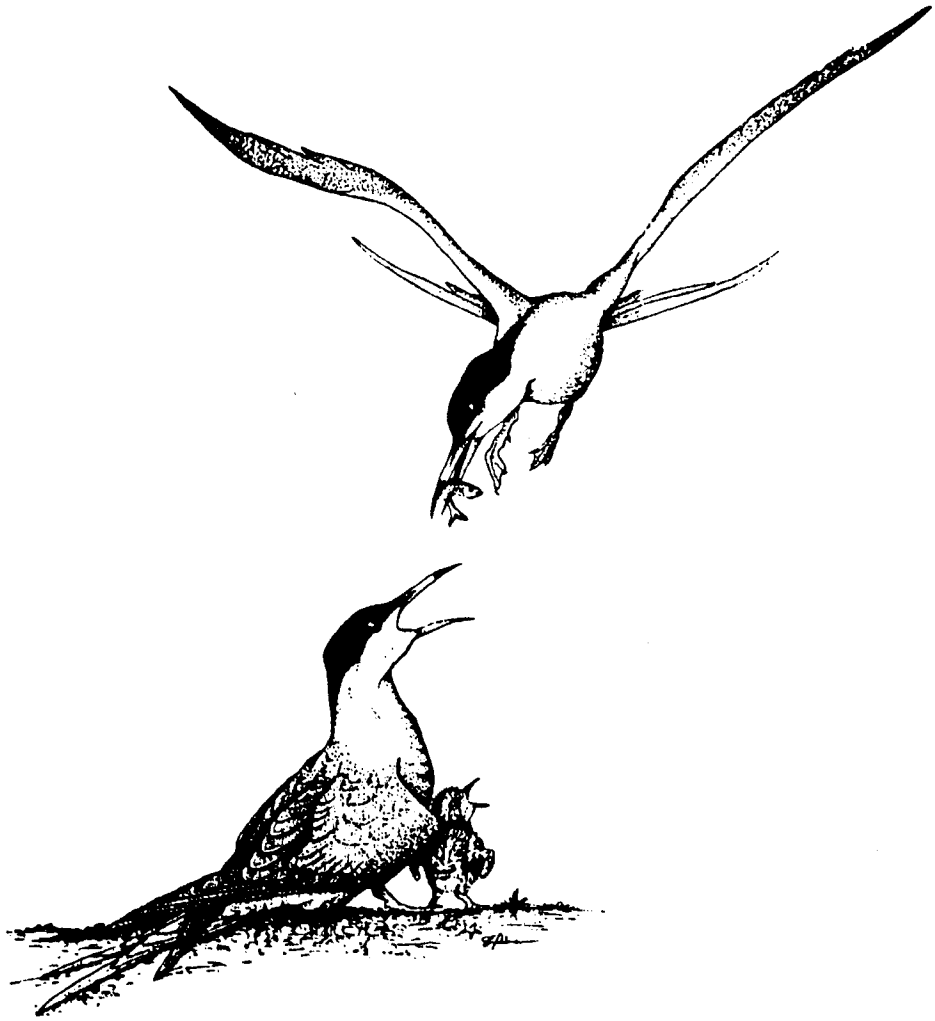
RECOVERY PLAN

Caribbean Roseate Tern

(Sterna dougallii)



U.S. Fish and Wildlife Service

CARIBBEAN ROSEATE TERN RECOVERY PLAN

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Approved: _____
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EXECUTIVE SUMMARY

Current Status: The roseate tern is listed as threatened in the Caribbean. This species is distributed throughout the Caribbean, with the largest populations occurring in the Lesser Antilles. Total population numbers are not known, but between 3,000 and 6,000 breeding pairs have been estimated for this region.

Habitat Requirements and Limiting Factors: Roseate terns in the Caribbean select sparsely vegetated, rocky offshore islands for nesting. Predation of eggs, and young and adult terns, as well as poaching of eggs and adults for human consumption, are the major threats to this species. Disturbance of nesting roseate terns early in the breeding season and when eggs are pipping may cause nest abandonment or exposure of eggs to extreme temperatures.

Recovery Objective: Delisting.

Recovery Criteria: Existing and new populations and their habitats must be protected (i.e., post and increase law enforcement and vigilance of breeding colonies and wintering areas) and managed (i.e., reduce or eliminate mortality factors through appropriate predator controls and enhancement of breeding grounds) to reduce mortality of eggs, young, and adult roseate terns.

Actions Needed:

1. Protect and manage roseate tern populations and their habitat to prevent further population decline and increase productivity.
2. Continue to gather information on the distribution and abundance of roseate terns in the Caribbean.
3. Conduct studies of the breeding biology and reproductive success of roseate terns in the Caribbean.
4. Determine post-breeding dispersal and wintering grounds.
5. Refine recovery goals.

Total Estimated Cost of Recovery: Recovery costs for roseate terns in the Caribbean have been estimated at $178,500 for the first 3 years. Subsequent expenditures will depend on the results of preliminary studies, and therefore cannot be estimated at this time.

Date of Recovery: Delisting should be initiated in 2020, if recovery criteria have been met.

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PART I. INTRODUCTION

The world distribution and status of the roseate tern, *Sterna dougallii*, have been reviewed by Nisbet (1980) and Gochfeld (1983). The Caribbean population of the roseate tern breeds from Florida through the West Indies to islands off Central America and northern South America. Roseate terns also breed in North America, the Palearctic, Indian Ocean, southern Africa, and Australasia. In addition to the North American population, the European and southern African populations are endangered (Randall and Randall 1980).

The decline of the northeastern population of roseate terns in the 1970's has been well documented (Nisbet 1981), and the population there appears to have stabilized. However, the history and status of the Caribbean colonies are little known. Much of our knowledge of the status and distribution of birds in the West Indies was compiled by Bond (1958). Bond and other ornithologists originally misidentified Caribbean roseate terns as common terns (*S. hirundo*) because of the similarity in their bill coloration (Furniss 1983). Failure to distinguish between the two species makes it difficult to reconstruct the history of roseate terns in the Caribbean. Reliable information on the distribution of these two species in the Caribbean has become available only recently (Halewyn and Norton 1984).

On December 30, 1982, the U.S. Fish and Wildlife Service (Service) listed the roseate tern as a category 2 species, its status pending acquisition of additional data (U.S. Fish and Wildlife Service 1982). On September 18, 1985, the status was revised to category 1, adequate information for determination on hand (U.S. Fish and Wildlife Service 1985). Finally, on November 4, 1986, the Service published a proposed rule listing the Caribbean population of the roseate tern as threatened, and the northeastern United States population as endangered (U.S. Fish and Wildlife Service 1986). After a comment period the final rule was published on November 2, 1987, and took effect on December 2, 1987 (U.S. Fish and Wildlife Service 1987).

Description

The roseate tern is a primarily white, slender-winged, long-tailed, typical capped tern (family Laridae, subfamily Sterninae). Its overall length is about 40 centimeters (cm), including tail streamers 15 to 25 cm in length. The wing chord is about 23 cm long and the wing span is about 60 cm. In roseates, the culmen is about 40 millimeters (mm) in length, and the length from the nostril to tip averages 28 mm.

The roseate tern has a black crown, pale grey upper surface and immaculate white underparts. Both the upper and under surfaces are paler than in the very similar common tern. The 3 or 4 outer primaries (wing feathers) are frosted with silver-grey and edged with black. The long tail streamers are pure white, whereas

and "pi-vik" notes as well as a very harsh grating "yaaach" note. Superficially, the call notes of the Caribbean birds sound similar to those of the northeastern population.

Breeding

In the Caribbean, roseate terns breed primarily on small offshore islands, or marine rocks, cays, and islets (Burger and Gochfeld 1988b, Norton 1988). Rarely do they breed on large islands proper (e.g., Punta Soldado, Culebra in 1989 and 1991, Saliva, pers. obs.). On Culebra and the Virgin Islands the birds constantly shift locations from year to year, both within the U.S. Virgin Islands (USVI) and apparently between the USVI and British Virgin Islands (BVI). The occurrence of large numbers of breeding birds in the USVI has coincided with lower numbers in the BVI and vice-versa, suggesting intermixing between these populations. Fidelity to a natal colony, or site tenacity to a previously used colony where the birds have reproduced successfully, may be as important as preference for a particular habitat (Spendelow 1989).

Nisbet (1980 and 1989) reviewed accounts of roseate tern habitat use in the northeast. Although the northeastern roseate terns typically nest under vegetation or other shelter (Spendelow 1982), this is not characteristic of the Caribbean birds. Roseate terns in the Caribbean have been reported nesting near vegetation or jagged limestone rock (Robertson 1976, Voous 1983, Burger and Gochfeld 1988b), on open sandy beaches (Robertson 1976), close to the water line on narrow ledges of emerging rocks (Norton and Pierce, pers. obs.), or among coral rubble (Saliva, pers. obs.). Although they may nest on slopes up to 70 degree angle (Norton and Pierce, pers. obs.), they generally seek flat or even back-sloping ledges for their nests. Most of them add little or no material to the nests but lay their eggs directly on the ground, rock, or vegetation.

Shelter for chicks may be found near nests (e.g., short vegetation, rocks, crevices); however, most nests are completely exposed. Therefore, eggs and young chicks are vulnerable to predators when the parents are off the nest. In some islands there is basically no shelter or it is occupied by other tern species (e.g., at Cayo Molinos, Culebra), whereas in other islands plenty of cover is available (e.g., at Cayo Turrumote, southwest Puerto Rico). This may account in part for the differences in breeding success and site fidelity among colonies.

Elsewhere in the tropics, roseate terns sometimes nest on open sand with minimal vegetative cover, as on the Great Barrier Reef, Australia (Hulsman 1977). They occasionally do this in the northeast, but some cover (e.g., rocks, crevices, vegetation, old tires) seems to be preferred.

Differences in aggressive behavior may be related to the degree of predation at the different colonies, or the absence of a more aggressive species nesting in the same breeding area.

Factors Affecting Reproduction and Survival

Breeding terns confront a variety of adversities, some of which directly affect the nest, eggs, and young or even the adults, while others affect the ability of the adults to obtain sufficient food to produce a large clutch or to feed their young. Among the direct factors are predation, storms, floods, or prolonged periods of cold wet weather which destroy the nests, eggs, or young.

In the Caribbean, potential predators include magnificent frigatebirds (*Fregata magnificens*), laughing gulls (*Larus atricilla*), red-tailed hawks (*Buteo jamaicensis*), peregrine falcons (*Falco peregrinus*), American kestrels (*Falco sparverius*), short-eared owls (*Asio flammeus*), cattle egrets (*Bubulcus ibis*), night herons (*Nycticorax nycticorax*), ruddy turnstones (*Arenaria interpres*), American oystercatchers (*Haematopus palliatus*), mockingbirds (*Mimus gilvus*), hermit crabs (*Coenobita clypeatus*), land crabs (*Geocarcinus ruricola*), marine or sally lightfoot crabs (*Grapsus grapsus*), feral cats, rats, and snakes (*Alsophis* spp.). One of the most significant and recurrent mortality factors is human interference. Humans take eggs for food or linger on nesting islands and cause fatal disturbance (Pierce and Shealer, pers. comm.).

Pierce (*in litt.*) found egg predation by laughing gulls to be moderately important in the USVI. In 1990, Shealer and Burger (1992) observed at Cayo Ratón, Culebra, several successful attacks on roseate tern chicks by laughing gulls and American kestrels.

Nisbet (1989) reported that roseate terns tend to shift colonies quickly in response to predation or reproductive failure. The number of potential predators found in or near some of the Caribbean roseate tern colonies may be an important factor explaining the poor colony-site fidelity, aggressive behavior, and lower reproductive success of this species in some of those areas.

Egging, the collecting of eggs for food or sale, is perhaps the major factor threatening many of the Caribbean colonies (Halewyn and Norton 1984, Pierce unpub. data). Human residential, commercial, and recreational activity in proximity to tern colonies is a potentially significant source of disturbance to breeding terns. Although terns can habituate to such activity, it may nonetheless cause chicks to run from nesting ledges or may keep adults off their nests, allowing predators to steal eggs.

Roseate terns tend to return to their colony sites in Puerto Rico in early May (Saliva, pers. obs.). At the Dry Tortugas, birds are in their colonies in mid-May, and there are few records earlier in the breeding cycle (Robertson 1964). Although there has been sporadic banding, few data are available to document migration.

Staging and Migration

The few observations obtained on the post-breeding activities of the Caribbean roseate terns suggest that their post-breeding behavior is similar to that of roseate terns in the northeast. Chicks move with their parents to offshore cays near their natal colonies (Saliva, pers. obs.), and they accompany adults during feeding excursions. However, chicks continue to be fed by the adults for at least a week after fledging. On July 31, 1989, after the breeding season, Saliva observed up to 130 roseate terns near Mary's Point on the north coast of St. John, USVI, and 40 adult and juvenile roseates at Great Thatch Island, not far from a suspected roseate colony at Jost Van Dyke, BVI.

The northeastern population stages in large flocks on barrier beaches in August, and most birds depart on their southward migration by mid September (U.S. Fish and Wildlife Service 1989). Migrants have been found in the West Indies in September and October. Nisbet (1984) summarized band recoveries of wintering roseate terns in South America. Most recoveries were from October through the winter in Guyana or from November in Brazil.

Nisbet (1984) suggested that Caribbean roseate terns mingle with the northeastern birds in South American waters, and the fact that three out of the five recoveries are from Guyana, where many of the northeastern birds apparently winter, is consistent with his suggestion. However, "leapfrogging" in migratory birds is well-established, with the more northern populations wintering further south, hence Caribbean roseate terns could maintain a discrete wintering area, perhaps in the southern Caribbean. The northeastern birds are known to winter from Colombia to Brazil (Hamilton 1981, Trull 1988). Bands have been recovered from birds trapped at night for food, particularly in Guyana. Immature birds and most yearlings generally do not migrate northward, but remain on wintering areas (Nisbet 1984).

Saliva (pers. obs.) reported a flock of about 55 roseate terns and a common tern approximately half a mile off Mary's Point, St. John, on October 8, 1992. Most roseates in that flock were adults in winter plumage. He also observed a flock of some 65 roseate terns, one common tern, and two black terns (*Chlidonias niger*) feeding about 2 miles off the coast of Ponce, Puerto Rico, on October 9, 1992. Roseates in that group were mostly adults in winter plumage, although several had tail streamers and bright orange legs. During January 1993, Saliva

with the passage of the Migratory Bird Treaty Act, significantly curtailing the exploitation of the past century. Following protection, roseate tern populations slowly recovered until the 1950's and 1960's when, somewhat erratically, they began to decline again. In the 1970's the decline became alarming, particularly in the face of a general increase in the population of common terns with which the roseates nest (Buckley and Buckley 1981).

Current Status and Trends

For the purpose of this recovery plan, the following seven areas comprise the Caribbean region:

Florida Keys and Dry Tortugas
Bahamas (including Turks & Caicos)
Greater Antilles and Virgin Islands
Lesser Antilles
Trinidad & Tobago
Southern Caribbean
Central American Coast

Countries included in these areas are shown in Figure 1. The known distribution of roseate terns within these seven areas is described below in Table 2.

TABLE 2. Estimated roseate tern population in the Neotropics* (after Gochfeld 1983).

Location	Documented pairs	Suspected additional pairs	Probable maximum pairs
Florida	200-300		
Bahamas	------	500-2500[a]	
Greater Antilles	200-500	500[a]	
Virgin Islands	1200-1600	400[a]	
Lesser Antilles and Trinidad	200-300	1000[a]	
Central America	15-50	500[a]	
South America	200-400	600[a]	
Regional Total	2015-3150	3500-5500	8450

* There was formerly a population on Bermuda which was extirpated by poaching in the 1850's, and the birds have not nested since, although they do occur as scarce spring migrants (Wingate 1973).

a= Area is characterized by scattered small colonies; larger colonies (> 100 pairs) are uncommon or undocumented.

Table 3. Key of known breeding locations of Roseate Terns in the Caribbean for Figure 1.

Figure Number	Location
1	Mexico (Gulf coast)
2	Belize (adjacent islands)
3	Honduras (adjacent islands)
4	Serrana Bank (Colombia)
5	Pedro Cays (Jamaica)
6	Jamaica
7	Haiti
8	Beata and Alto Velo (Dominican Republic)
9	Dominican Republic (Caribbean coast)
10	Saona and Catalinita (Dominican Republic)
11	La Parguera Cays (Puerto Rico)
12	Vieques (Puerto Rico) (adjacent islands)
13	St. Croix (U.S. Virgin Islands)
14	St. Kitts (British Virgin Islands)
15	La Orchilla (Venezuela)
16	Los Roques (Venezuela)
17	Las Aves Island (Venezuela)
18	Bonaire
19	Curaçao
20	Aruba
21	Tobago
22	Barbados
23	Grenada
24	St. Vincent
25	St. Lucia
26	Martinique
27	Dominica
28	Guadalupe
29	Antigua
30	St. Barts (adjacent islands)
31	St. Martin (adjacent islands)
32	Sombrero
33	British Virgin Islands
34	U.S. Virgin Islands
35	Culebra (Puerto Rico) (adjacent islands)
36	Cordillera Cays (Puerto Rico)
37	Bahía Samaná (Dominican Republic)
38	Turks and Caicos
39-43	Bahama Islands
44	Florida Keys and Dry Tortugas
45	Bermuda

estimates a total population range between 1,000 and 2,000 pairs, concordant with the less precise estimate by Gochfeld (1983) of 500 to 2,500 pairs.

Halewyn and Norton (1984) reported about eight breeding sites in the Bahamas and Turks and Caicos, but gave a documented estimate of about 50 pairs. Sprunt (pers. comm. in Nisbet 1980) did not observe roseate terns in an extensive cruise in the southern Bahamas in 1979, but saw 10 to 15 birds off Crooked Island and several hundreds in the Exumas. He found a colony of 40 pairs on Little Rock near Hawksbill Bay and suspected other colonies near Norman's Key and Guana Key. Bond (1958) cited a report of many "common terns" nesting on Stocking Cay off Great Exuma.

Sprunt (1984) reported confirmed breeding at Fish Cays (Little Bahama Bank), Hawksbill Rock, Little Bell Island, Little San Salvador, and Clarencetown Cays on the Great Bahama Bank. Paterson (cited in Nisbet 1980) did not list roseate terns at all for the Bahamas, but stated that common terns bred in colonies on cays from Abaco to Inagua between April and August. In contrast, Buden (1979) listed the common tern only as a migrant, and listed the roseate tern as a relatively uncommon but regular summer resident, reported from May through August. Buden (1979) listed records from Bird Rock, Crooked Island, Acklins, Great Inagua, Little Inagua, the Caicos (West, Ft. George Cay, Middle), and the Turks (Round, Long, Salt and Big Sand Cays; cited by Nisbet 1980).

Greater Antilles and Virgin Islands

Cuba - Nisbet (1980) found three references to roseate terns in Cuba. Montaña and Garrido (1965) found three nests on Cayuela La Vela in the same area in 1963, which they considered the first nesting record of the species in Cuba. According to Garrido and Montaña (1975), roseates probably nest also on Mono Grande and Los Ballenatos, but the location of these islands remains to be documented. Halewyn and Norton (1984) indicate four probable breeding areas but no population estimate.

Jamaica - Bond (1950) listed the species as breeding on the Pedro Cays south of Jamaica, but the basis of this record is unknown. There is no evidence that roseates have nested there since then (Haynes 1987). It is likely that disturbance and egg collecting contributed to their decline. Regarded as a luxury, seabird eggs are considered to have aphrodisiac properties and command a higher price than chicken eggs (Haynes 1987). Licenses are issued for legalized collecting of eggs, but there is no management, and adult seabirds may be shot for sport or fish bait.

Anegada, and the BVI without evidence of breeding, and as accidental in St. Croix. Halewyn and Norton (1984) show about 2,000 pairs of roseates in 3 to 6 colony sites for 1981 in the USVI, plus 40 pairs in the BVI. However, the numbers have been less than 1,500 pairs in recent years.

Roseate terns nest in several colonies in the USVI and BVI, and Nisbet (1980) considered this area the stronghold of the Caribbean roseate terns. Beatty (cited by Nisbet 1980) reported breeding at Bank Island, St. Croix, and colonies of 200 birds on cliffs at Bivoni Bay and at Little Saba Cay, St. Thomas, from 1939 to 1940.

Nichols (cited by Nisbet 1980) recorded roseates from 17 small islets of St. Thomas and St. John, but he reported only one definite colony of 200 pairs on Cas Cay, and 15 pairs of common terns on Little Flat Cay. According to R. A. Dewey (*in litt.* to Nisbet 1980) roseate terns also nested on Shark, Saba, Dog, and Flat Cays in 1956, and on Saba in 1971.

Nisbet (1980) reported on roseate terns studied by R. Dewey from 1976 to 1979. During that time, no common terns were found in the Virgin Islands. Estimates of breeding population on eight known colonies were summarized by Nisbet (1980), suggesting a decrease from about 1,500 pairs in 1976 to 750 pairs in 1979.

There is very little published information on seabirds of the BVI. Nisbet (1980) notes that the 1976 Cambridge Ornithological Expedition reported up to 200 roseate terns feeding, but the only breeding colonies noted were 30 pairs on Guana Island, 20 pairs on Cooper Island and perhaps 10 pairs on Cockroach Island. Dewey (Nisbet 1980) reported that fishermen from the USVI had told him that roseates used to nest in large numbers in BVI, but have been reduced by egging which is legal in the BVI.

In 1980, over 1,000 roseate terns were observed on Leduck Cay, St. John, and some nests were found (Norton 1980). In 1987, about 50 pairs of Roseates were nesting on a small cay off Middle Caicos (Norton 1987). Roseate terns were found nesting at additional sites in the BVI at Round Rock, Watson Rock (near Great Tobago) and off the west point of Jost Van Dyke, and probably also near Ballast Bay, St. Kitts (Norton 1987).

In late July 1991, adult and young roseate terns were observed roosting and feeding near Mary Point, Water Lemon Cay, and Great Thatch Island on the north coast of St. John (USVI). These were probably birds dispersing from their breeding colonies in either the USVI or BVI.

Lesser Antilles - Halewyn and Norton (1984) showed roseates nesting on 9 or 10 islands in this group with a maximum of 50 pairs on Antigua and a total of less than 100 pairs known.

Pinchón (cited in Nisbet 1980) reported a small colony of roseate terns nesting each year on the islets Poirier and Touaou in the Baie des Anglais in Martinique, and in Saint Lucia, a juvenile (young of the year) and several adult roseate terns were seen fishing on the Castries harbor in August 1991, suggesting a possible breeding site nearby (Saliva and Pierce, pers. obs.).

Wells (cited in Nisbet 1980) stated that roseate terns formerly bred in large numbers at Jacka-dan Island (Isle Jacques Adams) near Hillsborough, Carriacou, in the Grenadines but had recently moved to Frigate Island and Rose Rock. He also reported that roseate terns were numerous on Grenada frequenting all the bays around the coast. He found nests at Lee Rocks in May. Devas (1942) considered them common breeders but provided no details.

Danforth (1936) found a large colony of roseate terns nesting with laughing gulls on Glover's Island on July 31, 1935. Devas (1942) reported breeding roseate terns on Green Island.

Trinidad and Tobago - Bond (1970) reported that a colony of roseates was discovered at Tobago in 1966 on a rocky slope opposite the St. Giles Islets. Dinsmore (1972) saw 30 to 40 roseate terns on April 22 on the north side of Little Tobago, and in late May 1966, he located their nesting colony on the northeast tip of Tobago. About 200 adults were present. The colony was still active in 1967 (Dinsmore 1972). In mid-April 1978, French (*in litt.*) found 40 roseates in southwestern Tobago looking as if breeding was imminent. He estimated the population for the Tobago coast at 500 to 1,000 birds, but Halewyn and Norton (1984) give a value of 200 pairs.

Southern Caribbean - In the Southern Caribbean, roseate terns are known to nest on the Venezuelan Islands and on the Netherlands Antilles. Halewyn and Norton (1984) estimated about 140 pairs on Aruba, Curacao, Bonaire, and two Venezuelan island groups. Phelps and Phelps (1955) found roseate terns nesting on five islands in this archipelago (Noronqui, Buchiyaco, islet northeast of Nordisqui, Los Canquises, and Sarqui) between 1954 and 1958. LeCroy (1976) spent 6 weeks on Los Roques in 1973 studying nesting terns. She heard a pair of roseate terns daily on Fransisqui but never found their nest. She surmised from their bill color that these might have completed nesting.

Van de Werf *et al.* (1958) saw large numbers of roseates on Ave de Sotavento and Isla de Sterna on May 20-21, 1956, and found three nests on Isla de Bubí on May 18, 1956.

Voous (1983) reported that the roseates are summer visitors to the Netherland Antilles from mid-April to early August. The first breeding record was by Hartert in 1892, with no subsequent record until 1961 when roseates nested in the same place. At present they nest at one locality in Aruba (reef islands off

Shealer, unpub. data). As mentioned previously, behavioral differences are found between these two major nesting areas, namely within-season intercolony movement.

Although the cause remains unknown, it seems as if predation may be an important factor determining the differences in behavior and reproductive success. At Culebra, roseate terns confront 14 potential predators (Saliva and Burger 1989, Shealer and Burger 1992). Since fewer sheltered places for chicks are found at Culebra, they are more vulnerable to predators. The cays of La Parguera provide plenty of sheltered places for chicks to hide. Also, the major predators (hawks, laughing gulls, land crabs, and hermit crabs) are infrequent or absent from some of these cays. Halewyn and Norton (1984) mention egging, human disturbance, rat predation, and netting of adults in Guyana as the main factors affecting the Caribbean roseate terns.

Human Disturbance - Human disturbance poses a major threat to seabird colonies. Types of human disturbance include trampling of nests, flushing of adults and chicks, and collecting of eggs. In the Caribbean, egging has a long history and continues to be a major problem not only for roseate terns, but also for other seabirds (Ogden *et al.* 1985). Eggers have eliminated large colonies in the Virgin Islands (Philibosian in litt.). Egging is an annual event on the Central American coast as well (Udvardy 1973). Haynes (1987) provided an elaborate account of egging of Jamaica's terns. Halewyn (1987) noted that Aruba's terns were subject to egging even though it was illegal, and over 200 eggs were confiscated by police in 1977. Sprunt (1984) noted that although commercial egging has been stopped in the Bahamas, eggs and nestlings were still taken for food.

In Culebra, egging had been a tradition until the U.S. Navy transferred their land (including seabird nesting grounds) in Culebra to the Service. Since then, egging has diminished and people are more reluctant to collect eggs, fearing to be arrested by Service agents. Nevertheless, roseate tern colony site abandonment suggests that egging may still be occurring at Culebra.

Egging may be the greatest threat to nesting terns, and it is critical to document the extent of egging, particularly in colonies under United States jurisdiction. In some jurisdictions egging is legal. Such poaching should be either eliminated or regulated. Chicks and breeding adults are also captured for food (Ogden 1985), but the impact of this appears less impressive than the taking of eggs.

Predation - Predation is one of the major natural forces with which colonial nesting seabirds must contend. Predators can be placed into four major categories: crabs, ants, birds, and mammals.

Puerto Rico, can be severely affected and changed by high tides or strong waves. Human impact on the habitat of roseate terns has been considerable, like at Key West, Florida. In some other parts, such as the Dry Tortugas and Culebra, military ownership of the cays can provide some protection. On the other hand, military ownership can be detrimental to nesting terns when their habitat is used for military practices (Kepler and Kepler 1978).

Pollution - Hays and Risebrough (1972) suggested that congenital defects in roseate terns were related to organochlorine contamination, yet Custer *et al.* (1983) found low levels of organochlorines in roseate tern eggs in 1981. We have no data on the role of pollution in the Caribbean population. Data from feathers of 10 adult roseate terns from Culebra in 1989 had mercury levels of 700 to 3000 parts per billion (Burger and Gochfeld, unpub. data). These levels are lower than those associated with disease or birth defects on terns, but it would be important to document pollutant levels, particularly for pesticides which are widely used in the Caribbean Islands.

Oil spills and slicks might potentially affect roseate terns. Several seabird species in oiled condition are reported in Puerto Rico and the USVI, and some roseate terns with varying degrees of oiling have been observed (Shealer, pers. comm.).

B. Narrative Outline

1. Protect and manage roseate tern populations and their habitat to prevent further population decline and increase productivity. A stable population of roseate terns can only be obtained when breeding colonies are appropriately protected, and the habitat is enhanced for maximum breeding success.

   1.1 Protect breeding sites. The protection of currently known breeding areas should be given the highest priority.

      1.11 Develop protection programs at existing breeding areas. Conservation programs should be developed to encourage the protection of roseate tern colonies. Posting of breeding areas, regular patrolling of these areas during the breeding season, limiting recreational use, and techniques for predator control are examples of programs necessary to achieve protection of breeding terns. At present, programs to protect and manage roseate tern colonies in the Caribbean, other than those under the jurisdiction of the United States, are not known. The recovery of this species will depend on the development of these programs, coordinating efforts with all the different countries involved.

      1.12 Determine ownership of nesting areas. Ownership of sites used by roseate terns should be determined to effect protective measures. Landowners in these areas should be appraised of the importance of their land for breeding terns, and appropriate guidance should be provided to them as to how to avoid disturbance to nesting terns.

      1.13 Educate the public on protection and conservation of roseate terns and their habitat, and regulations pertaining to this species' survival. Governments and agencies with jurisdiction over roseate tern colonies should become involved in the education of the public on general conservation values as well as on the importance of protecting this species and adhering to Federal or local regulations. One step could be the preparation of an illustrated brochure to be distributed to local groups, schools, and organizations. Permitting and funding agencies should be made aware of the threatened status of Caribbean roseate terns, the pertinent laws

areas to feed. Whenever possible, these nuisance birds should be scared off or trapped and relocated away from tern colonies. If these measures prove unsuitable, shooting of the nuisance bird may be considered. Federal and State permits are required to remove these birds.

1.242 Control mammalian predators. Remoteness of roseate tern nesting colonies provides protection to the terns against mammals. However, some cases have been reported of roseate terns nesting on the mainland in areas where rats, cats, or dogs may reach them. Trapping, removal, and poisoning of these animals are some of the protective measures necessary to prevent loss of terns to these predators.

1.243 Control crabs. Hermit and land crabs prey upon hatchlings and very young terns. However, it seems as if chicks are vulnerable to these predators only when the adult terns are absent from the nest area. Otherwise, adults usually prevent crabs from getting close to the nests. In cases where crabs are too abundant, or when other disturbances keep adult terns away from the nests, trapping and relocation of crabs may be desirable.

1.244 Control ants. Some species of ants (e.g., *Solenopsis invicta*) may kill young terns when eggs are pipping or soon after hatching. The use of ant poisons or traps in areas of high incidence of these insects may be necessary.

1.245 Prevent human disturbance and predation. Poaching of eggs is the most important human factor affecting roseate terns. In some areas egging is legal, but there is no control on the number of eggs collected. The effect of this disturbance on the terns' reproductive success is not known. In other areas egging is illegal, but the governments do not have the facilities or manpower to patrol the tern colonies. Patrolling during the early stages of

mortality, interspecific interactions, and impacts of contaminants on breeding terns.

3.1 Determine food availability. Where possible, food used by roseate terns should be ascertained. This may involve direct observations of feeding birds, observations at the nesting colony, fish brought to chicks or dropped at nests, or regurgitation samples. Where roseate terns are feeding over shoals of fish, it would be desirable to collect samples of fish. A study of fish availability in the vicinity of colonies using an echo-sounder would be useful.

3.2 Determine hatching and fledging success. Clutch size should be determined to assess hatching and fledging success. The number of eggs hatched, as well as the number of chicks surviving to the fledging stage, should be monitored throughout the breeding season.

3.3 Determine causes of mortality. For each colony, the causes of reproductive failure should be documented. After determination of the causes of mortality, colonies which can be protected should be identified, and a colony-specific plan should be drawn up to develop protective measures which can be implemented effectively.

3.4 Evaluate interspecific interactions. There is basically no information on possible competition for nest space between roseate terns and other seabirds that use the same breeding areas. Particularly important is to determine the order of species arrival at the breeding areas, at what point roseate tern nesting habitat may be usurped, and which habitat characteristics the intruder species select that may affect subsequent utilization by roseate terns.

3.5 Evaluate impact of contaminants on roseate terns. Determination of toxicant levels in abandoned eggs, dying chicks, feather samples, and fish samples would be useful to evaluate the contribution of chemical contaminants to reproductive failure.

4. Determine post-breeding dispersal and wintering grounds.

4.1 Assess post-breeding dispersal of adult and young roseate terns. A Caribbean-wide survey of non-breeding roseate terns will be useful to supplement anecdotal reports in the literature. Where terns are sighted, species identification should be ascertained, and whenever possible, bill coloration and color band combinations, if present, should be documented.

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PART III. IMPLEMENTATION SCHEDULE

Priorities in Column 1 of the following Implementation Schedule are assigned as follows:

Priority 1 - An action that must be taken to prevent extinction or to prevent the species from declining irreversibly in the foreseeable future.

Priority 2 - An action that must be taken to prevent a significant decline in the species population/habitat quality or some other significant negative impact short of extinction.

Priority 3 - All other actions necessary to provide for full recovery of the species.

IMPLEMENTATION SCHEDULE

Priority #	Task #	Task Description	Task Duration (Yrs)	Responsible Party			Cost Estimates ($K)			Comments
				FWS Region	Division	Other	FY 1	FY 2	FY 3	
1	4.2	Determine wintering grounds.	4-6	4	TE	GOV NBS	12	10	10	
2	1.12	Determine ownership of nesting areas.	2-4	4	TE	GOV NBS	2	1		
2	1.21	Manipulation of vegetation.	annual	4	TE CINWR	PRDNR DPNR NBS	2	2	2	
2	2.11	Identify and evaluate potential breeding colony sites.	2-4	4	TE CINWR	PRDNR DPNR NBS	4	3	3	
2	3.4	Evaluate interspecific interactions.	3-5	4	TE	NBS	3	3	3	
2	3.5	Evaluate impact of contaminants.	annual	4	TE TS	PRDNR DPNR	4	4	4	
2	4.1	Assess post-breeding dispersal of adult and young.	3-4	4	FWE	NBS	10	10	10	

IMPLEMENTATION SCHEDULE

Priority #	Task #	Task Description	Task Duration (Yrs)	Responsible Party			Cost Estimates ($K)			Comments
				FWS Region	Division	Other	FY 1	FY 2	FY 3	
LIST OF ABBREVIATIONS, Continued										
PRDNR - Puerto Rico Department of Natural Resources										
DPNR - U.S. Virgin Islands Department of Planning and Natural Resources										
FAS - Florida Audubon Society										
GOV - Government agencies outside the U.S. with jurisdiction on roseate tern colonies										
NBS - National Biological Survey										