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ON THE
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THE CAT ISLAND TURTLE A REPTILE OF PROBLEMATIC ORIGIN; INCLUDING A
BIBLIOGRAPHY OF THE GENUS *TRACHEMYS* IN THE WEST INDIES REGION.

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ABSTRACT

Bahamian populations of *Trachemys terrapen* are currently considered to be derived from released individuals of Jamaican stocks. Based on the distribution of extant populations, zoogeographic affinities, and Pleistocene fossils, we suggest that this turtle may be a Bahamas endemic, which was introduced to Jamaica by pre-Columbian man. Because of the high conservation priority for this species, it is paramount that the geographic affinities of this turtle are resolved. The limited conservation resources available for the West Indies region makes it unlikely that either the Bahamas or Jamaica will focus conservation efforts on a species of problematic origin. A description of *Trachemys terrapen* and a brief review of the history of the species and a bibliography of the genus *Trachemys* in the West Indies are provided.

INTRODUCTION

The Cat Island turtle (Figure 1), once believed to be an endemic species, is currently regarded as an introduced population resulting from release of Jamaican stocks of *Trachemys terrapen*. It appears that the transplant of this turtle took place in the pre-European contact or early colonial period, but actually there is no evidence of the direction or timing of movement and, for reasons outlined below, we consider it likely that the species was introduced to Jamaica

from Bahamian stocks. Fossils from archeological sites show the genus, at least, to have been present in the Bahamas prior to European contact. While recent authors have addressed the systematics of Bahamian and Antillean freshwater turtles, to date there have been no detailed studies of any of the established or naturally occurring populations. Nearly all studies of *Trachemys terrapen* have focused on systematics (Bickham and Baker, 1976a and b; Seidel, 1988 a and b; Seidel and Adkins, 1987). Very little biological information is available for the species in Jamaica and the only published natural history information regarding the freshwater turtles on Cat Island is a brief report by Ross (1982). In this study we summarize what has been published on *Trachemys terrapen* regarding distribution and zoogeography. As the literature regarding these turtles is widely scattered and largely unavailable to biologists in the region we also provide a bibliography of the genus *Trachemys* in the West Indies.

HISTORY OF THE SPECIES

The Cat Island Turtle was formerly considered a distinct species, *Pseudemys felis* (Barbour, 1935), endemic to Cat Island. The type locality was designated as "Tea Bay, Cat Island, Bahamas Islands". *Holotype*: MCZ 38385. It was later regarded as being part of the Jamaican slider group (Parsons 1960) and until recently *P. felis* was regarded as a distinct endemic subspecies of *Pseudemys terrapen*. The

West Indian sliders were removed from the synonymy of *Pseudemys* (and *Chrysemys*) by Seidel and Smith (1986) and placed in the genus *Trachemys*. Most authors (Prichard, 1979;

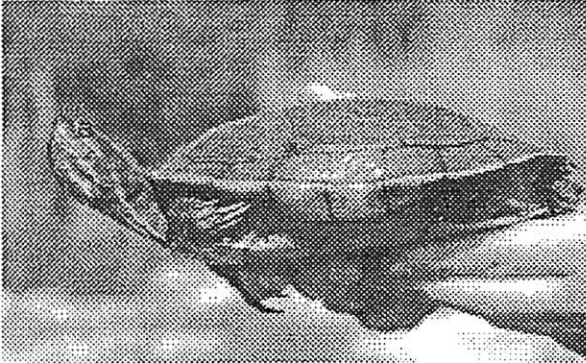


Figure 1. Adult Male *T. terrapen* from Tea Bay, Cat Island, Bahamas. Photo P. Ross.

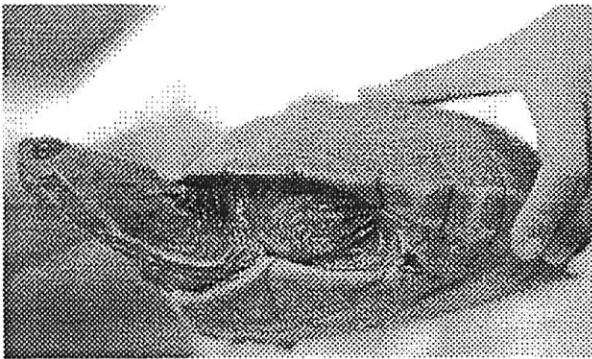


Figure 2. Adult female *T. terrapen* from Tea Bay, Cat Island, Bahamas. Photo P. Ross.

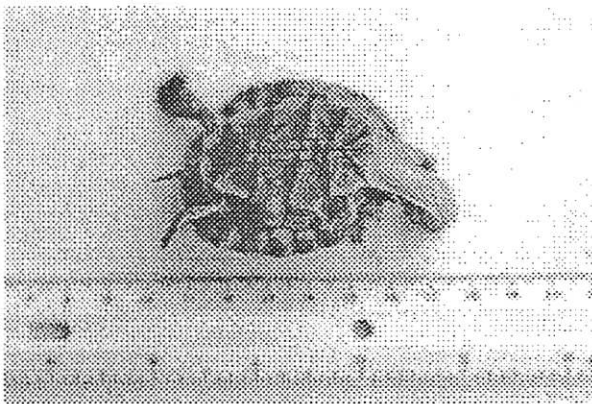


Figure 3. Ventral Pattern of young *T. terrapen* Cat Island, Bahamas. Photo P. Ross.



Figure 4. Adult female *T. scripta elegans* from near Freeport, Grand Bahama, Bahamas. Photo D. Lee.

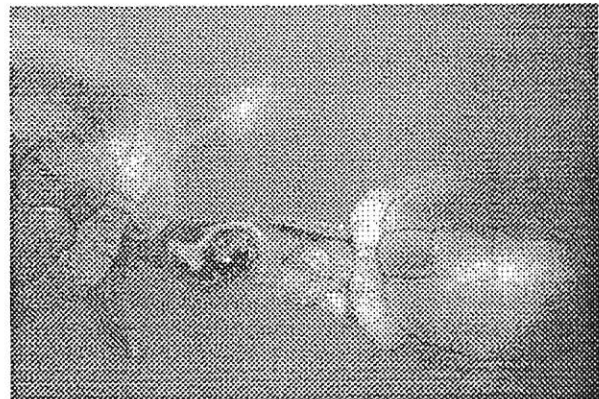


Figure 5. Courtship behavior of West Indian *Trachemys*. These individuals are from a feral hybrid swarm established on New Providence, Bahamas. Photo D. Lee.

Seidel, 1984 and 1988; and Seidel and Adkins, 1987) considered the turtles on Cat Island to be derived from an introduced population. This decision was based on comprehensive morphometric and biochemical analyses, but the Bahamas population is still recognized by the U.S. Fish and Wildlife Service and is regarded as endangered (Fed. Reg. 34415; September 26, 1986). An overview of the complex taxonomic history of this turtle is presented in Appendix 1.

The Jamaican Slider is one of four species of freshwater turtles known from the Bahamas and the West Indies. It is a monotypic species. Seidel (1996) stated that this species is the most distinct (divergent) of the freshwater turtles in the region. The other species in the region are the Northern Antillean Slider, *T. decussata*, which occurs on Cuba, the Isle of Pines and the Cayman Islands, the Hispaniolan Slider, *T. decorata*, which is endemic to southwestern Hispaniola, and the Central Antillean Slider, *T. stejnegeri*, which is found in eastern and northern Hispaniola, Puerto Rico and Great Inagua. The population of *T. stejnegeri* on Great Inagua is of natural occurrence and the turtle is regarded as an endemic subspecies, *T. s. malonei*. At this time it is recognized as the only naturally occurring population of *Trachemys* in the Bahamas archipelago (see discussion below in Zoogeography/Cultural Introduction). The last word in West Indian freshwater turtle taxonomy and zoogeography has not been written, but the most recent review was provided by Seidel (1996). As recently as the mid-1950s all the species of West Indian freshwater turtles were lumped under a single species, *Pseudemys terrapen* (Mertens and Wermuth, 1955). The systematics of *Trachemys* and the closely related *Pseudemys* of the southeastern United States is complex. Directions of movement and the sequence of speciation are unknown, and species limits are unclear. Intergradation and hybridization in the genus are common, and in the West Indies, at least, there is much evidence of transplants by both pre-Columbian and modern day people. Among turtles, *Trachemys* in particular have been introduced widely and naturalize well. In most cases these introductions and the source populations have remained undocumented. The questions are compounded

in the Bahamas and West Indies where zoogeographic patterns as they relate to Pleistocene events are often problematic, the fossil record is incomplete, and the role of pre-Columbian man in both the introduction and extinction of biota is poorly understood.

Late Pleistocene fossils from Puerto Rico and the Bahamas (Pregill, 1981; Olson, et al., 1990) indicate that the genus was in the region prior to the arrival of pre-Columbian people. Based on archeological evidence, if *Trachemys* is not native it was naturalized on Great Bahama Bank prior to the historical period and appears to have been a part of the various islands' faunal assemblages for a long time. Evidence of early human use of *Trachemys* is available from archeological sites on San Salvador (Berman, 1994) and the Caicos Bank (Seidel, 1996). Transport of *Trachemys* within the West Indies region is documented (Florida State Museum collections) from an archeological site 1300 BP on Saba, a 5 square mile volcanic island in the Lesser Antilles with no available surface water.

This archeological evidence shows the genus to have been present in the Bahamas prior to European contact, and the scant fossil record shows that some type of freshwater turtle (probably *Trachemys*) was present prior to aboriginal contact.

DESCRIPTION

Trachemys terrapen can be separated from other *Trachemys* in the Bahamas and West Indies region by the combination of its blunt and rounded snout, a distinct terminal notch in the upper jaw, the near lack of any pattern (or only a faint one) on the plastron, and carapacial scutes with deep longitudinal rugosities. The carapace is oval to elliptical, being wider posteriorly than anteriorly, and only slightly domed (Figure 2). A more detailed description is provided by Seidel (1988).

The young have not previously been described in detail. These descriptions are from slides taken by Ross in the early 1980s of Cat Island hatchlings less than 6 months of age (Tortoise Reserve photograph collection # 34, 2500, and 2510). The young are similar in shape to adults but have a more strongly keeled shell.

The horny laminae of the shell has less pigment, which allows the markings beneath to be seen more clearly. These markings are most intense in small specimens and fade as the turtles grow.

Shell: Dorsally the centrals and laterals are uniform olive green with black outlines between the laminae. The outer margin of the marginals is a pale yellow. Ventrally the young are off yellow. The marginals have "eye spots". These are paler and more ring-like than those of *T. scripta scripta* or *elegans*. The bridge is pigmented with undulating lines formed by a pattern similar to those of the "eye spots". The ventral laminae are 60 to 80% covered with a left to right symmetrical "ink-blot" pattern centered down the mid line of the shell (Figure 3). Minor variations in this "ink-blot" occur from individual to individual.

Skin: The skin is a dark olive green. Dorsally the head and neck are uniform and laterally and ventrally striped with pale yellow. The forelimbs have two yellowish stripes extending across the anterior surface, the lower one being nearly twice as wide as the one above it. The leading edges of the hind legs have a single wide stripe, the trailing edges have a very narrow and faint stripe. Some yellow pattern is present on the ventral surface. The tail has incomplete striping on the ventral surface.

DISTRIBUTION OF *TRACHEMYS* POPULATIONS IN THE BAHAMAS

In the Bahamas probably 60% of all individuals of this genus occur on Cat Island, perhaps as many as 20% occur on Inagua, and 19 % are a hybrid swarm found on New Providence with less than clear origins. It is not known if other populations are natural relicts of a once wider spread population or if they are undocumented prehistoric or historic introductions. On New Providence *Trachemys* are established on Paradise Island [Hog Island], Lyford Key and the large ridge lake behind Cable Beach (T. White, pers. comm.). Iverson (1992) regarded these turtles as ones introduced from Great Inagua but other authors have considered them as part of a feral hybrid swarm of *T. s.*

malonei and *T. terrapen* (i.e., Seidel and Atkins, 1987), and perhaps North American *T. scripta elegans* from the pet trade. In general appearance many of these turtles closely resemble *T. terrapen*, in fact we have documented a long term history of the residents bringing turtles from Cat Island to Nassau for sale in fund raising events. It is unclear if New Providence had a native population of freshwater turtles prior to these introductions.

Trachemys terrapen is also known from Eleuthera (Schwartz and Thomas, 1975), the Exumas (Franz, et al., 1993), and Andros (Schwartz and Henderson, 1991). On Eleuthera *Trachemys terrapen* has been reported only from Hatchet Bay. In the early 1960s Albert Schwartz collected 15 turtles from a deep solution hole at Bay Plantation. There were no subsequent reports from Eleuthera and the species was assumed to be extirpated. However Tony White (pers. comm.) has documented the occurrence of *Trachemys* on Eleuthera in the late 1990s with photographs of turtles from ponds at North Palmetto Point. The Andros record is based on a single specimen Schwartz collected in 1972 near Congo Town on South Andros and no additional information is available on the occurrence of these turtles on this island. The Exuma record from Great Exuma is also based on specimens, and extant populations are known from this island and others in the Exuma chain— Little Exuma, Darby Island and Hog Cay. Additionally, Craton (1968) mentions freshwater turtles on Long Island. While various authors have made statements about the sources of these populations it is unclear what the origins of the stocks actually are and in all cases natural occurrence should not be ruled out. All records of *Trachemys terrapen* and *terrapen* like turtles are from the Great Bahama Bank and none (fossil or recent) are known from the other banks in the Bahamas.

As previously stated *T. s. malonei* is considered to be endemic to Great Inagua. The genus is also recorded from Pine Cay (Caicos Bank) in the Turks and Caicos from a single specimen (UF 49423; Seidel, 1995) collected in 1973. This turtle was collected by Walter Auffenberg and is labeled as "*Chrysemys malonei*". "Lee (pers. obser.) saw unidentified

Trachemys in a fresh water pond on Pine Cay in December 1997. The origin of the turtles on Pine Cay is unknown and their identity needs confirmation.

The red-eared slider, *Trachemys scripta elegans*, a popular species in the pet trade has become established on Grand Bahama (Figure 4). Populations are known from the Rand Nature Center in Freeport (White, 1998), and Fortune Hills and Shannon Golf Course (Lee, pers. obser.). Based on photos at the Rand Nature Center these sliders have been present as breeding size adults since at least the early 1970s. This turtle has also been introduced on Guadeloupe and in Miami, Florida (Schwartz and Henderson, 1985). A threat to all populations of Bahamian *Trachemys* is the continued import of *Trachemys scripta elegans* (red-eared sliders) into the country for the pet trade. They were still being imported as recently as June 1999 (Lee, pers. obser.). Released individuals could quickly dilute the gene pools of native stocks.

FOSSIL FRESHWATER TURTLES IN THE BAHAMAS

Some evidence for a natural vs. introduced Bahamian origin of *Trachemys* is in the fossil record. A late Pleistocene fossil emydine was discovered 70 km SE of Cat Island on San Salvador (Olson, et al. 1990). This specimen (not identified to genus) might substantiate the presence of *Trachemys* on the Great Bahama Bank prior to human contact.

ZOOGEOGRAPHY/CULTURAL INTRODUCTIONS

Lindroth (1957) provides five criteria for identification of a species as being introduced. These are 1) historical evidence, 2) geographical distributions which are "immature" or "unnatural", 3) ecological distributions which are confined to disturbed habitats, 4) biological considerations which preclude any chance of the species being native (e.g., species dependent on an exotic food plant), and 5) taxonomic evidence. In the case of *Trachemys* in the Bahamas or Jamaica, excluding number 5, none of these

criterion clearly indicate the species is introduced. The taxonomic evidence shows the Bahama and Jamaica populations to be identical with no indication as to which is the source population.

From a zoogeographic perspective the occurrence of *Trachemys stejnegeri malonei* on Great Inagua makes sense in that southern Bahama Islands have close associations with Hispaniolan faunas (i.e., Buden 1985, 1987). *Trachemys* of an unknown origin are known from the Caicos Bank (both as extant individuals and archeological remains) and it would be interesting to learn their geographic affinities. The fossils are identified only to genus and the recent single specimen as *malonei*. The presence of a Jamaican species in the northern Bahamas does not fit any known zoogeographic pattern in that the northern islands' vertebrate faunas have their closest affiliations with Cuba and North America. None-the-less, it is curious that the six separate islands which support, or supported, *Trachemys terrapen* in the Bahamas are all on the Great Bahama Bank. During periods when Pleistocene sea levels were lowest (Wisconsin glaciation; 17,000 yr BP) it is estimated that the sea level was 120 m lower than present (Gascoyne, et al., 1979, Bloom, 1983). The landmass of the Great Bahama Bank was continuous and thereby larger than that of most of the islands in the Greater Antilles where other extant endemic *Trachemys* populations occur today. Lower Pleistocene sea levels would result in consolidation of the Bahamas into five major islands each exceeding 2,000 sq km in area. Between 14,000 and 6,000 yr BP sea levels rose rapidly reaching current levels by the early Holocene and fragmenting the larger islands into their current configuration. This took place approximately over 4,000 years ago and prior to the arrival of pre-Columbian man. The only previous sea level rise of this magnitude occurred during the previous interglacial about 120,000 yr BP (Neumann and Moore, 1975; Imbre, et al., 1983; Kaufmann, 1986) leaving a significant time period of a large exposed Pleistocene Bahamian land mass for the establishment of an extensive freshwater fauna.

While morphometric, biochemical and zoogeographic evidence indicate that *Trachemys*

terrapen's current distribution is from introduction by man, it is hard to determine when this occurred. Interviews with Cat Island residents (several of whom were in their mid 90s in 1998) indicate that the turtles were present on the island at least prior to their grandparents' time (early to mid- 1800s) and that there are no known family connections of Cat Island residents with Jamaica. Furthermore, the island had very little European or slave contact prior to the time of the American Revolutionary War. Combined with the history of the genus elsewhere in the region, it is therefore reasonable to assume that transport of the turtles was done by pre-Columbian humans. However, it is probably only because of the pattern of European colonization of the West Indies that *Trachemys terrapen* was first found in Jamaica and described from Jamaican specimens (Lacepede, 1788). Because of rules governing taxonomic priority, *felis* was synonymized under *terrapen*, and biologists have assumed Jamaican as the country of origin for the species. Neither of these points is relevant to the actual origin of the Cat Island or Jamaican populations. From the point of view of early human displacement alone, it is equally plausible that the species was transplanted by pre-Columbian or early colonial trade from the Bahamas to Jamaica. Archeological evidence supports that minimally some transport occurred in the pre-Columbian period.

From a zoogeographic perspective it would be logical that if freshwater turtles were native to Jamaica they would be descendents of *T. decorata* of southwestern Hispaniola, and for *T. terrapen* to have evolved on the large Pleistocene Great Bahama Bank. There are strong zoogeographic affinities between the northern Bahamas and Cuba and it would be expected that *T. terrapen* (assuming it is of Bahamian origin) would have closer affinities to *T. decussata* or *T. stejnegeri*. *T. terrapen* and *decussata* share pastral patterns (which frequently become obscured or disappear with age) that are generally continuous or only partially interrupted symmetrical figures. These are unlike the plastron patterns of *T. decorata* or *T. stejnegeri*. The head striping and degree of melanism in these latter two species is also more

similar than to that of *T. decussata* or *T. terrapen* (Seidel, 1988). Shared characters suggest a common evolutionary history of the Cuban and Bahamian stocks and this would parallel what has been reported for other elements in the herpetofauna (Franz, et al., 1996), Chiloptera (Clark and Lee, 1999), and in the resident land bird community (Buden, 1987). This same pattern is supported by freshwater species such as cave fish of the genus *Lucifuga* (Lee, et al., 1983) and the Cuban Crocodile, *Crocodylus rhombifer* (Franz, et al., 1995). In fact, the combined current and fossil distribution of *C. rhombifer* matches the current aggregate distribution of *T. terrapen* and *T. decussata* (northern Bahamas, Cuba and Cayman Islands). *Lucifuga* is known only from two species in Cuba and a species endemic to Grand Bahama Bank.

The origin of *Trachemys* in the Bahamas and West Indies is unresolved but based on sexual characters and reproductive behavior is likely to be of North American origin. The male *Trachemys* in Central America and South America lack the elongated fore claws and exhibit biting and not titillating mating behaviors which are shared between southeastern North American *T. scripta* and West Indian sliders (*Figure 5*).

The Bahamas is in the proximity of North American stocks of *Trachemys* and it would be hard to believe that these turtles could have colonized the Greater Antilles while skipping the accessible large exposed Pleistocene landmass of the Bahamas. Conversely, if one assumed a West Indian or Central or South American origin (the presumed origin of most of the West Indian herpetofauna) it would still be difficult to explain the absence of native *Trachemys* from the northern Bahamas since proximal populations in Cuba are closer to the Pleistocene North Bahama land mass than the distance between other West Indian land masses colonized by this genus. With rising sea levels the postulated Pleistocene Bahama population of *T. terrapen* became restricted to a few relict sites which maintained suitable freshwater habitats. Both the Bahamas and Jamaica have relatively limited freshwater fish faunas (Lee, et al., 1983). The limited Bahamian fauna can be

explained by the low nature of the islands and the loss of freshwater habitats with rising sea levels. Jamaica, on the other hand, has numerous freshwater habitats and the lack of diversity in freshwater species is assumed to result from the isolated history of the island. For a review of the freshwater zoogeography of the West Indies see Franz and Burgess (1989).

Based on the modern fragmented distribution of *T. terrapen* in the Bahamas, zoogeographic affinities of other species, and the tenuous nature of their continued existence on these low islands, the scenario of a Bahaman origin is a likely one. However, the available information can be interpreted either way and a Jamaican origin should not be ruled out. At the same time while there is evidence of the existence of *Trachemys* in the pre-Columbian period, introductions, or additional introductions in the early colonial period are possible.

Cat Island is rich in caves with perhaps as many as 2,000 individual caves on the island (Moncure, no date), several visited by Clark and Lee (1999) appear to be prime for fossil deposits. Examination of these caves for sub-fossil and fossil remains of turtles, or their absence, and carbon dating of material recovered could provide information as to the history and origin of the species on the Great Bahama Bank and its presence in the Pleistocene on Cat Island *per se*. The absence of this genus from the other Bahama banks (excluding occurrence in one pond on Pine Cay and archeological remains from the Caicos Bank--which appear to be *T. s. malonei*) suggests that the early inhabitants of the islands were not randomly moving turtles about and the fact that all *T. terrapen* records to date are from this single bank supports the concept that they were formerly wide spread on the Great Bahama Bank. Nevertheless, Seidel (1996), even in the face of additional reported island populations, and new fossil and archeological *Trachemys* from the Great Bahama Bank, concluded that the extant Bahama populations are the result of human introduction.

Because of the problematic origin of *Trachemys terrapen* and growing evidence that this species evolved on the Great Bahama Bank the common name "Jamaican Slider" is an unfortunate one. This vernacular name could do

much to undermine conservation efforts for a highly endangered turtle which is likely a species endemic to the Bahamas.

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APPENDIX 1:

Abbreviated taxonomic history of *Trachemys terrapen* (modified from Seidel 1988).

- 1788 *Testudo terrapen* described from specimen from Jamaica. No holotype designated. Lecepede 1788
- 1789 *Testudo palustris* described from Jamaica. No holotype designated. Gmelin 1789
- 1798 *Testudo fasciata* of Suckow (1798) type locality revised as "Jamaica" by Seidel (1988).
- 1800s Various names applied including *Testudo rugosa* (identity questionable), *Testudo rugosa livida*, *Emys decussata*, *Emys rugosa*, *Chrysemys scripta rugosa*, *Trachemys palustris*. Shaw 1802, Gray 1831, Gosse 1851, Boulenger 1889, Baur 1893
- 1904 *Pseudemys palustris* . Stejneger 1904
- 1909 *Chrysemys scripta palustris* . Siebenrock 1909
- 1935 Thomas Barbour discovers and names Cat Island population as a new species *Pseudemys felis*. Type Locality Tea Bay, Cat Island, Bahamas. Holotype Mus. Comp. Zoo., Harvard 38385. Barbour 1935
- 1939 Mertens considers *felis* as a subspecies of *Pseudemys palustris*. Mertens 1939
- 1940 The earliest name for Jamaican population resurrected as *Pseudemys terrapen*. Barbour and Carr 1840
- 1955 All freshwater turtles in the Bahamas and Greater Antillean region regarded as a single species *Pseudemys terrapen*. Mertens and Wermuth 1955
- 1960 Cat Island population considered a subspecies of Jamaican Slider *Pseudemys terrapen felis*. Parsons 1960
- 1964 All *Pseudemys* synonymized with *Chrysemys*. *Chrysemys terrapen*. McDowell 1964
- 1968 Schwartz discusses Cat Island Turtles as a full species *Chrysemys felis* and a subspecies of *Chrysemys decussata*. Schwartz 1968

- 1983-85 As recently as the early 1980s Jamaican population was considered as nominate, with Cat Island populations as *T. terrapen felis* (Obst 1983, Iverson 1985) or as a full species *Trachemys felis* (Ross 1982). This slider was named as a species of both *Chrysemys* and *Trachemys*.
- 1987-1988 Morphological and biochemical evidence shows Cat Island populations to be referable to *Trachemys terrapen* of Jamaica (Seidel and Adkins 1987, Seidel 1988a and b) and all Bahama populations are believed to be ones resulting from transplants from Jamaica. Paradise Island [Hog Island] population recognized as a feral hybrid swarm.
- 1999 Clumative evidence suggest *Trachemys terrapen* is endemic to Great Bahama Bank and was transplanted to Jamaica by pre-Columbian man. The actual origin of this species is unresolved. This study

APPENDIX 2:

Bibliography of Antillean Terrapines of the genus *Trachemys*

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