Listed Distinct Population Segment of the Brown Pelican *(Pelecanus occidentalis)*

5-Year Review: Summary and Evaluation

U.S. Fish and Wildlife Service
Division of Ecological Services
Southwestern Regional Office
Albuquerque, New Mexico

5-YEAR REVIEW

Species reviewed: Listed Distinct Population Segment of the Brown pelican (*Pelecanus occidentalis*)

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I. GENERAL INFORMATION

The brown pelican (*Pelecanus occidentalis)* is listed as an endangered distinct population segment (DPS) throughout its range except for the Atlantic coast of the U.S., Florida and Alabama. This DPS has a wide distribution including the Gulf Coast of the U.S. from Mississippi to Texas, California, Mexico, the Caribbean, Central America, and South America.

I.A. Methodology used to complete the review

We published a notice in the Federal Register on May 24, 2006, that announced a 90-day finding on a petition to delist the California brown pelican and the initiation of a 5-year review of the status of the listed brown pelican. Information was directly requested from resource agencies in states, U.S. Territories, the Commonwealth Puerto Rico, and foreign countries within the range of the listed brown pelican distinct population segment. This information, along with scientific information from Service offices and National Wildlife Refuges, recovery plans, biological opinions, species experts, state agencies, peer-reviewed literature, unpublished reports, and information available on the Internet was used in the preparation of this document. Various portions of this document were drafted by staff of the Southwestern Regional Office of the U.S. Fish and Wildlife Service, the Clear Lake Ecological Services Field Office (Texas), and the Ventura Fish and Wildlife Office (California).

I.B. Reviewers

Lead Regional Office (for this 5-year review): Southwest Regional Office, Albuquerque. Contact: Steven M. Chambers, 505/248-6658.

Cooperating Regional Offices:

Southeast Regional Office, Atlanta, Georgia. Contact: Kelly Ann Bibb, 404/679-7132.

California-Nevada Operations Office, Sacramento. Contact: Diane Elam, 916/414-6453.

I.C. Background

I.C.1. FR Notice citation announcing initiation of this review: 71 Federal Register 29908-29910; May 24, 2006.

I.C.2. Listing history

The brown pelican was included on the United States List of Endangered Foreign Fish and Wildlife that was published in the Federal Register (35 FR 84960) on June 2, 1970, and on the United States List of Endangered Native Fish and Wildlife that was published in the Federal Register (35 FR 16047) on October13, 1970. These separate lists of foreign and native species were compiled under the authority of the Endangered Species Conservation Act of 1969 and effectively listed the brown pelican throughout its range.

These lists were republished in the Federal Register (39 FR 1171) on January 4, 1974, along with new regulations for endangered wildlife. This Federal Register publication cited the authority of the Fish and Wildlife Conservation Act of 1969. This publication date immediately followed the December 28, 1973, signing of the Endangered Species Act of 1973. When these lists and other endangered species regulations were published at 50 CFR Part 17, the authority citation was changed to the Endangered Species Act of 1973. This effectively established ("grandfathered") the earlier lists, which included the brown pelican, as lists of endangered species under the Endangered Species Act of 1973.

On February 4, 1985, the Service published a final rule in the Federal Register (50 FR 4938-4945) that removed endangered status for brown pelicans on the Atlantic and Gulf coasts of the United States, except for Texas, Louisiana, and Mississippi. The remaining listed entity is described in the "Vertebrate population where listed as threatened or endangered" column of the list (50 CFR 17.11) as "Entire—except U.S. Atlantic coast, Florida, and Alabama."

The entity that remains listed as endangered under the Endangered Species Act is therefore a distinct population segment of the brown pelican. This distinct population segment is the subject of this 5-year review.

I.C.3. Associated rulemakings: None.

I.C.4. Review History

A 5-year review was carried out in 1979. The 1984 reclassification that removed endangered status for brown pelicans on the U.S. Atlantic coast, Florida, and Alabama was the result of that review.

I.C.5. Species' Recovery Priority Number at start of review: 9.

I.C.6. Recovery Plan or Outline

Recovery Plan for the Eastern Brown Pelican, August 1, 1980.

Brown Pelican Recovery Plan; Puerto Rico/U.S. Virgin Islands Population, December 24, 1986.

The California Brown Pelican Recovery Plan, February 3, 1983.

No subsequent revisions have been made to any of these original recovery plans.

II. REVIEW ANALYSIS

II.A. Application of the 1996 Distinct Population Segment (DPS) policy

II.A.1. Is the species under review listed as a DPS? Yes.

II.A.2. Was the DPS listed prior to 1996? Yes. The reclassification that designated the DPS was published in the Federal Register on February 4, 1985 (USFWS 1985).

II.A.2.a. Prior to this 5-year review, was the DPS classification reviewed to ensure it meets the 1996 policy standards? No.

II.A.2.b. Does the original DPS listing meet the discreteness and significance elements of the 1996 DPS policy? No.

The listed DPS does not meet the discreteness criterion of the DPS policy because it is not markedly separated from other populations of the same taxon. The boundary between the listed DPS and other populations of brown pelicans is the state boundary between Mississippi and Alabama. The best argument that can be made that this markedly separates the DPS from other brown pelicans is the historical absence of breeding records for the species in Mississippi. This argument is ultimately unconvincing because the gap in the brown pelican's range represented by Mississippi's Gulf Coast represents a very small distance relative to the documented dispersal powers of brown pelicans along the Gulf Coast (Holm et al., 2003). Although brown pelicans are not known to nest in Mississippi, they are consistently present in certain areas.

II.A.3. Is there relevant new information regarding application of the DPS policy to this DPS (i.e., is there new information since the original (either pre- or post-1996) DPS listing that indicates a need for splitting out, combining or otherwise re-configuring DPSs, or that the listed entity is no longer consistent with the DPS policy)?

Yes. Designation of this DPS preceded the issuance of the DPS policy and was the incidental outcome of the delisting of brown pelicans in a large portion of the species' range in the eastern U.S.

II.A.4. Is there relevant new information that would lead you to consider

listing this species as a DPS in accordance with the 1996 policy? No.

II.B. Recovery Criteria

II.B.1. Does the species have a final, approved recovery plan?

No. The three approved recovery plans each cover a portion of the range of the brown pelican (eastern U.S., Puerto Rico/Virgin Islands, and California) but do not together cover the entire range of the species or of the listed DPS. The remainder of the range outside the U.S., including Central America, South America, and most of the Caribbean region is not covered by a recovery plan.

II.B.2. Does the recovery plan contain objective, measurable recovery criteria?

The recovery plan for brown pelicans in the eastern U.S. does not include downlisting or delisting criteria.

The recovery plan for the brown pelicans in Puerto Rico and the U.S. Virgin Islands includes objective, measurable delisting criteria for the area covered by the plan.

The recovery plan for the California brown pelican includes objective, measurable criteria for delisting the subspecies breeding in California and Baja California.

II.B.3. Adequacy of recovery criteria.

a. Do the recovery criteria reflect the best available (i.e., most up-to-date) information on the biology of the species and its habitat? No.

Recovery Plan for the Eastern Brown Pelican: The plan does not identify recovery criteria. It states a general objective to re-establish brown pelicans on all historically used nesting sites in Louisiana and Texas. This objective has been achieved through importation of pelicans from Florida, natural immigration of Florida pelicans, subsequent successful reproduction, and creation and enhancement of nesting areas.

The Recovery Plan for the Brown Pelican in Puerto Rico and the U.S. Virgin Islands Population has recovery criteria solely for the area covered by the plan.

The California Brown Pelican Recovery Plan: The criteria are out of date because they do not reflect the best available information on the biology of the subspecies. Since the development of the recovery plan, it has become apparent that the target productivity for downlisting or delisting is probably too high to be attainable. These target productivity values were based on productivity of California brown pelicans in the Gulf of California, Mexico, and of eastern brown pelicans in

Florida, and were thought to be a conservative index for a stable, self-sustaining population (USFWS 1983). However, California brown pelicans have consistently exhibited lower than target productivity over the last 20 years in the Southern California Bight, although the population appears to be stable and healthy (Gress et al. 2003). This lower productivity may be natural in the Southern California Bight, and food resources may not support higher productivity (Anderson et al. 1982).

b. Are all of the 5 listing factors that are relevant to the species addressed in the recovery criteria? No. Procedures followed at the time the brown pelican was originally listed in 1970 did not include a 5 factor analysis published in the Federal Register.

II.B.4. List the recovery criteria as they appear in the recovery plan, and discuss how each criterion has or has not been met, citing information. For threats-related recovery criteria, please note which of the 5 listing factors are addressed by that criterion. If any of the 5-listing factors are not relevant to this species, please note that here.

<u>Recovery Plan for the Eastern Brown Pelican</u>**:** Recovery criteria were not included. A stated objective to restore the brown pelican to former nesting areas of Louisiana and Texas has generally been met (see pages 8-9).

<u>Brown Pelican Recovery Plan; Puerto Rico/U.S. Virgin Islands Population:</u>

1. Observed mean level of 2,300 individuals during winter.

2. Observed mean level of 350 breeding pairs at the peak of the breeding season.

These levels were maintained during the years 1980 through 1984 (Collazo, 1985). Winter counts from 1992 through 1995 averaged only 593 brown pelicans (Collazo et al. 1998).

<u>The California Brown Pelican Recovery Plan:</u>

The goal of the California Brown Pelican Recovery Plan is to restore and maintain stable, self-sustaining populations throughout the subspecies' range. Accomplishment of this goal requires achievement of the following objectives--1) maintain existing populations in Mexico; 2) assure long-term protection of adequate food supplies and essential nesting, roosting, and offshore habitat throughout the range; and 3) restore population size and productivity to self-sustaining levels in the Southern California Bight at both the Anacapa and Los Coronados colonies.

Objective 1 may have been met, as there have been no reported declines of the existing populations in Mexico. However, a range-wide population survey of all

Mexican colonies had not been conducted in more than ten years (Anderson et al. 2004). A survey of all U.S. and Mexican colonies was recently completed in April 2006, and but the results of this survey are not yet available. This survey will help to assess the status of the population and detect if declines have occurred in Mexico.

Significant progress towards objective 2 has been made. Long-term protection of food supplies has been addressed through the Coastal Pelagic Species Fishery Management Plan, which should ensure that adequate forage reserves are available to pelicans and other species along the Pacific Coast in the U.S. Food supplies in Mexico are not assured protection in the long term because pelagic fisheries are not managed, although there are not any currently known threats to food supplies. All nesting colonies in the U.S. are protected from habitat loss and disturbance. All island nesting colonies in Mexico are legally protected, although enforcement is limited and intermittent, resulting in disturbances that reduce nesting success and have been known to result in colony abandonment. Much of the roosting habitat has not been adequately protected in the U.S. or in Mexico, and much of this habitat is susceptible to human disturbance. There is no information that indicates that disturbances to roosting habitat are adversely impacting pelican survival or productivity. However, this issue has received more attention in recent years, and there has been some progress towards this goal (see the 5-factor analysis below for details).

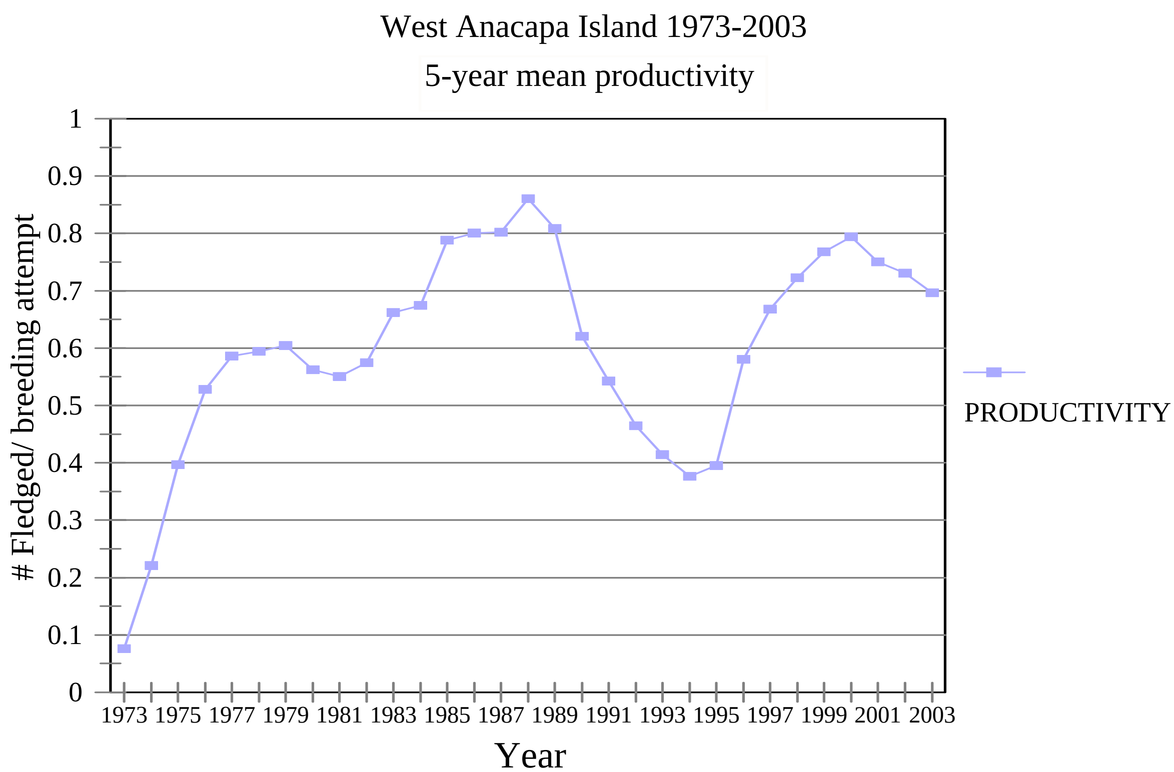
The recovery plan listed specific criteria that should be achieved to fulfill objective 3. These criteria were defined for reclassification and delisting:

a) when any 5-year mean productivity for the Southern California Bight population reaches at least 0.7 young per nesting attempt from a breeding population of at least 3,000 pairs, the subspecies should be considered for threatened status; and

b) when any 5-year mean productivity for the Southern California Bight population reaches at least 0.9 young per nesting attempt from a breeding population of at least 3,000 pairs, the subspecies should be considered for delisting. Consideration for reclassification to threatened would require a total production averaging at least 2,100 fledglings per year over any 5-year period. Consideration for delisting would require a total production averaging at least 2,700 fledglings per year over any 5-year period.

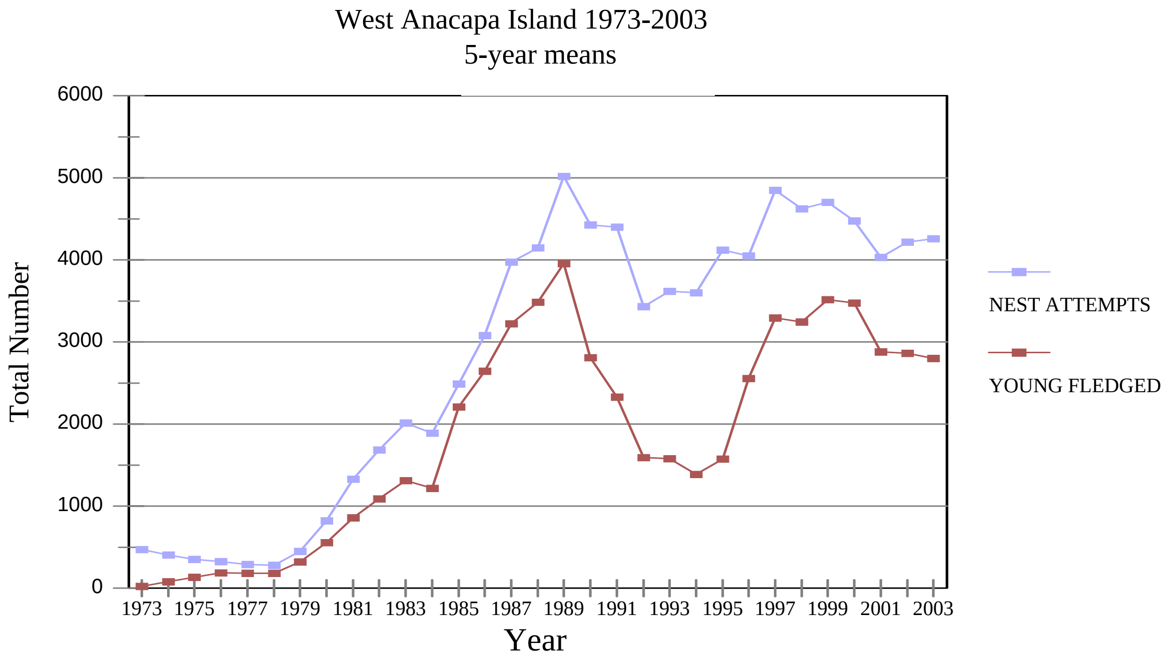
The productivity criterion for reclassification to threatened status has been met at least 10 times since 1985 (Figure 1). The productivity criterion for delisting has not been met, and the Southern California Bight population consistently has low productivity, with a mean of 0.63 from 1985 to 2005 (Figure 1). However, the population criterion of at least 3,000 breeding pairs has been exceeded every year since 1985, with the exception of 1990 and 1992 which saw only 2,825 and 1,752 pairs, respectively (Figure 2). The recovery criterion for reclassification to threatened status of at least 2,100 fledglings per year over any 5-year period has been met at least 15 times since 1985, and the criterion for delisting of at least 2,700 fledglings per year over any 5-year period has been met at least 11 times since 1985 (Figure 2).

Figure 1



Data from Anderson et al. 1975, 1977; Gress 1981; Anderson and Gress 1983; Gress and Anderson 1983; Gress et al. 1990, 1996, 2002, 2003, 2005; Carter et al. 1995

Figure 2



Data from Anderson et al. 1975, 1977; Gress 1981; Anderson and Gress 1983; Gress and Anderson 1983; Gress et al. 1990, 1996, 2002, 2003, 2005; Carter et al. 1995

II.C. Updated Information and Current Species Status

II.C.1. Biology and Habitat

II.C.1.a. Abundance, population trends (e.g. increasing, decreasing, stable), demographic features (e.g., age structure, sex ratio, family size, birth rate, age at mortality, mortality rate, etc.), or demographic trends:

An analysis and summary of information on abundance and population trends is provided in section II.D. (Synthesis) of this document. Population estimates by state and country used in this analysis are provided in Attachments 1-3 to this document.

State of Mississippi: There are no known records of brown pelicans nesting in Mississippi, although they are commonly seen roosting and feeding along the Gulf Coast and on coastal islands.

Louisiana: King et al. (1977) reported the estimated brown pelican population size in 1920 as 12,000 to 85,000 total birds. The historic level of nesting pairs has been estimated as 10,000 to 15,000 nests (USFWS 1985). By the 1960s, brown pelicans in Louisiana experienced total reproductive failure from the effects of pesticide residues in the environment.

Between 1968 and 1980 the Louisiana Department of Wildlife and Fisheries (LDWF) conducted a successful program to reintroduce brown pelicans to Louisiana using Florida colonies as a source of birds. The number of nesting colonies increased to a peak of 14 in 2003. The estimated total number of successful nests increased since the initiation of reintroduction to 16,405 in 2001. The decrease in successful nests to 13,044 in 2003 was attributed to four severe storms that eroded portions of some nest islands and some late nests in various colonies (LDWF 2006a). The population appeared to recover from these impacts and a peak of 16,501 nests were recorded in 2004 (LDWF 2006a, Table 5; LDWF 2006b).

Following the severe hurricane and tropical storm season of 2005, LDWF surveys in 2006 detected 4 nesting colonies and 5,425 nests west of the Mississippi River and 2,205 nests east of the river. Tropical storms in 2004 had already resulted in the loss of three nesting islands west of the river. These 2005 storm events caused additional habitat degradation and negative effects on production west of the river (LDWF 2006b).

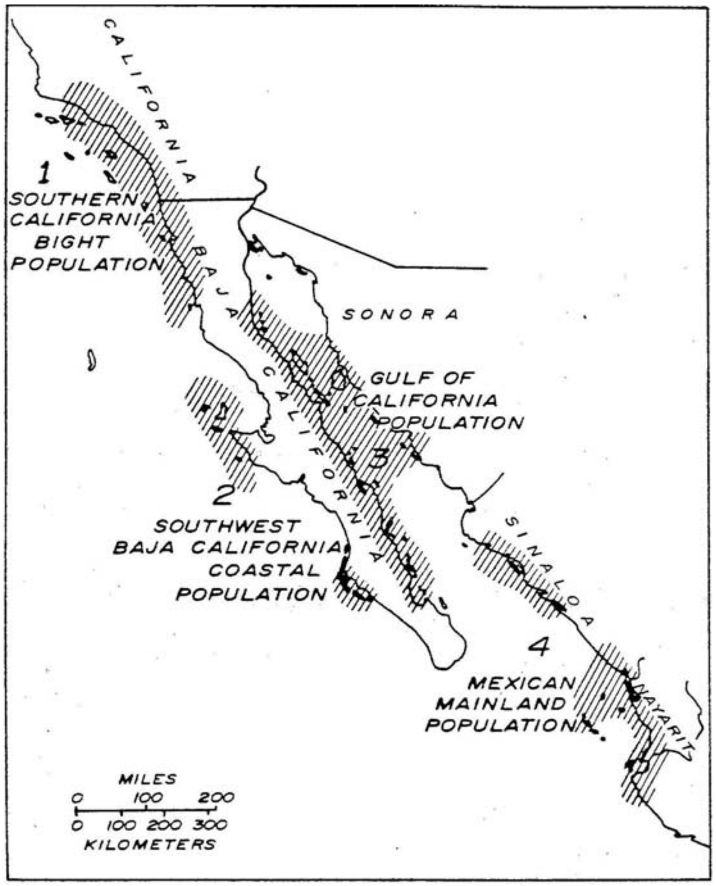
Texas: The Service has estimated that historic population sizes for Texas were in the range of 1,500 to 4,000 nesting pairs (USFWS 1985). Although the brown pelican Texas did not experience the total reproductive failure recorded in Louisiana, only two nests were recorded in the state in 1968 (USFWS 1985). Since that time, there has been an overall increasing trend in both numbers of nesting pairs and active nests, with some year-to-year variation so that small decreases were recorded in some years (TPWD 2006). By 2003, there were 8 colonies and 3,895 active nests (TPWD 2006).

Puerto Rico: Brown pelican reproduction is not believed to have been affected by pesticide contamination in Puerto Rico (Collazo et al. 1998).

The recovery plan (USFWS 1986) identified a delisting criterion for Puerto Rico and the U.S. Virgin Islands as maintaining a 5-year observed mean level of 2,300 individuals during winter and 350 pairs at the peak of the breeding season. The plan then stated that these levels were maintained during the years 1980 through 1984 (Collazo 1985). Winter counts in 1992 through 1995 averaged only 593 birds. The cause of the decline has not been identified.

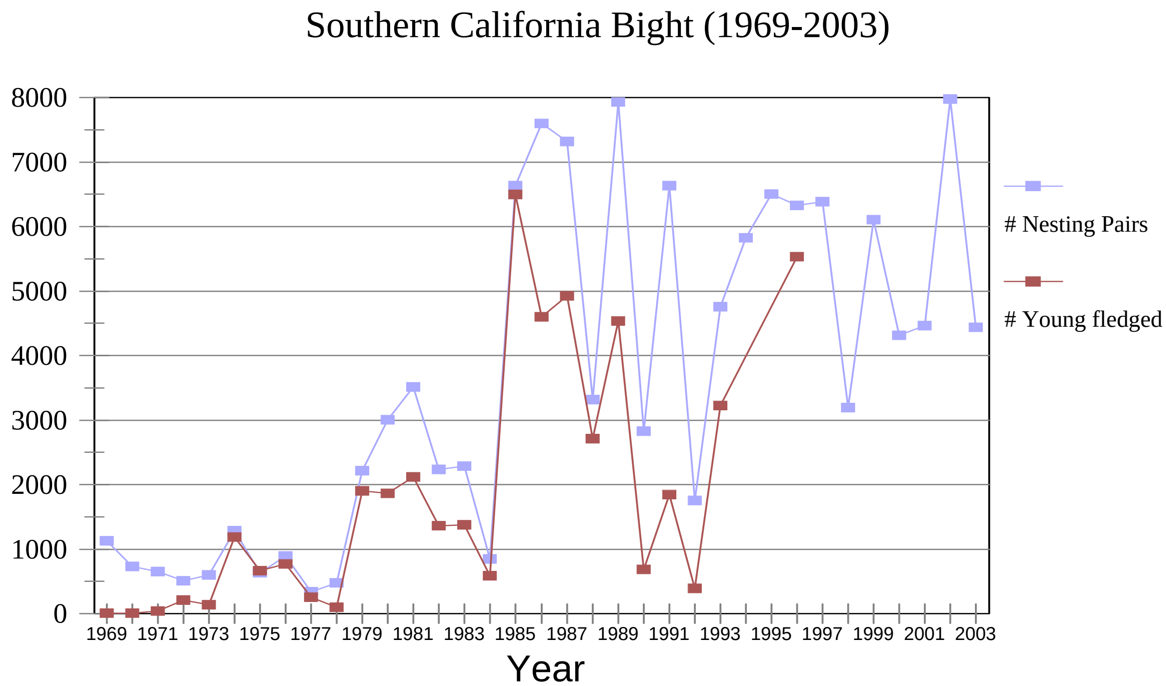
California: The California brown pelican (*Pelecanus occidentalis californicus*) ranges from California to Mexico along the Pacific coast (del Hoyo et al. 1992). The most recent estimate of the total population in 2002 is 150,000 birds (Gress in litt. 2005). They nest in four distinct geographic areas: 1) Southern California Bight, 2) Gulf of California, 3) southwest Baja California coast, and 4) mainland Mexico (i.e., Sinaloa and Nayarit) (Figure 3). Approximately 5-10 percent of the population nests in the Southern California Bight and 90-95 percent nests in southwest coastal Baja California, the Gulf of California, and along the coast of mainland Mexico.

Figure 3. Map of the four nesting populations of California brown pelicans



The Southern California Bight population is currently estimated at 6,000 nesting pairs at five colonies: West Anacapa Island, Santa Barbara Island, Coronados Islands, Islas Todos Santos, and Isla San Martín. This population declined to fewer than 1,000 pairs, and reproductive success was nearly zero, during the late 1960s and early 1970s (Service 1983). Reproductive success and population numbers began recovering in the late 1970s, although productivity and number of nesting pairs at all colonies fluctuates widely by year in response to food availability (Figure 4). The largest colony in the Southern California Bight occurs at West Anacapa Island, with a mean of 4,500 nesting pairs and a mean of 0.67 young fledged per nest attempt from 1985-2005 (Gress and Harvey 2004; Gress in litt. 2005). The Coronados Islands colony in the Southern California Bight declined and experienced low productivity from the late 1970s to the late 1980s due to chronic human disturbance from fishermen visiting the islands and possible overfishing (Anderson 1988). It is thought that many of these pelicans went to Anacapa and Santa Barbara Islands, because a colony was established at Santa Barbara Island in the early 1980s after a 50-year or longer absence, and the Anacapa Island colony increased dramatically during this time (USFWS 1983, Gress et al. 2005). The Santa Barbara Island colony has continued as the second-largest colony in the Southern California Bight since the 1980s, with a mean of 825 pairs from 1985-2005. The Coronados Islands had a mean of 630 pairs from 1985-2005 (Gress 2005); however, this colony has improved in recent years and there were about 830 pairs per year from 2002 to 2004 (Gress et al. 2005, Gress 2005).

Figure 4



No data from Los Coronados Islands from 1992, 1994, 1996-2001
Data for # young fledged not available for SCB after 1996

Data from Anderson et al. 1975, 1977; Gress 1981; Anderson and Gress 1983; Gress and Anderson 1983; Gress et al. 1990, 1996, 2002, 2003, 2005; Carter et al. 1995.

Two previously extirpated colonies in the Southern California Bight, Islas Todos Santos (extirpated in 1923) and San Martín (extirpated in 1974), were recently found to be occupied (Gress et al. 2005). At Todos Santos Island, about 65 nests were seen in 2004, there were not nests in 2005, and this colony is considered to be ephemeral (Gress et al. 2005). At San Martín Island, 35 pairs were observed in 1999, a small colony was noted in 2000, and 125-200 pairs were observed in 2002, 2003, and 2004 (no surveys in 2001 and 2005; Gress et al. 2005) These islands may have been recolonized as a result of relatively low human disturbance in 2002 and 2003 (Gress et al. 2005). In addition, recent seabird restoration projects that occurred at both islands may have benefited nesting pelicans. Feral cats were eradicated from San Martín in 1999-2000 (Lukenbach Trustee Council 2000). Cats and rabbits were eradicated from Todos Santos in 1998, and burros were removed in 2004 (Montrose Settlements Restoration Program 2005).

The Gulf of California population is estimated at 40,000 breeding pairs, the southwest Baja California coastal population has about 4,000 pairs and the mainland Mexico population has about 15,000 pairs, although this is based on data that is more than 10 years old (Anderson et al. 2004). It is thought that these populations have been stable since the early 1970s because of their lower exposure to organochlorine pesticides, although annual numbers fluctuate widely due to prey availability and human disturbance at colonies (Everett and Anderson 1991).

Roosting is an essential life-history trait for pelicans, as it allows them to conserve energy and dry and maintain plumage (Jaques and Strong 2002; Strong and Jaques 2003). Pelicans gather in communal roosts along the Pacific Coast as far north as British Columbia. Major roosts are found on manmade structures such as piers, breakwaters, and jetties, on islands and offshore rocks, and on beaches at the mouths of estuaries (Jaques and Anderson 1987). The central California coast supports an important temporal component of their roosting habitat; during fall surveys (1998-2000), 69-75 percent of pelicans were found at roost sites in this area (Strong and Jaques 2003).

The Salton Sea is used as a roosting area for non-breeding California brown pelicans (i.e., juveniles and sub-adults) during the post-breeding season. Current numbers far exceed historical numbers from the 1970s. A maximum of 105 birds was recorded in August 1972, and currently 3,000-4,000 birds are regularly recorded in July and August (Sony Bono Salton Sea National Wildlife Refuge Complex 2005a). There was a small number of breeding attempts at the Salton Sea in the mid-1980s, although none have been reported before or since (Sony Bono Salton Sea National Wildlife Refuge Complex 2002). The Salton Sea may be a significant roosting/foraging area, or it may eventually become a new breeding location. The nearby Colorado River Delta is also an important post-breeding roosting area.

<u>Other countries:</u> A few population estimates have been made for local populations in other countries:

> Eastern Mexico: The largest known breeding colony in eastern Mexico, mainly on Isla Contoy, Quintana Roo, was reported to be 432 pairs in 1986 and 700-1,000 pairs in 1996 (Blankenship 1987, Shields 2002). Four other colonies in this region colonies accounted for 128 nesting pairs in 1986 (Blankenship 1987). Aerial surveys of eastern Mexico resulted in counts of 4,438 birds in 1979-1980 and 2,270 birds in 1986 (Blankenship 1987).
>
> Belize and Caribbean coast of Honduras: Fewer than 100 breeding pairs (Shields 2002).
>
> El Salvador: About 800 individuals (estimated from graph of abundance in Ibarra Portillo [2006]) are widely-distributed along the Pacific Coast of

El Salvador.

Pacific coasts of Honduras and Costa Rica: “Perhaps as many as 1,000 pairs” (Shields 2002). The Costa Rican Ministry for Environment and Energy has reported to us that several breeding colonies exist on the Pacific coast from the Nicaraguan border to the Gulf of Nicoya and include the islands of Bolaños and Guayabo. The Ministry provides legal protection from hunting and trade and for breeding areas (Ramírez 2006).

Panama: In 1988, 6,031 brown pelicans were counted in the Gulf of Panama, and in 1993, 582 brown pelicans were counted on the Caribbean coast and 3017 on the Pacific coast (Shields 2002). Angehr (2005) has provided estimates of 15,000 brown pelicans for Panama and 290,000 for the global population of the species. He reported nest numbers for the two known nesting areas as 4,877 at 18 sites on the Gulf of Panama and 150 nests at Isla Coiba off the Pacific coast in 1976. He also reported that individual colonies that had been studied experienced an overall increase of 70% in nest numbers from 1979 to 2005. These estimates for the Gulf of Panama contrast with earlier reports for the Gulf of 70,000 adults at 7 colonies in 1982 (Montgomery and Murcia 1982) and 25,500 brown pelican adults and chicks in just the Pearl Island Archipelago in 1981 (Batista and Montgomery 1982). Brown pelicans were reported to breed at the Isla Iguana Wildlife Refuge but were not breeding there in 2005 (Agehr 2005). Overall, Agehr (2005, Table 1) describes the brown pelican in Panama as an “abundant breeder” on the Pacific coast and a “fairly common migrant” on the Atlantic coast.

Montgomery and Martinez (1984) have studied the effect of offshore winds in the Gulf of Panama on reproductive success of brown pelicans. Normal offshore winds cause upwelling that decreases the surface temperatures, which increases the availability of fish prey of pelicans. Brown pelican courtship activity corresponds with these drops in surface temperatures, and nests fail when during periods that the winds cease and surface temperatures rise.

West Indies: Raffaele et al. (1998) provide the following description of the brown pelican as, “A common year-round resident in the southern Bahamas, Greater Antilles and locally in the northern Lesser Antilles east to Montserrat. It is common to rare through the rest of the West Indies with some birds wandering between islands. Migrants that breed in North America augment local numbers primarily from November to February.”

The population of the West Indies has been estimated to be “about” 1,500 breeding pairs (Collazo et al. 2000, cited in Shields 2002). The entire population of the subspecies *Pelecanus occidentalis occidentalis*, which includes eastern Mexico and the Caribbean (Wetmore 1945) has been reported to have declined by 20% from 6,200 pairs (Shields 2002).

In a search for additional seabird breeding colonies in the Lesser Antilles, Collier et al. (2003) did not find brown pelican nesting on Angulla, Saba, and Dominica. In an attempt to survey seabirds in St.Vincent and the Grenadines, Hayes (2002) found brown pelicans only in the central Grenadines. He notes that brown pelicans were once considered common in the Grenadines and suggests that a small nesting colony may exist there, although there is no historic record of nesting.

St. Martin: Three nesting areas have been identified, and the population for the entire island has been estimated to be 75 breeding pairs (Rojer 1997). Two colonies were reported on St. Martin by Collier et al. (2003). Forty-eight pairs were found nesting at one site in 2001, but no breeding was found in 2002. The other colony had an estimated 48 breeding pairs in 2001, but none in 2002. This latter site is near a resort area and the surrounding waters are heavily used for aquatic recreation (Collier et al. 2003).

Surinam: Haverschmidt (1946) reported that brown pelicans regularly occurred in small numbers along the coast of Surinam, but that there was no indication of breeding.

Venezuela: Based on aerial surveys of the Venezuelan coast, Guzman and Schreiber (1987) estimated a population size of 17,500 brown pelicans in 25 colonies. In breeding colonies, 3,369 nests were counted.

Ecuador, Galapagos Islands: Shields (2002) cites reports of a few thousand pairs in the islands. Mortality of brown pelicans was observed during the especially severe El Niño of 1983 (Duffy 1986), whereas it had not been noted during the less-severe event of 1978 (Boersma 1978). Transect studies during and following 1983 did not reveal significant effects on brown pelican densities (Duffy 1986).

Ecuador, mainland, and Pacific coast of Colombia: The only known breeding colony of the subspecies *Pelecanus occidentalis murphyi* was estimated to be 500 pairs of more in 1993 (Ridgely and Greenfield 2001, cited in Shields 2002). The Ministerio del Ambiente of Ecuador has reported that nesting brown pelicans are widely distributed and fairly common along the mainland coast of that country (Rojas 2006).

Peru: Total size of the population of Peru was estimated to be 400,000 individuals in 1996 (Jahncke 1998 *in* Shields 2002). Other estimates include 420,000 adults in 1981-1982 and 620,000 in 1985-1986 (Shields 2002), with low points associated with years of El Niño (El Niño/Southern Oscillation) weather patterns in the Pacific Ocean. Shortages of food sources during El Niño years result in loss of reproduction and in severe conditions result in starvation of adults and movements of populated areas such as Lima where they scavenge for food (Leck 1973).

Duffy (1983b) has described the effect of the availability of nesting sites on populations of brown pelicans and other birds that nest on islands on the Peruvian coast. These islands provided economically important production of guano for fertilizer. Protections to increase the amount of nesting space in the 1940s were followed by an increase in the total population of the brown pelican, Guanay cormorant (*Phalacrocorax bouganvillii*), and Peruvian booby (*Sula variegate*) from 8 million to 20 million birds, and an annual rate of increase of the combined population from 8% to 18%. The interpretation is that the availability of nesting space can limit brown pelican populations using these islands, although over-fishing was cited as the cause of reductions in the population during the 1970s to levels comparable to those preceding the protection of nesting islands (Duffy 1983b, Muck and Pauly 1987). The relative proportions of the three species were not provided, but there is some habitat separation among them and brown pelicans appear to be dominant in the areas of overlap (Duffy 1983b).

Nest desertion by brown pelicans and other colonial nesting birds in one high-density nesting island was attributed to a heavy infestation of ticks (Duffy 1983a).

Chile: The breeding population on Isla Pájaro Niño in central Chile was 2,699 pairs in 1995-1996, 1,032 pairs in 1996-1997, and none during the 1997-1998 El Niño year (Simeone and Bernal 2000, p. 453). In that same El Niño year, CNN (1997) reported an increase in the local pelican population in the city of Arica in extreme northern Chile from 200 to 4,000 birds within a few weeks. The range in Chile includes Arica (as the subspecies *P. o. thagus*, Rodrígues 2006) and occasionally occurs as far south as Isla Chiloé (Aves de Chile 2006). The total population size for Chile is unknown (Shields 2002).

Argentina: Two sightings of brown pelicans in Argentina in 1993 and 1999 are considered “hypothetical” records because they are not documented by specimens, photographs, or other concrete evidence (Lichtschein 2006).

Some other Pacific Coast populations in addition to California brown pelicans experience breeding failures during years of El Niño (El Niño Southern Ocillation) weather patterns, when warmer waters become unsuitable for their major food sources (Shields 2002). El Niño events have also been suggested as responsible for somewhat shorter reproductive life span in Peruvian populations (Shields 2002). Boersma (1978) reported El Niño-season starvation of nestling brown pelicans in the Galapagos Islands, but no adult mortality. In extreme El Niño events adult mortality can result (Anderson et al. 1982, Shields 2002).

II.C.1.b. Genetics, genetic variation, or trends in genetic variation (e.g., loss of genetic variation, genetic drift, inbreeding, etc.):

We are not aware of any completed or ongoing studies or monitoring of genetic variation in the brown pelican. Shields (2002) has identified genetic studies as a research priority to determine genetic variation within and among recognized subspecies and to define subspecific boundaries.

II.C.1.c.Taxonomic classification or changes in nomenclature:

Wetmore's 1945 study remains the most recent review of the subspecies of brown pelican. The classification followed by the American Ornithological Union (AOU 1957) and by Palmer (1962) is based on the Wetmore's (1945) review, which itself was based on few specimens from some portions of the range. The subspecies recognized by Wetmore, along with a very general description of their breeding ranges are:

> *Pelecanus occidentalis occidentalis* Linnaeus, 1766: Islands of the Caribbean and the Caribbean coast of Mexico
>
> *Pelecanus occidentalis carolinensis* Gmelin, 1798: Atlantic and Gulf coasts of the United States. This subspecies includes the brown pelicans delisted in 1995 on the U.S. Atlantic coast, Florida, and Alabama. It also includes brown pelicans of Mississippi, Louisiana, and Texas.
>
> *Pelecanus occidentalis californicus* Ridgeway, 1884: California and northwestern Mexico.
>
> *Pelecanus occidentalis urinator* Wetmore, 1945: Galapagos Islands.
>
> *Pelecanus occidentalis murphyi* Wetmore, 1945: Ecuador and Pacific coast of Colombia.
>
> *Pelecanus occidentalis thagus* Molina, 1782: Peru and Chile.

II.C.1.d. Spatial distribution, trends in spatial distribution (e.g. increasingly fragmented, increased numbers of corridors, etc.), or historic range (e.g. corrections to the historical range, change in distribution of the species within its historic range, etc.):

The brown pelican is widely distributed in southern coastal areas of the continental United States, Pacific Coast of Mexico, Central America, and the Pacific and Caribbean coasts of South America.

Although abundance and distribution can fluctuate greatly on a local scale depending on storms and other factors, large scale or regional changes in distribution, other than past reproductive failure associated with pesticides and the recovery in Louisiana and Texas, have not been noted.

Sites where nesting had been previously reported, but not used on subsequent occasions are identified above in II.C.1.a.

II.C.1.e. Habitat or ecosystem conditions (e.g., amount, distribution, and suitability of the habitat or ecosystem):

Brown pelicans nest on various types of islands throughout their range and do not appear to be limited by the availability of island nesting habitat. They reach their greatest abundances in California, Baja California, and Peru, where there are islands for nesting and an abundance of small pelagic fishes is available for feeding.

Brown pelicans have established breeding areas on islands newly-created by dredge spoil in Texas. Some island nesting sites have been completely obliterated and others degraded to the point of becoming unsuitable for nesting by large storm events, such as hurricane Katrina in Louisiana (LDWF 2006b). Small islands used for nesting on the U.S. Gulf Coast are ephemeral and dynamic, being both created and destroyed over a span of years.

Mangrove habitat has been lost to recreational and other coastal development in Puerto Rico (Collazo et. al 1998), but there is no evidence that the availability of mangroves is limiting brown pelican populations here or elsewhere in the Caribbean (NatureServe 2006).

The positive response of brown pelican population numbers to enhancement or protections of nesting habitat in Peru (Duffy 1983b), Louisiana, and Texas indicates the effectiveness of these measures in some situations.

II.C.2. Five-Factor Analysis (threats, conservation measures, and regulatory mechanisms)

II.C.2.a. Present or threatened destruction, modification or curtailment of its habitat or range:

As discussed previously many nesting islands along the U.S. Gulf Coast are ephemeral and dynamic, being both created and destroyed by storms over a span of years. Overall trends have not been documented at a large scale. Brown pelicans seem well adapted to responding to loss of breeding sites by using their dispersal capabilities to locate and use other areas. Pelicans generally exhibit nest site fidelity but have established breeding colonies on islands artificially created by deposit of dredge spoil in Texas and Louisiana. Many of these spoil islands are leased and managed by the National Audubon Society (TPWD 2006). Use of these islands by pelicans demonstrates both the utility of these artificially generated habitats and the pelican's ability to find and establish nesting colonies on them. In other cases, dredge spoil has served to stabilize natural island nest sites used by pelicans.

Mangrove islands are important components of nesting habitats in many tropical and subtropical areas. Mangrove forests are lost to many types of coastal development, such as sea walls and marinas. The value of mangroves in stabilizing and protecting from hurricanes has become more appreciated, which may result in their protection in some areas. We do not have sufficient information on trends in amounts of mangrove forest to determine overall rates of loss, or to determine a critical point at which availability of mangroves might be a limiting factor for brown pelican populations. Although loss of mangroves may affect pelican populations on a local scale, we have no evidence that mangroves are limiting the brown pelican population on a regional scale.

California brown pelican nesting habitat in the U.S. is not threatened because all of the nesting colonies occur within Channel Islands National Park (CHINP). According to the Park's enabling legislation, CHINP was set aside to "…protect the nationally significant natural, scenic, wildlife, marine, ecological, historical, archeological, cultural, and scientific values of the Channel Islands…". In addition, pelican nesting areas are specifically listed as "scientific values" in the enabling legislation; therefore, we expect that nesting colonies in CHINP will be protected in perpetuity (NPS 2004).

In southern California, roost sites are particularly important to pelicans because of their proximity to nesting colonies in the Southern California Bight (Strong and Jaques 2003). Shoreline development and wetland filling has eliminated much of the natural onshore roost habitat in southern California, although some losses have been offset by the addition of manmade structures such as jetties, breakwaters, and floating structures (American Trader Trustee Council (ATTC) 2001). Roosting habitat is limited along the southern California coastline, with large gaps in the availability of quality roost habitat along the Santa Barbara coast and in the San Diego area (Strong and Jaques 2003). The majority of important roosting habitats in southern California are jetties and breakwaters owned by local harbor districts under the jurisdiction of Army Corps of Engineers (Strong and Jaques 2003). Since 1986, two important roost sites have been eliminated, two are under threat of removal, and one has been degraded, all of which were on private property in southern California (Strong and Jaques 2003).

Creation, enhancement, and protection of roost sites in southern California was proposed in the American Trader Restoration Plan (ATTC 2001), although a pilot program to create new roosting habitat began in 2004, in the form of a floating barge in the San Diego saltponds, has failed to attract pelicans to roost (ATTC

2006). Pelicans are found as far north as British Colombia during the non-breeding season, although there is little information about the status of roost sites within the rest of the subspecies' range. In the Pacific northwest where offshore rocks for roosting are limited, sand islands within large estuaries serve as the primary night roosts, and the greatest pelican concentrations in Oregon and Washington occur at only three large estuaries (Jaques and O'Casey 2006).

None of the California brown pelican nesting colonies in Mexico are threatened with habitat destruction or modification because all of the nesting islands in Mexico are federally protected and designated as either Biosphere Reserves or Natural Protected areas (Anderson and Palacios 2005). However, there is minimal enforcement of protections at these colonies, and many are susceptible to disturbances from fishermen, boaters, and other types of recreation on the islands (Carlos Godinez, CONANP, Mexico, pers. comm. 2006). Mainland colonies in Mexico are susceptible to mangrove habitat destruction for mariculture (Anderson et al. 2003).

Some mangrove island habitat has been lost to recreational and other coastal development in Puerto Rico (Collazo et. al 1998) and probably elsewhere in the Caribbean. We have no evidence that these losses have had long-term effects on the overall brown pelican population in regions with climates that support mangroves, and it seems unlikely that the availability of mangroves is limiting brown pelican populations (Collazo et al. 1998, NatureServe 2006).

Losses to nesting habitat owing to hurricanes and storms have been documented, but the impacts are generally localized and recovery of populations generally follows as other nesting areas are established, and the regional distribution of the species is not greatly reduced. Use of dredge spoil to create nesting islands or protect and expand existing areas has likely assisted the recovery of pelican populations in coastal Louisiana and Texas. Protection of nesting islands in Peru in the 1940s has been credited with the growth of those populations (Duffy 1983b), but even in that case it is not clear the response was owing to expanding limited habitat or to protecting breeding colonies from human intrusions that disrupt nesting.

In addition to the special protective status afforded to nesting habitat of the California brown pelican and measures taken in the 1940s in Peru, described above, formal protective status has been established for certain nesting areas by the governments of Panama and Ecuador. These protections are further discussed below in section II.C.2.d. on adequacy of existing regulatory mechanisms.

In summary, we have no evidence that the overall range of the brown pelican has been reduced, except the reductions on the U.S. Gulf coast and in California caused by pesticide effects on reproduction, from which pelican populations in these areas have now recovered. Although various threats that can affect pelicans locally still exist, they are not of sufficient magnitude to lead us to predict that they would lead to a curtailment of the range of the listed brown pelican.

II.C.2.b. Overutilization for commercial, recreational, scientific, or educational purposes:

Collection of eggs by local people has been identified as a threat in some areas (Shields 2002). We are not aware of any commercial use of brown pelicans, although there are sometimes local impacts associated with commercial and recreational fishing that have incidental effects on brown pelicans. These impacts to pelicans are further discussed under II.C.2.e.

II.C.2.c. Disease or predation:

Ticks have been implicated as the cause of nest abandonment on a Texas island (King et al. 1977b). Mites and liver flukes have also been reported (USFWS 1985). Red imported fire ants (*Solenopsis invicta*) have been reported on one nesting island in Texas, but effects to pelicans have not been noted. We have no evidence that any of these predators or parasites are limiting brown pelican populations, and it seems unlikely except at a very local scale.

Several diseases have been identified as causing illness and mortality of California brown pelicans. However, these diseases probably do not impact long-term population trends because occurrences have been sporadic, occasional, and self-limiting.

The disease erysipelas, caused by the bacterium *Erysipelothrix rhusiopathiae*, caused mortality of about 350 pelicans off the coast of California during the winter of 1987-88 (Windingstad 1991**)**. The outbreak was thought to have been caused by unusually warm waters combined with an increased number of pelicans along the California coast.

Domoic acid, a toxin produced by the diatom *Pseudo-itzschia australis* that occasionally blooms in large numbers off the coast of California, has been identified as a sporadic and occasional cause of mortality for pelicans. Domoic acid poisoning was the suspected cause of an unquantified number of sick and dying pelicans near Santa Cruz, California in October of 1991 (Silver 2000), of at least 200 pelican deaths in the Southern California Bight in the spring of 2002 (California Department of Fish and Game 2002), and recently, of at least 30 pelicans deaths in the spring of 2006 (International Bird Rescue Research Center 2006). In 2002 over 3700 pelican chicks died in the Anacapa Island nesting colony, which amounted to 53.6 percent chick mortality in that year, and the cause of death was thought to be domoic acid toxicity as a result of chicks being fed prey items harboring domoic acid (Gress et al. 2003).

Avian botulism, caused by the bacterium *Clostridium botulinum*, has caused illness and mortality of pelicans at the Salton Sea in southern California. During the period from 1994 to 2005, approximately 2,300 carcasses and 3,200 sick brown pelicans were recorded (Sony Bono Salton Sea National Wildlife Refuge Complex 2005b). During outbreaks of avian botulism or other contagious avian diseases, wildlife managers at the Salton Sea remove sick and dead birds to restrict the spread of the disease and limit mortality (Sony Bono Salton Sea National Wildlife Refuge Complex 2006).

There are no known significant predators of adult pelicans, and they generally nest on colonies free of mammalian predators of eggs and young. At least one member of a pair usually remains at the nest to protect eggs or chicks, as unguarded nests are vulnerable to predation by avian predators, such as gulls, crows, and ravens. Introduced mammalian predators, such as domestic cats (*Felis catus*) and rats (*Rattus* spp.), can have serious impacts on small and medium-sized seabirds on seabird nesting islands, although they appear to have little impact on pelicans (Anderson et al. 1989)**.** Disturbances to nesting colonies may flush pelicans from nests, increasing the risk of predation on eggs and young.

II.C.2.d. Inadequacy of existing regulatory mechanisms:

Brown pelicans in the U.S. are protected by the Migratory Bird Treaty Act (MBTA) and that act's protections would continue even if protections under the Endangered Species Act were not available. The MBTA governs the taking, killing, possession, transportation, and importation of migratory birds, their eggs, parts, and nests. Provisions within the MBTA allow for the taking and use of migratory birds, but require that such use not adversely affect populations.

Other U.S. laws that provide protections to brown pelican habitat are the Fish and Wildlife Coordination Act (16 U.S.C. 661 et seq.), which requires equal consideration and coordination of wildlife conservation with other water resources development, and the Estuary Protection Act (16 U.S.C. l221 et seq.), which requires Federal agencies to assess impacts of commercial and industrial developments on estuaries. Section 10 of the Rivers and Harbors Act (33 U.S.C. 401 et seq.) regulates the building of any wharfs, piers, jetties, and other structures and the excavation or fill within navigable water. Sections 402 and 404 of the Federal Water Pollution Control Act (33 U.S.C. 1251 et seq.), as amended by the Clean Water Act (91 Stat. 1566) and the Water Quality Improvement Act (101 Stat.7), provide for the development of comprehensive programs for water pollution control and efficient and coordinated action to minimize damage from oil discharges. Additional environmental laws that help protect pelican habitat and food sources include: The Emergency Wetlands Resources Act of 1986 (100 Stat. 3585), which authorizes the purchase of wetlands from Land & Water Conservation Fund monies; The North American Wetlands Conservation Act of 1989 (103 Stat. 1968), which provides funding for wetland conservation programs in Canada, Mexico, and the U.S.; The Coastal Wetlands Planning, Protection and Restoration Act of 1990 (104 Stat. 4779), which provides Federal grants to acquire, restore, and enhance wetlands of coastal States; Anadromous Fish

Conservation Act of 1965 (79 Stat. 1125), which provides funds for conservation, development, and enhancement of anadromous fish through cooperation with States and other non-Federal interests; Coastal Barrier Resources Act (96 Stat. 1653), as amended by the Coastal Barrier Improvement Act of 1990, which prohibits direct and indirect Federal financial assistance that might support the development of coastal barriers; The Coastal Zone Management Act of 1972 (16 U.S.C. 1451-1464), which provides fiscal incentives for the protection, restoration, or enhancement of existing coastal wetlands or creating new coastal wetlands and assessing the cumulative effects of coastal development of coastal wetlands and fishery resources; Magnuson Fishery Conservation and Management Act of 1976 (U.S.C. 1801-1882) which provides for the management of fish and other species in U.S. jurisdictional waters; Shore Protection Act of 1988; Outer Continental Shelf Lands Act of 1954, as amended in 1978 and 1985; National Ocean Pollution Planning Act of 1978; Oil Pollution Act of 1990; The Act to Prevent Pollution From Ships of 1980; Marine Pollution and Research and Control Act of 1989; Ocean Dumping Ban Act of 1988; and the Marine Protection, Research, and Sanctuaries Act. These laws and regulations, taken collectively, help ensure the conservation of brown pelicans and their habitat through project reviews and consideration of impacts to the brown pelican.

An important regulatory mechanism affecting brown pelicans is the requirement that pesticides be registered with the EPA. Under the authority of the Federal Insecticide, Fungicide, and Rodenticide Act (7 U.S.C. 136), which was enacted in 1996, the EPA requires environmental testing of the effects of all new pesticides on representative wildlife species prior to EPA granting a pesticide registration. The EPA evaluates pesticides before they can be marketed and used in the U.S. to ensure that they will not pose unreasonable adverse effects to human health and the environment. Pesticides that meet this test are granted a license or "registration" which permits their distribution, sales, and use according to requirements set by EPA to protect human health and the environment. The requirement for evaluation of pesticides during the registration process would not be altered if ESA protection were not available.

The brown pelican in the eastern U.S. is currently protected under State wildlife laws in Mississippi, Louisiana, and Texas. Protection from take is provided to the brown pelican under these State laws.

The California brown pelican is currently designated as endangered under the California Endangered Species Act (CESA). Section 2080 of the California Fish and Game Code prohibits "take" of species that are designated as threatened or endangered by the CESA. On May 26, 2006, the California Fish and Game Commission received a petition to delist the subspecies, and they are currently considering this petition. If California does delist the California brown pelican under State law, the removal of State protective regulations would not trigger the need to re-list the brown pelican because other laws and regulations provide adequate protection.

Various officially protected designations that benefit brown pelicans have been made in countries outside the United States.

Mexico: All of the islands with pelican nesting colonies in Baja California are federally protected and designated as Natural Protected Areas or Biosphere Reserves (Anderson and Palacios 2005). However, there is minimal enforcement of protections at these colonies, and they are susceptible to disturbances from fishermen, boaters, and other types of recreation on the islands (Godinez 2006). A proposal to designate the California brown pelican for special protections under the Mexican Species Act was submitted in 2005 and is currently being considered, which would presumably result in additional protections and possibly enforcement of those protections (Godinez 2006). A proposal to restrict fishing around pelican nesting islands during the breeding season is also being considered (Godinez 2006), which would reduce the probability of interactions such as hooking fledgling pelicans.

Panama: Angehr (2005) identifies the following areas used by brown pelicans that are on lands with some office protective status: a nesting site of an estimated 150 pairs on Isla Barca Quebrada is within Coiba National Park; Iguana island, which hast been a nesting site in the past is within Isla Iguana Wildlife Refuge; important nesting sites on a group of small islands are mostly within the Taboga Wildlife Refuge; and a nesting site in the Pearl Islands is owned by the environmental organization ANCON. Many more nesting areas lack protective status.

Ecuador: About 87% of the area of the Galapagos Islands is a National Park (Exploring Ecuador 2006) and commercial and tourist access is regulated by the government of Ecuador to protect natural resources. The resident human population has expanded in recent years, as has the number of tourists. The Charles Darwin Foundation, which works in the islands under an agreement with the government of Ecuador, has developed a strategic plan (Charles Darwin Foundation 2006) to address the management of increasing presence in the islands. The plan’s general objective is to “forge a sustainable Galapagos society in which the people who inhabit the islands will act as agents of conservation.”

Peru: Estimated increase in the brown pelican population has been attributed to protective measures by the Peruvian government for nesting areas on the guano islands were brown pelicans breed. Guano islands receive protection and management from PROABONOS, an agency in the Ministry of Agriculture of the Peruvian government (Zavalaga et al. 2002, PROABONOS 2006).

The Ministry of Agriculture’s Forest and Wild Fauna Management Authority (IRENA) lists the Peruvian pelican as *Pelecanus thagus* as endangered, and provides prohibitions of take of the species without a permit (Taura 2006). We consider the Peruvian pelican to be one of six subspecies of brown pelican

(Wetmore 1945, with a range of coastal Peru and Chile

Chile: Simeone and Bernal (2002) reported that Isla Pájaro Niño has been designated a Nature Reserve by the Chilean government for the protection of Humboldt penguins, brown pelicans, and other seabirds. The breakwater connecting the island to the mainland has been gated and public access is prohibited, although trespass has been reported.

II.C.2.e. Other natural or manmade factors affecting its continued existence:

1. Natural Factors

When a portion of the range of the brown pelican was delisted in 1985, we stated that brown pelican reproductive success was strongly influenced by the weather at the time of breeding. High winds or waters destroyed or inundated nests, untimely cold snaps contributed to the death of eggs or nestlings, and periodic food shortages resulted in decreased nesting and/or fewer young reared. We found that brown pelican productivity normally fluctuated considerably from year to year and place to place and that a complete local reproductive failure in one season in one locality was not an uncommon occurrence and no cause for alarm (Schrieber 1979).

We also stated in 1985 that brown pelicans switched breeding sites from year to year, especially in Florida. Therefore, abandonment of one or several rookeries was no indication of an overall declining population. Examples of localized population declines were numerous at the time brown pelicans were delisted along the Atlantic coast and in Florida and were thought to be related to a changing distribution and/or abundance of fish species. However, despite these localized declines, the total populations of brown pelicans in Florida had remained relatively stable (February 4, 1985, 50 FR 4943).

Storms accompanied by severe tidal flooding are the most frequent and most significant negative factor affecting productivity of brown pelicans in Louisiana (McNease and Perry 1998). Eggs and nestlings may be lost due to flooding. In addition, a female that has produced nestlings will not nest again in the same season. Likewise, renesting may not occur when eggs are lost late in the nesting cycle. Severe weather in Louisiana in 2003 and 2005 resulted in a reduced number of pairs that successfully reared eggs and young, and the 2005 hurricanes resulted in the loss of nesting habitat (LDWF 2006b).

Severe freezes may also affect brown pelicans, causing a high initial mortality of brown pelicans from hypothermia, mortality due to prolonged exposure (frost bite), and death while plunge-diving into ice (McNease and Perry 1998). Severe freezes also cause surface ice to form, which limits feeding by the pelicans. Fish mortality related to freezes also negatively impacts the pelican’s food supply on a short-term basis. Finally, vegetation in which pelicans nest, such as black mangrove, is killed off by extreme cold weather.

Severely low reproductive success of California brown pelicans because of DDT contamination in the 1960s and early 1970s may have masked the effects of other limiting factors on reproductive success. Since pelicans began to recover in the late 1970's, the number of breeding pairs and reproductive success in the Southern California Bight has been highly variable from year to year (Gress et al. 2003), and productivity continues to fall short of the recovery goal of 0.9 young per pair. Persistent, low-level DDT contamination in the Southern California Bight may be contributing to low productivity through eggshell thinning for some pelicans, although prey availability is more likely the most important factor. Northern anchovy (*Engraulis mordax*) availability within foraging distance of colonies is the most important factor influencing pelican breeding success within the Southern California Bight (Anderson et al. 1982). California brown pelicans also feed on other forage fishes, such as Pacific sardines (*Sardinops sagax*) and Pacific mackerel (*Scomber japonicus*) (USFWS 1983), and the availability of these fish may also impact productivity. California brown pelicans feed predominately on anchovies probably because they are the most abundant and available fish in the Southern California Bight (Gress et al. 1990), and they would likely respond to changes in prey biomass by switching to feed on other fish species. In the Gulf of California, at least 30 fish species are found in pelican diets, with no species dominating (Gress et al. 1990).

A mixture of subarctic and tropical waters, upwelling events, and complex bathymetry that is characteristic of the Southern California Bight results in seasonal, interannual, and long-term variability in fish and zooplankton populations (Dailey et al. 1993). El Niño events that occur periodically in the Southern California Bight are characterized by warm, nutrient-poor water, and reduced primary productivity (Dailey et al. 1993). Reduced reproductive success and significant mortality in pelican chicks has been attributed to El Niño events (Hayward 2000), and is likely because of reduced availability and abundance of anchovies and other prey. Impacts from an El Niño event are generally limited to a single breeding season and would not result in long-term population declines. Pelicans are long-lived and have evolved with this "boom or bust" reproductive strategy. Although they have the flexibility to respond to food supplies through variable reproductive rates, a long-term decline in anchovy abundance could have serious impacts on the pelican population, particularly if other forage fishes are not available to use as a substitute (Anderson et al. 1982). In the absence of other pressures on the pelican population, such as increased pollution, fishing pressures, or long-term environmental changes (i.e. climate change) that result in long-term unfavorable conditions for anchovies and other prey, natural factors are not likely to threaten the subspecies.

Just as for the California brown pelican some other Pacific Coast populations experience breeding failures during years of El Niño weather patterns, when

warmer waters become unsuitable for their major food sources, especially the anchoveta (Shields 2002). El Niño events have also been suggested as responsible for somewhat shorter reproductive life span in Peruvian populations (Shields 2002). Boersma (1978) reported El Niño-season starvation of nestling brown pelicans in the Galapagos Islands, but no adult mortality. In extreme events adult mortality can result (Anderson et al. 1982, Shields 2002). An incidental affect of El Niño is that movement of some brown pelicans into developed areas, presumably in search of food, exposes them to hazards of collisions with structures and vehicles (Leck 1973, CNN 1997).
In summary, natural factors may adversely affect brown pelicans on a short-term, localized basis, but in and of themselves, pose no threat to the continued existence of the species. The pelican is a long-lived species that has evolved with natural phenomena such as winter storms and hurricanes. These factors are only significant when population sizes are small and reproduction is limited. Because current populations are large and reproduction has been restored to a level that can compensate for normal environmental flucations, these factors no longer pose a significant threat to the species.

2. Human-related factors

a. Pesticides and contaminants

During initial recovery planning for brown pelicans, it was recognized that organochlorine pesticides were the major threat to the brown pelican in the U.S. and these pesticides acted by direct toxicity (affected all age classes) and by impairing reproduction (reduced recruitment into the population) (Blus et al., 1979a). Impairment of reproduction was attributed primarily to the organochlorine pesticide known as DDT and its principal metabolite, DDE. These substances accumulate in the tissues of species at the top of the food chain, such as the brown pelican. DDE interferes with calcium deposition during eggshell formation, resulting in the production of thin-shelled eggs that are easily crushed during incubation. DDE also causes the death of embryos in the egg, and the death or aberrant behavior of recently hatched young (Blus 1982). The Environmental Protection Agency banned the use of DDT in the United States in 1972 (37 FR 13369).

The organochlorine pesticide endrin is the probable cause of the brown pelican's rapid decline and subsequent disappearance in Louisiana (King et al. 1977a). Endrin was first used in the Mississippi River Basin in 1952. In 1958, dead fish were reported near sugarcane fields where endrin was used, and die-offs of fish and other wildlife began to consistently occur when heavy rains produced runoffs from cane fields (Biglane, 1964 in King et al. 1977a). McAllister (1964 in King et al. 1977a) reported an estimated six million menhaden found dead between 1960 and 1963. Extensive fish kills persisted in the lower Mississippi River and other streams in sugarcane growing parishes of Louisiana through 1964 (U.S. Congress, 1966:1706 in King et al. 1977a). It was concluded that endrin from both agricultural and industrial sources was responsible for the fish kills (Biglane 1964 in King et al. 1977a; Mount 1964 in King et al. 1977a). Fish eating ducks, such as mergansers, were also reported floating dead in streams and bayous (Graham 1970 in King et al. 1977a).

The adverse impact of endrin on brown pelicans was demonstrated when more than 300 of the 465 birds introduced to Louisiana since 1968 died during April and May 1975. Brain tissue from five dead pelicans was analyzed. Chemists at Louisiana State University identified seven pesticides in the brain tissue, all chlorinated hydrocarbons widely used in agriculture. Most of the birds analyzed contained what experts regard as potentially lethal levels of endrin; only one bird had less than 0.3 ppm of endrin, generally considered a lethal dose, and as much as 0.7 ppm of endrin was discovered. In addition to endrin, residues of six other organochlorine pesticides (dieldrin, toxaphene, DDE, benzene hexachloride, hexachloro-benzene, and heptachlor epoxide) and PCBs were found (Winn 1975). This significant die-off demonstrated the vulnerability of brown pelicans to endrin and emphasized the possible role of insecticides in the eastern brown pelican's decline in the eastern U.S.

Each of the 36 brown pelican eggs collected in Louisiana from 1971 through 1973 contained residues of DDE. The average levels of DDE for each year were 0.97 ppm, 1.36 ppm, and 1.31 ppm, respectively, and thus were below the levels associated with impaired reproductive success. However, 18 of the 36 eggs contained more than 0.54 ppm of dieldrin (an organochlorine pesticide), a level considered detrimental to reproductive success (Blus et al. 1974; Blus et al. 1975). There is only slight evidence that dieldrin thins eggshells, whereas there is strong evidence indicating that it adversely affects egg hatching, post-hatching survival, and behavior of young birds (Blus 1982).

Blus (1982) determined that residue levels in brown pelican eggs of 3 parts per million (ppm) (wet-weight) DDE was associated with impaired reproductive success and a residue of 4 ppm was associated with total reproductive failure. The contents of 11 brown pelican eggs collected in Texas in 1970 contained DDE residues. DDE levels in the egg samples ranged from 2.4-4.1 ppm and averaged 3.39 ppm, indicating that DDE was contributing to poor reproduction among Texas brown pelicans (King et al. 1977a).

DDE levels in the egg samples were similar to those found in brown pelican prey in Texas. Fish collections from 1967 through 1969 from rivers, bays, and estuaries in Texas contained moderate levels of DDT and its metabolites. Residues of up to 9.3 ppm were found in menhaden (*Brevoortia* sp.) and 6.4 ppm in anchovies (*Anchoa* sp.) (Childress 1970 in King et al. 1977a). As little as 2.8 ppm of DDE in the diet can cause eggshell thinning in some species of birds (King et al. 1977a).

Brown pelican eggshell thickness in Texas before 1943 (pre-DDT) averaged

0.557 millimeter (mm) (.022 inches (in)). The thickness of eggshells collected in 1961 averaged 0.473 mm (.018 in), a 15 percent reduction from the pre-1943 level. Egg loss becomes evident with decreases of 10 to 15 percent (Hickey and Anderson 1968) and serious breakage, usually accompanied by population decline, occurs when eggshell thinning exceeds 15 percent (Risebrough et al. 1970; Risebrough et al. 1971). This decrease in shell thickness corresponded with the years of rapid population decline of eastern brown pelicans in Texas.

The mean pre-1947 brown pelican eggshell thickness of Louisiana eggs was 0.554 mm (.022 in). The shell thickness of eggs averaged 0.517 mm (.020 in) in 1971, 0.486 mm (.019 in) in 1972 and 0.488 mm (.0190 in) in 1973 (Blus et al. 1975). This represents a 7 percent reduction in shell thickness in 1971 and a 12 percent thinning in both 1972 and 1973.

Currently applied, short-lived, non-organochlorine pesticides do not threaten the brown pelican in the eastern U.S. These newer non-organochlorine pesticides may cause occasional mortality of an individual pelicans, but because they do not bioaccumulate nor do they persist in the environment, they are unlikely to result in widespread reproductive failure like that caused by the use of organochlorine pesticides.

As already noted, susceptibility to organochlorine pesticide residues was probably the primary factor contributing to the original endangerment of the brown pelican. When the brown pelican was delisted in Florida and along the Atlantic coast in 1985, we determined that the threat of organochlorine pesticide pollution in the U.S. had been greatly reduced, and the residues of persistent compounds in brown pelican eggs had shown a steady decrease. This trend was a major factor supporting the delisting action. By 1974 in Louisiana, the levels of DDE had declined to less than 1.0 ppm (Blus et al. 1979). The level of DDE residues in eggs collected in Texas from 1975-81 was about one half the level found in eggs collected in 1970 (King et al. 1985; King et al. 1977a). DDT residues in the brain tissues of two dying adult females from Texas were well below the lethal limit (King et al. 1985).

Organochlorine residues were not detected in the 19 brown pelican food items, such as menhaden and anchovy, collected in Texas between 1977 and 1979 (King et al. 1985). Dieldrin residues averaged 0.3 ppm or less in all brown pelican eggs collected in Texas from 1975 through 1978 (King et al. 1985). These levels do not pose a threat to reproductive success and survival. Other organochlorine insecticides including chlordane-related compounds, HCB, and toxaphene were infrequently detected and are not considered biologically significant (King et al. 1985). PCB concentrations in brown pelican eggs collected in Texas declined more than eight-fold between 1970 and 1981 and the analysis of three brown pelican eggs taken from Texas colony in 1996 show levels of DDE below the threshold of concern.

While the effects of environmental contaminants other than the organochlorines were not thoroughly known, there were indications that some localized contaminant-related problems still existed for the brown pelican. National Wildlife Health Laboratory records of brown pelican mortality from 1976 to 1983 documented ten die-off incidents totaling over 212 birds in the states covered by the 1985 rule. Almost five percent of these reported mortalities were related to actual or suspected pesticide or heavy metal contamination. About 47 percent of the reported mortalities occurred in the vicinity of illegally released untreated sewage. Other sources of mortality included parasites or enteritis, drowning and/or starvation, and unknown causes. These die-offs were small and occurred in numerous other seabirds feeding in coastal areas as well.

National Wildlife Health Laboratory records from July 1994 through June 2003 document thirteen incidents of brown pelican mortality for the continental U.S. east of the Rocky Mountains. None of these records cite problems with heavy metals and pesticides were implicated in just one of these cases (National Wildlife Health Center 2003b). Two pelicans from Florida had moderate brain acetlycholinesterase activity depression (i.e., an indicator of poisoning from either of these two groups of pesticides), potentially implicating organophosphorus or carbamate pesticides. These pesticides have been increasingly used since the 1970s, when DDT and dieldrin were banned in the U.S. Organophosphorous and carbamate pesticides are generally short-lived in the environment, lasting only days or months.

We concluded in 1985 that the threat from existing short-lived, non-organochlorine pesticides did not constitute sufficient reason for the continued listed status of an animal with as large and stable a population as the brown pelican. In addition, because of the conspicuous nature of the pelican, the sudden loss of an unusual number of birds or nests would be reported quickly.

The major threat to the California brown pelican was the nearly total reproductive failure in Southern California Bight colonies, caused by excessive thinning of eggshells, a result of physiological responses to high levels of DDT/DDE in the Southern California Bight in the late 1960s to early 1970s (Gress 1994). Ocean sediments off Los Angeles, California were heavily contaminated with DDT residues from a DDT manufacturing facility that discharged waste into the sewage system, which entered the marine environment through a submarine outfall (Gress 1995). This input ceased in 1970 after which DDT residues in the marine environment decreased sharply, and pelican reproductive success improved as eggshell thickness increased (Gress 1995). Eggshells collected from Anacapa Island in 1969 were up to 50 percent thinner than pre-1947 averages (Gress 1994). Use of DDT has been restricted in the U.S. and Canada since the early 1970s, and beginning in 1970, DDT input into the Southern California Bight marine environment ceased and DDT residues declined. DDE (metabolite of DDT) residues in pelicans rapidly declined and then leveled off by 1972, and improvements in reproductive success were seen by 1974 (Gress 1994).

However, acute contamination of the Southern California Bight was likely replaced by a low-level, persistent contamination, and in 1984, eggshells were 21 percent thinner than the pre-1947 mean, a level that has been shown to reduce reproductive success and contribute to population declines (Gress 1994). From 1986 to 1990, mean eggshell thickness was only 4.6 percent thinner than the pre-1947 mean, a level that may contribute to lowered fledging rates in some individuals, but is not causing population-wide reproductive impairment (Gress 1995). Although low-level DDT contamination will probably continue to persist in the Southern California Bight for many years, the impact to the pelican population is probably negligible and will continue to lessen over time.

In 1997, Mexico introduced a plan to strictly curtail and then phase out use of DDT by 2007 (Environmental Health Perspectives 1997), and they eliminated use of DDT by 2000, several years ahead of schedule (Gonzalez 2005).

Pesticide residues in brown pelican eggs in Puerto Rico and the U.S.Virgin Islands are not at high enough levels to be of concern (Collazo et al. 1998).

Claims have been made that organochlorine pesticides are still used in South America and Central America (NatureServe 2006). We are not aware of any reports of pesticides affecting reproduction outside of the United States (Schreiber and Risebrough 1972, Shields 2002, USGS 2006). Mexico used DDT for control of malaria until 1999 (Environmental Health Perspectives 1997, Salazar-García et al 2004). Nearly every nation within the range of the brown pelican has signed the 2001 Stockholm Convention on Persistent Organic Pollutants (World Bank 2006, Stockholm Convention 2006). Signatories to the Convention agree to eliminate the production and use of DDT and endrin, with an exemption for use of DDT for disease vector control in accordance with World Health Organization recommendations and guidelines and when alternatives are not available. Parties exercising this exemption are to periodically report their use. These reports are listed on the Convention's website: http://www.pops.int/.

Mercury contamination has been identified as a potential threat to brown pelicans in Venezuela, where mercury has been reported in fishes of the Tucacas region (Guzman and Schreiber 1987).

<u>b. Colony Disturbance.</u>

When the brown pelican was delisted in Florida and on the Atlantic coast in 1985, we concluded that human intrusion into brown pelican nesting areas, both by scientists and the general public, had increased in the 1960s, leading to decreased brown pelican productivity. Human disturbance caused the adults to flush, resulting in egg breakage, thermal stress, and increased predation of eggs and nestlings. By 1985, access to brown pelican colonies was limited to scientific investigators and resource managers on federally-owned nesting sites and sites designated by local governments or private owners as sanctuaries. Individual pelicans nesting on privately owned sites remained protected from injury or taking by the MBTA and any applicable State laws. It was determined in the 1985 delisting rule that current State laws were adequate to ensure the continued protection from take of brown pelicans in Florida and the Atlantic Coast States.

The majority of brown pelican colonies in Texas and Louisiana are located on Federal or State owned land. Access to these colonies is still limited to scientific investigators and to resource managers. The two largest brown pelican nesting colonies in Texas (Sundown Island and Pelican Island) are part of the Texas Audubon Society's Coastal Sanctuaries program. Audubon staff and wardens continuously assess the condition of these islands and protect the birds nesting there. The third major nesting site, Little Pelican Island, is owned by the U.S. Army Corps of Engineers (COE). The Service, in cooperation with the COE and State agencies, has posted signs at the waters edge that warn against landing during the nesting season. The current success of nesting pelicans on these lands indicates that human disturbance is not adversely impacting the nesting birds.

Louisiana's North Island and East Breton Island are all located within the Service's National Wildlife Refuge system. Signs are posted at the edge of the water indicating that the site is closed to human intrusion during the nesting season. In addition, during the nesting season, law enforcement personnel patrol the islands during periods of high human presence, such as on weekends and holidays. Except for the federally-owned sites discussed above, the two largest Louisiana pelican nesting colonies (Last or Raccoon Island and Queen Bess Island) are managed by the LDWF. There are several small colony sites that are privately owned and intermittently used by nesting pelicans, such as Martin Island and Brush Island. These are typically remote and not subject to much disturbance (e.g. some offshore recreational and commercial fishing activity occurs in the area). The protections against human disturbance provided by the National Wildlife Refuge system and LDWF would not be altered by delisting the brown pelican under the Act.

In California, the adverse effects of human disturbances by recreation, educational groups, and fishermen on nesting pelicans have been well-documented (Anderson 1988, Anderson and Keith 1980). Disturbance at nesting colonies has been shown to adversely affect reproductive success of pelicans, and even result in abandonment of nests or entire colonies (Schreiber 1979, Anderson and Keith 1980). There are protections to ensure that disturbance is not a significant threat to brown pelican nesting colonies in the California. West Anacapa Island, where approximately 75 percent of the Southern California Bight population nests (Gress et al. 2003) is designated as a research natural area by CHINP and closed to the public (NPS 2004). In 1979, California Department of Fish and Game (CDFG) designated the area adjacent to the West Anacapa Island colony as a State Marine Conservation Area. Fishing and other boating activities are prohibited at depths of less than 20 fathoms offshore in this area during the breeding season, from January 1 to October 31 of each year (Title 14 of the Fish and Game Code). CDFG also closed the airspace below 1000 ft (305 m) to flights over the colony, to prevent disturbance of the colony. On Santa Barbara Island, trails are seasonally closed to protect pelican nesting areas (NPS 2004). In fact, the entire island was closed to visitors during the breeding season in 2006 because pelicans began nesting along the main access trail, and it was determined that any visitor use would disrupt these pelicans. Although occasional disturbances may occur, such as illegal boating within the Conservation Area, the protections and active enforcement by CHINP and CDFG have ensured that all nesting colonies in the U.S. remain relatively disturbance-free.

Disturbance-free roosting habitat is essential for pelicans throughout the year for drying and maintaining plumage, resting and sleeping, and reducing foraging effort through close proximity to prey resources (Jaques and Anderson 1983). High levels of human disturbance to roosting pelicans have been reported at sites in central and southern California (Jaques and Strong 2002), although impacts to the population are unknown. Reducing human disturbance at roost cites in central and southern California was proposed in the American Trader Restoration Plan and in the Command Oil Spill Restoration Plan through signage, education, and creating additional disturbance-free roost sites (ATTC 2001; Command Oil Spill Trustee Council 2004). Most of these projects have not yet been implemented, and it will be several years before these projects are completed and results can be evaluated.

Roosting pelicans are known to flush in response to low-flying aircraft. Pelicans on nests rarely flush, although agitation and fright response are noticeable. Loud noises (aircraft, sonic booms, boats, etc.) may cause desertion of nesting or roosting colonies. At the time of listing, military and civilian aircraft flying low over the pelican colony at Anacapa Island and over roosting areas were a recurring source of disturbance (USFWS 1983). However, this is no longer a threat, because flights below 1,000 feet over Anacapa and Santa Barbara Islands are prohibited. The U.S. Navy has also minimized this threat by diverting helicopter flights away from the colonies. Vandenberg Air Force Base (Vandenberg) consulted with the Service regarding the effects of low-flying test flights and agreed to avoid flying directly over roosting pelicans (USFWS 2004).

When the recovery plan for the California brown pelican was prepared there were concerns over potential impacts on pelicans from Space Shuttle flights leaving and returning to Vandenberg (USFWS 1983). The primary concern was that sonic booms may disturb nesting pelicans on Anacapa Island. However, the Vandenberg Space Shuttle program was discontinued before any were launched. The Service has consulted with Vandenberg multiple times regarding the impacts of missile launches on roosting pelicans on Vandenberg and determined that impacts are limited to a short-term startle effect (e.g., USFWS 1998, 1999a, 2003). For the next five years, a maximum of only 25 missile launches per year at Vandenberg are estimated for Vandenberg Air Force Base (Frye 2006). Therefore, potential impacts from missile launches are discountable because they are temporary in nature, and will likely only occur few times per month.

The current protections provided to prevent human disturbance to nesting colonies, as discussed above, as well as the protection afforded by the MBTA, will adequately continue to protect brown pelicans throughout their range in the United States.

Island nesting colonies in Mexico are protected, but there is minimal enforcement of these protections (Godinez 2006). Human disturbance of pelican colonies in Mexico has resulted in nest abandonment, predation of eggs and chicks, and total abandonment or relocation of individual colonies (Anderson and Keith 1980). Pelican colonies on San Martin and Todos Santos islands were abandoned for many years due to disturbances, although both islands were recently found to be occupied (Gress et al. 2005). Many islands remain threatened by disturbances from fishing camps, tour groups, and other recreational activities, and the Gulf of California is under increasing commercial and recreational fishing pressure, which could result in increased colony disturbances (Anderson and Palacios 2005). Fishermen, birders, photographers, educational groups, and egg collectors (in past years) have occasionally disturbed the pelican colony at the Coronados Islands at critical times during the breeding season (Gress et al. 2005). A seabird colony restoration project is proposed for six islands along the Pacific Coast of Baja California, five of which support pelican nesting colonies (Lukenbach Trustee Council 2006). Proposed restoration activities include re-designing paths and walkways to manage human traffic, shielding light sources, and public outreach and education. This project, combined with other conservation efforts in the past 10 years at several Mexican islands, may have reduced some of these threats to pelicans in Mexico (Lukenbach Trustee Council 2006). Although the treat of human disturbance has declined in Mexico as a result of conservation efforts and increased protection, enforcement remains limited (Anderson et al. 2003).

Disturbance of nests by recreationsts and human intruders can cause failure of breeding or even abandonment of a colony (Schreiber and Risebrough 1972, Shields 2002). Collier et al. (2003) offer human disturbance as the cause of a suspension of breeding activity in a formerly active brown pelican colony on St. Martin in the Lesser Antilles. The colony was near a resort with heavy use by boats and jet skis. They describe the flushing of 40 pelicans when a jet ski passed about 400m from a colony, but no flushing when a slow-moving dive boat approached to 10m from the colony. There are also situations where brown pelicans have become habituated to nearby intense uses without obvious affect on breeding efforts (Schreiber et al. 1981).

Collection of eggs by local people is a threat in some areas (Shields 2002).

<u>c. Fishing activity</u>

Fishing tackle can cause direct physical injury to pelicans. Pelicans are occasionally hooked by people fishing from piers or boats. Superficially embedded hooks can often be removed without damage; however, a small tear in a pouch can hinder feeding and death from starvation may occur (USFWS 1983). Mortality can occur if a hook is swallowed or there is substantial injury from hook removal. Pelicans can become ensnared in monofilament fishing line which can result in serious injury, infections from cuts, impaired movement and flight, inability to feed, and death (USFWS 1983).

When the status of the brown pelican was reviewed in 1985 for purposes of delisting in Alabama, Florida, and along the Atlantic Coast, we found that every year a number of brown pelicans became hooked or entangled in monofilament line or were caught by baited hooks, resulting in injury. Pelican Harbor Seabird Station, Inc. reported that of the 200 pelicans handled in 1982, roughly 71 percent had fishing-related injuries. Of these, 12 (8.5 percent) died or were permanently crippled; the remainder were rehabilitated. Fishing-related injuries comprised about 35 percent of all observed mortality. Another seabird rehabilitation group reported treating some 450 brown pelicans for fish line or hook injuries over a four-year period (USFWS 1985). These impacts are largely accidental, and the net effect of such losses has not inhibited the recovery of the brown pelican on the Gulf Coast.

Fishing may have been a significant cause of injury/mortality to newly fledged pelicans near colony sites in California in the early 1980s (USFWS 1983). Live anchovies used for bait and chumming attracts young pelicans and they often swallow baited hooks which become embedded in bills or pouches (USFWS 1983). In the early 1980s, about 10 percent of newly fledged brown pelicans captured for radio-marking near West Anacapa Island were hooked or entangled with fishing line (Gress 1995). The closure to vessels at depths of less than 20 fathoms offshore of West Anacapa Island has provided physical separation between fishing boats and the nesting colony, which has greatly reduced the chance of these interactions (Gress 2006). Several pamphlets have been developed and distributed by NMFS, in conjunction with USFWS, NPS, and CDFG to inform recreational fishermen about the impacts of hook and line injuries to pelicans and other seabirds and give step-by-step instructions for removing hooks and fishing lines from entangled birds.

The Texas State Aquarium in Corpus Christi reports that of the 74 eastern brown pelicans received for rehabilitation during three and one-half years, only 13 of these had hook and line injuries (Setter 1998). All 13 birds were juveniles and all were released after rehabilitation.

Twenty-nine of the 74 eastern brown pelicans brought in for rehabilitation at the Texas State Aquarium had wing injuries. In 1998, a number of immature brown pelicans washed up on the beach at Matagorda National Wildlife Refuge (USFWS 1998b). Approximately 50 percent of these dead birds had wing damage. In the rest, the cause of death could not be determined. These deaths coincided with the opening of the shrimp season in July. It is possible that the young, inexperienced birds were colliding with the shrimp net lines while attempting to feed on the bycatch.

Food availability is the most important limiting factor influencing California brown pelican breeding success within the Southern California Bight. Therefore, commercial harvests of pelican prey species, particularly northern anchovy, have the potential to affect California brown pelican prey dynamics. The Magnuson-Stevens Fishery Conservation and Management Act of 1976 requires agencies to formulate management plans for commercial fish species to ensure optimum yield (OY) with guaranteed perpetuation of that resource and minimal impact to the ecosystem of which it is a part. Special consideration is also given to endangered species in these management plans. Under the authorities of this act, the Anchovy Fishery Management Plan (AFMP) was prepared by the Pacific Fishery Management Council. Amendment 8 to the AFMP, adopted December 15, 1999 (64 FR 240), changed the name of the AFMP to the Coastal Pelagic Species Fishery Management Plan (CPSFMP) and added Pacific sardine (*Sardinops sagax*), Pacific mackerel (*Scomber japonicus*), jack mackerel (*Trachurus symmetricus*), and market squid (*Loligo opalscens*) to the fishery management unit (Coastal Pelagic Species Fishery Management Plan 1998). Amendment 8 divided these species into actively managed and monitored categories. Harvest guidelines for actively managed species, Pacific sardine and Pacific mackerel, are based on formulas applied to current biomass estimates and designed to ensure that adequate forage is available for seabirds, marine mammals, and other fish. There are no harvest guidelines for the monitored species, northern anchovy, jack mackerel, and market squid, because they do not currently have an intensive fishery, although harvest and abundance data will be monitored. The northern anchovy fishery essentially ceased in 1983 due to a depressed market. Although the fishery continues today at a minimal level, the depression of the market is thought to be a long-term or possibly permanent condition (CDFG 2001). A comprehensive assessment of the northern anchovy fishery will be conducted if the annual harvest approaches 25,000 metric tons (mt). The current northern anchovy harvest is only about 7,000 mt of an estimated biomass of 388,000 mt (USFWS 1999b). On June 10, 1999, the Service determined that Amendment 8 to the FMP will not adversely affect California brown pelicans because it would not decrease the availability of fish to pelicans (USFWS 1999b). The CPSFMP will continue to ensure that adequate anchovies are available to pelicans if economic conditions change and northern anchovy becomes more intensively fished. The CPFSMP will also ensure that other forage fishes known to be used by pelicans, such as Pacific sardines and Pacific mackerel, are also managed to preserve adequate forage reserves.

The central subpopulation of the northern anchovy extends south of the U.S. border along the west coast of Baja California, Mexico. However, there is no bilateral agreement between the U.S. and Mexico regarding the management of this subpopulation, and the Mexican fishery is managed independently and not restricted by a quota (CDFG 2001). The Coronados Islands pelican population during the late 1970s may have suffered reduced breeding success as a result of intensive commercial anchovy harvests in Mexico (Anderson and Gress 1982). Declines in the anchovy population in the early 1980s may have been caused by intensive harvesting in Mexico that far exceeded the California fishery (Service 1983). Similar to the U.S. fishery, anchovy harvests in Mexico decreased sharply in recent years, from an average of 85,000 tons per year from 1962 to 1989, to an average of 3.6 tons per year from 1990 to 1999 (CDFG 2001). If economic conditions change and anchovies become more intensively harvested in Mexico, availability of anchovies for pelicans could be reduced. An expanded Mexican fishery would be more of a concern than in the U.S., because there are currently no management or enforcement plans in place that would ensure adequate forage for pelicans.

In 1999, commercial squid fishing boats using bright lights at night to attract market squid to the surface operating offshore of West Anacapa and Santa Barbara Islands during the pelican breeding season were associated with high nest abandonment and chick mortality, resulting in very low productivity (ATTC 2001). Squid fishing occurred within the boundaries of the pelican closure offshore of West Anacapa Island, presumably because the (non-local) fishermen were unaware of the closure (Gress 1999). To reduce impacts to nesting seabirds in the Channel Islands, the California Fish and Game Commission required light shields and a limit of 30,000 watts per boat, adopted in 2004 (CDFG Regulations, Section 149, Title 14, CCR), although squid fishing in the Channel Islands beyond the West Anacapa Island pelican closure was not restricted. It is unknown if the pelican closure (if observed), in combination with the required light shields, would be sufficient to reduce impacts. Squid fishing has been observed around the Channel Islands in recent years (Whitworth et al. 2005). However, it has not occurred near the nesting colonies at a noticeable level since 1999, presumably because the abundance and location of squid is highly variable, and squid may have not been available near the colonies. Squid fishing is highly profitable, so this threat could recur at some point in the future. It is unknown if commercial squid fishing is a threat to nesting pelicans in Mexico; however, the range of the market squid includes coastal Baja California, Mexico.

Entanglement in fishing lines, nets, and other gear also occurs in other countries, and persecution of pelicans and intrusion into nesting areas by fishers is also likely (Shields 2002). Over-fishing of the anchoveta (*Engraulis ringens*) for production of fishmeal in Peru has been implicated as a cause of declines in brown pelicans and other seabirds (Duffy 1983b, Muck and Pauly 1987).

<u>d. Coastal oil and gas activities</u>

Petroleum products are produced, imported, and exported from the Gulf Coast region, with between 60 and 65 percent of the crude oil imported into the U.S.

coming through Gulf waters. In 1995, approximately 1.689 billion barrels of crude oil and 0.195 billion barrels of petroleum products were offloaded at Gulf ports. Approximately the same volume of petroleum products was exported through the Gulf Coast region (Minerals Management Service 1998).

In addition, oil and gas production occurs both in coastal waters and on the Outer Continental Shelf of the Gulf. In 1996, oil production from the Gulf Coast was 121 million barrels, down from 400 million barrels in 1977 (Minerals Management Service 1998). Gas production in this area totaled 1.6 trillion cubic feet, compared with 4.7 trillion cubic feet in 1977. Outer Continental Shelf oil production offshore of Louisiana and Texas increased yearly until 1972, and then leveled off at approximately 350 million barrels (Minerals Management Service 1998). Offshore gas production in this same area has gradually increased over the years, with production of approximately 780 million barrels in 1995. A negligible amount of oil and gas is produced in Mississippi offshore waters (Minerals Management Service 1998).

Oil and gas production and transport has the potential of introducing hydrocarbon pollutants into the marine environment. Demonstrated adverse effects of oil on avian species include decreased survival of eggs, direct toxicity and stress from oil ingested during feeding or preening, and feather fouling, resulting in decreased insulation and hypothermia. The impact of an oil spill on brown pelicans is a factor of the size of the spill, the time of year, the type of oil, the distance offshore of the spill, environmental conditions at the time of the spill, and spill response actions such as burning, use of dispersants, installation of barriers, and cleanup. The quickness and efficiency of a response to a spill often determines the significance of the impacts to the environment.

All owners and operators of oil handling, storage, or transportation facilities located seaward of the coastline must submit an Oil Spill Response Plan to the Minerals Management Service for approval. In the absence of swift and effective action by the responsible party for a spill, the U.S. Coast Guard will initiate action pursuant to the Oil Pollution Act of 1990 (OPA) to control and clean up a spill offshore under regional area contingency plans, which have been developed for this scenario. For onshore operations in Texas, oil spill response planning is regulated by the Texas General Land Office through the approval of facility, vessel, and pipeline response plans. This State agency, as well as the U.S. Coast Guard, is empowered by State and Federal OPAs to act to reduce impacts when necessary and appropriate.

While spills may kill or harm brown pelicans, spill response activities have become more organized and effective. Therefore, we believe that oil and gas activities, while they may occasionally have short term impacts to local populations, are not a significant threat to brown pelicans on the Gulf Coast.

Oil spills and chronic oil pollution from oil tankers and other vessels, offshore oil platforms in the Southern California Bight, and numerous natural oil seeps in the Santa Barbara Channel, continue to represent a potential and significant source of injury and mortality to pelicans (Carter 2003). The effects of oiling on pelicans persist beyond immediate physiological injuries. Survival and future reproductive success of oiled pelicans that are rehabilitated and released are lower than for non-oiled pelicans (Anderson et al. 1996). Injury and mortality of large numbers of pelicans would likely result if a significant oil spill occurred near a nesting colony during the breeding season, or near traditional roost sites in the Southern California Bight or in Mexico. During the fall and winter, thousands of pelicans migrate into the Southern California Bight from Mexico, and could also be susceptible to injury and mortality by a major oil spill (Anderson and Anderson 1976; Briggs et al. 1981).

Oil spills from oil tankers and other vessels are far more common than spills from oil platforms (Carter 2003; Hampton et al. 2003). Since 1984, twelve major oil spill-related seabird mortality events occurred along the coast of California, all of which may have adversely affected breeding, roosting, or migrating pelicans (Hampton et al. 2003). Only one of these events was from an offshore oil platform, the Platform Irene spill in the Santa Barbara Channel in 1997; the rest were from tankers, oil barges, or non-tanker vessels (Hampton et al. 2003). On February 7, 1990, the oil tanker vessel American Trader ran aground at Huntington Beach, California, and spilled 416,598 gallons of Alaskan crude oil (ATTC 2001). An estimated 195 pelicans died as a result of the spill, and 725 to 1,000 oiled pelicans were observed roosting in the Long Beach Breakwater after the spill (ATTC 2001). The spill occurred just before the start of the breeding season as the birds gathered at traditional roosts before moving to breeding islands, making large numbers of birds vulnerable to the oil (ATTC 2001).

Marine sanctuary regulations prohibit vessels, including oil tankers, from operating within 1.85 km (1 nautical mile) of any of the Channel Islands. In the event of a major oil spill, this is probably an insufficient distance from the pelican nesting colonies to prevent impacts**.** Oil tankers and other cargo vessels frequently pass through the Southern California Bight in established shipping lanes that are within 5 km of Anacapa Island to the north and within 50 km to the south (Carter et al. 2000). A traffic separation scheme north of Anacapa Island in the Santa Barbara Channel separates opposing flows of vessel traffic. The shipping lanes and traffic separation scheme in the Southern California Bight reduces the likelihood of spills because it reduces the probability of vessel-to-vessel and vessel-to platform collisions. However, shipping traffic is increasing offshore of California, and this may result in increased oil spills and pollution events, resulting in increased threats to pelicans (McCrary et al. 2003). There is also a shipping lane that passes within 25 km of the Coronados Islands in Mexico, which represents a threat to the pelican nesting colony there (Carter et al. 2000).

There are 27 offshore oil platforms and 6 artificial oil and gas islands off the coast of southern and central California, and there is currently a moratorium on new oil platforms in State and Federal waters (McCrary et al. 2003). There are no platforms within the Channel Islands National Marine Sanctuary which extends 6 nautical miles offshore from each of the Channel Islands (McCrary et al. 2003). Petroleum operations are prohibited within the sanctuary, with the exception of a few leases within sanctuary boundaries that existed prior to the sanctuary's creation in 1980, although new petroleum operations are unlikely to occur on these leases (McCrary et al. 2003). The sanctuary essentially provides a minor buffer for the colony on West Anacapa Island from the threat of oil platform accidents, allowing time for break-up of oil discharges, and time to respond before reaching shore. The last major spill from any of the oil platforms or associated pipelines was a well blowout in 1969 that released 80,000 barrels in the Santa Barbara Channel; however, Minerals Management Service (MMS) estimates the risk of a spill of 1,000 barrels or more over the next 28 years at 41 percent (McCrary et al. 2003).

MMS is responsible for inspection and monitoring of Outer Continental Shelf oil and gas operations (McCrary et al. 2003). Several Federal and State laws were instituted in the 1970s to reduce oil pollution (Carter 2003). In 1990, State and Federal oil pollution acts were passed, and agencies developed programs to gather data on seabird mortality from oil spills, improve seabird rehabilitation programs, and develop restoration projects for seabirds (Carter 2003). There have also been improvements in oil spill response time, containment, and cleanup equipment (McCrary et al. 2003). These measures have not eliminated the threat of oil spills, but have reduced the likelihood of spills, and may alleviate impacts on pelicans and other seabirds if a spill were to occur (Carter 2003).

Oil spills from oilfields, pipelines, or ships have impacted brown pelicans in some in other countries. Reports of oiling relate to an oilfield in Mexico (King et al 1979) and from a ship in the Galapagos Islands (Lougheed et al. 2002). Although 117 brown pelicans were reported as affected by the 2001 spill in the Galapagos Islands, Ecuador, from the fuel tanker Jessica, no mortalities of pelicans were reported (Lougheed et al. 2002). From these accounts, brown pelicans frequently survive these incidences, especially when receiving some rescue clean-up. Oil spills have been identified as a possible threat in oil-producing areas of Venezuela, with concern for effects on marine productivity and the food supply of brown pelicans, as well as for direct oiling of birds.

e. Collisions and Avoidance of Human-made Structures

Impacts of planned offshore wind farms along the Texas Gulf Coast are an impending potential risk to pelicans. Wind energy's clean power production eliminates environmental pollution and greenhouse gas emissions and broadly benefits wildlife. However, because there are no offshore wind farms yet in the U.S., there have been no studies assessing site-specific effects of wind turbines on pelicans off U.S. coastal areas. In 2006, two offshore wind farms were approved for development on Texas state submerged lands. One wind farm is to be located off the coast of Galveston Island, near the large Pelican Island rookery, and the other is to be built south of Corpus Christi, off of Padre Island, south of Baffin Bay (Mufson and Eilperin 2006, Shields 2006). The farm near Padre Island will be the largest in the United States, encompassing 39,900 acres with as many as 170 turbines up to 525 feet tall situated from three to eight miles offshore (Greenr 2006). Future growth in wind energy development is expected and wind farm expansion in Texas has been encouraged by the Texas Land Commissioner (Perin 2004; Mufson and Eilperin 2006).

Conflicts between wind turbines and waterbirds arise due to the coincidence of shallow seas favored as both wind energy sites and foraging areas, combined with the use of wind for both migration flyways and productive wind turbine locations. Wind turbines pose a direct threat to individual birds through collision, and potentially affect movement patterns, access to breeding colonies and roost sites, and foraging behaviors. Collisions involving resident and migrant waterbirds with wind turbines and associated meteorological towers have been documented in Europe, with moonless nights and unfavorable weather presenting the greatest collision risk conditions (Montes and Jaque 1995; Still et al. 1995; Exo et al. 2003; Everaert 2004). Definitive effects of wind farms on other pelican species are unclear, however, reports of avian mortality due to wind turbine collisions in Europe and the United States detected a bias toward medium to larger birds (Montes and Jaque 1995; Still et al. 1995; Erickson et al. 2001). The American white pelican, *Pelecanus erythrorhynchos*, has been ranked as the ninth most hazardous bird species during low-level aircraft flight in the U.S. (Kelly 2000). A fatal collision with a wind turbine has been recorded for the brown pelican at Altamont Pass, an inland wind farm in California (Erickson et al. 2001).

Significant but localized incidences of mortality through collisions with vehicles, powerlines, and other structures have been reported in Peru (Leck 1973), Chile (CNN 1997), and Venezuela (McNeil 1985).

II.D. Synthesis

1. Gulf Coast of the U.S.:

The number of nesting brown pelicans on the Gulf Coast has increased dramatically since extirpation in Louisiana and near-extirpation in Texas in the 1960s. Before the 2005 hurricane season, nesting populations along the Gulf Coast had rebounded to levels within the range of estimates of historical abundance. This recovery of nesting numbers is the result of the decreasing impact of persistent pesticide residues; importation of pelicans from Florida; protection and enhancement activities by state, federal, and private agencies; creation of nesting islands by the deposit of dredge spoil; and natural reproduction.

The number of nesting brown pelicans counted in Louisiana in 2006 was less than recent years as the result of an oil spill and several hurricanes in 2005. Nesting numbers declined by over half from recent peak years. The number of nesting colonies decreased by less than 40% from recent high years. At this point, we do not know how many of these birds were able to disperse to other areas not covered by surveys. Dispersed birds may return to breed in the following year. Pelican populations have rebounded following hurricane and storm caused impacts before, although impacts of 2005 were especially severe. Surveys in 2006 reveal the loss of some nesting island habitat east of the Mississippi River in Louisiana. We anticipate that continued deposition of dredge spoil materials will create and enhance nesting habitat as it has in the recent past.

Human disturbance of nesting colony sites occasionally occurs, but currently most nesting islands are in federal (National Wildlife Refuges and Corps of Engineers) or state ownership where access is very limited. Other islands are monitored by the Texas Audubon Society's Coastal Sanctuaries program.

Brown pelicans are subject to several avian diseases and parasites. There is also some concern about imported red fire ants on nesting islands. There is no evidence that any of these factors has limited brown pelican numbers on the Gulf Coast.

State agencies have demonstrated a commitment to the brown pelican and led the recovery for the brown pelican on the Gulf Coast through the enforcement of state protective laws and in active management actions including re-introduction and cooperating with the U.S. Army Corps of Engineers and other agencies in the protection and enhancement of habitat. We expect these efforts to continue.

Portions of the coasts of Texas and Louisiana are sites of intense oil and gas production. Oil spills occur and impact coastal resources, such as the 2005 incident in Louisiana. Oil spill response activities have become more organized and effective in protecting all coastal resources through the activities of the Minerals Management Service, the U.S. Coast Guard, and other agencies, so that we believe these activities are no longer a significant threat requiring special protections for the brown pelican.

2. California brown pelican:

Nesting colonies in the U.S. are expected to be protected from habitat modification and human disturbance in perpetuity. The threat of human disturbance at nesting colonies in the U.S. has been greatly reduced, although roosting habitat in some areas continues to be threatened with chronic human disturbance. However, there is no evidence that lack of roosting habitat has limited the recovery of pelicans in California. Most nesting colonies in Mexico have protected status, and significant progress has been made towards reducing threats at these colonies. Disturbances at nesting colonies continue to be a threat in Mexico, although there is no evidence that this is resulting in population declines. We have no specific information about roost sites in Mexico, although presumably roost sites would be afforded protections where they occur on islands and may not be protected where they occur at mainland sites. It is possible that the population remains stable despite disturbances at some colonies because they respond to inhabitable conditions (i.e., frequent disturbances, inadequate food resources) by moving to another colony. However, it is important to monitor this situation to ensure that a sufficient amount of “safe” disturbance-free roosting and nesting habitat remains available to the subspecies to prevent future population declines.

Several diseases have been identified as a source of mortality for pelicans; however, disease is not likely to impact long-term population trends because they are self-limiting and sporadic. Natural factors, such as oceanic conditions that affect prey abundance and availability, and El Niño events may adversely affect reproductive success and adult survival on a short-term localized basis, but alone pose a minimal threat to the subspecies. The CPSFMP will likely ensure that northern anchovies and other forage fishes are managed so that there are adequate food supplies available to pelicans in the U.S. However, food supplies may not be adequately protected in Mexico, and pelicans could be adversely affected if anchovies or other prey species become intensively harvested in the future. Current regulations may not be sufficient to ensure that the market squid fishery will not adversely affect nesting pelicans in the U.S., and this fishery should be closely monitored to re-evaluate and prevent impacts from occurring in the future.

Oil spills and oil pollution continue to be a potential threat but the breeding range is large enough that a single spill, even a major one, would likely only threaten a fraction of the population. This threat has been alleviated in the U.S. to some degree by stringent regulations for extraction equipment and procedures, the traffic separation scheme and shipping lanes that reduce the likelihood of collisions, and improvements in oil spill response, containment, and cleanup. These measures reduce the probability of spills and also may reduce adverse impacts if a spill were to occur.

The primary reason for severe declines in the population was DDT contamination in the Southern California Bight in the early 1970s, but this is no longer a serious threat. Pelicans achieved a dramatic recovery in the early 1980s in the Southern California Bight, and although reproductive success varies widely from year to year, the population has been stable since then. There are several remaining threats to the subspecies, most notably disturbances and minimal enforcement of nesting colony protections in Mexico, and elimination or chronic disturbances of roost sites in the U.S. Significant progress has been made in addressing these threats, and should continue to ensure that the population remains stable. However, despite the remaining threats, the population has remained stable for at least 20 years within its entire range with a population of approximately 150,000 birds. This suggests that they are resilient to known threats and may no longer require the protections of the Endangered Species Act.

Since the development of the recovery plan, it has become apparent that the target productivity for downlisting or delisting is probably too high to be attainable. As discussed earlier in section II.B.3.a. the California brown pelican population in the Southern California Bight appears to be stable and healthy (Gress et al. 2003) even thought it has consistently exhibited lower than target productivity over the last 20 years.

3. Status of the brown pelican throughout its listed range:

The brown pelican was initially listed as endangered under the Endangered Species Conservation Act of 1969, as described in the listing history section (I.C.2) of this document. This initial listing preceded the passage of the Endangered Species Act of 1973, which formally introduced the five factors that we now carefully consider and document when making listing determinations. Implementing regulations at 50 CFR 17 for the 1969 Act were published on June 2,1970 (35 FR 8491). These regulations provided no direction or criteria for making listing determinations. The Federal Register documents that listed the brown pelican were simply lists of species that had been identified as being endangered in the United States and in foreign countries and did not provide the specific reasons or rationale for the determinations.

We have not been able to locate a record of the reasons that the brown pelican was placed on the 1970 lists, if one ever existed. We can therefore only speculate on the reasons for the inclusion of the brown pelican on these lists, although a reasonable reconstruction of the reason(s) for listing can be made based on the scientific literature on brown pelicans available in 1969 and 1970.

Pesticides

The most likely reason for considering the brown pelican as endangered is the effect of pesticides in use at the time on reproduction. Schrieber and Riseborough's (1972) review and presentation of the evidence for the involvement of DDT in reproductive failure in brown pelicans includes numerous references to evidence available throughout the 1960s. Among the published information that was available at the time of listing was the report that wild brown pelicans had not successfully reproduced in Louisiana since 1961, and only 18 young were produced in Texas in 1963. On Anacapa Island, California, only four young were fledged in 1969 from 1272 nests built, 75% of which had eggs. Although Schreiber and Riseborough's review was limited to the United States, DDT and other pesticides were used outside U.S. borders, especially in tropical areas where control of malarial vectors is a major health concern.

We have determined in this review that pesticide effects on reproduction are no longer a serious threat to the brown pelican. We have no information that indicates that pesticide-caused reproductive failures have occurred in other countries.

Population sizes

The population estimates for various states, regions, and countries reviewed in section II.C.1.a are not strictly comparable because they were not made using any standard protocol or methodology, and in many cases the process by which the estimates were developed is not described. Although in some cases these estimates may be reliable in describing local abundance and trend, they have limited value in estimating absolute size or trend in the global population. Because these estimates are the best available information, we have attempted to use some conservative assumptions in tabulating these data in order to make a conservative estimate of the global population size of the listed brown pelican population. Attachment 1 tabulates the actual population estimates from the literature, as described in section II.C.1.a of this review. Assumptions made for some entries are described in the notes following Attachment 1.

Data on numbers of nests from Attachment 1 were then used to estimate the total population size for each area. These new estimates of total population size were generated by doubling the number of nests or nesting pairs reported in Attachment 1. For some areas there are two rows of estimates, one based on nests and one based on the reported direct estimates. The estimates from nest numbers are underestimates of the population size because there are also likely to be non-breeding birds in the population, either unpaired adults or immature birds. Angehr (2005) adjusted his estimates by multiplying the number of nests by three, rather than two, to account for non-breeding birds. The different multiplication factors are not likely to be important for the very general comparisons we are making in this analysis. These new estimates are presented in Attachment 2 along with the direct estimates of total population size.

It is desirable to compare historical population sizes with current population sizes to assess the status and trends of the brown pelican populations. Because the currently available data do not provide such estimates for all areas, we have used the available data from Attachment 2 to derive estimates of the earliest estimates of population size for an area with the most recent for the same area. These estimates are provided in Attachment 3.

Because there are very large ranges in estimates of the Louisiana population in 1920 and the Gulf of Panama population in 1982, we performed the comparison twice. Attachment 3 therefore contains two sets of estimates: The first four columns incorporate the lower estimates and the last four incorporate the higher estimates from these two areas. Other assumptions in developing the numbers in Attachment 3 are explained in the notes following the table.

In interpreting the estimates in Attachment 3, the great proportion of the global population that is represented by pelicans in Peru and within the range of the California subspecies must be considered. Peru represents 63 % to 74%, depending on the estimate, of the brown pelican totals, and Peru and the California subspecies together represent 82% to 92 % of the global population estimates of brown pelicans. The food-rich coldwater currents that are responsible for these two large components of the global population also make them susceptible to El Niño driven fluctuations in productivity and sometimes population sizes. This factor is evident in the different estimates for Peru, but we do not have similar comparative estimates for the California subspecies. We also do not have estimates for the Peruvian population subsequent to the low, later estimate. In an attempt to control for this natural factor affecting populations, data in Attachment 3 also include totals with the Peruvian data excluded.

The totals indicate that the current population of the brown pelican is large. This total, or global estimate, is for the listed brown pelican, which does not include the Atlantic coast of the U.S., Florida, and Alabama. The total based on the regional estimates is over

620,000 birds. This number is based on available estimates and does not include Guatemala and Nicaragua, for which no estimates were found. This total is over twice the global estimate provided by Angehr (2005) of 290,000 birds. Excluding the large Peruvian component still leaves a current total of over 230,000 birds, so that the population total outside Peru is still large.

Overall population trends:

For reasons given in the preceding paragraphs on population sizes, and the fact that dates of "earlier" estimates range from "historic" to 1980 and dates of "later" estimates range from 1987 to 2006, we do not believe that the available data are appropriate for indicating population trends. We can make some observations on the totals derived in our analysis. Using the lower estimates for historic earlier estimates for Louisiana and the Gulf of Panama, the later estimate is about 74% of the earlier. This result is dominated by the Peruvian estimates: the later estimate of the population outside of Peru is actually slightly larger (by 1.7 %) than the earlier estimate. Using the higher earlier estimates for Louisiana and the Gulf of Panama, the later estimate is about 68% of the earlier estimate; outside of Peru the later estimate is about 73% of the earlier. The greatest difference is by less than a factor of 1/3 of the estimate of the earlier population. Given the subjective and non-comparable nature of most of the underlying data, we cannot conclude that any of the differences in total estimates represent either a population decrease or an increase.

Regional population status and trends:

Some data on regional status can be interpreted as indicating local trends. There is little doubt that brown pelican numbers in Louisiana, Texas, and southern California have increased with protection and active restoration since the banning of persistent pesticides. Brown pelican population sizes in these areas are at or near historic levels, even though the nest counts in Louisiana following the 2005 hurricane season were greatly diminished from the immediately preceding years. The decline in wintering birds in Puerto Rico and the Virgin Islands may reflect changes in migration patterns rather than a decline in breeding populations elsewhere. Although the population of the West Indies is small compared to populations in Peru and California, the brown pelican is still considered a common resident bird in the Bahamas, Greater Antilles, and northern Lesser Antilles (Raffaele et al. 1998).

Distribution:

The brown pelican population is well-distributed, with no evidence of any historical contraction of the range now that Louisiana is again populated with breeding brown pelicans.

Threats:

Remaining threats include injury from fishing gear, other conflicts with fishing activities (including overfishing), intrusions on nesting areas during breeding seasons, loss of habitat due to hurricanes, collisions, and oil spills. Disturbance-related threats are likely to have ameliorated since the time of listing as states and countries have established or enforced existing protections of pelicans and their nesting habitats, but they still occur in some locales. Oil spills, collisions, and overfishing remain potentially significant causes of mortality to local populations however, none appear to threaten the brown pelican with extinction over a significant portion of its range, nor cause it to be likely to become endangered in the foreseeable future.

Conclusion:

The brown pelican is well-distributed throughout its known historic range. Even the most conservative, available estimates indicate that its global population size is large, consisting of hundreds of thousands of individuals. Local or regional populations may fluctuate in response to such factors as severe storms and to variable weather patterns such as El Niño that affect food supply. Brown pelicans have evolved with these natural factors and have demonstrated the ability to recover from their effects. The basis for the listing of the brown pelican was most likely the failure of reproduction owing to the effects of persistent pesticides then is use. In areas where this threat is known to have occurred it is no longer a factor limiting brown pelican populations, which have subsequently recovered to historic levels. Residual threats are localized and do not appear to have a significant affect on the global population and its distribution. The best available information that we have on the size and distribution of the brown pelican population, together with an absence of limiting threats, indicates that the listed brown pelican population does not meet the definition of an endangered or threatened species under the Endangered Species Act.

This conclusion must be tempered by an acknowledgement that the information on population sizes is based in most cases on expert opinion and expert estimates rather than any consistent or rigorous methodology. We respect and value the efforts experts who have applied their knowledge to further our understanding of the status of the brown pelican. We believe that we have used the best available information relevant to the status of the brown pelican, and that our conclusions are based on the most reasonable interpretation of that information.

III. RESULTS

III.A. Recommended Classification:

____ Downlist to Threatened
____ Uplist to Endangered
_X_ Delist (*Indicate reasons for delisting per 50 CFR 424.11):*
____ Extinction
_X___ Recovery
____ Original data for classification in error
____ No change is needed

III.B. New Recovery Priority Number __N.A._

III.C. If a reclassification is recommended, indicate the Listing and Reclassification Priority Number (FWS only):

Reclassification (from Threatened to Endangered) Priority Number: ____

Reclassification (from Endangered to Threatened) Priority Number: ____

Delisting (Removal from list regardless of current classification) Priority Number: __2__

IV. RECOMMENDATIONS FOR FUTURE ACTIONS

Evaluate new information expected in the near future: Although our discussion and analysis is based on the information currently available to us at this time, we are aware of other sources of relevant information that will likely be available in the near future. The Service's Division of Migratory Bird Management has funded the development of national-scale aquatic bird reports for all nations in Central America and South America and for some Caribbean islands. These reports are to address subjects including habitat, threats, and population numbers. The only report in this series now available to us is the report for Panama (Angehr 2005), which is the basis of much of our discussion of that country in this review. We recommend that any additional reports be reviewed when available, and any improved information from these reports be incorporated into a revised 5-year review document or a proposed rule for reclassification.

Verify population estimate and pesticide risk analyses: Our assessment that the global population of the listed brown pelican is large is a major factor in our recommendation that the DPS be delisted, but we have acknowledged major deficiencies in the available data on population sizes. Attempts must be made to either confirm these estimates or replace them with better-documented estimates. Our assessment is also based on our assumption, based on a lack of reports, that persistent pesticides are not limiting brown pelican reproduction outside of the U.S. It is possible that such pesticide effects have occurred but have not been reported. Any subsequent notice on the status of brown pelicans or proposed rule to delist the DPS should clearly identify the uncertainties associated with our assessments of population sizes and pesticide threats and solicit technical comments and information from knowledgeable sources to help us evaluate the appropriateness of our conclusions and correct them if necessary. Collecting, maintaining, or verifying information on these two issues should be considered in the development of any post-delisting monitoring plan.

Conduct baseline studies prior to wind farm development: Pelican distributions, behavior, and food and roost site locations should be monitored before construction of wind farms along shorelines as well as offshore. A thorough evaluation of a proposed site, incorporating pre-wind farm pelican mortality rates and the spatial and demographic structure of the pelican population, is important to quantify and reduce risks to brown pelicans (Anderson et al. 2000). As the wind energy industry is expected to grow, adequate planning before wind farm construction combined with appropriate management after construction can reduce negative impacts to birds, as well as minimize expenses and delays (Anderson et al. 2000; Janss 2000, Perin 2004; Senia 2005). Consideration should be given to seasonal and hourly timing and orientation of migration routes, occurrence of favored stopover habitats, responses of pelicans to meteorological conditions, frequency and altitude of local diurnal and nocturnal movements, foraging timing and locations, and ecological value of the proposed wind farm site to calculate the brown pelican’s susceptibility to collision accidents and potential effects on access to foraging/roosting/breeding areas (Anderson et al. 2000; Garthe and Huppop 2004; Drewitt and Langston 2006). Doppler and other forms of radar, thermal imaging, remote sensing, and direct visual methods are effective tools for locating prominent passages by birds before construction and can be used to set heights and field sizes of turbines in order to minimize negative impacts to pelicans (Kelly 2000; Richardson 2000, Gauthreaux and Belser 2003, Huppop et al. 2006). These methods also can be used to detect flocks approaching on a day to day basis and adjust wind speeds at which rotor blades start and stop in response to immediate bird movements (Lowther 1998). Turbine blade orientation and height can be set to account for the least possible impact to pelicans.

The impact of human disturbance related to future wind turbine maintenance, and use of surrounding physical and biological characteristics by pelicans should be factored into potential effects of wind farm location and configuration. European data found that extended lines of turbines formed flight path barriers to waterbirds, particularly when the turbine lines were situated between feeding and roosting locations (Dirksen et al. 2000). Avoidance maneuvers could lead to increased energy needs and displacement from feeding or roosting habitats. From acquired data of pelican movement patterns, regions of dominant passageways should be left open as flight corridors with turbine construction prevented in these locations. Potential cumulative effects of wind farms to pelicans should be factored in to the wind farm design.

Monitor effects of wind farm construction and operation: Wind farm construction and operation has been known to change shorebird behavior, primarily through avoidance of turbine locations due to blade movement, rotary acoustical effects, and possibly vibrations from towers (Merck and Nordheim 1999; De Lucas et al. 2004, Everaert 2004; Desholm and Kahlert 2005). Maritime species consumed by the brown pelican also may be influenced by turbine location and operation, indirectly affecting pelican foraging. Maintaining records of pelican densities, flight and foraging behavior, and roosting access and locations in the vicinity of wind farms is important to gain information of pelican mortality and responses to wind farms and to adjust blades to perform in a manner that minimizes negative impacts to pelicans.

Monitor effects from Pacific squid fishery: Current regulations may not be sufficient to ensure that the market squid fishery will not adversely affect nesting pelicans, and this fishery should be closely monitored to re-evaluate and prevent impacts from occurring in the future. There is little information about the impacts of nighttime lighting associated with the squid fishery on pelicans. Research is needed to determine the amount of light that pelicans are able to tolerate without adverse impacts.

Protect important roosting habitat: Protection of important roost sites was listed as a recovery action in the recovery plan. Given that roosting habitat in the U.S. is still threatened with disturbance or elimination, particularly in California, we should seek opportunities to protect and secure existing roosting habitat, and decrease human disturbance at roost sites. Pelicans are found as far north as British Colombia during the non-breeding season, although there is little information about the status of roost sites within the majority of the subspecies' range. An atlas of pelican roost sites in California is in preparation which will help to evaluate the status of roosting habitat and target important roosting areas that are in need of additional protections. However, this atlas is only partially funded and needs additional support to analyze and complete. A complete atlas could be used to identify important roost areas in need of additional protections.

Ensure protection of nesting colonies in Mexico: Because the vast majority of the population of the California brown pelican nests in Mexico (90 to 95 percent), the protection of Mexican nesting colonies are critical to the continued recovery and maintenance of the population. To date, the Service has had little involvement in the conservation of pelicans in Mexico, and we should work with appropriate Mexican agencies to ensure that nesting colonies are managed to protect the subspecies. Significant progress has been made through various conservation and government agencies to protect and restore seabird nesting colonies on islands in Mexico, and these have undoubtedly benefited pelicans.

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Attachment 1. Brown pelican estimates considered in estimating current population sizes.								
	Number of nests or pairs				Number of birds			
	Low	Date	High	Date	Low	Date	High	Date
Louisiana	10,000	historic	15,000	historic	12,000	1920	85,000	1920
La-census	7,630	2006	16,501	2005				
Texas	1,500	historic	4,000	historic				
Texas - census			3,800	2003				
California	1,752	1992	6,000	many yrs				
California subspecies							150,000	2002
Puerto Rico/USVI			>350	1984				
Puerto Rico/USVI - winter					593	1995	>2300	1984
West Indies-entire			1,500	2000				
Eastern Mexico	560	1986	700-1000	1996	2,270	1986	4,438	1980
Belize/E. Honduras			<100					
El Salvador					800	2002	800	2002
W Costa Rica & Honduras			<1000					
Panama					6613	1993	15,000	2005
Gulf of Panama			5,027	2005	6,031	1993	70,000	1982
Venezuela			3,369	1987			17,500	1987
Ecuador-mainland			>500	1993				
Ecuador-Galapagos			3,000					
Peru					400,000	1996	620,000	1986
Chile-Isla Pajaro Nino	1,032	1998	2,699	1996				
Global (Angehr 2005)							290,000	2005

Notes on Attachment 1.

California: California brown pelican only in California.

California subspecies: Includes pelicans in the entire range of the subspecies, both in Mexico and California.

PR/VI: Puerto Rico and the U.S. Virgin Islands. Only resident, nesting birds are included; does not include winter migrants. Estimate is a 5-year running average.

PR/VI –winter; Includes both residents and winter migrants. Estimates for 1984 are 5-year running averages

Eastern Mexico: This is outside the range of the California subspecies and therefore does not include any California brown pelicans.

Gulf of Panama: The high number of 70,000 birds is an order of magnitude greater than the low figure in the table and an additional estimate of 3017 from Shields (2002).

Ecuador, Galapagos: The actual estimate was “a few thousand” (Shields 2002).

Chile, Isla Pajaro Niño: This does not represent the entire population in Chile.

Attachment 2. Estimated population sizes of brown pelicans as reported or as derived from number of nesting pairs				
	Number of birds			
	Low	Date	High	Date
Louisiana	12,000	1920	85,000	1920
Louisiana (nests)	20,000	historic	30,000	historic
Louisiana (nests) census	15,260	2006	33,002	2005
Texas (nests)	3,000	historic	8,000	historic
Texas (nests) census			7,600	2003
California (nests)	3,504	1992	12,000	many yrs
California subspecies			150,000	2002
PR/VI (nests)			>350	1984
PR/VI-winter	593	1995	>2300	1984
West Indies-entire			3,000	2000
Eastern Mexico	2,270	1986	4,438	1980
Eastern Mexico (nests)	1,120	1986	1400-2000	1996
Belize/E. Honduras			<200	2002
W Costa Rica & Honduras			<2000	
El Salvador	800	2002	800	2002
Panama	6,613	1993	15,000	2005
Gulf of Panama	6,031	1993	70,000	1982
Gulf of Panama (nests)			10,054	2005
Venezuela			17,500	1987
Ecuador-mainland (nests)			>1000	1993
Ecuador-Galapagos			6,000	
Peru	400,000	1996	620,000	1986
Chile-Isla Pajaro Niño (nests)	2,064	1998	5,398	1996
Global (Angehr 2005)			290,000	2005

Note on Attachment 2.

"(nests)": Indicates that the population estimate was derived by multiplying by 2 the number of nests or nesting pairs reported in Attachment 1.

Attachment 3. Comparison of earilier with later population estimates of brown pelican populations								
	Number of birds using *lower* estimates for Louisiana and Gulf of Panama				Number of birds using *higher* estimates for Louisiana and Gulf of Panama			
	Earlier	Date	Later	Date	Earlier	Date	Later	Date
Louisiana	16,000	historic	15,260	2006	57,500	historic	15,260	2006
Texas	5,500	historic	7,600	2003	5,500	historic	7,600	2003
California subspecies	150,000	2002	150,000	2002	150,000	2002	150,000	2002
West Indies-entire	3,000	2000	3,000	2000	3,000	2000	3,000	2000
Eastern Mexico	4,438	1980	1,700	1996	4,438	1980	17,000	1996
Beliz/E. Honduras	200	2002	200	2002	200	2002	200	2002
W Costa Rica & Honduras	2,000	2002	2,000	2002	2,000	2002	2,000	2002
El Salvador	800	2002	800	2002	800	2002	800	2002
Panama	6,613	1993	15,000	2006	70,000	1982	15,000	2006
Venezuela	17,500	1987	17,500	1987	17,500	1987	17,500	1987
Ecuador-mainland	1,000	1993	1,000	1993	1,000	1993	1,000	1993
Ecuador-Galapagos	6,000	2002	6,000	2002	6,000	2002	6,000	2002
Peru	620,000	1986	400,000	1996	620,000	1986	400,000	1996
Chile-Isla Pajaro Niño	5,398	1996	2,064	1998	5,398	1996	2,064	1998
Totals:	838,449		622,124		943,336		637,424	
Totals without Peru:	218,449		222,124		323,336		237,424	
Global (Angehr 2005)							290,000	
% Peru	74%		64%		66%		63%	
% Peru + California subsp.	92%		88%		82%		86%	

Notes on Attachment 3

Louisiana: A high and low range was reported in the original estimates of the historical population and the population in1920, which we view as equivalent to a historic population level. Because the high estimates differ so greatly (12,000-80,000) for the 1920 estimate, we use the lower number for the comparisons in the first for columns, and the higher estimate in the second comparisons. The earlier population size in the first comparison was derived by averaging the 1920 and historic estimates, which differed by less than a factor of two. The earlier size for the second comparison is the also the mean of 1920 and historic estimates.

Texas: The earlier estimate is the mean of the high and low historic estimates.

California: The historic and current population sizes are assumed to be the same, as supported by the results of our review that the California brown pelican has recovered.

West Indies: We do not have an estimate for the historical population size. Although a decline in the number of wintering birds in Puerto Rico and the Virgin Islands has been noted, we do not have information to determine if this represents a decline in the entire population of the West Indies. The reported size of the Puerto Rico and Virgin Islands population is about 350 nesting pairs, or roughly one-fourth the estimated size of the current population of the West Indies, so that while important we do not believe it dominates the overall population status of the region. We used the same estimate for earlier and later population sizes, but acknowledge that the historic size may have been larger, but not substantially so.

Eastern Mexico: The later value is the mean of the high and low estimates based on nests in 1996. Being based on nests, we acknowledge that it somewhat underestimates the total number of birds, perhaps by 50%.

Belize and Eastern Honduras, West coasts of Costa Rica and Honduras, Venezuela, and Ecuador (mainland and Galapagos Islands): Because we do not have an estimate of historic size and we have no evidence for a decline is these areas, we have assumed that historic and current population sizes are the same.

U.S. FISH AND WILDLIFE SERVICE

5-YEAR REVIEW OF THE LISTED DISTINCT POPULATION SEGMENT OF THE BROWN PELICAN *(Pelecanus occidentalis)*

Current Classification: Endangered distinct population segment
Recommendation resulting from the 5-Year Review

____ **Downlist to Threatened**
____ **Uplist to Endangered**
_X_ **Delist**
____ **No change is needed**

Appropriate Listing/Reclassification Priority Number, if applicable _____

Review Conducted By Regional Office staff, Region 2, with major contributions from the Clear Lake Ecological Services Office, Region 2, and Ventura Fish and Wildlife Office. ~~Region 1.~~ CNO

REGIONAL OFFICE APPROVAL:

Lead Region:

Regional Director, Region ~~2, Fish and~~ Wildlife Service

Approve________________ Date 1-8-07

Supporting Regions:

California and Nevada Operations Manager, Fish and Wildlife Service

_X_ Concur _____ Do Not Concur

Signature________________ Date 1/24/2007

Regional Director, Region 4, Fish and Wildlife Service

_✓_ Concur _____ Do Not Concur

Signature________________ Date 2/7/07