water depth.

A single pre-Columbian record of the manatee for the island of Saba is represented by a ceremonial pipe that was collected from a Taino archeological site. The pipe is made from manatee bone and is shaped like a fish (Hoogland 1996; Hoogland and Hofman 1999). Ceremonial paraphernalia made from manatee bone are common from Taino sites throughout the Greater Antilles (Richard 2001; C. Hofman, pers. comm.) but are also known from the Lesser Antilles (e.g., Douglas 1991). The steep volcanic island of Saba has no lagoonal or seagrass habitat and is unlikely to have been able to support any manatees during recent millennia. Therefore, this artifact was most certainly introduced to the island. Archeological excavations have so far not produced any manatee records for St. Eustatius (van der Klift 1992) or St. Maarten (Haviser 1991; Nokkert 1999a, 1999b). However, manatee bones have been documented at prehistoric Amerindian sites on several other Lesser Antillean islands, such as Antigua (Wing et al. 1968), Barbuda (Watters et al. 1984), Carriacou (Sutty 1990), Guadeloupe and Martinique (Richard 2001), St. Kitts (Wing 1973) and Anguilla (Douglas 1991). On Guadeloupe the species is portrayed in prehistoric rock art on the Bananier River (Richard 2001), while original place names referring to the manatee are found on both Guadeloupe and Martinique (Ray 1960).

While sightings of manatee are not regarded as particularly noteworthy in the Dutch Windward Islands because they concern a species generally known to inhabit

the nearby waters of Puerto Rico (F. van der Hoeven, long-time president of the St. Maarten National Parks Foundation, pers. comm.), we nevertheless can report a sighting record for St. Maarten dating from the late 1980s.

In the late 1980s, probably 1987 or 1988, Mr. Robbie Cijntje and his wife and children observed a single, 3-m long manatee at close range one day while boating in the 8.6 km^2 Simpson Bay Lagoon, St. Maarten. The animal in question remained in the lagoon for over a week and drew considerable attention from boaters, but then disappeared (Robbie Cijntje, Nature Foundation, St. Maarten, pers. comm.). St. Maarten has a sizeable lagoon with sheltered seagrass beds, as well as several smaller lagoons, but no permanently-flowing freshwater streams. While it is not known with certainty whether the manatee requires fresh water to drink (Lefebvre et al. 1989; Morales-Vela et al. 2003), if such is the case, then St. Maarten cannot be expected to have supported manatees in the recent past. However, Hartog (1964) finds indication that in former times (prior to deforestation of the island) there could well have been small permanent streams on the island. At present, there are no manatees in the Lesser Antilles (Ray 1960; Lefebvre et al. 1989). Manatees are also virtually unknown from the U. S. Virgin Islands (Lefebvre et al. 1989) but do persist in the Greater Antilles to the west, including Puerto Rico. Hence, this sighting record clearly constitutes a rare case of vagrancy.

During the early 17th century manatees were abundant in nearby Guadeloupe, to the point that they constituted an important part of the diet of the French colonists (Richard 2001). According to at least two sources at that time, Guadeloupe Amerindian natives did not cherish manatee flesh, due to the copious amounts of fat, which they detested, and because of the superstition that consumption of manatee flesh caused the recurrence of maladies including venereal disease and others (Moreau 1991; Richard 2001). Late 17th century sources attributed the disappearance of manatees in Guadeloupe and Martinique to excessive hunting by colonists (Richard 2001). In Grenada, where the species persisted until at least the 17th century (Romero and Hayford 2000), its disappearance is also ascribed to excessive hunting. Thus, in light of early French colonial sources, it is certain that in pre-colonial times manatees would have occurred regularly around St. Maarten, though it is not certain whether local conditions could have allowed manatees to persist year-round.

For the Dutch Leeward Islands there is no mention of the manatee in historical accounts (Hartog 1968; Schiltkamp and de Smidt 1978) or in early species lists (Hering 1779; Bosch 1836; Teenstra 1836; Simons 1868; Boeke 1907), nor has the species yet been found at any Amerindian sites (Hooijer 1960, 1963; Versteeg 1991; Haviser 1994; Grouard 1997). However, Martin (1888) provides Pleistocene (possibly pre-Pleistocene: see de Buisonjé 1974) fossil records for "*Manatus*" sp. for Aruba at Seroe Colorado and for Bonaire at Fontein. These records originate from rare marine vertebrate phosphate deposits, one of four types of phosphate deposits known from the Dutch Leeward Islands (de Buisonjé 1974). Van Oort (1902) provides further details of the Aruban record, which was based on a vertebra, while Rutten (1931) cites both records in his paleontology review paper. No fossil record for the manatee has yet been documented for Curaçao, where marine vertebrate phosphate deposits are also not known (de Buisonjé 1974). Records of extinct mammals (Hooijer 1967), speleological studies (de Buisonjé 1974), as well as a synthesis of palynological studies (Haviser 1987) would indicate that prior to about 5000 B.P., rainfall was higher in the Dutch Leeward Islands. During the Holocene (10,000 B.P.) sea level may have also been much lower (Colin-Girard 2002; Peltier 2002), which could have facilitated colonization by the manatee and created more suitable habitats for manatee than those found today. Therefore, these fossil records possibly stem from a time prior to the arrival of man and in which permanent freshwater streams and better habitat conditions could have been available on the island. In the absence of diagnostic specimens, however, and in view of the prevalence of other

sirenians (Dugongidae) in the Caribbean Tertiary (Domning 2001), it cannot even be assumed that these fossil records pertain to manatees (Trichechidae).

For Curaçao a reliable sighting record for the manatee that dates from the late 1970s was when Max Rijna saw a manatee at close range from a boat on the wave-exposed northeast coast of Curaçao in the vicinity of Boka Wandomi (M. Rijna†, pers. comm. to GvB, late 1970s). While no details were recorded, this sighting can be considered reliable as it concerns a face-to-face encounter with an experienced diver, familiar with the manatee. The wary animal dove rapidly after the encounter.

At about 3:00 P.M. on the afternoon of February 1, 2001, experienced diver A. Huang and buddy R. van Duuren observed a manatee from about 8 m distance above them while diving at a depth of 15 m at the Directiestrand, Caracasbaai, along the southwest coast of Curaçao. The animal was 1.5-2 m long, generally rotund, appeared greyish-green in color, had a large, flat, paddle-like tail, short and stubby "arms", and a bulky head with tiny eyes and whiskers. As soon as the animal saw the divers it went rapidly off towards shallower waters. The divers did not realise they had seen a manatee until after the dive, when they consulted marine fauna literature.

On September 12, 2005, R. Siberie and F. Lucas saw an animal with a big round tail and a "pig's face" repeatedly surface to breath about 5 m from their fishing spot in the coastal lagoon of Ascención, on the northeast coast of Curaçao. They recognized it as a manatee as seen on television and called AOD, who immediately drove to the site and confirmed the sighting upon arrival at 2:00 P.M. Several photographs were made to document the record. The solitary animal was orange/greenish-brown, at most 1.6 m in length and did not appear to be wounded. The sighting was amply reported in the media (e.g., Anonymous 2005). The animal was further seen on September 14th and 16th.

Recent sightings for Curaçao indicate that manatees clearly have the dispersal capabilities to reach the Dutch Leeward Islands and may even suggest that the islands could somehow still form part of the active range of these rare and elusive creatures. The relevance of and need for additional protective legislation is evident.

Manatees are actively protected in Venezuela (Ojeda 1997). However, in this section of the Venezuelan coast they have not been abundant since at least historical times, probably due to the combination of restricted habitat availability and Amerindian hunting (O'Shea et al. 1988). UNEP (1995) listed only two recent records for the Caribbean coast of Venezuela. So far no manatee remains have been found at Amerindian archeological sites on Venezuelan coastal islands (Antczak 1999; Mackowiak de Antczak and Antczak 2005) and there are only two mentions of manatee bones recovered from Amerindian sites on the mainland coast of Venezuela. The first one comes from the site of Trompis in western part of the central coast, dated to approximately A.D. 260-290 (Rouse and Cruxent 1963). The second mention is from a site at Palmasola, not so far from Trompis and dated to approximately A.D. 250-500 (Sýkora 2005). Both reports are related to the first centuries of the presence of the Amerindian agriculturalists and pottery bearers in the region, suggesting that manatees might have already been overexploited during these early times. The West Indian manatee has gregarious feeding tendencies and is essentially defenseless, which would have made it a favorite target for the very early Amerindian groups (Paleo and Meso Indians *sensu* Rouse and Cruxent 1963).

Geographic locations bearing historical or pre-Columbian names referring to extinct or extirpated fauna (toponyms) may provide clues about the former occurrence of such species and constitute useful information (i.e., a "record") for historical biogeography purposes (e.g., Ray 1960; Romero et al. 2002; Adam and Garcia 2003). On Bonaire, the 7.3 km^2 Lac Bay mangrove and seagrass lagoon, located on the island's east coast, is the only potential former manatee habitat. An area south of the lagoon is known as "Manparia Kutu", the Papiamento word referring to a siren legend

(e.g., Hass 1956). Keeping in mind that legends of sirens are common from mainland tribal folklore (van Buurt and Joubert 1997), this place name could have originated from manatee presence in southern Bonaire. However, possible association of this term and place name with the extinct West Indian monk seal, *Monachus tropicalis,* instead of the manatee, should not be excluded (van Buurt and Joubert 1997).

All three Dutch Leeward Islands presently have sheltered habitat with seagrass growing in abundance in semi-enclosed lagoons formed by inundation of Pleistocene coastal valleys. In Curaçao for instance, the three largest lagoons alone comprise more than 11 km^2 in combined surface area (discounting modern land reclamation activity). These lagoons provide sufficient feeding areas to have supported small herds of manatees on all three islands. Manatees are good osmoregulators in both fresh and saltwater (Ortíz et al. 1998), and like both pinnipeds and cetaceans have the ability to concentrate urine above the concentration of seawater (Ortíz 2001). Studies further indicate that manatees chronically exposed to salt water will reduce their water turnover rates to only 15% of turnover rates typical of freshwater conditions (Ortíz et al. 1999), and that during periods of reduced food consumption, they may be able to activate lipolysis to meet water requirements (Ortíz et al. 2000). Yet, it is still not known to what extent the manatee requires periodic access to freshwater for survival. Even though the existence of permanently-flowing freshwater streams on Curaçao in the last centuries before discovery is doubtful, it is possible that naturally occurring seasonal streams and/or groundwater seeps may have been sufficient to meet manatee water needs. If such is the case, then Curaçao, and possibly Aruba and Bonaire, could have supported small populations of the manatee. The rarity or even absence of this near-shore, estuarine species prior to European arrival would then have to be attributed to extirpation by the early Amerindian inhabitants of these islands, in contrast to for instance the West Indian monk seal, *Monachus tropicalis*, which had the habit of frequenting small, isolated offshore islands and which persisted into the early 17th century (Debrot 2000).

In implementation of the CITES Treaty and the SPAW Protocol of the Cartagena Convention to which the Kingdom of the Netherlands is party on behalf of the Netherlands Antilles, the manatee is afforded limited protection in the Netherlands Antilles by means of the National Fisheries Ordinance of 1991 (P.B. 1991 No. 74) and the National Nature Management Ordinance of 1998 (P.B. 1998, No.49). However, while the SPAW Protocol specifies the need for protection against disturbance, at the insular level there is no legislation to either implement protection or provide a workable definition of disturbance. In the early 1930s (probably 1932) after a period of heavy rainfall, a large, aggressive crocodilian crawled onto the island of Klein Curaçao (van Buurt 2001). After a few days the animal was killed by the lighthouse watch, butchered and transported to the main island of Curaçao for consumption. The animal was landed at Boka St. Michiel with its tail already hacked into steaks (Ciro Maduro† and Kichin Zimmerman, pers. observ. as communicated to GvB). This is the only known record of a crocodilian for the Dutch Leeward Islands and we surmise it to have been an American crocodile, *Crocodylus acutus*, a species that is well capable of oceanic dispersal, as its presence on several Caribbean islands would indicate (Platt et al. 1999). In Venezuela it is known by the Arawak name of "Caiman", a name that Linnaeus erroneously applied to a genus of crocodilians more akin to the alligators. The species was formerly abundant all along the coast of Venezuela, where it survives to this date (Corcuera 1984), but has become very rare along most of the coast. The extant population nearest to the Leeward Islands today is that of the Cuare Reserve, about 130 km due south of Bonaire. Rivas Fuenmayor et al. (2005) have raised doubts about the recent occurrence of this species on Margarita Island, Venezuela. In the coastal town of Barcelona, west of Margarita, crocodiles were a common sight on the street up into the 1920s. In 1992 an inhabitant recounted that the "last" crocodile of the Rio Man-

zanares in Cumaná was shot in 1948 (GvB, pers. comm.). Today the species is actively protected in Venezuela, and has benefitted from at least one breeding-and release program (Ojeda 1997). So far no crocodile remains have been found at Amerindian archeological sites along the mainland coast of Venezuela or its islands (Rouse and Cruxent 1963; Antczak 1999; Mackowiak de Antczak and Antczak 2005; Sýkora 2005). It is possible that some remains have been recovered but have not been discriminated from among the remains of the freshwater species (AAA, pers. obs.).

As is the case with the manatee, the American crocodile has not been recorded in historical accounts, early species lists, or any Amerindian sites for any of the Dutch Leeward Islands. The species, and notably its hatchlings and young, depend on the availability of fresh or brackish water for osmoregulation (Neill 1971; Mazotti et al. 1986). Yet in the past and even today, suitable habitat with shallow fresh and brackish water pools on shore bordering mangrove-lined lagoons is common (Debrot 2004). High groundwater levels at the margins of these lagoons formed the basis for human settlement of these islands dating to more than 3500 years B.P. (Haviser 1987). Therefore, it is curious that the species has not yet been recorded in the Dutch Leeward Islands. Like the manatee, this large vertebrate was (Scudder 1991; Marchena 1995; Wing and Wing 1995) and still is widely used as food by the native peoples of the region, and we surmise that a possible reason for the lack of pre-Columbian records may be that its limited populations became extirpated due to hunting well before European colonization of these islands. It may also be that proper preservation sites for this species have not yet been surveyed. Freshwater caverns have only recently yielded crocodilian remains in the Cayman Islands (Morgan et al. 1993) and Bahamas (Franz et al. 1995). Such habitat is present in several low-lying coastal areas in the Dutch Leeward Islands but has not yet been explored.

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