Recovery Plan for the Endangered and Threatened Species of the California Channel Islands

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Original Prepared by: USFWS, Portland OR

DRAFT AMENDMENT

We have identified best available information that indicates the need to amend recovery criteria for two taxa in the Channel Islands Recovery Plan. In this proposed modification, we synthesize the adequacy of the existing recovery criteria, show amended recovery criteria, and describe the rationale supporting the proposed recovery plan modification. The proposed modification is shown as an appendix that supplements the recovery plan, augmenting the Objectives identified under Part II (pp. 105–107) of the recovery plan for San Clemente loggerhead shrike and San Clemente Island woodland-star.

For
U.S. Fish and Wildlife Service
Region 8
Carlsbad, CA

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METHODOLOGY USED TO COMPLETE THE RECOVERY PLAN AMENDMENT

Recovery criteria were updated for this addendum through internal coordination with staff and through external coordination with our partners. Work was done to update criteria for delisting and to provide quantitative criteria for both San Clemente Island loggerhead shrike and San Clemente Island woodland-star. We coordinated with the U.S. Navy (Navy) to discuss the species needs and requested information regarding recovery goals. We will make this addendum

available for public review as well as solicit peer review. These coordinated efforts help to develop new quantitative criteria for the recovery plan that will better serve us as we work to recover these listed taxa on San Clemente Island.

ADEQUACY OF RECOVERY CRITERIA

Section 4(f)(1)(B)(ii) of the Endangered Species Act (Act) requires that each recovery plan shall incorporate, to the maximum extent practicable, "objective, measurable criteria which, when met, would result in a determination…that the species be removed from the list." Legal challenges to recovery plans (see Fund for Animals v. Babbitt, 903 F. Supp. 96 (D.D.C. 1995)) and a Government Accountability Audit (GAO 2006) also have affirmed the need to frame recovery criteria in terms of threats assessed under the five delisting factors.

Introductory statement

The 1984 California Channel Island Species Recovery Plan (Recovery Plan) was written to address recovery of nine taxa largely restricted to San Clemente Island, although two taxa also occurred on other Channel Islands (USFWS 1984, pp. 1–2). Of these, San Clemente Island paintbrush (*Castilleja grisea*), San Clemente Island larkspur (*Delphinium variegatum* subsp. *kinkiense*), San Clemente Island lotus (=San Clemente Island broom)(*Acmispon dendroideus var. traskiae* (= *Lotus dendroideus subsp. traskiae*)), San Clemente Island bush-mallow (*Malacothamnus clementinus*), and San Clemente loggerhead shrike (*Lanius ludovicianus mearnsi*) were federally-listed as endangered; San Clemente Bell's sage sparrow (San Clemente sage sparrow)(Artemisiospiza belli clementeae (=*Amphispiza belli clementeae*) and Island night lizard (*Xantusia* (+*Klaubernia*) *riversiana*) were federally-listed as threatened; and Thorne's royal larkspur (*Delphinium variegatum* subsp. *thornei*), San Clemente Island woodland-star (*Lithophragma maxima*), San Clemente Island silver hosackia (*Lotus argophyllus* subsp. *adsurgens*) were Candidate species for listing. Since 1984, the listing status of many of these taxa has changed: the Island night lizard was delisted due to recovery (USFWS 2014); San Clemente Island paintbrush and San Clemente Island lotus were reclassified as "threatened" species (USFWS 2013); Thorne's royal larkspur and San Clemente Island silver hosackia are no longer considered candidates for listing (USFWS 1996); San Clemente Island woodland-star and Santa Cruz Island rockcress (*Sibara filifolia*) were listed, as endangered (USFWS 1997). No critical habitat has been proposed or designated for these taxa. All taxa are endemic to San Clemente Island with the exception of Santa Cruz Island rockcress, which also occurs on Santa Catalina Island. Here we only address two of these species, the San Clemente loggerhead shrike and the San Clemente woodland-star.

Recovery Criteria

The Recovery Plan focuses on protection and restoration of habitat on the island to support viable, self-sustaining populations of the listed and candidate taxa. The Recovery Plan includes broad, habitat-based recommendations for the recovery of the island ecosystems (USFWS 1984, pp. 1, 105–141). The Recovery Plan defers development of quantified delisting criteria pending

adequate research and assessment of vegetation recovery, population sizes, and available habitat necessary for sustainable populations (USFWS 1984, pp. 111, 121).

The primary cause of species-decline identified in the Recovery Plan is the loss of, and changes to vegetation from historical grazing, browsing, trampling, and rooting by nonnative grazers and browsers. Introduced sheep, goats, pigs, and mule deer previously inhabited San Clemente Island and incurred significant impact to natural vegetation and soils except in steep, inaccessible canyons on the eastern escarpment (USFWS 1984, p. 16; USFWS 2008, p. 11). When the Recovery Plan was finalized, goats and mule deer still inhabited the island. Therefore, resource protection outlined in the Recovery Plan includes removal of nonnative herbivores, control of erosion in sensitive areas, and direction of military operations away from biologically sensitive areas. Habitat restoration with native plant taxa, identification of listed species habitat requirements, and other species-specific actions are proposed to promote self-sustaining populations and eventual reclassification of taxa (USFWS 1984, pp. 107, 121, 126, 135–6). The recovery plan establishes the following objectives for recovery of the species (USFWS 1984, pp. 106–107):

1. Identify present adverse impacts to biological resources and strive to eliminate them;
2. Protect known resources from further degradation by:
    a. removal of feral herbivores, carnivores, and selected exotic plant species;
    b. control of erosion in sensitive locations;
    c. directing military operations and adverse recreational uses away from biologically sensitive areas;
3. Restore habitats by revegetation of disturbed areas using native species;
4. Identify areas of San Clemente Island where habitat restoration and population increase of certain addressed taxa may be achieved through a careful survey of the island and research on habitat requirements of each taxon;
5. Delist or upgrade the listing status of those taxa that achieve vigorous, self-sustaining population levels as the result of habitat stabilization, restoration, and preventing or minimizing adverse human related impacts; and
6. Monitor effectiveness of recovery efforts by undertaking baseline quantitative studies and subsequent follow-up work.

As indicated in the Recovery Plan, species will be considered "recovered" when sufficient habitat has been restored on San Clemente Island to support viable self-sustaining populations of the threatened or endangered taxa and when management and use of habitat to support survivability of the populations is assured (USFWS 1984, Executive Summary). In order to assist us in applying the information we have to these objectives, we are using the concepts of representation, redundancy, and resilience (after Shaffer and Stein 2000) as this approach can be applied where knowledge of species-specific biology and dispersal processes is incomplete (Wolf *et al.* 2015, entire). Briefly stated, the USFWS employs these terms as follows (Smith *et al.* 2018, p. 3):

1. *Representation* is the ability of a species to adapt to changing environmental conditions over time as characterized by the breadth of genetic and environmental diversity within and among populations;

2. *Redundancy* is the ability of a species to withstand catastrophic events by spreading risk among multiple populations (or occurrences) or across a large area;
3. *Resilience* is the ability of a species to withstand stochastic disturbance and is positively related to population size and growth rate and may be influenced by connectivity among populations (or occurrences).

The recovery criteria below will be added to the recovery plan through this addendum for both the San Clemente loggerhead shrike and the San Clemente Island woodland-star.

SAN CLEMENTE LOGGERHEAD SHRIKE (*LANIUS LUDOVICIANUS MEARNSI*)

Synthesis

The San Clemente loggerhead shrike (*Lanius ludovicianus mearnsi*) is a medium sized, predatory passerine found only on San Clemente Island, California. The San Clemente loggerhead shrike 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; Rutledge *et al.* 2017). Rutledge *et al.* (2017) found historically close allele associations with shrikes found on Catalina Island (*L. l. anthonyi*), but significant shifts in allele frequency attributed to bottlenecking in the San Clemente shrike has occurred since the start of the captive breeding program. The species was listed as endangered under the Act in August, 1977 due to loss of habitat associated with overgrazing, depredation by feral cats, low population size, and potential for introduction of invasive species (USFWS 1977). Only 14 adult shrikes were detected during comprehensive survey efforts conducted in 1998, and shrike distribution was extremely restricted; over half of the shrike breeding pairs nested in the same canyon, which was located within the Ship to Shore Bombardment Area (SHOBA) (Warnock and Mader 1998, p. 13).

The San Clemente loggerhead shrike is distributed primarily within the southern 2/3 of San Clemente Island along canyons that support canyon woodland and maritime desert scrub vegetation. The U.S. Navy conducts military training exercises on the island. The Navy also works cooperatively with the Service and numerous partners (Zoological Society of San Diego, Institute for Wildlife Studies, and San Diego State Soil Ecology and Research Group; and past contributors, Point Reyes Bird Observatory, Endangered Species Recovery Council, and APHIS Wildlife Services) to support a recovery program for the San Clemente loggerhead shrike. The recovery program includes captive propagation and release, intensive monitoring, predator management, and species research. Island vegetation, including shrike habitat, is successfully recovering after the Navy's successful removal of introduced herbivores from the island.

The aggressive recovery effort implemented by the Navy has contributed to expanded distribution and abundance of shrikes on San Clemente Island, and by the time our last status review was finalized (2009), the San Clemente loggerhead shrike potential breeding population had increased from 14, detected in 1998, to approximately 179 adult shrikes in 2009 (Stahl *et. al* 2010, p. 20) (Figure 1). However, between 2009 and 2016, the potential breeding population declined approximately 65 percent to 63 adult shrikes (Stahl *et. al* 2017, p. 20).

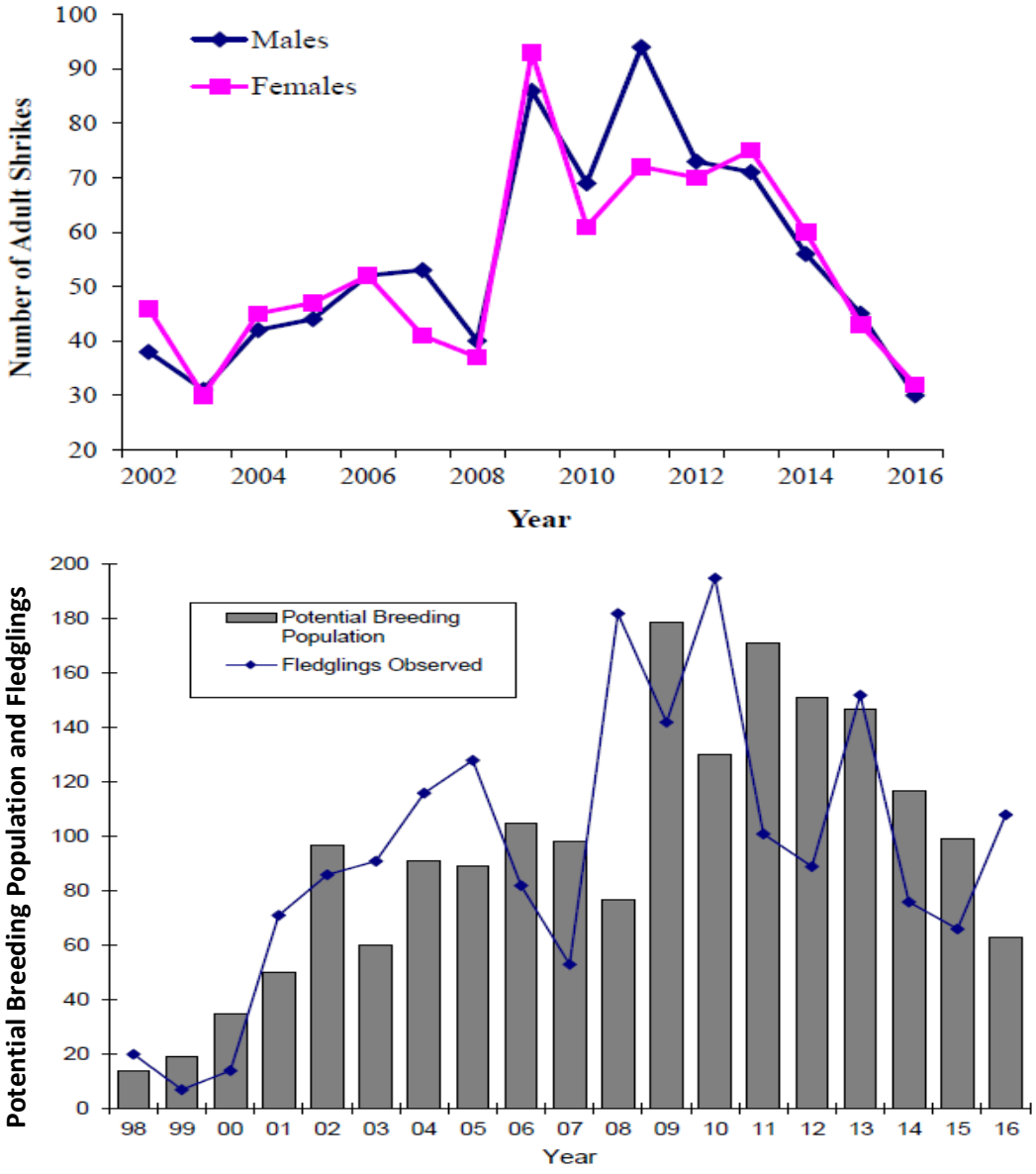

Figure 1. Number of male and female adult San Clemente loggerhead shrikes (above). Number of fledglings observed and potential individuals in the breeding population (below) (Stahl *et. al* 2017, p. 32).

Threats

Threats to the San Clemente loggerhead shrike are summarized below as identified in either the Listing Rule (USFWS 1977), Recovery Plan (USFWS 1984), or 5-year review (USFWS 2009b).

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

The final listing rule identifies habitat degradation by nonnative herbivores as a primary threat to the subspecies (USFWS 1977). The recovery plan is more specific and indicates that goats were the primary threat when the recovery plan was finalized (USFWS 1984). By 2009, when the most recent 5-year review was finalized, domestic and nonnative grazing animals had been removed from the islands and ongoing habitat modification due to browsing and grazing had been eliminated. However, in the 2009 5-year review, we noted that consequences of historical grazing impacts to the habitat (nonnative plant proliferation, erosion, changes in soil composition) remain.

Fire is not identified as a threat to the subspecies in the listing rule or Recovery Plan; however, our understanding of fire frequency on San Clemente Island, as well as the role of fire in maritime island scrub habitat and grasslands, has changed since the listing of the subspecies in 1977 (see Dyer 2002). In 2009, we identified fire as a threat to the San Clemente loggerhead shrike, due to the elevated fire frequency in and around shrike habitat, and the potential for uncontrolled wildfire on this remote island (USFWS 2009). The Navy has a management plan in place to minimize impacts from fire, to the extent feasible, given the military mission on the island, and the constraints associated with island topography and unexploded ordnance (Navy 2009).

The 2009 5-year review determines that military land use and development impacts are relatively limited in relation to the size of San Clemente Island and thus, does not identify either as a substantial threat to the San Clemente loggerhead shrike. The 2009 5-year review recognizes the contributions of the Navy's natural resource monitoring (see Heath *et al.* 2007; Bradley *et al.* 2007), planning, and protection efforts [(Integrated Natural Resources Management Plan (INRMP) (Navy 2002; 2013b)], in reduction of the impacts to the island resources.

Invasive, nonnative plants are described as a threat in the 2009 species assessment, due to their potential contribution to fuel load, and creation of micro-climates that exacerbate fire danger to maritime scrub plant communities on San Clemente Island.

Although the extirpation of the nonnative grazers from the island has reduced their contribution to island erosion, erosion associated with military training is identified as a potential impact of proposed military training in the 2008 biological opinion and the INRMP. The potential for erosion on SCI is increasingly reduced as revegetation continues to occur. The Navy is implementing an erosion control plan to evaluate and minimize impacts to listed species from the anticipated use of assault vehicle maneuver areas (Navy 2013a).

Currently the predominant threats to the shrike include impacts from a changing climate and fire. Threats linked to land use, fire, and erosion are largely mitigated through implementation of existing management plans (Erosion Control Plan, Wildlife Fire Management Plan, and Integrated Natural Resources Management Plan). Severe drought linked to climate change also impacts shrike habitat, and possibly the habitat needs for their prey base, limiting the shrike's prey availability. While the threat of fire has been ameliorated by Navy planning, the potential threat of a catastrophic single event is still a possibility.

FACTOR C: Disease or Predation

The final listing rule recognizes predation by feral cats as a primary threat to the subspecies (USFWS 1977), however the recovery plan does not identify predation as a threat to the subspecies (USFWS 1984). The 2009 5-year review addresses predation and states: "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 1984 Recovery Plan hypothesizes that interspecific competition with a large population of American kestrels may be a threat to the shrike. Conversely, the 2009 5-year review does not identify American kestrels as a threat, stating: "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 Clemente 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."

Current threats from predation are a major source of shrike mortality and hindrance to shrike recovery. Currently, feral cats and black rat populations are managed under the Predator Research and Ecosystem Management project but impacts are still a major issue. While predation from other native birds, for example the American kestrel, is not considered a current threat, these interactions should be monitored in the future.

FACTOR E: Other Natural or Manmade Factors Affecting Its Continued Existence

The 1977 final listing rule does not mention any of the Factor E threats listed above. The 1984 Recovery Plan does not specifically state any Factor E threats but states in a general manner that military activities "need to be scrutinized to insure that such activities are not detrimental to recovery efforts" for endangered/threatened species on both San Clemente Island and San Nicolas Island.

The 2009 5-Year review recognizes the potential for impacts associated with military training on San Clemente Island, as well as the contributions of the Navy's natural resource monitoring (see Heath *et al.* 2007; Bradley *et al.* 2007), planning, and protection efforts [(Integrated Natural Resources Management Plan (INRMP) (Navy 2002; 2013b)], in reduction of the impacts to the island resources.

Small population size is also identified as a threat in the 5-year review, which states that 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). Genetic effects may further influence population demography via inbreeding depression and genetic drift.

The 2009 5-year review discusses how 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, The 5-year review concludes by stating "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 loggerhead shrike".

Small population size and changing weather patterns are Factor E threats that currently affect the potential for shrike recovery. The impacts of small population size have been reduced by implementation of a captive propagation program that directly increases the population size, while limiting inbreeding depression to the extent possible. The boost in population size helps alleviate the risks from stochastic events. A recent episode of prolonged drought has significantly affected shrike demographics, and illustrated the vulnerability of the species to this stressor. Researchers now consider prolonged drought a primary threat to the shrike population. Impacts from drought decreases nesting success, clutch size, and may be influencing prey availability, which also increases the threat of predation from other species.

Threats Summary:

Historical threats to the shrike consisted of overgrazing by feral livestock and the array of impacts associated with it, including erosion and habitat loss. These impacts have been slowly reduced as revegetation occurs, coupled with ongoing management by the Navy to support habitat occupied by the shrike. Predation and small population size have been considered threats since listing (Table 1). The threats of land use, erosion, and fire have more recently been minimized through implementation of the Navy's INRMP (2013b), Erosion Control (2013a), and Fire Management Plans (2009), although fire still has the potential to be a catastrophic single event. Drought and climate change present emerging threats to the shrike.

Table 1. Review of past threats assessed for the San Clemente loggerhead shrike.

[a] Specific cause for the decline of the San Clemente loggerhead shrike was largely unknown at this time.

[b] Drought was discussed in the 2009 5-year review, but future impacts were largely unknown.

Threat	Listing 1977	Recovery Plan 1984[a]	5-year Review 2009
Feral Livestock	X	X	-
Erosion	-	-	-
Fire	-	-	X
Predation	X	-	X
Land Use	-	-	X
Small Population Size	X	-	X
Climate Change (Drought)	-	-	X[b]

AMENDED RECOVERY CRITERIA

Recovery criteria serve as objective, measurable guidelines to assist in determining when an endangered species has recovered to the point that it may be downlisted to threatened, or that the protections afforded by the Act are no longer necessary and the San Clemente Loggerheaded shrike may be delisted. Delisting is the removal of a species from the Federal Lists of Endangered and Threatened Wildlife and Plants. Downlisting is the reclassification of a species from endangered to threatened. The term "endangered species" means any species (species, sub-species, or DPS) which is in danger of extinction throughout all or a significant portion of its range. The term "threatened species" means any species, which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.

We provide both downlisting and delisting criteria for the San Clemente Loggerheaded shrike, which will supersede those included in California Channel Islands Species Recovery Plan, as follows:

Downlisting Recovery Criteria

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

In order to downlist San Clemente Loggerhead Shrike to threatened status, threats to the species due to degraded or limited habitat must be reduced. This will have been accomplished if the following have occurred:

A.1: Habitat loss from invasive herbivores is effectively managed and curtailed to no longer impact habitat for the shrike.

A.2: Impacts to the habitat from erosion, fire, and land use have been effectively reduced or managed. Fire management is updated in accordance with changes in shrike habitat, vegetation, and ignition sources.

A.3: Impacts from invasive plants are reduced or managed as necessary to levels that do not pose a threat to the persistence of the San Clemente loggerhead shrike. A San Clemente Island Biosecurity Instruction has been implemented to decrease likelihood of new invasive plant or animal species from establishing on the island.

A.4: Successful nesting has occurred in a minimum of 65 breeding territories each year for 7 sequential years.

(Successful nesting in 65 breeding territories indicates sufficient habitat is available to support the target population size through changing environmental conditions. A period of 7 years was selected to include at least one drought cycle.)

A.5: At least 60 percent of the potential breeding population is distributed outside of the Shore Bombardment Area (SHOBA).

(Based on observed loggerhead shrike distribution a significant percentage of the high quality loggerhead shrike habitat on San Clemente Island is within SHOBA, however this area is more vulnerable to anthropogenic fires and is subject to limited access for management and monitoring. Distribution of over half of the loggerhead shrike population outside of SHOBA will reduce vulnerability to impacts from fires, and facilitate adequate accessibility for management needs. It will assure representation in areas of the island that support different management priorities.)

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

No known threats exist under this factor, therefore no criteria are necessary.

Factor C: Disease or Predation

C.1: Impacts from nonnative predators (such as black rats and cats) have been reduced or managed to levels that do not pose a threat to the persistence of the San Clemente loggerhead shrike.

Factor D: Inadequacy of Existing Regulatory Mechanisms

No known threats exist under this factor, therefore no criteria are necessary.

Factor E: Other Natural or Manmade Factors Affecting Its Continued Existence

E.1: The annual potential breeding population in the wild remains above 165 individuals for 7 years.

(San Clemente Island is about 35,000 acres (14,164 ha)) and can support a relatively small loggerhead shrike population compared, for example, to more extensive mainland habitat. Based on the observed fluctuations in the potential breeding population of loggerhead shrikes (Figure 1), we consider this number of potential breeding individuals to represent a “basement level” of adequate size and duration for population rebound.)

E.2: A rangewide monitoring program is in place to determine long-term trends in the nesting population, specifically, nest success, breeding distribution, and annual potential breeding population (total).

E.3 A population model is completed that: a) outlines the population size and productivity recommended for discontinuing captive breeding and reintroduction efforts, and b) develops recommended metrics for the San Clemente Island loggerhead shrike population size and demographics that reflect population stability in the absence of captive breeding.

Delisting Recovery Criteria

The San Clemente Loggerheaded shrike may be considered for delisting when the population demonstrates stability in the absence of the augmentation associated with the captive re-introduction program. The criteria below largely re-iterate those recommended for downlisting, but over a longer time period and in the absence of augmentation, which may be curtailed only when supported by a robust population viability assessment. Thus, delisting the loggerhead shrike should be considered when the following criteria have been met:

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

A.6: Enough suitable habitat is protected and managed as specified in a shrike management plan (described below) to sustain at least 65 breeding territories with successful nesting over 14 sequential years.

(Successful nesting at 65 of the territories each year over two drought cycles (estimated at 14 years), indicates sufficient suitable habitat to support loggerhead shrike resiliency to changing weather patterns, and support the population at target levels.)

A.7: Future training needs are addressed in an updated operational management plan such that training expansion does not pose a threat to the persistence of San Clemente Island loggerhead shrike.

Factor E: Other Natural or Manmade Factors Affecting Its Continued Existence

E.4: A minimum potential breeding population of 165 individuals is maintained and demonstrates a stable or increasing trends without augmentation from captive rearing or supplemental food for 14 years.

E.5: A management plan is implemented for the San Clemente Loggerhead Shrike Management Plan to ensure long-term management and support sustainability of the shrike population. The Management Plan will include habitat protection, population monitoring, predator management, biosecurity management, genetic rescue scenarios, and ongoing management of fire, erosion, and land use activities that prioritize protection of the canyon woodlands and east side scrub.

RATIONALE FOR AMENDED RECOVERY CRITERIA

The relatively small size of San Clemente Island limits the population size achievable on the island, and the population is likely to fluctuate in response to precipitation patterns and effects on predator presence and prey availability. The loggerhead shrike requires ongoing management to ensure that anthropogenic and other stressors do not result in habitat degradation or excessive predation. Resilience will be evident if the population is sustained above an identified "basement" level. A benchmark for representation will ensure that a significant percentage of the shrike population occupies habitat that can be managed, if necessary. However, increases in population distribution and local abundance from current levels are necessary to provide resilience and redundancy.

The amended criteria provide management benchmarks that ensure ongoing management to reduce current and future threats, where possible, and benchmarks that demonstrate a resilient, sustainable shrike population that is represented in habitats across the island. The criteria iterate the need for long term planning and management to protect the loggerhead shrike into the future, even when the species is recovered. Due to the inherently small population size, it is likely that some degree of management, and protection from large-scale habitat modification, will be necessary for loggerhead shrike to share the island with the US Navy.

Based on population estimates from prior years (Figure 1), if the fluctuating population does not drop below 165 individuals for an extended time period, it is likely that it will be resilient to predator populations, stochastic events, and the changing weather patterns on the island. The weather patterns associated with drought cycles have typically occurred at 7-year intervals. Drought is a primary threat and affects the island's shrike population size and their subsequent resiliency. A loggerhead shrike population that remains above 165 individuals during a complete drought cycle (at least 7 years) demonstrates sufficient resiliency to warrant downlisting. If the population remains above this level for two drought cycles (at least 14 years) it demonstrates long-term resiliency adequate for delisting.

The number of shrike breeding territories and winter home ranges can be used to confirm a minimum amount of suitable habitat available on the island. This approach allows shrike occupancy to determine what is, and what is not shrike habitat. Currently 149 established breeding territories have been documented since 1998 (Stahl *et. al* 2018, p. 27). Successful nesting at 65 of the territories each year over a drought cycle(s) is indicative of adequate suitable habitat adequate to support loggerhead shrike resiliency to changing weather patterns, and support the population at target levels. Drought is a limiting factor on shrike resiliency and it is important to capture a complete drought cycle(s) when assessing shrike resiliency.

All classification decisions consider the following five factors: (1) is there a present or threatened destruction, modification, or curtailment of the species' habitat or range; (2) is the species subject to overutilization for commercial, recreational scientific or educational purposes; (3) is disease or predation a factor; (4) are there inadequate existing regulatory mechanisms in place outside the ESA (taking into account the efforts by states and other organizations to protect the species or habitat); and (5) are other natural or manmade factors affecting its continued existence. When delisting or downlisting a species, we first propose the action in the *Federal Register* and seek public comment. Our final decision is announced in the *Federal Register*.

SAN CLEMENTE ISLAND WOODLAND-STAR (LITHOPHRAGMA MAXIMUM)

Synthesis

Unless otherwise noted, the following information came from our 2007 5-year Review for this taxon and more specific information regarding its status can be found therein (USFWS 2007). San Clemente Island woodland-star is a rhizomatous, perennial species typically producing 2 to 3 flowering stems bearing small, white to pinkish, bisexual, campanulate (bell-shaped) flowers in April through June. While not studied for this particular taxon, several other species of *Lithophragma* are moth-pollinated (*e.g.*, moths of the species *Greya*) (Brown *et al.* 1997, entire; Thompson and Cunningham 2002, p. 736). Bees and other insects have been considered as possible pollinators, but this has not been studied. All other species within the genus *Lithophragma* are considered to be either fully or partially self-incompatible. Fruits produce numerous seeds that appear to be gravity-dispersed. Pollinator movement may be restricted by topography and these two factors likely reduce the distance of maternal and paternal gene-flow (Furches *et al*. 2009, pp. 123–124). Past attempts to propagate this and other species within *Lithophragma* from seed have been largely unsuccessful, as has a more-recent attempt to propagate San Clemente Island woodland-star (SERG 2016, p. 11).

San Clemente Island woodland-star is restricted to a few steep canyons along the eastern escarpment towards the southern end of San Clemente Island (Figure 2). Plants generally occur in shady conditions on steep north-facing slopes in moist canyon-bottoms or on canyon-wall ledges between elevations of 400 to 1,200 feet (120 to 366 meters).

Originally collected in 1936, this species was thought to be extinct until rediscovery in 1979 in Bryce (ca. 9 plants) and Eagle (ca. 3 plants) canyons and in 1984, the population was considered to consist of no more than 50 individuals (USFWS 1984, p. 65). At listing in 1997, the known distribution of this species was contained in 11 occurrences supporting about 200 plants (USFWS 1997, p. 42694). By 2007, 17 occurrences of this species had been documented, but all occurrences were located in just five canyon areas; three of the canyons supported only very small satellite populations of between 10 and 34 plants. The credibility of the collection reported from Lemon Tank Canyon is uncertain (USFWS 2007, pp. 2–3), but Furches *et al*. (2009, pp. 124–125) consider it unlikely that this species ever occurred at this locality based upon habitat conditions.

The most-recent information shows that distribution is confined to a roughly 2.3-mile (3.7-kilometer) span encompassing the following eight areas from north to south: Grove, Eagle, Bryce, Negative, Malo, Keco, Mosquito, and Canchalagua canyons (SERG 2016, pp. 35–36). The 2016 survey data denoted 33 distinct point localities (or sites) identified since 1979 within these eight canyons with a highly variable number of plants being observed at these localities over time; however, site-visits have been conducted on an irregular basis with most sites being visited fewer than five times since 1979; in 67 percent of all surveys, plants were not detected at visited sites (SERG 2016, p. 35). Total annual census numbers (1979-2016) have ranged between 2 and 363 plants and all occurrences are small, ranging from 2 to a maximum of approximately 100 individuals (SERG 2016, p. 35).

The 2016 database suggests that perhaps 10 localities consistently support some plants in seven of the eight canyons mentioned above. The 2016 data shows that plants of San Clemente Island woodland-star were not found since 2000 in any of the previously-occupied localities within Eagle Canyon (SERG 2016, p. 35). However, a new point locality supporting San Clemente Island woodland-star was found in 2016 in Bryce Canyon and was the only one of five sites visited in Bryce Canyon that year that supported any plants of this species (SERG 2016, p. 35-36). Documentation of a new point-locality supporting plants suggests that plants may exist undetected in other areas. Because of the inconsistent number and irregular frequency of site-visits, demographic trends cannot be inferred. Nonetheless, over time a consistent decline in observed abundance has been recorded (SERG 2016, p. 35). It is unclear whether this apparent decline represents demographic trends and whether absence represents true extirpation from a locality, or merely that plants were not detected; *e.g*., they are very difficult to locate when not flowering. We have little demographic information for this species: the age of plants has been generally recorded as an adult or mature age-class, although young plants have also been observed indicating that plants grow from seed on occasion.

The results of the most recent genetic diversity assessment revealed substantial genetic variation at microsatellite loci. Detection of a lower-than-expected number of heterozygous loci, however, suggests inbreeding due to mating between closely-related individuals within occurrences and/or a lack of gene-flow between occurrences; hence, most occurrences may be individual populations in the sense that they are reproductively isolated from conspecifics in the vicinity (Furches *et al*. 2009, pp. 121, 123). Some evidence of migration was noted between occurrences sampled in Malo and Keco Canyons (Furches *et al*. 2009, p. 120). Most of the genetic diversity (77 percent) in the sampled distribution of San Clemente Island woodland-star was found in just three occupied canyons: South Vista Canyon (which we presume corresponds to Grove Canyon), Keco Canyon, and DMC Canyon (which we presume corresponds to Malo Canyon) (Furches *et al.* 2009, p. 124). However, because a large portion of the species' genetic diversity exists among rather than within populations, persistence of as many populations as possible is necessary to maintain existing genetic variability (Furches *et al*. 2009, p. 124). Based upon these results and life-history information, the authors speculate that San Clemente Island woodland-star most likely persisted during the centuries of over-grazing via their persistent rhizomes and that as grazing-pressure was reduced, plants resumed above-ground expression with flowering and some amount of seed production (Furches *et al.* 2009, p. 124).

The difficulty in accessing occupied habitat areas is great; many sites are largely unsafe to access due to steepness of the terrain and the presence of unexploded ordnance.

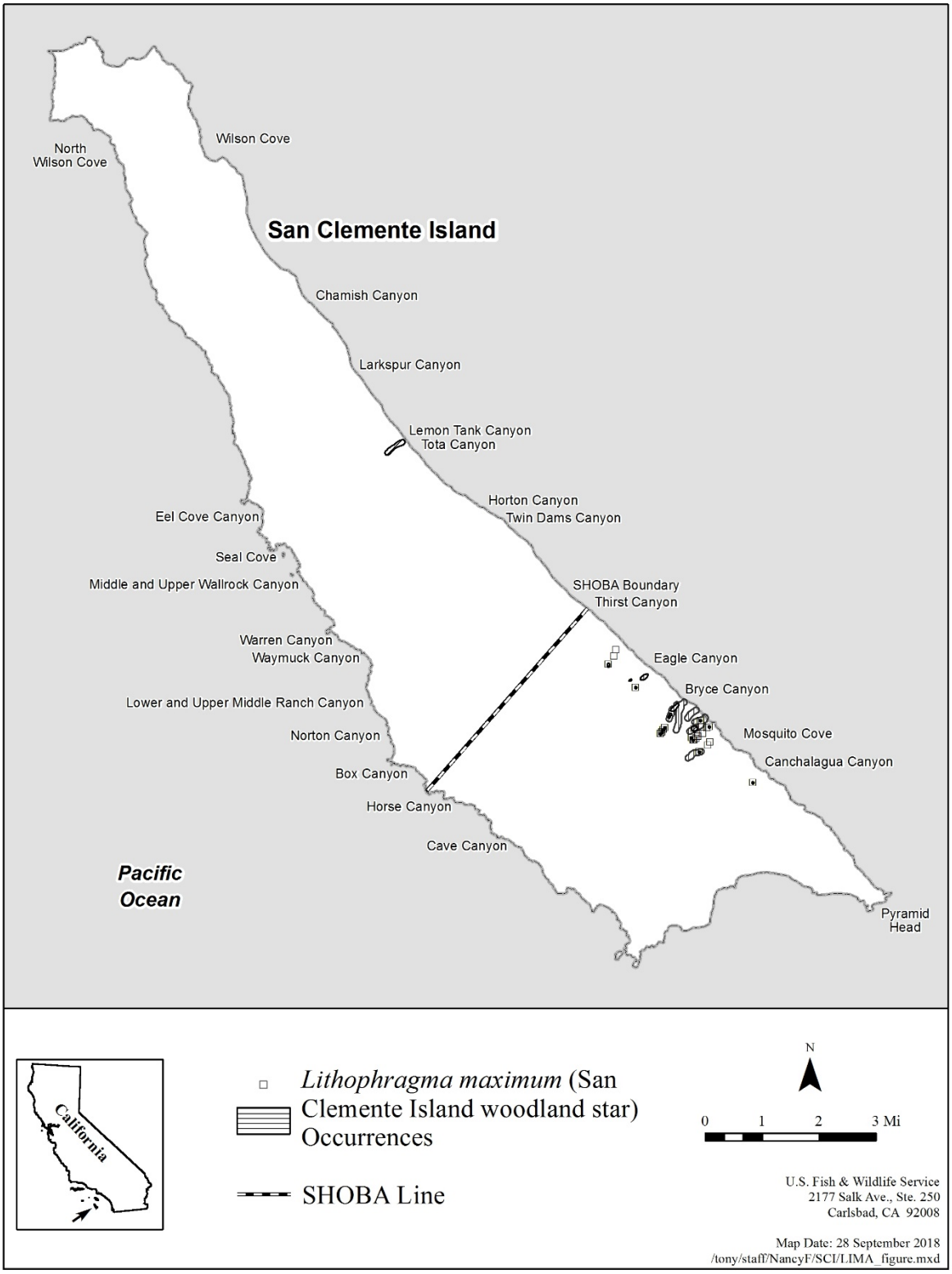

Figure 2. Distribution of San Clemente Island woodland-star on San Clemente Island.

Threats:

Threats to the San Clemente Island woodland-star are summarized below as identified in either the Listing Rule (USFWS 1997), Recovery Plan (USFWS 1984), and 5-year review (USFWS 2007).

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

At listing, we considered that San Clemente Island woodland-star was threatened by a variety of factors including grazing, fire, competition from nonnative plant species, and erosion (USFWS 1997, p. 46292) (Table 2). In 2007, we identified military training (land-use), fire, erosion (exceptional events such as landslides), and impacts from the spread of nonnative invasive plants as threats (USFWS 2007, pp. 10–14). Even though military training is not conducted in areas supporting San Clemente Island woodland-star, the entire genus is located within the Shore Bombardment Area (SHOBA) of San Clemente Island where most wildfires are ignited and where they burn the greatest amount of area. Hence, training was considered a risk to this species primarily as a result of increased ignition risk. Although this taxon is located in the SHOBA buffer area (away from designated training areas) and in moist micro-sites located in deep canyons on the eastern escarpment, fire has burned into the eastern escarpment on several occasions, most recently in 2017 (Munson 2017, pers. comm.). Overall, fire has affected roughly 22 of the 33 localities thought to support San Clemente Island woodland-star (CFWO GIS internal database 2018). We have no information about the response of this species to fire. The presence of associated plants is not well documented in habitat occupied by San Clemente Island woodland-star, but the native fiddleneck (*Amsinckia intermedia*) and the nonnative ripgut grass (*Bromus diandrus*) have been considered a potential threat to fitness through competitive exclusion and possibly inhibiting pollinator access to stands of San Clemente Island woodland-star (Furches *et al*. 2009, p. 125; McGlaughlin 2018, pers. comm.). The ability of nonnative annual grass to carry wildfire into occupied sites, which might not otherwise burn has also been considered a threat to persistence (USFWS 2007, p. 12). Erosion of topsoil and loss of organic matter resulting from severe herbivory has been ameliorated by the final removal of feral herbivores by the U.S. Navy in 1992 and the regrowth of vegetation across SCI; however, due to inherent steepness and instability of slopes along the eastern escarpment of San Clemente Island and the possible role of fire in promoting conditions conducive to slope-failure, erosion remains a risk-factor (USFWS 2007, p. 11).

We have been advised that additional changes to training operations are anticipated and that information will be forthcoming in 2019 (Golumbfskie-Jones 2018, pers. comm.). It is unknown at this time whether changes to training operations would affect habitat for San Clemente Island woodland-star.

FACTOR E: Other Natural or Manmade Factors Affecting Its Continued Existence

Small population-size and limited distribution within a restricted range place San Clemente Island woodland star at greater risk of extirpation resulting from various types of stochastic events: demographic, environmental, and/or genetic (USFWS 2007, pp. 19–20) which may act independently or in concert (Menges 1991, pp. 46–48). Given the exceedingly small number of

plants routinely found at occurrences, chance reductions in vital demographic rates (*e.g.*, production of viable seed; rates of germination and recruitment into the reproductive population) could more easily result in extirpation of occurrences. Pollinator-service may be limited either by a reduction in pollinator species following centuries of over-grazing on San Clemente Island or the inability of pollinators to detect plants when they occur in such small numbers (USFWS 2007, p. 19). Extinction risk is likely greater for plants dependent upon a specific pollinator (Rejmánek 2017, p. 134), which could be the case for San Clemente Island woodland-star. Environmental changes such as a large fire in occupied habitat or prolonged drought and catastrophic slope-failure could also lead to extirpation of some or all occurrences of this species (USFWS 2007, p. 20; Furches *et al.* 2009, pp. 117, 124). We do not know whether the existing fire-regime has altered habitat supporting San Clemente Island woodland-star, perhaps increasing invasion by nonnative annual grasses or the propensity of habitat to burn (USFWS 2007, p. 12). Impacts to habitat for this taxon from wildfires, most-recently affecting nine occurrences in 2017, are unknown at this time (Munson 2017, pers. comm.). Founder effects (a reduction in total genetic variation resulting when a new population is founded by only low number of individuals), genetic drift (random loss of alleles in small populations), and inbreeding depression (a loss of reproductive fitness or plant-vigor resulting from mating between closely related individuals or self-fertilization) are forms of genetic stochasticity, which may be limiting demographic increase of this taxon and that could eventually lead to its extirpation (USFWS 2007, pp. 19-20; Furches *et al.* 2009, pp. 123).

Restricted access by non-military personnel to the SHOBA was also considered a potential threat to San Clemente Island woodland-star if inability to manage threats were to impair recovery (USFWS 2007, pp. 20–21).

Table 2. Review of threats to San Clemente Island woodland-star

Threat	Listing (1997)	Recovery Plan (1984)	5-year Review (2007)
Feral Livestock	X		
Invasive Nonnative Plants	X		X
Erosion			X
Land Use: military training		X	X
Wildfire		X	X
Restricted Access			X
Population Genetics			X

AMENDED RECOVERY CRITERIA

Recovery criteria serve as objective, measurable guidelines to assist in determining when an endangered species has recovered to the point that it may be downlisted to threatened, or that the protections afforded by the Act are no longer necessary and the species may be delisted. Delisting is the removal of a species from the Federal Lists of Endangered and Threatened Wildlife and Plants. Downlisting is the reclassification of a species from endangered to threatened. The term “endangered species” means any species (species, sub-species, or DPS)

which is in danger of extinction throughout all or a significant portion of its range. The term "threatened species" means any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.

We provide downlisting and delisting criteria for the threatened San Clemente Island woodland star, which will supersede those included in California Channel Islands Species Recovery Plan, as follows:

Downlisting of San Clemente Island woodland-star may be considered when all of the following criteria have been met to address threats to the species:

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

A.1: Feral grazing animals have been removed from San Clemente Island and recovery of native vegetation is evident where San Clemente Island woodland-star occurs.

A.2: A survey methodology is developed which allows tracking of persistence of San Clemente Island woodland-star over time and relative changes in abundance at some selected number of occurrences; the locations will be determined based upon feasibility of maintaining consistent access. Information is quantitative in nature and includes a standardized estimate of abundance at occurrences that can be tracked over time, and indicators of demographic status (*e.g.*, flowering; production of viable seed; relative estimated age of plants within the monitored occurrence; evidence of fruit or seed depredation; potential pollinators).

A.3: A quantitative measure of density of associated, co-occurring vegetation (native and nonnative) is made and includes height of co-occurring vegetation relative to that of San Clemente Island woodland-star. Encroachment of nonnative annual grasses and other nonnative invasive plants is monitored and controlled at select San Clemente Island woodland-star occurrences as determined in A.2 above.

A.4: The response of San Clemente Island woodland-star to fire is quantitatively assessed and monitored for a minimum of 5 years following burning to measure survival, re-emergence from rhizomes, seed-germination, and status of co-occurring vegetation and incorporated with long-term monitoring of demographic parameters described in A.2 above.

Factor E: Other Natural or Manmade Factors Affecting Its Continued Existence

E.1: A minimum of five canyons support San Clemente Island woodland-star as demonstrated with persistence of at least one occurrence per canyon for a minimum of 10 years through consistent monitoring. Grove, Keco, and Mosquito canyons are included as three of the five canyons addressed by this criterion. At least one occurrence within each of the five canyons is managed for long-term persistence.

(Recent survey-information suggests that this taxon may now persist in only seven of the eight canyons where it has been detected since 1979 (SERG 2016, p. 35). Presence of San Clemente Island woodland-star in five canyons provides the needed redundancy and representation to safeguard the species from extinction. However, maintaining this species across its extant range would be optimal given its seemingly natural rarity and the distribution of genetic diversity among, rather than within, populations. Sampled populations in South Vista Canyon (i.e., Grove Canyon), Keco Canyon, and DMC Canyon (i.e., Mosquito Canyon) contained roughly 77 percent of the observed microsatellite variation in San Clemente Island woodland-star (Furches *et al*. 2009, p. 124) and plants were detected in all three of these canyons in the most-recent survey information available (SERG 2016, p. 35). Hence, these three canyons are selected for inclusion in criterion E/1 above. The life-span of plants is unknown, but as noted, could be between 3 and 5 years. Because population growth rates of San Clemente Island woodland-star may differ over time and perhaps differ between occurrences, we consider that a minimum of 10 years would be required to obtain baseline demographic information and assess changes anticipated to result from management.)

E.2: If wildfire is determined to be detrimental to the survival of San Clemente Island woodland-star, a Fire Management Plan is developed and implemented to allow suppression of wildfire within SHOBA where it may threaten to extend into the eastern escarpment where canyons supporting San Clemente Island woodland-star occur.

E.3: Erosion potential is assessed at localities selected in Criterion E.1 (e.g., comparative assessment of on-site slope, aspect, vegetation cover, land-use, and fire-history) and controlled to ensure long-term persistence of the species.

Delisting of San Clemente Island woodland-star may be considered when all of the following additional criteria have been met to address threats to the species:

A.5: Changes to land use (e.g. training) are addressed in an updated operational management plan such that training expansion does not directly or indirectly pose a threat to the persistence of San Clemente Island woodland-star (e.g., through an increase in wildfires and/or an increased probability of slope-failure or erosion would result).

Factor E: Other Natural or Manmade Factors Affecting Its Continued Existence

E.4: A minimum of eight canyons support San Clemente Island woodland-star as demonstrated with consistent monitoring at each site for 20 years. A subset of the occurrences within each canyon is managed for long-term persistence through implementation of A.2 and A.3 above.

(Because a large portion of the species' genetic diversity exists among rather than within populations, persistence of as many populations as possible is necessary to maintain existing genetic variability. Therefore, the goal is to retain the genetic diversity within occurrences in these eight canyons where it occurred historically. In order to ensure that we have not overestimated the perceived level of recovery of San Clemente Island woodland-star; i.e., short-

term demographic recovery alone may not indicate that a species is secure from all threats (Wolf *et al.* 2015, p. 202) at least 20 years of observation at each occurrence is required for delisting to account for trends over multiple generations encompassing diverse environmental conditions and effects of threats.)

RATIONALE FOR AMENDED RECOVERY CRITERIA

The amended criteria provide more updated benchmarks that clearly link and address current threats. The criteria ensure that the underlying causes of decline are addressed and mitigated, providing a valid path to recovery.

The 1984 Recovery Plan focused on the protection and restoration of habitat and ecosystem recovery so that the island could eventually support viable, self-sustaining populations of San Clemente Island woodland-star (USFWS 1984, pp. 1, 105–141). The assumption at the time the Recovery Plan was written was that populations of San Clemente Island woodland-star persisted at much lower than historical levels as a result of human disturbance (military operations), habitat destruction (uncontrolled grazing, erosion), and competition from exotic plants. Once feral grazers could be removed from San Clemente Island, natural recovery of vegetation was expected to ensue, although nonnative plants and human activities would need to be managed. Changes to listing status would be possible providing that San Clemente Island woodland-star achieved vigorous, self-sustaining population-levels as a result of habitat stabilization, habitat restoration, and management to prevent or minimize human-related impacts. All of these factors are addressed in the above recovery criteria.

Although access to most sites supporting San Clemente Island woodland-star is difficult, demographic and environmental information including impacts from Factor A threats (e.g., fire; nonnative or other invasive plant species; erosion/slope-collapse) are critical to assessing the actual status of extant occurrences of this taxon. If this species is pollinated primarily by a moth in the genus *Greya*, some level of seed depredation may be occurring which could be having a significant adverse effect on demographic increase in some occurrences (Thompson and Cunningham 2002, p. 737). The ability to determine whether this taxon is stable, increasing, or declining in abundance relies on consistent data collections regarding local abundance, age of plants, and reproductive fitness (i.e., a basic understanding of seed-production, germination and recruitment).

An assessment of ecosystem function is also critical to understanding when the recovery of self-sustaining populations has been achieved (Wolf *et al.* 2015, p. 204). The extent of naturalized invasive species within occupied habitat and potential impacts on pollination-success and possibly seed-dispersal, recovery from fire, and impacts of implementing future training regimens should all be quantitatively monitored and assessed.

Erosion-potential has already been addressed on a broad scale by the USN (Navy 2013b, p. 3-32). However, the relative danger of erosion at each site supporting San Clemente Island woodland-star and factors contributing to it at each site may differ. While we know of no recent instances of slope-failure, topography indicates that habitat loss from catastrophic erosion

remains a perpetual risk. Preventive management for large-scale collapse of slopes is likely not possible, but erosion potential at individual occurrences could be exacerbated by fire if bare soils are subsequently more vulnerable to erosion from wind and water (USFWS 2007, p. 20). Walking in habitat may also increase the risk of erosion to unacceptable levels, so considering factors listed in Criterion E.3 and development of minimally intrusive techniques to monitor and manage this taxon are recommended as part of implementing the above criteria. Genetic factors may contribute to a negligible rate of population increase, even with habitat management.

What information we have suggests that persistence of San Clemente Island woodland-star in the broad sense may be fairly stable, and although it has not been documented recently in Eagle canyon, extirpation has not been confirmed. Nonetheless, documented abundance is critically low. Although no consistent survey methodology has ever been used, the numbers of plants found in past decades have been orders of magnitude greater than those found since 2000 with only two localities (Grove 3 and Malo 2) consistently supporting one or more dozens of plants (SERG 2016, p. 35). Survey information as noted above, indicates that absence of plants is more common than presence. So, while the geographic extent of distribution may be maintained, distribution within the geographic range may be quite sparse. Therefore, implementation of Criteria E.2 in concert with planning associated with implementation of Criteria A.4 are considered necessary to increase and stabilize levels of abundance within the extant geographic range.

No quantified assessment of plants or occurrences were developed for this species in the Recovery Plan and the use at this time of theoretical projections is unwarranted given uncertainty in application of published target population-numbers for long-term viability to specific taxa (Traill *et al.* 2007, p. 165; Flather *et al*. 2011, p. 314) and the unknown nature of factors affecting San Clemente Island woodland-star. The amended criterion and application of the conservation principles inherent in the 3-R's, allows us to assess population recovery based on the species' response to management.

With the successful implementation of the criteria listed above, the species could be considered sufficiently resilient (i.e., possessing adequate genetic diversity, not subject to inbreeding depression, and an overall trend in demographic increase is noted at numerous occurrences in various habitat-types) to withstand stochastic events and sufficiently redundant (i.e., with a stable distribution over the geographic range defined above) to withstand catastrophes and that sufficient representation, as evidenced by persistence in changing environmental conditions, had been achieved.

All classification decisions consider the following five factors: (1) is there a present or threatened destruction, modification, or curtailment of the species' habitat or range; (2) is the species subject to overutilization for commercial, recreational scientific or educational purposes; (3) is disease or predation a factor; (4) are there inadequate existing regulatory mechanisms in place outside the ESA (taking into account the efforts by states and other organizations to protect the species or habitat); and (5) are other natural or manmade factors affecting its continued existence. When delisting or downlisting a species, we first propose the action in the *Federal Register* and seek public comment. Our final decision is announced in the *Federal Register*.

REFERECES CITED

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

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 Clemente Island, California. Inst. Wildl. Studies, Arcata. Unpub. Rept.

Brown, J.M., J.H. Leebens-Mack, J.N. Thompson, O. Pellmyr, and R.G. Harrison. 1997. Phylogeography and host association in a pollinating seed parasite, *Greya politella* (Lepidoptera: Prodoxidae*).* Mol. Ecol. 6: 215-224.

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.

Flather, C.H., G.D. Hayward, S.R. Beissinger, and P.A. Stephens. 2011. Minimum viable populations: is there a 'magic number' for conservation practitioners? Trends in Ecol. and Evol. 26(6): 307-316.

Furches, M.S., L.E. Wallace, and K. Helenurm. 2009. High genetic divergence characterizes populations of the endemic plant *Lithophragma maximum* (Saxifragaceae) on San Clemente Island. Conserv. Genet: 115-126.

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.

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

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.

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

Menges, E.S. 1991. Application of Minimum Viable Population Theory to Plants. Pp. 45-61 in **Genetics and Conservation of Rare Plants** eds. D.A. Falk and K.E. Holsinger. Oxford University Press.

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., C.S. Winchell, and D.S. Woodruff. 1997a. Genetic differences between the endangered San Clemente loggerhead shrike (*Lanius ludovicianus mearnsi*) and two neighboring 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 Clemente Island loggerhead shrike (*Lanius ludovicianus mearnsi*). Proc. R. Soc. Lond. B. 264: 869–875.

Rejmánek, M. 2018. Vascular plant extinctions in California: A critical assessment. Diversity and Distributions 24:129-136.

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.

Rutledge, L. Y., A. Coxon, and B. N. White. 2017. Genetic assessment of the San Clemente Island loggerhead shrike reveals evidence of historical gene flow with Santa Catalina Island. Global Ecology and Conservation 11**:** 42-52.

Schaffer, M.I. and B. Stein. 2000. Safeguarding our precious heritage. Pages 301-322 in Stein B.A., Kutner, L.S., Adams J.S. eds. Precious Heritage: The Status of Biodiversity in the United States. Oxford University Press.

[SERG] Soil Ecology and Restoration Group. 2016. draft San Clemente Island Native Habitat Restoration Program, 2016 Annual Report. *Prepared by* Emma Havstad, Giovanna Figueroa, Carolyn Mills, and Thomas A. Zink, Soil Ecology and Restoration Group, San Diego State University Research Foundation, San Diego, CA *for* Zia Flossman, U.S. Army Corps of Engineers, Bryan Munson, Botany Program Manager, Naval Base Coronado, Kimberly O'Connor, Project Manager, SSC Pacific. Agreement W9126G-15-2-0040. February 2017. 71 pp.

Smith, D.R., N.L. Allan, C.P. McGowan, J.A. Szymanski, S.R. Oetker, and H.M. Bell. 2018. Development of a Species Status Assessment Process for Decisions under the U.S.

Endangered Species Act. Journal of Fish and Wildlife Management: June 2018, Vol. 9, No. 1, pp. 302-320

Stahl, J.T., M.G. Hethcoat, J.G. Yoo, A.S. Bridges, and D.K. Garcelon. 2010. San Clemente loggerhead shrike monitoring program final report- 2009. U.S. Navy, Environmental Department, Naval Facilities Engineering Command Southwest, San Diego, California. 182 pp.

Stahl, J.T., N.J. Desnoyers, A.S. Bridges, and D.K. Garcelon. 2014. San Clemente loggerhead shrike monitoring and release project final annual report- 2013. U.S. Navy, Environmental Department, Naval Facilities Engineering Command Southwest, San Diego, California. 72 pp.

Stahl, J.T., N.J. Desnoyers, A.S. Bridges, and D.K. Garcelon. 2017. San Clemente loggerhead shrike monitoring and release project final annual report- 2016. U.S. Navy, Environmental Department, Naval Facilities Engineering Command Southwest, San Diego, California. 70 pp.

Stahl, J.T., N.J. Desnoyers, A.S. Bridges, and D.K. Garcelon. 2018. San Clemente loggerhead shrike monitoring and release project final annual report final annual report- 2017. U.S. Navy, Environmental Department, Naval Facilities Engineering Command Southwest, San Diego, California. 86 pp.

Traill, L.W., C.J.A. Bradshaw and B.W. Brook. 2007. Minimum viable population size: A meta-analysis of 30 years of published estimates. Biol. Conserv. 139: 159-166.

Thompson, J.N. and B.M. Cunningham. 2002. Geographic structure and dynamics of co-evolutionary selection. *Nature*: 417(13): 735-738.

[USFWS] U.S. Fish and Wildlife Service. 1977. Determination that seven California Channel Island animals and plants are either Endangered Species or Threatened Species. *Federal Register* 42: FR 40682–40685.

[USFWS] 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, Oregon. 165 pp.

[USFWS] U.S. Fish and Wildlife Service. 1997. Endangered and Threatened Wildlife and Plants: Determination of Endangered Status for Three Plants From the Channel Islands of Southern California. *Federal Register* 42: FR 42692–42702.

[USFWS] U.S. Fish and Wildlife Service. 2007. *Lithophragma maximum* (San Clemente Island Woodland Star) 5-Year Review: Summary and Evaluation. September 2007. 31 pp.

[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.

[USFWS] U.S. Fish and Wildlife Service. 2009b. San Clemente Loggerhead Shrike; 5 year review. Carlsbad Fish and Wildlife Office.

[Navy] U.S. Department of the Navy, Southwest Division. 2002. San Clemente Island Integrated Natural Resources Management Plan Final, May 2002. Prepared by Tierra Data Systems, Escondido, California.

[Navy] U.S. Department of the Navy. 2009. San Clemente Island Wildland Fire Management Plan, Commander Navy Region Southwest Natural Resource Office.

[Navy] U.S. Department of the Navy. 2013a. Preliminary Final B Erosion Control Plan for San Clemente Island. *Prepared for*: Naval facilities Engineering Command Southwest, 1220 Pacific Coast Highway, San Diego, California 92132. *Prepared by*: Science Applications International Corporation, 5464 Carpinteria Avenue, Suite K, Carpinteria, CA 93013. 132 pp.

[Navy] U.S. Department of the Navy. 2013b. Integrated Natural Resources Management Plan, Naval Auxiliary Landing Field San Clemente Island. *Prepared for*: Naval Base Coronado Natural Resources Office, 3 Wright Avenue, Building 3, San Diego, CA 92135. *Prepared by*: Tierra Data Inc., 10110 W. Lilac Road, Escondido, CA 92026. June 2013. 784 pp.

Warnock, N. and T. Mader. 1998. 1998 breeding season population monitoring of the loggerhead shrike on NALF, San Clemente Island, California. NACDACENGCOM, San Diego. 67 pp.

Wolf, S. and B. Hartl, C. Carroll, M.C. Neel, and D.N., Greenwald. 2015. Beyond PVA: Why Recovery under the Endangered Species Act is More than Population Viability. BioScience 65(2): 200-207.

Personal Communication

Golumbfskie-Jones, J. 2018. Installation Environmental Director, Naval Base Coronado. Discussion during meetings July 2018 and September 2018. Subject: USN planning regarding section 7 consultation and species recovery on San Clemente Island.

McGlaughlin, Mitchell, Ph. D. 2018. Professor, Associate Director, School of Biological Sciences, University of Northern Colorado. Telephone conversation on December 20, 2018. Subject: Field observations and status of *Lithophragma maximum*.

Munson, Bryan M. 2017. Botany Program Manager, Naval Base Coronado. Electronic mail August 14, 2017. Subject: "26-28 June 2017 Fire Report" 39 pp.