

TROPICAL AND SUBTROPICAL RECORDS OF HOODED SEALS (*CYSTOPHORA CRISTATA*) DISPEL THE MYTH OF EXTANT CARIBBEAN MONK SEALS (*MONACHUS TROPICALIS*)

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ABSTRACT

Since the late 1950s, undocumented sightings of seals in the Caribbean have been reported. It has been suggested that the Caribbean monk seal (*Monachus tropicalis*) might not be extinct based on circumstantial evidence. We provide an explanation for recent sightings of seals in the tropical and subtropical Western North Atlantic as we present eight new extra-limital records of hooded seals (*Cystophora cristata*) from North Carolina south to the Caribbean. The unexplained behavior of young hooded seals straying south of their whelping area may encompass long distance movements, extending as far south as the Caribbean. Our records provide an unequivocal explanation for pinniped sightings in the subtropical and tropical waters of the Western North Atlantic that, without definite evidence, such as a specimen or photograph, may have been attributed to the extinct Caribbean monk seal.

Two phocid and five otterid pinniped species are distributed worldwide in tropical and subtropical waters. These include the Mediterranean monk seal (*Monachus monachus*), Hawaiian monk seal (*M. schauinslandi*), California sea lion (*Zalophus californianus*), Southern sea lion (*Otaria byronia*), Galapagos fur seal (*Arctocephalus galapagoensis*), Guadalupe fur seal (*A. townsendi*), and the South American fur seal (*A. australis*) (Jefferson et al., 1993). In the Western North Atlantic, only the Caribbean monk seal (*M. tropicalis*), discovered during Christopher Columbus' second voyage to America (Herrera y Tordesillas, 1601; Kerr, 1824), has been recorded in the tropical waters of the Caribbean Sea and Gulf of Mexico (Fig. 1, King, 1956). After surveys conducted in 1973 off the Yucatán Peninsula, south to Nicaragua and east to Jamaica, Kenyon (1977) concluded that the Caribbean monk seal was probably extinct, with last sightings from Serranilla Bank, between Jamaica and Nicaragua in 1952 (Rice, 1973), and presumably from Isla Mujeres, Mexico in 1962 (Goodwin and Goodwin, 1973). Surveys conducted in the western Caribbean in 1984 found no seals in the area (Le Boeuf et al., 1986).

Since the late 1950s, over 20 undocumented sightings of seals have been reported in the Caribbean (King, 1983; Mignucci-Giannoni, 1989; Bonner, 1994; Table 1). Boyd and Stanfield (1998) suggested that the Caribbean monk seal might not be extinct based on circumstantial evidence derived from interviews with fishermen in Jamaica and Haiti. These undocumented sightings and this circumstantial evidence of seal presence lead to three suggestions: (1) the Caribbean monk seal is not extinct, (2) sightings of California sea lions or other pinnipeds which have escaped from local zoos or aquaria, and (3) observers are reporting rare occurrences of stray arctic seals, either grey seals (*Helichoerus grypus*), harbor seals (*Phoca vitulina*), harp seals (*Phoca groenlandica*) or hooded seals (*Cystophora cristata*).

Here we present extra-limital records of arctic phocids from North Carolina south to the northeastern Caribbean. These records support the latter explanation for recent sightings of seals in the tropical and subtropical Western North Atlantic.

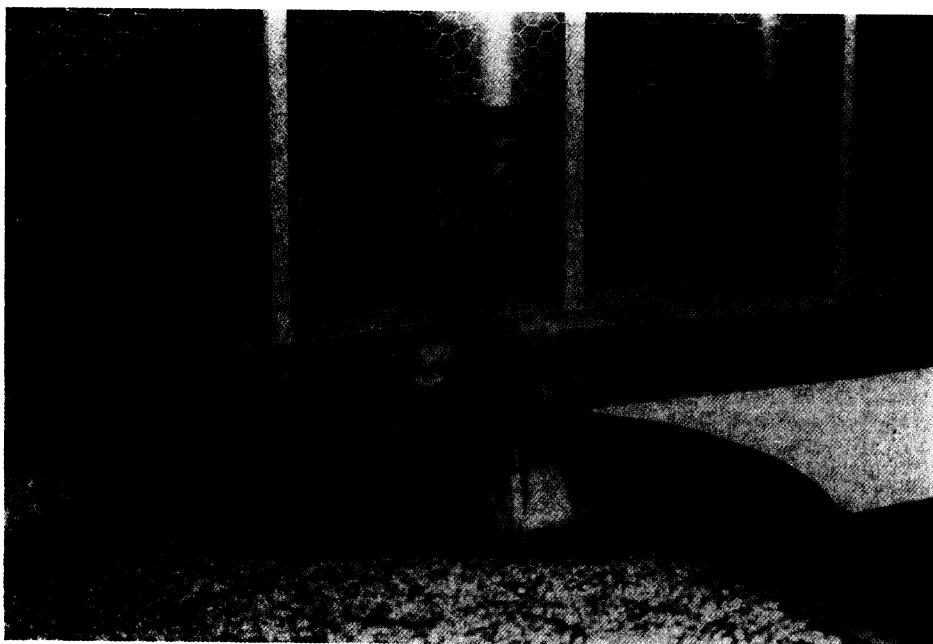


Figure 1. A Caribbean monk seal (*Monachus tropicalis*) held captive in the New York Aquarium in 1910 (photo courtesy, and printed with permission of the New York Zoological Society).

Table 1. Sightings of unidentified pinnipeds in the Caribbean and Gulf of Mexico.

Date	Locality	Report source
—	Chinchorro Reef, Yucatán, Mexico	Knudston, 1977
—	Chinchorro Reef, Yucatán, Mexico	Knudston, 1977
—	N of Ile de la Tortue, Haiti	Woods and Hermanson, 1987
1957	Bolivar Peninsula in Rockport, Texas	Anonymous, 1957
1964	Mira por Vos Cays, Bahamas	Sergeant et al., 1980
1964	Between Belize and Canal de Yucatán, Mexico	Rice, 1973
1964	Isla Mujeres, Mexico	Rice, 1973
1965	Acklins Island, Bahamas	Sergeant et al., 1980
1973	Near Cay Verde, Bahamas	Sergeant et al., 1980
<1976	Between Punta Gorda (Belize) and Livingston (Guatemala)	Knudston, 1977
15 Apr 1977	12 mi S of Bahía de Guánica, Puerto Rico	L. Almodovar, pers. comm.
1978	Ragged Island, Bahamas	Sergeant et al., 1980
1978	Acklins Island, Bahamas	Sergeant et al., 1980
Spring 1979	Playa del Tamarindo, Aguadilla, Puerto Rico	M. Beza, pers. comm.
1980	Playa Crash Boat, Aguadilla, Puerto Rico	R. Florit, pers. comm.
1981	Baie de l'Acuil, Ile Rat, Haiti	Woods and Hermanson, 1987
Oct 1983	Playa La Salina, Bahía Las Calderas, Dominican Republic	Bonnelly de Calventi, 1986
1984	Punta Algodones, Ceiba, Puerto Rico	T. Carr, pers. comm.
1987	Off the S coast of Cuba	S. Minasian, pers. comm.
1995	Virgen Gorda, British Virgin Islands	J. Overing, pers. comm.

METHODS

As part of the efforts of the Southeastern United States (U.S.) Marine Mammal Stranding Network (SEUS MMSN) and the Caribbean Stranding Network (CSN) to document and analyze marine mammal strandings and mortality (Odell, 1979, 1991; Mignucci-Giannoni, 1996), stranded seals were rescued or salvaged and level A data (Geraci and St. Aubin, 1979) and additional detailed information was gathered opportunistically. Seals were identified to genera and species by us, based on tooth counts, morphology and pelt coloration using King (1956, 1983). In two cases (one in North Carolina and one in Florida) in which we personally did not identify the species, photographic evidence was used to confirm positive identification.

RESULTS

Three arctic phocids were reported for Florida and North Carolina by Miller (1917) and Brimley (1946a,b,c). All were identified as hooded seals (Table 2). We report six new extra-limital records of hooded seals stranded between Florida and just north of Cape Hatteras between 1975 and 1996, and the rescue of two additional hooded seals in the northeastern Caribbean in 1993 and 1996 (Table 2, Fig. 2). Following, we detail each event by locality, including, in some cases, initial rehabilitation efforts and cause of death.

NORTH CAROLINA.—Three records of hooded seals exist for North Carolina. The first is of a male specimen found in North Banks Beach (Dare County) in August 1910. The seal's complete skeleton and skin, donated through the U.S. National Zoo, are housed at the U.S. National Museum of Natural History (Brimley, 1946a; Moore, 1953). The second record is of a seal that stranded on the beach on Bogue Banks, near Salter Path, Morehead City (Carteret County) on 17 September 1944. The animal, a 119-cm, 45-kg male, was active when found. The seal was exhibited to the public at the U.S. Fisheries Laboratory in Beaufort. The animal did not feed during the following 7 wks, losing 13 kg, and consequently died. A necropsy revealed the seal choked on an unidentified hard shell clam. Its remains were sent to the North Carolina State Museum (now the North Carolina Museum of Natural Science) on 20 November of the same year (Brimley, 1946a,b,c; Moore, 1953), where both the complete skeleton and skin are housed. Recently, a female hooded seal stranded in Corolla (Dare County) on 24 March 1996 (L. Phymell, North Carolina Aquarium, in litt.). The 114-cm animal appeared highly emaciated (21 kg), and given a poor prognosis by the veterinarian, it was euthanized. The necropsy revealed severe pneumonia and helminths in the heart and lung. The skeletal remains were not salvaged.

GEORGIA.—A 226-cm male hooded seal was observed resting on South Beach at St. Catherines Island (Liberty County) during the night and early morning of 17 July 1986 (D. K. Caldwell, Marineland of Florida, unpubl. data). The animal was later sighted during the evening and most of the night of 19 July at Glynn County's Sea Island (J. Veazey, in litt.), and off Fernandina Beach (Nassau County) in Florida. The seal was finally rescued by personnel from Marineland of Florida on 21 July at Ponte Vedra Beach (St. Johns County), also in Florida. Later during the same day, the animal was transferred to SeaWorld of Florida (SWF) for rehabilitation (Fig. 3A). The seal was subsequently transferred to SeaWorld of Ohio on 12 February 1987 for captive maintenance, but died on 18 August 1988 from necrotizing pneumonia. Its skeletal remains were not salvaged.

Table 2. Eleven confirmed records of hooded seals (*Cystophora cristata*) in the tropical and subtropical Western North Atlantic.

Catalog No.	Date	Locality	Latitude/Longitude	Sex	Length, Weight	Reference
USNM172681	August 1910	North Banks Beach, Dare, North Carolina	-	M	-	Brimley, 1946a
USNM216637	Winter 1916	Cape Canaveral, Brevard, Florida	28° 27'N, 80° 33'W	F	183 cm, 91 kg	Miller, 1917
NCSM383	17 September 1944	Bogue Banks, Carteret, North Carolina	34° 43'N, 76° 44'W	M	119 cm, 45 kg	Brimley, 1946a
UF13483	24 October 1975	Jacksonville Beach, Duval, Florida	30° 16'N, 81° 23'W	M	117 cm, 34 kg	This paper
USNM550444	2 October 1984	Fort Lauderdale Beach, Broward, Florida	26° 08'N, 80° 04'W	M	113 cm, 32 kg	This paper
SWF-CC-8643-B	17 July 1986	St. Catherines Island, Liberty, Georgia	31° 38'N, 81° 08'W	M	226 cm	This paper
SWF-CC-9311-B	3 July 1993	Cape Canaveral, Brevard, Florida	28° 25.4'N, 80° 34.5'W	F	107 cm, 19 kg	This paper
NEPST222	17 July 1993	La Poza de las Mujeres, Camuy, Puerto Rico	18° 29.4'N, 66° 50.3'W	M	109 cm, 33 kg	This paper
SWF-CC-9413-B	18 August 1994	Neptune Beach, Jacksonville, Duval, Florida	30° 18.0'N, 81° 23.6'W	F	140 cm, 23 kg	This paper
NC9649	24 March 1996	Corolla, Dare, North Carolina	36° 23.1'N, 75° 49.6'W	F	114 cm, 21 kg	This paper
NEPST520	4 September 1996	Maho Bay, St. John, US Virgin Islands	18° 22'N, 64° 45'W	M	123 cm, 45 kg	This paper

NC = North Carolina Stranding Network, NCSM = North Carolina Museum of Natural Science, NEPST = Caribbean Stranding Network, SWF= SeaWorld of Florida, UF = Florida Museum of Natural History, USNM = United States National Museum of Natural History.

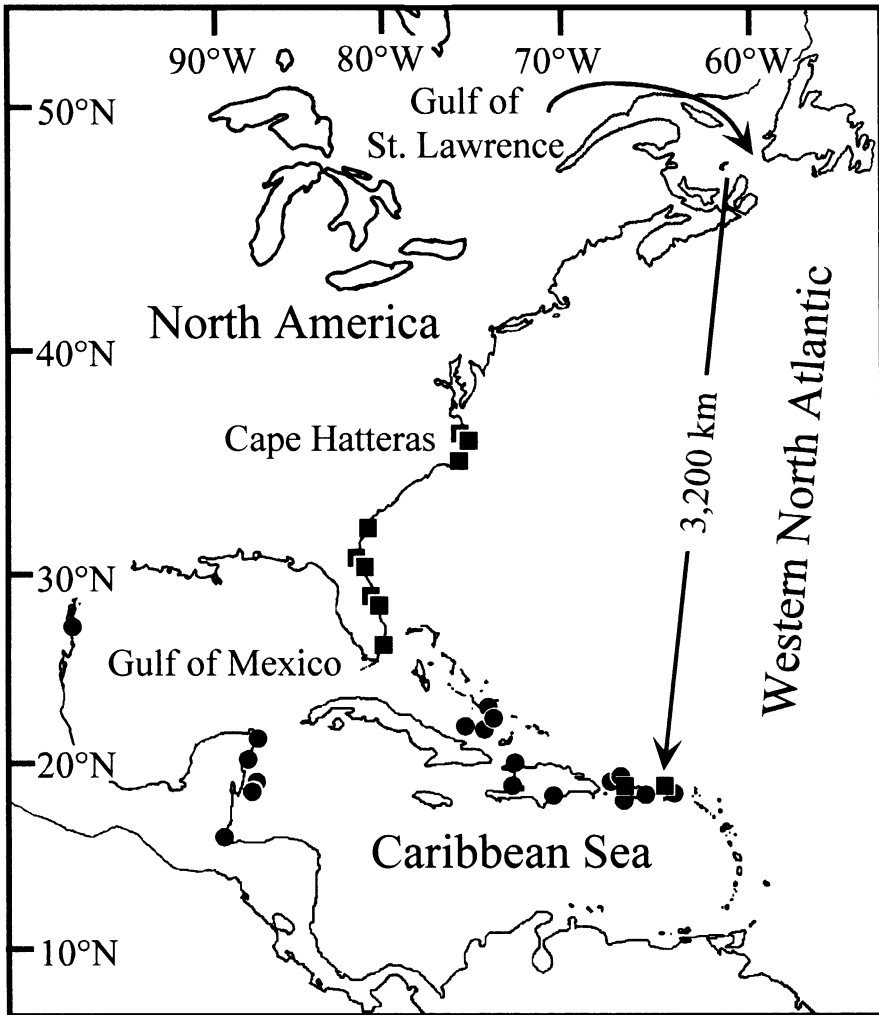


Figure 2. Locality map of undocumented pinniped sightings in the Caribbean (●), and confirmed hooded seal (*Cystophora cristata*) records in the tropical and subtropical Western North Atlantic (■).

FLORIDA.—Five records of hooded seals exist from Florida. The first record is of a female hooded seal which was killed at Cape Canaveral (Brevard County) during the winter of 1916 (Miller, 1917). The seal was recorded to be 183 cm in length and 91 kg in weight, with blue-back pelt characteristic of young hooded seals. The skin and skull of the animal are housed at the U.S. National Museum of Natural History. A second hooded seal, a 117-cm, 34-kg male, was found in Jacksonville (Duval County) on 24 October 1975 and rescued by personnel from Marineland of Florida (D. K. Caldwell, in litt.). The animal was found with a large gash on its left rear flank. The seal died shortly after and the necropsy conducted only found digeneans in the small intestine. The seal's skeletal remains are housed at the Florida Museum of Natural History.

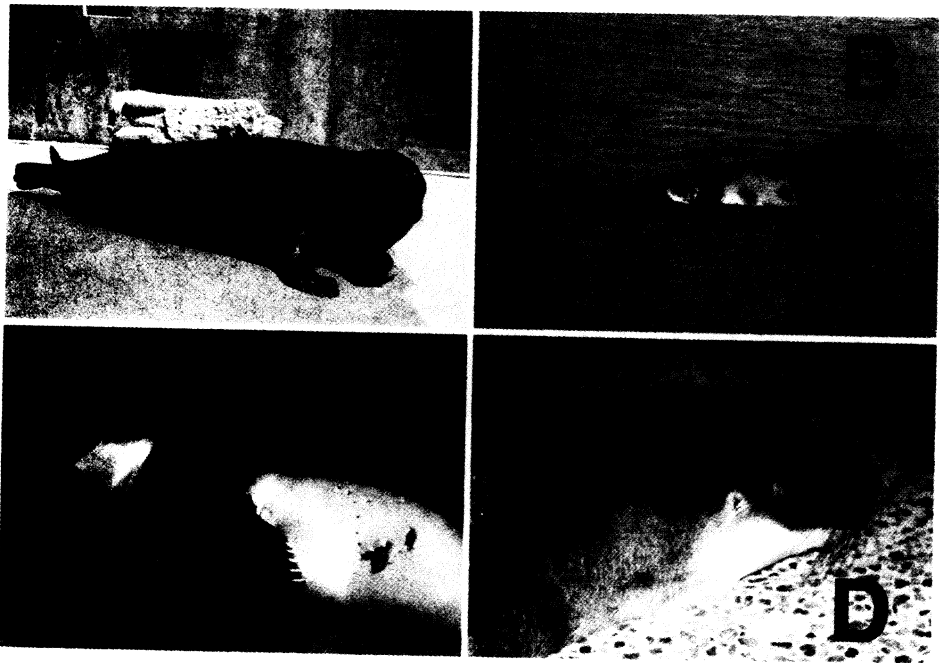


Figure 3. Photographs of three hooded seals (*Cystophora cristata*) which stranded in St. Catherines Island, Georgia in 1986 (a); Camuy, Puerto Rico in 1993 (b, c); and St. John, U.S. Virgin Islands in 1996 (d).

A third hooded seal was rescued by local lifeguards at the beach in Fort Lauderdale (Broward County) on 2 October 1984 (G. D. Bossart, University of Miami School of Medicine, in litt.). The seal, a 113-cm, 32-kg male, was transported to OceanWorld for rehabilitation. The animal was found weak and suffering from conjunctivitis. After gaining 9 kg, the seal was flown on 14 December 1984 to Mystic Marineland Aquarium (MMA) in Connecticut in preparation for release. The seal arrived in a lethargic and cyanotic condition, and died 3 d later from pulmonary edema, bronchopneumonia and gastroenteritis (R. Nawojchik, MMA, in litt.). Bacteriological cultures of the left and right nasal showed growth of *Escherichia coli*, *Pseudomonas aeruginosa*, *Streptococcus* sp. and *Vibrio parahaemolyticus*. Anal cultures grew *Escherichia coli*, *Klebsiella pneumoniae*, *Morganella morganii*, *Pseudomonas aeruginosa*, *Pseudomonas* sp. and *Vibrio parahaemolyticus*. Unidentified gram variable rods were cultured from all internal organs. Additional cultures also revealed growth morphologically and biochemically characteristic of *Erysipelothrix rhusiopathiae*. The animal's skeletal remains are housed at the U.S. National Museum of Natural History.

Another hooded seal was rescued in Cape Canaveral on 3 July 1993 by SWF personnel. The 107-cm, 19-kg female was found emaciated and placed in rehabilitation in Orlando. The seal responded well to treatment and accepted fish readily, but died on 14 October 1994, from complications caused by parasitism by *Nocardia* spp. The seal's skeletal remains were not saved.

A fifth hooded seal stranded alive just south of Neptune Beach in Jacksonville on 18 August 1994. The female seal, 140 cm in length and 23 kg in weight, was transported via Marineland to SWF for rehabilitation. The animal was found alert, but slightly dehy-

drated and emaciated. Blood values confirmed the diagnosis, and showed otherwise to be in good health. The seal responded well to treatment and gained weight progressively. In late November, the seal presented an acute infection on the left eye, which was treated with antibiotics and other medications, with no improvement. The seal died on 9 December 1994, and the necropsy revealed that its cause of death was due to nocardial meningoencephalitis and sepsis, probably originating from the eye. The seal's skeletal remains are housed at SWF.

PUERTO RICO.—A 109-cm, 33-kg male hooded seal stranded alive on 17 July 1993 at La Poza de las Mujeres, Camuy, Puerto Rico (Fig. 3B). The seal exhibited six shark-bite wounds (1.0 to 8.5 cm in length) on the back, pelvis and legs. The young seal was rescued by CSN personnel and transported by U.S. Coast Guard helicopter to the CSN Rehabilitation Center in La Parguera (Fig. 3C). Examination revealed an emaciated animal, suffering from dehydration, and lymphocytosis. Fecal cultures grew *Pseudomonas putrefaciens*, but no *Compylobacter*, *Salmonella*, or *Shigella* was isolated. The animal was treated for its wounds and condition with antibiotics and tube-fed a fish-gruel formula as it would not feed on its own. Once its condition was stabilized, the seal was transported to SWF on 23 July 1993 to continue its rehabilitation. It was placed with a young female hooded seal found stranded in Cape Canaveral on 3 July 1993. The seal acclimated well, recuperated from its wounds and began accepting fish. Unexpectedly, the seal died on 9 November 1993. A necropsy revealed a fungal infection in the brain. The seal's skeletal remains are housed at the CSN in San Juan.

US VIRGIN ISLANDS.—On 4 September 1996, a 123-cm, 45-kg male hooded seal was sighted by National Park Service personnel off Maho Bay in St. John, U.S. Virgin Islands. The animal moved to Francis Bay and was later netted in Cinnamon Bay in the same island. The seal was transported with the help of a U.S. Coast Guard helicopter to San Juan, Puerto Rico for examination and rehabilitation by CSN personnel. It was found to be in good shape although its vital signs were slightly depressed (Fig. 3D). The seal was found to be molting. Blood tests showed the seal to be dehydrated and with signs of a bacterial infection. Antibiotics and electrolytes were administered to stabilize the animal. Initially the animal readily accepted local fish, but after the second week, showed inanition. Signs of abdominal tenderness and pain were apparent. The animal did not accept any food. Anti-inflammatory medications were administered, but the seal died on 11 September. The necropsy conducted the following day revealed sand impaction in the pyloric stomach. Histopathological analysis revealed subacute necrotizing enteritis. Small infarcts were found in the lungs, heart and kidneys. Bacteriological cultures of the lung and bronchi showed growth of *P. aeruginosa* and *Proteus mirabilis*, respectively. Fecal cultures grew *Citrobacter freundii*, *P. putrefaciens*, and *Shewanella* sp. The acanthocephalan *Corynosoma wegeberi* was collected from the small intestine. Fungal culture of the skin revealed growth of *Candida* sp. The seal's skeletal remains are housed at the CSN.

DISCUSSION

The only resident pinniped in the Southeastern U.S., Gulf of Mexico and Caribbean was the Caribbean monk seal (Timm et al., 1997). Notwithstanding, other pinniped species, including harbor seals, hooded seals and California sea lions, have been sighted since 1910 in the Southeastern U.S., including Alabama, Florida, Georgia, Louisiana,

North Carolina, and South Carolina (Miller, 1917; Moore, 1953; Anonymous, 1957; Caldwell and Golley, 1965; Anonymous, 1966a,b,c, 1967; Layne, 1965; Gunter, 1968; Caldwell and Caldwell, 1969, 1974; Caldwell et al., 1971; Lowery, 1974; Winn et al., 1979). California sea lion records represent animals which escaped from zoos and aquaria, including two cases reported from Puerto Rico in 1955 and in 1967 (Mignucci-Giannoni, 1998) and one case in March 1993 of a male *Z. californianus* which escaped from the Acuario Nacional in La Habana, Cuba (G. García-Montero, Acuario Nacional de Cuba, pers. comm.). All escaped pinnipeds from Puerto Rico and Cuba were later recovered. At present in the Caribbean, California sea lions are exhibited in Colombia, Cuba and Curaçao; South American sea lions are kept captive in Colombia, Cuba, Dominican Republic and Venezuela; and an African fur seal (*Arctocephalus pusillus*) is maintained in an aquarium in Cuba. Harbor seal and hooded seal records represent extra-limital occurrences of animals that strayed from their normal distribution.

The new cases reported herein are of eight positively identified hooded seals. Initial identification was based on external morphological comparisons (Figs. 1,3), followed by confirmation based on dentition. Hooded seals have a dental formula of $i\ 2/1$, $c\ 1/1$, $pc\ 5/5$, total 30; this contrasts with the dental formula of the three species of monk seals ($i\ 2/2$, $c\ 1/1$, $pc\ 5/5$, total 32), grey seals ($i\ 3/2$, $c\ 1/1$, $pc\ 5-6/5$, total 34-36), and harbor and harp seals ($i\ 3/2$, $c\ 1/1$, $pc\ 5/5$, total 34), which have higher tooth counts (King, 1983). While it was previously believed that stray seals were mostly males, both male and females were reported. Six of the animals were less than 122 cm in length and 35 kg in weight, still bearing their blue-back pelt (Fig. 3B,C), characteristic of the newborn pups and pre-molting juveniles of the species. Based on the date of each stranding, the known pupping season for the species in the Western North Atlantic (mid March to early April; Lavigne and Kovacs, 1988), their size (hooded seal pups are born between 100 and 105 cm in length and 20 and 30 kg in weight; Reeves and Ling, 1981), and color of pelt of each animal, the seals found were most probably between 1 to 8 mo of age. Notwithstanding, two of the animals were already molting juveniles (Fig. 3D), while one was an 226-cm adult male (Fig. 3A). On average, rescued seals were in rehabilitation for a year (7 d–2.1 yr, $n = 6$); notwithstanding, none of the animals survived.

The normal distribution of hooded seals extends from Greenland to the Gulf of St. Lawrence in the Western North Atlantic (Lavigne and Kovacs, 1988; Rice, 1998). While stray individuals were reported to have pupped off the coast of Maine in 1974 (Richardson, 1975), the Gulf of St. Lawrence is the southern-most whelping area for the species (Fig. 2). Young hooded seals, still in their blue-back stage are known as stray animals out of their natural range (Kovacs and Lavigne, 1986), and extra-limital sightings have been recorded for much of the U.S. eastern seaboard (Sergeant, 1974) and Europe (van Bree, 1997a,b). The southernmost record in Europe is from El Coto de Doñana, Huelva (36°54'N) in Spain (Ibáñez et al., 1988). The only record known for the Pacific Ocean is of a stray 170-cm, subadult female hooded seal which stranded in San Diego (San Diego County), California (32°37.4'N) on 23 July 1990 (Dudley, 1991). The stranding events for Puerto Rico (18°29.4'N) and the Virgin Islands (18°22'N) reported herein are the southernmost records for the species in the North Atlantic.

The northern part of the U.S. eastern seaboard has experienced over the later part of the 1980s and the earlier part the 1990s, a dramatic increase in stranded arctic seals (G. Early, New England Aquarium, pers. comm.; Stevick and Fernald, 1998; McAlpine and Walker, 1999; McAlpine et al., 1999a). Prior to this, stranding of these seals, other than harbor

seals, were infrequent (McAlpine and Walker, 1990). After 1994, the stranding network in the New York area was recovering these species annually to the extent that the number of harp seals almost equaled the number of harbor seals (S. Sadove, Okeanos Ocean Research Foundation, in litt.). A similar situation has been suggested to be occurring off the coasts of Bay of Fundy and Northern Gulf of Maine (McAlpine et al., 1999b) and even Europe (van Bree, 1997b). Possible explanations for this, in addition to an increase in marine mammal research effort, could be that seals have shifted breeding patches further south, the seal populations may be increasing, or that collapsed fish stocks may no longer support current high populations of arctic seals, thus forcing them into poorer feeding areas south (McAlpine et al., 1999a). While speculative, one or a combination of these factors may be having an effect on the distribution of hooded seals to an extent that not only the northeastern U.S. is getting more of these seals (McAlpine et al., 1999b), but also the southeastern U.S. and the Caribbean are receiving the species wandering juveniles.

Our records show that the unexplained behavior of young hooded seals straying south of their whelping area may encompass long distance movements, at times over 3200 km, and extend as far south as the Caribbean Sea (Fig. 2). The list of undocumented sightings of pinnipeds in the Caribbean suggest that this phenomenon may have occurred as early as the 1960s, and recent evidence, considering our records and the stranding records of the northeastern US, show that these occurrences may be on the rise (J. G. Mead, Smithsonian Institution, pers. comm.). Furthermore, and of greater importance, our records provide an unequivocal explanation for pinniped sightings in the subtropical and tropical waters of the Western North Atlantic that, without definitive evidence, such as a specimen or photograph, may have been attributed to the extinct Caribbean monk seal. Stranding network participants, local wildlife officers and scientists must pay close attention to seal sightings or strandings south of the Carolinas on the U.S. eastern seaboard, including the Gulf of Mexico and the Caribbean, to further document the phenomenon of stray arctic seals in the tropics.

ACKNOWLEDGMENTS

The collection and handling of specimens was carried out under letters of authorization from NOAA's National Marine Fisheries Service's Protected Species Management Branch, and the U.S. Virgin Islands Department of Planning and Natural Resources, and a cooperative agreement with Puerto Rico's Department of Natural and Environmental Resources. We also thank all those who we interviewed and detailed stranding or sightings events, especially the late L. Almodovar (University of Puerto Rico), M. Beza, R. Florit (U.S. Department of Agriculture), T. Carr (Caribbean Conservation Corporation), S. Minasian (Marine Mammal Fund), and J. Overing (British Virgin Islands' Conservation and Fisheries Department). SEUS MMSN and CSN participants and volunteers were instrumental in the development of this study. Veterinarians G. D. Bossart (Miami Seaquarium), M. Walsh, T. Campbell (SWF), J. L. Dunn (MMA), D. Moore, C. Ruiz, and L. Benitez (CSN) carried out the treatment of the animals reported here. The late D. K. Caldwell and M. C. Caldwell (Marineland of Florida) kindly provided unpublished data on some of the animals reported herein. N. Barros (Hubbs Sea World Research Institute), L. Phynell (North Carolina Aquarium), R. Nawojchik (MMA), S. Sadove (Okeanos Ocean Research Foundation), G. Early (New England Aquarium), and D. Lavigne (International Marine Mammal Association) provided additional information on some of the seals under their care and on hooded seals. J. G. Mead (U.S. National Museum of Natural History), L. Wilkens (Florida Museum of Natural History) and M. K.

Clark (North Carolina Museum of Natural Science) confirmed museum accession numbers of voucher specimens. A. Cardona and J. J. Pérez-Zayas (CSN) assisted with the map. We appreciate the encouragement provided by K. W. Kenyon (Fish and Wildlife Service) and P. J. H. van Bree (University of Amsterdam's Zoology Museum) in the completion of this manuscript. They, in addition to D. F. McAlpine and an anonymous reviewer also commented on the manuscript. This is SeaWorld of Florida technical contribution 9902-F.

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DATE SUBMITTED: November 23, 1999.

DATE ACCEPTED: August 20, 2000.

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