San Clemente Loggerhead Shrike
Lanius ludovicianus mearnsi

5-Year Review:
Summary and Evaluation

U.S. Fish and Wildlife Service
Carlsbad Fish and Wildlife Office
Carlsbad, CA

June 17, 2009

5-YEAR REVIEW

San Clemente loggerhead shrike (*Lanius ludovicianus mearnsi)*

I. GENERAL INFORMATION

Purpose of 5-Year Reviews:

The U.S. Fish and Wildlife Service (Service) is required by section 4(c)(2) of the Endangered Species Act (Act) to conduct a status review of each listed species at least once every 5 years. The purpose of a 5-year review is to evaluate whether or not the species' status has changed since it was listed (or since the most recent 5-year review). Based on the 5-year review, we recommend whether the species should be removed from the list of endangered and threatened species, changed in status from endangered to threatened, or changed in status from threatened to endangered. Our original listing of a species as endangered or threatened is based on the existence of threats attributable to one or more of the five threat factors described in section 4(a)(1) of the Act, and we must consider these same five factors in any subsequent consideration of reclassification or delisting of a species. In the 5-year review, we consider the best available scientific and commercial data on the species, and focus on new information available since the species was listed or last reviewed. If we recommend a change in listing status based on the results of the 5-year review, we must propose to do so through a separate rule-making process defined in the Act that includes public review and comment.

Species Overview

As summarized in the listing document, the San Clemente loggerhead shrike (*Lanius ludovicianus mearnsi*) is a medium sized, predatory passerine bird found only on San Clemente Island, California. Its population at the low in 1998 was 14 individuals; current populations have resurged to a maximum population of approximately 206 individuals, including breeders, floaters (non-breeding adults), and captive released birds, minus known mortalities by November 30, 2006. Bradley (2007, p. 7) reported the minimum population estimate from the "*beginning of March – mid April* 2006 *was 82 birds*." The San Clemente loggerhead shrike has been found throughout xeric habitat on the island, including woodlands and maritime desert scrub. The current wild population reproduces naturally, however due to extremely low population and high levels of predation, is annually supplemented with additional young birds, adult pairs, and pairs with offspring, which have been released from the captive breeding program coordinated by the U.S. Navy, Zoological Society of San Diego, and the Institute for Wildlife Studies.

Methodology Used to Complete This Review:

This review was prepared by the Carlsbad Fish and Wildlife Office (CFWO) using the Region 8 guidance issued in March 2008. We used information from the listing decision, unpublished annual survey information from species specialists who have been monitoring this species, and published literature. We received no additional information from the public. This 5-year review contains updated information on the species' biology and threats, and an assessment of that information compared to that known at the time of listing or since the last 5-year review. We

focus on current threats to the species that are attributable to the Act's five listing factors. The review synthesizes all this information to evaluate the listing status of the species and provide an indication of its progress towards recovery. Finally, based on this synthesis and the threats identified in the five-factor analysis, we recommend a prioritized list of conservation actions to be completed within the next 5 years.

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Federal Register (FR) Notice Citation Announcing Initiation of This Review: 72 FR 7064–7084, February 14, 2007; Initiation of 5-Year Reviews of 58 Species in California and Nevada; Availability of Completed 5-Year Reviews in California and Nevada

Listing History:

Original Listing
FR Notice: 42 FR 40682–40685
Date of Final Listing Rule: August 11, 1977
Entity Listed: subspecies
Classification: endangered

State Listing: Not listed

Associated Rulemakings:

Sept. 27, 1982:	47 FR 42387–42388	5-year review notice
April 5, 1985:	50 FR 13707–13722	Revised list of migratory birds
July 7, 1987:	52 FR 25523–25528	Notice of review

Review History: Last 5-year review completed in 1987 (52 FR 25523).

Species' Recovery Priority Number at Start of 5-Year Review: The recovery priority number for San Clemente loggerhead shrike (*Lanius ludovicianus mearnsi)* is 12 according to the Service's 2007 Recovery Data Call for the Carlsbad Fish and Wildlife Office, based on a 1–18 ranking system where 1 is the highest-ranked recovery priority and 18 is the lowest (Endangered and Threatened Species Listing and Recovery Priority Guidelines, 48 FR 43098, September 21, 1983). This number indicates that the taxon is a *subspecies* that faces a moderate degree of threat and has a low potential for recovery.

Recovery Plan or Outline

U.S. Fish and Wildlife Service. 1984. Recovery Plan for the Endangered and Threatened Species of the California Channel Islands. U.S. Fish and Wildlife Service, Portland, OR. 165 pp.

Date Issued: January 26, 1984

II. REVIEW ANALYSIS

Application of the 1996 Distinct Population Segment (DPS) Policy

The Endangered Species Act defines species as including any subspecies of fish or wildlife or plants, and any distinct population segment (DPS) of any species of vertebrate wildlife. This definition limits listing as distinct population segments to vertebrate species of fish and wildlife. The 1996 Policy Regarding the Recognition of Distinct Vertebrate Population Segments under the Endangered Species Act (61 FR 4722, February 7, 1996) clarifies the interpretation of the phrase "distinct population segment" for the purposes of listing, delisting, and reclassifying species under the Act. The San Clemente loggerhead shrike is an evolutionary significant unit which has been given subspecies status recognized by the scientific community (see below).

Information on the Species and its Status

Species Biology and Life History: The San Clemente loggerhead shrike, like other loggerhead shrikes, is a medium sized (45–50 grams) passerine that has a maxillary "tooth" on its bill to enable predation on insects, lizards, and mice. It is slightly color-dimorphic, with vivid black, white and grey plumage, and prominent black/white patches on wings and tails that are flashed in display flights (Cade 1962). It has been recognized as a subspecies since the early 1900s (Ridgeway 1903, 1904), later supported by additional scientific analyses (Miller 1931; Bent 1950; Johnson 1972; Hyde 1980, 1982; Mundy *et al.* 1997a,b; Eggert *et al.* 2004).

San Clemente loggerhead shrikes consume available arthropods such as Hymenoptera, Lepidoptera, Homoptera, and Orthoptera, and reptiles such as lizards. Some small mammals such as mice, and small birds such as wrens and warblers are also used as prey. In 2006, nests had been constructed in ten species of trees and shrubs (mostly *Prunus* spp. and *Rhus* spp.), and on two artificial structures (buildings) (Bradley *et al.* 2006). This shrike, like other shrikes, reaches maturity after one year (Miller 1931; Yosef 1996), and lay clutches of 4–6 eggs which are incubated 15–18 days (Scott and Morrison 1990). Young fledge approximately 2.5–3 weeks post-hatch (Yosef 1996). Adults feed fledglings for another 3–4 weeks (Scott and Morrison 1990). Heath *et al.* (2007, p. 33) noted that 66% of shrikes released from 1999–2005 survived the first year and of these "*61% survived to two years post release."* Turner *et al.* (2003) and Heath *et al.* (2007, p. 33) both conclude that *"juvenile releases contribute the most to the long term augmentation of San Clemente loggerhead shrike on San Clemente Island."*

Spatial Distribution: The San Clemente loggerhead shrike is a non-migratory island endemic; it historically occupied most of the 14,500-hectare San Clemente Island, one in the chain of the Channel Islands archipelago located 80 kilometers from the California coastline (Scott and Morrison 1990). It has the smallest distribution of any subspecies of shrike, as it occurs only on San Clemente Island. Geographical isolation and separation from the mainland resulted in morphological divergence from the *Lanius ludovicianus gambeli* lineage (Johnson 1972).

Abundance: The San Clemente Island population of the loggerhead shrike was recently perilously close to extinction, with a low of 14 individuals known in 1998 (Warnock and Mader 1998). Survivorship of nests (chicks) and fledglings has increased by a factor of two since the early 1980s, often at nests built higher in trees and shrubs and earlier clutches. Mortality during the first month and year are a significant impact on short- and long-term demography (Heath *et al.* 2007); however, adult shrikes have lived up to 11 years (U.S. Navy 2002). Annual efforts to captive breed and release San Clemente loggerhead shrikes on the island have occurred since 1991. Between 1999 and 2005, 255 captive reared shrikes were released using "hacking" techniques into wild habitat on San Clemente Island (Heath *et al.* 2007). Current goals are to maintain 55–65 individuals for captive breeding, annually incorporate (through rotation) wild pedigree stock into the flock, and produce sufficient shrikes in captivity to release up to three adult pairs (and broods produced in captivity) and 15–25 juveniles (Grant and Wiese 2006).

Most recently (2006), three family groups (six adults and nine juveniles) and 25 independent captive reared juveniles were released (Heath *et al.* 2007) using "hacking" techniques to augment the extant wild population of 46 pairs (Bradley *et al.* 2007). On November 30, 2006, the entire San Clemente Island wild shrike population was 206 adults, including wild-born and released juveniles (Bradley *et al.* 2007). The increase since 2000 has been due to captive breeding efforts, predator management, and habitat protection. Wild breeding pairs in 2006 fledged 1.6 (± 1.5) young per nest; overall nest success was 51 percent, with predators the probable cause of nesting failure at 45 percent of all nests (Bradley *et al.* 2007).

Habitat or Ecosystem: As a maritime volcanic island, San Clemente Island had unique maritime sage scrub, coastal salt marsh, and island grassland flora and fauna endemic only to that locale. Much of the original vegetation (diversity, structure, and function) has been lost due to habitat conversion caused by sheep ranching from 1862 through 1934 (Johnson 1972; Ferguson 1979), cattle ranching from 1850–1934 (up to 1,000 head of cattle), feral goats which numbered in the early 1970's to over 12,000 goats (later removed by 1991), and introduction of other non-native plant and animal species, including feral cats and black rats which were predatory on the shrike (Scott and Morrison 1990; U.S. Navy 2002). Habitat conversion which altered the shrub and tree components where shrike nest, in addition to the alterations to the forb and herb layer, combined to dramatically change, in some cases permanently, the San Clemente Island ecosystem. This change created ecological situations for which the San Clemente loggerhead shrike was not adapted and caused population decline, leading to extremely low known populations and the listing of the subspecies in 1977 (Scott and Morrison 1990; Eggert *et al.* 2004).

Lynn et al. (1999, p. 1) described during what is now known as the population low that *"62.5% of breeding pairs nested in only one major canyon…This represents a decrease in central breeding range of approximately 87% (7,200 ha to 960 ha)."* Since then, shrikes have nested in

other areas throughout the island including the east side, west side, and the shore bombardment area, with 12 new territories (never before occupied) in 2006 (Bradley *et al.* 2007). As habitat improvements incur greater areas of restored vegetation, including nest trees and shrubs with suitable structure for nests, it is likely that shrike nests will expand to the plateau and other areas made available for nesting. However, expansion into this newer habitat may also correlate with increased exposure to predation risk (Bradley *et al.* 2007).

Changes in Taxonomic Classification or Nomenclature: None since listing.

Genetics: Mundy and Woodruff (1996, 1998) and Mundy *et al.* (1997a,b) examined mitochondrial DNA (mtDNA) variation and found that the island subspecies (*Lanius ludovicianus mearnsi*) evolved "*sufficient genetic independence to justify ongoing conservation efforts*" (Mundy *et al.* 1997b, p. 869). Patten and Campbell (2000), and later Roemer and Wayne (2003), described morphological characters and molecular genetic evidence (respectively) suggesting that *L. l. mearnsi* was swamped by *L. l. anthonyi* to the point where *L. l. mearnsi* is "*no longer diagnosable*" (Patten and Campbell 2000, p. 177). Eggert *et al*. (2004) noted that Patten and Campbell (2000) and Roemer and Wayne (2003) failed to compare contemporary *L. l. mearnsi* with shrikes from Santa Catalina Island, the closest island in the Channel Island chain. Eggert *et al*. (2004) confirmed the genetic distinctiveness of the *L. l. mearnsi* subspecies by examining mitochondrial control region sequences and nuclear microsatellites of those shrikes occupying San Clemente Island, Santa Catalina Island, northern Channel Islands, and the nearby mainland. They concluded by indicating loggerhead shrikes should not be managed as a single taxonomic entity, and Channel Island loggerhead shrikes comprise three distinct genetic clusters which utilize San Clemente Island, Santa Catalina Island, and the northern Channel Islands/mainland (Eggert *et al.* 2004).

Species-specific Research and/or Grant-supported Activities: Every wild and captive released bird of this subspecies has been, where possible, affixed with a visual identification VID and U.S. Geological Survey band and followed throughout their life (see Bradley *et al.* 2007). This effort becomes more difficult each year as more nests are built and birds survive on the island. Productivity per each wild nest and sire/dam is documented, and young are banded where possible and followed annually by periodic visual surveys. Release of captive bred shrikes is also closely monitored for genetics and demography (see Grant and Lynch 2003, 2005; Grant and Wiese 2006; Heath et al. 2007; Bradley *et al.* 2007), and has resulted in detailed studbooks used for captive propagation efforts.

Considerable cooperative effort has been expended by the U.S. Navy to enhance degraded nesting habitat, manage anthropogenic activities, as well as conduct captive breeding of the subspecies to allow annual introductions of young birds to make up for natural mortality not maintained by wild productivity. Predation by feral cats and black rats continues to adversely affect the nesting population, and is the highest cause of mortality. The population in recent years has increased to an estimated 206 wild breeders and floaters (Bradley *et al.* 2007), which is considerably above its 1998 population (Lynn *et al.* 1999).

Due to the complexity of the recovery effort, numerous partnerships have aided monitoring and population resurgence projects. In 1992–1993, the California Department of Fish and Game

received $60,000 in Endangered Species Act section 6 funding for captive propagation of the shrike. The Navy continues to support via funding, field assistance, and in-kind services a majority of the recovery effort as an offset to ongoing training activities and to uphold their conservation mandate. These efforts are aided by the Zoological Society of San Diego, Institute for Wildlife Studies (Arcata, California), Point Reyes Bird Observatory (Petaluma, California), Soil Ecology and Restoration Group (San Diego State University), and the Service.

Five-Factor Analysis

The following five-factor analysis describes and evaluates the threats attributable to one or more of the five listing factors outlined in section 4(a)(1) of the Act.

FACTOR A: Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range

The San Clemente loggerhead shrike is endemic to San Clemente Island. The island is currently a Naval range complex-owned and managed entirely by the U.S. Navy. The island is used for live bombing, missile launches, live-fire training missions, and special weapons and tactics training. To support training activities, the island hosts about 300 buildings, a primary airfield, Special Warfare training ranges, and live bombing areas. The Navy plans to increase the frequency and types of training on the island, including the designation and use of several Assault Vehicle Maneuver Areas. The area directly impacted by ordnance and training activities is a small portion of the island; much of San Clemente Island is managed for infrequent human use (USFWS 2008). Natural resources conservation activities occur throughout the island, including substantial efforts to aid the recovery the shrike.

The final listing rule identified habitat degradation by non-native herbivores as a primary threat to the subspecies (42 FR 40682–40685); the recovery plan was more specific and indicated that goats were the primary threat, at the time (USFWS 1984). Starting in 1862, San Clemente Island was used for sheep, goat, and pig ranching, at one time hosting island-wide non-native herbivores at an estimated field density of 0.7 to 0.8 per hectare (Van Vuren and Coblentz 1989). With over 150 years of non-native grazers defoliating ground cover, shrubs, and trees, and contributing towards soil compaction, erosion, alteration of soil chemistry, native vegetation and plant systems have been significantly changed, and native habitat including scrubland and woodland have contracted. Ranching altered island ecology including herb/forb vegetation and the shrubs and trees shrikes used for nest and perch sites (Scott and Morrison 1990; U.S. Navy 2002). Currently only 16 percent of the island (2,282 hectares) is suitable for nesting by San Clemente loggerhead shrikes.

The island reverted from private landowner to Navy control in 1934 by Executive Order 6897 of the Franklin D. Roosevelt administration, and has been used as a primary training location for Marine, Army, and Navy forces, including Special Operations, land bombardment, and other related military training.

The primary threat which caused the listing of the San Clemente loggerhead shrike was grazing by invasive animals (42 FR 40682). Sheep, goats, and pigs were eradicated from the island by

the early 1990s. Approximately 29,000 goats were removed from San Clemente Island between 1972 and 1991 (Keegan *et al.* 1994). Cessation of the defoliation of native vegetation and soil compaction caused by human-introduced grazing animals has stopped direct habitat degradation. Although canyon shrub/woodland and maritime desert scrub cholla habitat (including the appropriate nesting substrate) is beginning to recover in many areas affected by overgrazing, nesting habitat on San Clemente Island remains very limited owing to the absence in many areas of trees and shrubs suitable for nesting (USFWS 2008, pg 151). At present, only cats and rodents remain as invasive vertebrates. Rodents subtly affect habitat components; being omnivores, they will consume plant material. Predator populations and their control are addressed as a part of the Predator Management Program enacted by the Navy (U.S. Navy 2002).

The Navy prepared the San Clemente Island Integrated Natural Resources Management Plan (INRMP) in 2002 to provide for mission and natural resource protection on San Clemente Island (U.S. Navy 2002). The Navy continues its commitment for conservation of the San Clemente loggerhead shrike with multiple conservation approaches. Just over 1 percent (145 hectares) of the island was developed specifically for training and billeting of staff and operators using the island. Development of this small amount of the island maintains the military mission to ensure *"no net loss of the capability of the installation's lands to support the military mission"* (U.S. Navy 2002, pp. 1–3). Other areas away from the main encampments are used by reconnaissance and Special Operations forces who train for covert insertion; they move quickly through habitat and leave no trace of their presence, which melds well with the conservation intent for San Clemente loggerhead shrike recovery efforts.

FACTOR B: Overutilization for Commercial, Recreational, Scientific, or Educational Purposes

Overutilization for commercial, recreational, scientific or educational purposes was not known to be a factor in the final rule (42 FR 40682). Overutilization for any purpose does not appear to be a threat at this time.

FACTOR C: Disease or Predation

The final listing rule identified predation by feral cats as a primary threat to the subspecies (42 FR 40682–40685); the recovery plan neglected to account for predation as a threat to the subspecies (USFWS 1984).

San Clemente loggerhead shrikes are not known at this time to be subject to disease which would cause a widespread threat to the subspecies. West Nile Virus is known to be extant in southern California since 2004, but no records to date suggest that this disease has affected adult or fledgling shrikes on San Clemente Island. The captive population is vaccinated for West Nile Virus prior to release. West Nile Virus does affect other subspecies of shrikes (see Bertelsen 2004).

Predation by introduced black rats and feral cats, and natural predators such as native raptors and foxes, continue to be a threat to the low extant populations of shrike on San Clemente Island, and while rarely documented, is considered to be the greatest cause of annual mortality (Juola *et al.*

1997; Bradley et al. 2007; Heath *et al.* 2007). In 2006, "*we strongly suspect that 48% of nest failures recorded in 2006 were due to predation*" (Bradley et al. 2007, p. 54).

Efforts to negate predation by non-native vertebrate species have continued, and are treated by the Navy's INRMP (U.S. Navy 2002), which provides practicable means to reduce and eliminate feral cats, black rats, and other non-native rodents. Feral cats are not allowed to be fed, and are removed through trapping and spotlighting. Rodent control is through traps and bait stations around nest sites using Quintox (active ingredient choelcalciferol); in 2000 this rodenticide was calculated to have impacted 26,473 rodents (U.S. Navy 2002). Natural predators (San Clemente Island fox, ravens, American kestrels, red-tailed hawks, sharp-shinned hawks, Coopers' hawks, merlin, and peregrine falcons) will continue to opportunistically kill San Clement loggerhead shrikes. According to the INRMP, they will be controlled and managed reflective of their threat to shrikes, and may be captured and moved when and where appropriate based on monitoring. Sheep, goats, and cattle have been removed, as discussed above under Factor A, which has changed habitat conditions from just a decade ago and allowed an increase in natural cover for the shrikes. Previously defoliated vegetation is recovering, and increasing in age and size without the pressure from non-native herbivores; this affords more cover for both predators and the shrikes on more areas of the island.

FACTOR D: Inadequacy of Existing Regulatory Mechanisms

State Protections

California Environmental Quality Act (CEQA): CEQA requires review of any project that is undertaken, funded, or permitted by the State or a local governmental agency. If significant effects are identified, the lead agency has the option of requiring mitigation through changes in the project or to decide that overriding considerations make mitigation infeasible (CEQA section 21002). Protection of listed species through CEQA is, therefore, dependent upon the discretion of the lead agency involved. Due to San Clemente being a Federal installation, few opportunities occur for a State or local government nexus, and CEQA is not mandated.

California Coastal Act (CCA): The California Coastal Commission considers the presence of listed species in determining environmentally sensitive habitat lands subject to section 30240 of the California Coastal Act of 1976, which requires their protection. Some of the major accomplishments of this act include: reduction in overall development, the acquisition of prime habitat along the coast, restoration of coastal streams and rivers, and a reduction in the rate of wetland loss. CCA was not discussed in the INRMP.

Federal Protections

National Environmental Policy Act (NEPA): NEPA (42 U.S.C. 4371 *et seq*.) provides some protection for listed species that may be affected by activities undertaken, authorized, or funded by Federal agencies. Prior to implementation of such projects with a Federal nexus, NEPA requires the agency to analyze the project for potential impacts to the human environment, including natural resources. In cases where that analysis reveals significant environmental effects, the Federal agency must propose mitigations that could offset those effects (40 C.F.R.

1502.16). These mitigations usually provide some protection for listed species. However, NEPA does not require that adverse impacts be fully mitigated, only that impacts be assessed and the analysis disclosed to the public.

Endangered Species Act of 1973, as amended (ESA): The ESA is the primary Federal law providing protection for this species. The Service's responsibilities include administering the ESA, including sections 7, 9, and 10. Since listing, the Service has analyzed the potential effects of Federal projects under section 7(a)(2), which requires Federal agencies to consult with the Service prior to authorizing, funding, or carrying out activities that may affect listed species. A jeopardy determination is made for a project that is reasonably expected, either directly or indirectly, to appreciably reduce the likelihood of both the survival and recovery of a listed species in the wild by reducing its reproduction, numbers, or distribution (50 C.F.R. § 402.02). A non-jeopardy opinion may include reasonable and prudent measures that minimize the amount or extent of incidental take of listed species associated with a project.

Section 9 prohibits the taking of any federally listed endangered or threatened species. Section 3(18) defines "take" to mean "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct." Service regulations (50 CFR 17.3) define "harm" to include significant habitat modification or degradation which actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding or sheltering. Harassment is defined by the Service as an intentional or negligent action that creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering. The ESA provides for civil and criminal penalties for the unlawful taking of listed species. Incidental take refers to taking of listed species that results from, but is not the purpose of, carrying out an otherwise lawful activity by a Federal agency or applicant (50 C.F.R. § 402.02). Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the ESA provided that such taking is in compliance with the terms and conditions of an incidental take statement.

Sikes Act: The Sikes Act (16 U.S.C. 670) authorizes the Secretary of Defense to develop cooperative plans with the Secretaries of Agriculture and the Interior for natural resources on public lands. The Sikes Act Improvement Act of 1997 requires Department of Defense installations to prepare Integrated Natural Resource Management Plans (INRMP) that provide for the conservation and rehabilitation of natural resources on military lands consistent with the use of military installations to ensure the readiness of the Armed Forces. INRMPs incorporate, to the maximum extent practicable, ecosystem management principles and provide the landscape necessary to sustain military land uses. While INRMPs are not technically a regulatory mechanism because their implementation is subject to funding availability, they can be an added conservation tool in promoting the recovery of endangered and threatened species on military lands. An INRMP was created for San Clemente Island in 2002 by the U.S. Navy.

Migratory Bird Treaty Act (MBTA): The MBTA and its implementing regulations (50 CFR Parts 20 and 21) directly protect certain bird species, and their eggs and nests, from being killed,

taken, captured, or pursued. However, it does not protect habitat except to the extent that habitat alterations would directly kill birds.

Summary of Factor D: In summary, the Endangered Species Act is the primary Federal law that provides protection for this species since its listing as endangered in 1977. Other Federal and State regulatory mechanisms provide discretionary protections for the species based on current management direction, but do not guarantee protection for the species absent its status under the Act. Therefore, we continue to believe other laws and regulations have limited ability to protect the species in absence of the Endangered Species Act.

FACTOR E: Other Natural or Human-made Factors Affecting Its Continued Existence

The final listing rule identified exotic species as a primary threat to the subspecies (42 FR 40682–40685); the recovery plan indicated that goats were the primary threat, at the time (USFWS 1984). This has been discussed in Factor A. Recent Factor E threats discerned post-listing include the following activities.

Military Bombing and Training

Human activities related to military readiness and training continue on the island, and are managed and directed by the U.S. Navy. Activities such as shore bombardment in the shore bombardment area (SHOBA), covert training, grenade and small arms practice, and other support activities continue in specified training areas on the island to augment military readiness and national security. Shrikes that live in close proximity to training areas are at increased risk to disturbance or harm from training activities. Several shrikes have also been accidentally hit and killed by vehicles during travel on San Clemente Island gravel roads (Bradley *et al.* 2007). The U.S. Navy has worked closely with the Service to promote protection and population resurgence of the San Clemente Island loggerhead shrike, and through adaptive management, regularly alter training activities and flight patterns of helicopters if shrike breeding areas are nearby. Implementation of the U.S. Navy's Loggerhead Shrike Recovery Program (U.S. Navy 2002) has resulted in expanded distribution of the species on the island, with a greater percentage of the population now distant from potential training conflicts. Negative impacts to land and resources have been successfully ameliorated by implementation of the INRMP (U.S. Navy 2002), and rigorous monitoring (see Heath *et al.* 2007; Bradley *et al.* 2007) which results in changing human management practices.

Fire from Military Activities

Fire was not considered a severe threat to the subspecies in the listing rule; however, our understanding of fire in maritime island scrub habitat and grasslands has changed since the listing of the subspecies in 1977 (see Dyer 2002). Fire is a natural component for regeneration and maintenance of many habitats; however, endemic vegetation on San Clemente Island was never fire dependent due to maritime related humidity, limited natural ignition sources, and adaptations of specific indigenous plants. Sources of fire have historically been natural lightning (rare) and pre-historic humans (U.S. Navy 2002).

Shore bombardment can result in uncontrolled fire on San Clemente Island. Shrike habitat consisting of large shrubs and trees in xeric environments faces two seemingly diametrically opposed forces in a landscape altered by past livestock grazing now currently comprised largely of invasive grasses and forbs: a) lack of periodic surface fires to control build-up of dead, non-native vegetation versus b) occasional occurrence of fires that can destroy nesting habitat. Frequent, accidental fires (via explosives ordinance) can become catastrophic when they burn dead grasses and downed branches that have accumulated because of the lack of periodic fire. Conversely, intense fires can destroy not only surface fuels (grasses and forbs) but also the woody vegetation used for nesting by shrikes.

Threats to the habitat from fire, which impacts processes that historically created and maintained suitable habitat for the subspecies, may make the shrike even more vulnerable to extinction if uncontrolled fire destroys available nesting habitat, or sets back vegetation age. The cascading ecological effects of fire introduced in the habitat of San Clemente Island, which now contains areas of dense non-native plant cover, have not been specifically detailed; however, we believe the general habitat structure and fire ecology processes are comparable to other areas where these effects have been studied (e.g., Keane *et al.* 2002; D'Antonio and Vitousek 1992). We believe that fire caused by anthropogenic activities on San Clemente Island habitat affects 1) nutrient recycling, 2) natural regulation of succession via selecting and regenerating plants, 3) biological diversity, 4) biomass, 5) insect and disease populations, 6) interaction between plants and animals, and 7) biological and biogeochemical processes (i.e., soil property alteration) (after Keane *et al.* 2002).

Invasive, non-native plants have exacerbated fire danger to maritime scrub plant communities on San Clemente Island by creating micro-climates that increase the risk of conflagrations during more times of the year (see MALGBC 2007). Fire can severely impact or eliminate populations by killing individual plants, their underground rhizomes, and the soil seed bank, and leave the soil under hydrophobic (water-repellant) conditions (Agee 1993; Keane *et al.* 2002; Keeley 2002; Arno and Fiedler 2005). Historically, this might not have been a problem where there were other adjacent areas on the island which were more fire-resistant.

The threat of wildfire is high on San Clemente Island due to anthropogenic ignition sources such as shore bombardment and special weapons training. We believe the threat from fires is likely to persist in the future due to required training activities. A model by Snyder *et al.* (2002) suggests higher average temperatures for every month in every part of California over the next century as a result of climate change, which may also create drier, more combustible fuel types on San Clemente Island, especially where non-native grasses persist. Small escaped fires have the potential to turn into large conflagrations due to wind, and weather conditions of temperature and humidity. Historical fire wildfire patterns burned primarily on the terraces and remained outside of the canyons, the latter which have become preferred breeding habitat. Fire can be positive on the islands but only if kept small; Don Brubaker (Service, San Diego National Wildlife Refuge, pers. comm. 2008) proposed the use of small fires (0.8–1.2 hectares) to increase open forage habitat to benefit wild shrike pairs, after observing that *"[a pair of] adults were literally flying themselves ragged in their attempts to bring forage to their young from [a] burned area*" nearly a mile from their nest.

Fire may adversely affect regeneration patterns of shrubs and small trees on San Clemente. We believe that catastrophic conflagrations pose the greatest stochastic single-event risk to the San Clemente loggerhead shrike, a risk second only to that of a severe storm event sweeping over the island. With the implementation of the INRMP (U.S. Navy 2002) and development of a Fire Management Plan (U.S Navy 2006; USFWS 2008), the Navy intends to limit ignitions and effectively control fires on San Clemente Island. The use of helicopters for firefighting, seasonal limitations on training activities likely to start fires, and an increase in the on-island firefighting cadre has reduced fire sizes since implementation of these precautionary measures (U.S. Navy 2002).

Small Population Size

Small populations are more vulnerable to natural catastrophes and stochastic demographic, genetic, and environmental events. Chance events outside the range of natural variability, such as floods, fires, or drought, can substantially reduce or eliminate small populations and increase the likelihood of extinction (Lande 1993). While few nests of the shrike were known at the time of listing, the population further declined to 14 individuals in 1998. The current population is slowly increasing, however, reduction of extant San Clemente loggerhead shrike numbers through stochastic (random or unpredictable) processes may accelerate extinction of the subspecies population. Population modeling also suggests that the San Clemente loggerhead shrike faces an unacceptable risk of extinction due to stochastic events (Grant and Wiese 2006).

Genetic effects may further influence population demography via inbreeding depression and genetic drift. Allee (1931) suggested small, single populations are vulnerable to extirpation when opportunities for reproduction diminish because of reduced opportunity of individuals to find each other (Allee effect or depensation). Stephens *et al.* (1999) and Dennis (2002) suggest that the Allee effect is a density-dependent event that is inversely related to population size. Aspects of conservation biology literature commonly note the vulnerability of taxa known from one or very few locations and/or from small populations, and the effects on the demography of declining, or in this instance, populations that have been small and are slowly increasing (e.g., Caughley 1994; Groom *et al.* 2006). Small populations are more vulnerable to demographic, genetic, and environmental stochastic events, and natural catastrophes (see Caughley 1994). Genetic stochastic events can further influence population demography via inbreeding depression and genetic drift (Lande 1987). In particular, small population size makes it difficult for the San Clemente loggerhead shrike to persist without captive breeding and population augmentation, all while sustaining the impacts of fire, unusual precipitation or storm events, and invasion of non-native plants in nesting/roosting and foraging habitat.

Drought/Climate Change

Few studies have assessed the biological impact of summer or seasonal droughts on predator and prey dynamics (Archaux and Wolters 2006). Periodic and successive droughts are an underestimated ecological stress and selection factor that impact forest and glade biological diversity, depending on species-specific ability to withstand these effects (Gutschick and BrassiriRad 2003, Archaux and Wolters 2006). The current extended drought in southern California may be having effects on shrike demography. Drought on San Clemente Island has

not been studied specifically in relation to the shrike or its prey, but has been addressed as having deleterious impacts for the San Clemente sage sparrow (Kaiser et al. 2008).

Climate change is expected to affect plants and wildlife in southern California, as well as throughout the world, by expediting alterations of naturalized conditions in which the species have evolved, and by creating conditions where invasive species out-compete the endemics (Field *et al.* 1999; CEPA 2006; IPCC 2007). From an ecological context, current models and scientific thought suggest that southern California likely will be adversely affected by global climate change through prolonged seasonal droughts, and rainfall coming at unusual periods and amounts (Pierce 2004; Cayan *et al.* 2005; CEPA 2006). Climate change related effects are not now known to be directly causing impacts on site-specific adaptations of species and endemic terrestrial biodiversity on San Clemente Island due to a lack of island-specific climate change related research, but are being experienced in other locations where they are studied (McDonald and Brown 1992; Boggs and Murphy 1997; Parmesan and Yohe 2003; Parmesan 2006; Schwartz *et al.* 2006; Thomas *et al.* 2004, 2006).

Current climate change predictions for terrestrial areas in the Northern Hemisphere indicate warmer air temperatures, more intense precipitation events, and increased summer continental drying (Field *et al.* 1999; Cayan *et al.* 2005; IPCC 2007). Predictions of climatic conditions for smaller sub-regions such as California, and the Channel Islands, remain uncertain. It is unknown at this time if climate change in California will result in a warmer trend with localized drying, higher precipitation events, and more frequent El Niño or La Niña events (Pierce 2004). While we recognize that climate change is an important issue with potential effects to listed species and their habitats, we lack adequate information to make accurate predictions regarding its effects to the San Clemente Island loggerhead shrike.

III. RECOVERY CRITERIA

Recovery plans provide guidance to the Service, States, and other partners and interested parties on ways to minimize threats to listed species, and on criteria that may be used to determine when recovery goals are achieved. There are many paths to accomplishing the recovery of a species and recovery may be achieved without fully meeting all recovery plan criteria. For example, one or more criteria may have been exceeded while other criteria may not have been accomplished. In that instance, we may determine that, over all, the threats have been minimized sufficiently, and the species is robust enough, to downlist or delist the species. In other cases, new recovery approaches or opportunities unknown at the time the recovery plan was finalized may be more appropriate to achieve recovery. Likewise, new information may change the extent that criteria need to be met for recognizing recovery of the species. Overall, recovery is a dynamic process requiring adaptive management, and assessing a species' degree of recovery is likewise an adaptive process that may, or may not, fully follow the guidance provided in a recovery plan. We focus our evaluation of species status in this 5-year review on progress that has been made toward recovery since the species was listed (or since the most recent 5-year review) by eliminating or reducing the threats discussed in the five-factor analysis. In that context, progress towards fulfilling recovery criteria serves to indicate the extent to which threat factors have been reduced or eliminated.

No recovery criteria were delineated in the recovery plan (USFWS 1984). The plan broadly indicated that *"recovery of these endangered and threatened (E/T) taxa will be dependent upon the restoration, enhancement, and management of respective island ecosystems on San Clemente, Santa Barbara, and San Nicolas Islands."* While not specific to population demography or habitat standards as recovery criteria, the narrative did briefly assess the extant threats to the San Clemente loggerhead shrike, concentrating mostly on habitat conversion caused by non-native grazing animals. Despite this, the U.S. Navy has made progress in developing programs to create the resurgence to the population, which has increased the number of wild shrikes from the low of 14 individuals (1998) to the 2006 population of approximately 206 individuals. Due to current anthropogenic activities, conversion of habitat caused by historical grazing pressure by non-native animals, and low numbers, recovery for the shrike has not been attained.

IV. SYNTHESIS

The status of the San Clemente loggerhead shrike has greatly improved during the past decade. While still an extremely small population, the number of individuals has increased from 14 in 1998 to approximately 46 pairs of adults (floaters and breeders) and 100 juveniles in the wild today. Captive breeding augmentation of the wild population and correlative work to decrease the annual mortality rate of juveniles and adults shows great promise to gradually increase the subspecies numbers to a stable level. Non-native grazers have been completely removed from the island, which has allowed native shrubs and trees to begin the process of vegetation recovery that is expected to support nesting by shrikes and increase the invertebrate and vertebrate prey base. Non-native predators (cats and black rats) are now considered the highest cause of mortality to shrikes on San Clemente Island, despite current efforts to remove the predator pressure. The U.S. Navy has provided leadership to forestall extinction of the subspecies in the past ten years through proactive conservation, including removing non-native species, managing anthropogenic disturbance to shrike nesting habitat, and promoting captive propagation to support augmentation of the extant wild population. Despite these efforts, the status of the subspecies remains endangered due to low numbers of individuals, and the necessity of the annual efforts involving captive breeding, wild nest protection, and maintenance of long-term genetic heterozygosity.

V. RESULTS

Recommended Listing Action:

____ Downlist to Threatened
____ Uplist to Endangered
____ Delist (indicate reason for delisting according to 50 CFR 424.11):
    ____ *Extinction*
    ____ *Recovery*
    ____ *Original data for classification in error*
_x__ No Change

New Recovery Priority Number and Brief Rationale: No Change

VI. RECOMMENDATIONS FOR ACTIONS OVER THE NEXT 5 YEARS

1) Eliminate cats, black rats, and other non-native rodents from San Clemente Island.

2) Summarize and publish extant shrike resurgence data and information, vegetation restoration results, and management related information in peer-reviewed journals to aid similar island passerine recovery efforts, and to allow comment and modification, if appropriate, of current methodology.

3) Consider developing and providing for peer review (see Ralls *et al.* 1996): a) a recovery plan utilizing recent published and unpublished empirical data, and b) criteria for reclassification under the Endangered Species Act.

4) Increase emphasis on vegetation restoration to support expansion of the shrike population throughout San Clemente Island.

5) Continue emphasis in population augmentation and restoration for the San Clemente loggerhead shrike.

VII. REFERENCES CITED

Agee, J.K. 1993. Fire ecology of Pacific Northwest forests. Island Press.

Allee, W.C. 1931. Animal aggregations: a study in general sociology. Univ. Chicago Press, Chicago, IL.

Archaux, F. and V. Wolters. 2006. Impact of summer drought on forest biodiversity: what do we know? Ann. For. Sci. 63:645–652.

Arno, S.F. and C.E. Fiedler. 2005. Mimicking nature's fire; restoring fire-prone forests in the west. Island Press.

Bent, A.C. 1950. Live histories of North American wagtails, shrikes, vireos, and their allies. U.S. Natl. Mus. Bull. 197.

Bertelsen, M.F., R. Olberg, G.J. Cranshaw, A. Dibernardo, L.R. Lindsay, M. Drebot, and I.K. Barker. 2004. West Nile virus infection in the eastern loggerhead shrike (Lanius ludovicianus migrans): Pathology, epidemiology, and immunization. J. Wildl. Diseases 40:538–542.

Bradley, J.E., S.W. Stuart, B.R. Hudgens, and D.K. Garcelon. 2007. Final report 2006 population monitoring of the San Clemente Loggerhead Shrike on NALF, San Clement Island, California. Inst. Wildl. Studies, Arcata. Unpub. Rept.

Boggs, C.L. and D.D. Murphy. 1997. Community composition in mountain ecosystems: climatic determinants of montane butterfly distributions. Global Ecol. and Biogeograph. Letters 6:39–48.

Cade, T.J. 1962. Wing movements, hunting, and displays of the northern shrike. Wilson Bull. 74:386–408.

Caughley, G. 1994. Directions in conservation biology. J. Animal Ecol. 63:215–244.

Cayan, D., M. Dettinger, I. Stewart, and N. Knowles. 2005. Recent changes towards earlier springs: early signs of climate warming in western North America? U.S. Geological Survey, Scripps Institution of Oceanography, La Jolla, California.

CEPA. 2006. Climate Action Team Report to Governor Schwarzenegger and the Legislature. California Environmental Protection Agency, Sacramento, CA.

Dennis, B. 2002. Allee effects in stochastic populations. Oikos 96:389–401.

Dyer, A.R. 2002. Burning and grazing management in a California grassland; effect on bunchgrass seed viability. Rest. Ecol. 10:107–111.

Eggert, L.S., N.I. Mundy, and D.S. Woodruff. 2004. Population structure of loggerhead shrikes in the California Channel Islands. Molec. Ecol. 13:2121–2133.

Ferguson, H.C. 1979. The goats of San Clemente Island. Fremontia 7:3–8.

Field, C.B., G.C. Daily, F.W. Davis, S. Gaines, P.A. Matson, J. Melack, and N.L. Miller. 1999. Confronting climate change in California. Ecological impacts on the Golden State. A report of the Union of Concerned Scientists, Cambridge, Massachusetts, and the Ecological Society of America, Washington, DC.

Grant, T. and C. Lynch. 2003. Analysis and breeding recommendations; San Clemente Loggerhead Shrike, *Lanius ludovicianus mearnsi*; Population biology management plan. Zoo. Soc. San Diego. Unpub. Rept.

Grant, T. and C. Lynch. 2005. Analysis and breeding recommendations; San Clemente Loggerhead Shrike, *Lanius ludovicianus mearnsi*; Population biology management plan. Zoo. Soc. San Diego. Unpub. Rept.

Grant, T. and R. Wiese. 2006. Master plan and breeding recommendations; San Clemente Loggerhead Shrike, *Lanius ludovicianus mearnsi*; Population biology management plan. Zoo. Soc. San Diego. Unpub. Rept.

Groom, M.J., G.K. Meffe, and C.R. Carroll. 2006. Principles of conservation biology, third edition. Sinauer Associates, Inc., Sunderland, Massachusetts.

Gutschick, V.P. and H. BassiriRad. 2003. Extreme events as shaping physiology, ecology, and evolution of plants: Toward a unified definition and evaluation of their consequences. New Phytologist 160:21–42.

Heath, S.R., J.C. Fidorra, A. Easley, L.H. Webb, E.L. Kerschner, and D.K. Garcelon. 2007. San Clemente loggerhead shrike release program—2006. Inst. Wildl. Studies, Arcata, CA. Unpub. Rept.

Hyde, K.M. 1980. San Clemente Loggerhead shrike/sage sparrow study. Ca Dept. Fish and Game; Int. Rept. Job v-2-.1.

Hyde, K.M. 1982. San Clemente Loggerhead shrike/sage sparrow study, 1980–1982. Unpub. Rept to Nat. Res. Manage. Off., NAS North Island, San Diego, CA.

[IPCC] Intergovernmental Panel on Climate Change. 2007. Climate change 2007: the physical science basis. Summary for policymakers. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, IPCC Secretariat, World Meteorological Organization and United Nations Environment Programme, Geneva, Switzerland.

Johnson, N.K. 1972. Origin and differentiation of the avifauna of the Channel Islands, California. Condor 74:295–315.

Juola, F.A., M.A. Booker, and W.T. Everett. 1997. Final Report: 1997 population and habitat survey of the loggerhead shrike on NALF San Clemente Island, California. Nat. Res. Spec. Support Team, SW Division, Nav. Fac. Eng. Command, San Diego.

Kaiser, S.A., B.R. Hudgens, E.L. Kershner, K. Brock, T. Mizerek, and D.K. Garcelon. 2008. A management plan for the San Clemente Sage Sparrow on San Clemente Island. Unpub. Rept. prepared by the Institute for Wildl. Studies for the U.S. Navy, Navy Region Southwest, San Diego, CA.

Keane, R.W., K.C. Ryan, T.T. Beblen, C.D. Allen, J. Logan and B. Hawkes. 2002. Cascading effects of fire exclusion in Rocky Mountain ecosystems: A literature review. GT Rept. RMRS-GTR-91.

Keegan, D.R., B.E. Coblentz, and C.S. Winhell. 1994. Feral goat eradication on San Clemente Island, California. Wildl. Soc. Bull. 22:56–61.

Keeley, J.E. 2002. Fire and invasive species in Mediterranean-climate ecosystems of California. IN K.E.M. Galley and T.P. Wilson (eds.). Proceedings of the invasive species workshop; the role of fire in the control and spread of invasive species. Fire Conf. 2000: First Nat. Cong. On Fire Ecol., Prevention, and Manage. Misc. Pub. No. 11, Tall Timbers Res. Stat. Tallahassee, FL.

Lande, R. 1993. Risks of population extinction from demographic and environmental stochasticity and random catastrophes. Am. Nat. 142:911–927.

Lynn, S., J.A. Martin, K.M. Wakelee, D.M. Cooper, G.A. Schmitt, and D.K. Garcelon. 1999. Research efforts to aid in the recovery of the San Clemente Loggerhead Shrike—1998. Final Rept. Inst. Wildl. Studies, Arcata, CA.

MALGBC. 2007. Ministry of Agriculture and Lands, Government of British Columbia. 2007. Fire effects on grasses and forbs. http://www.agf.gov.bc.ca/range/publications/documents/fire3.htm. Accessed February 2007.

McDonald, K.A. and J.H. Brown. 1992. Using montane mammals to model extinctions due to global change. Consv. Biol. 6:406–415.

Miller, A.H. 1931. Systematic revision and natural history of the American shrikes (Lanius). Univ. Calif. Publications in Zool. 38:11–242.

Mundy, N.I. and D.S. Woodruff. 1996. Polymorphic microsatellite markers in the loggerhead shrike (*Lanius ludovicianus*) isolated from a library enriched for CA repeats. Molecular Ecol. 5: 811–813.

Mundy, N.I., C.S. Winchell, and D.S. Woodruff. 1997a. Genetic differences between the endangered San Clemente loggerhead shrike (*Lanius ludovicianus mearnsi*) and two neighboruring subspecies demonstrated by mtDNA control region and cytochrome b sequence variation. Molec. Ecol. 6:29–37.

Mundy, N.I., C.S. Winchell, T. Burr, and D.S. Woodruff. 1997b. Microsatellite variation and microevolution in the critically endangered San Clement Island loggerhead shrike (*Lanius ludovicianus mearnsi*). Proc. R. Soc. Lond. B. 264:869–875.

Mundy, N.I and D.S. Woodruff. 1998. Conservation genetics of the San Clemente loggerhead shrike (*Lanius ludovicianus mearnsi*). IN Yosef and Lohrer (eds). Proceedings of the 2nd Int. Shrike Symp.

Patten, M.A. and K.F. Campbell. 2000. Typological thinking and the conservation of subspecies: the case of the San Clemente Island loggerhead shrike. J. Consv. Biogeog. 6(4):177–188.

Parmesan, C. 2006. Ecological and evolutionary responses to recent climate change. Annual Rev. Ecol. Evol. Syst. 37:637–669.

Parmesan, C. and G. Yohe. 2003. A globally coherent fingerprint of climate change impacts across natural systems. Nature 421:37–42.

Pierce, D.W. 2004. Effects of North Pacific Oscillation and ENSO on seasonally averaged temperatures in California. Climate Research Division, Scripps Inst. of Oceanography. Cal. Energy Comm., PIER Energy-related Env. Res. CEC-500-2005-002.

Ralls, K., D.P. Demaster, and J.A. Estes. 1996. Developing a criterion for delisting the southern sea otter under the US Endangered Species Act. Consv. Biol. 10:1528–1537.

Ridgeway, R. 1903. Descriptions of new genera, species and subspecies of American birds. Proc. Biol. Soc. Wash. 16:105–111.

Ridgeway, R. 1904. The birds of North and Middle America. Bull. U.S. Nat. Mus., # 50, Part III.

Roemer, G.W. and R.K. Wayne. 2003. Conservation in conflict: the tale of two endangered species. Conserv. Biol. 17:1251–1260.

Schwartz, M.W., L.R. Iverson, A.M. Prasad, S.N. Matthews, and R.J. O'Connor. 2006. Predicting extinctions as a result of climate change. Ecology 87:1611–1615.

Scott, T.A. and M.L. Morrison. 1990. Natural history and management of the San Clemente Loggerhead Shrike. Proc. West. Found. Vert. Zool. 4(2).

Snyder, M.A., J.L. Bell, L.C. Sloan, P.B. Duffy, and G. Balasubramanian. 2002. Climate responses to a doubling of atmospheric carbon dioxide for a climatically vulnerable region. Geophysical Res. Let. 29:1514.

Stephens, P.A., W.J. Sutherland, and R.P. Freckleton. 1999. What is the Allee effect? Oikos 87:185–190.

Thomas, C.D., A. Cameron, R.E. Green, M. Bakkenes, L.J. Beaumont, Y.C. Collingham, B.F.N. Erasmus, M.F. de Siqueira, A. Grainger, L. Hannah, L. Hughes, B. Huntley, A.S. van Jaarsveld, G.F. Midgley, L. Miles, M.A. Oretega-Huerta, A.T. Peterson, O.L. Phillips and S.E. Williams. 2004. Extinction risk from climate change. Nature 427:145–148.

Thomas, C.D., A.M.A. Franco and J.K. Hill. 2006. Range retractions and extinction in the face of climate warming. TREE 21:415–416.

Turner, J.M., E.L. Kershner, J.L. Struthers, C.L. Sulzman, C.L. Dabrowski, D.L. Brubaker, and D.K. Garcelon. 2003. San Clemente Loggerhead shrike release program—2002. Final Report. Inst. Wildl. Studies. Unpubl. Rept.

[USFWS] U.S. Fish and Wildlife Service. 1984. California Channel Islands species recovery plan. Portland, OR.

[USFWS] U.S. Fish and Wildlife Service. 2008. Biological Opinion on the U.S. Navy's San Clemente Island Military Training Program and Fire Management Plan, Los Angeles, CA. Nov. 17, 2008: FWS-LA-09B0027-09F0040. Carlsbad Fish and Wildlife Office.

U.S. Navy. 2002. San Clemente Island Integrated Natural Resources Management Plan Draft Final. San Diego, CA.

U.S. Navy. 2006. San Clemente Island Fire Management Plan, Commander Navy Region Southwest Natural Resource Office. Screencheck Draft. September.

Van Vuren, D. and B.E. Coblentz. 1989. Population characteristics of feral sheep on Santa Cruz Island. J. Wildl. Manage. 53:306–313.

Warnock, N. and T. Mader. 1998. 1998 breeding season population monitoring of the loggerhead shrike on NALF, San Clemente Island, California. NACDACENGCOM, San Diego.

Yosef, R. 1996. Loggerhead shrike. Birds of N. Am. # 231. Acad. Of Nat. Sci., Philadelphia, and AOU, Washington DC.

Personal Communication

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U.S. FISH AND WILDLIFE SERVICE
5-YEAR REVIEW

San Clemente Loggerhead Shrike
Lanius ludovicianus mearnsi

Current Classification: Endangered

Recommendation Resulting from the 5-Year Review:

____ Downlist to Threatened
____ Uplist to Endangered
____ Delist
__x_ No change needed

Review Conducted By: Carlsbad Fish and Wildlife Office

FIELD OFFICE APPROVAL:

Lead Field Supervisor, U.S. Fish and Wildlife Service

Approve _____ Date June 17, 2009