5-YEAR REVIEW

Pacific Coast Distinct Population Segment of Western Snowy Plover (*Charadrius nivosus nivosus*) 2024

GENERAL INFORMATION:

Species: Pacific Coast population Distinct Population Segment (DPS) of western snowy plover (*Charadrius nivosus nivosus*)
Date Listed: March 5, 1993
Federal Register (FR) citation: 58 FR 12864 (Service 1993)
Classification: Threatened

State Listing:
The Pacific Coast population DPS of the western snowy plover was listed as a State Endangered species by the State of Washington in 1981 (Richardson 1995, p. viii). Western snowy plover was listed as a State Threatened species by the State of Oregon in 1975 (Service 2007, p. 1). Western snowy plover was listed as a bird species of special concern by the State of California in 1978 (Service 2007, p. 1).

BACKGROUND:

Species Overview:

The Pacific Coast population Distinct Population Segment of western snowy plover (snowy plover) is a small (around 6 inches in length), ground nesting shorebird in the family Charadriidae. Snowy plovers are pale gray-brown and white, with a white neck and gray-brown breast patch. Plumages are monomorphic in the nonbreeding season, and dimorphic in the breeding season when males molt to exhibit black markings on the head and breast, with some males exhibiting a rufous crown (Service 2007, p. 4). Snowy plover range from Grays Harbor, Washington, south along the Pacific Coast to southern Baja California, Mexico, with wintering populations found as far north as British Columbia, Canada.

The breeding season for snowy plovers begins in early March when first clutches are laid and finishes in September when the last chicks are fledged, except in the southern portion of its range where breeding can begin as early as February 1. Snowy plovers exhibit polyandry, where females will leave the brood tending to the male and reinitiate another nest after chicks hatch (Service 2007, p. 13). If all broods successfully fledge, males can rear two broods in a season while females will have up to three broods (Page et al. 2023, Breeding). However, males and females have been documented renesting up to five times in a given season when they experience clutch loss (Warriner et al. 1986, p. 26). Snowy plovers have an average lifespan of 3 years (Service 2007, p. 4).

Most Recent Status Review:

We did not recommend a status change in the 2019 status Review (Service 2019, entire).

FR Notice Citation Announcing This Status Review:

[Service] U.S. Fish and Wildlife Service. 2023. Endangered and Threatened Wildlife and Plants; Initiation of 5-Year Status Reviews of 47 Species in California, Nevada, and Oregon. Federal Register 88:56042–56044.

We did not receive information from the public regarding the snowy plover in response to this notice.

ASSESSMENT:

Information Acquired Since the Last Status Review

This 5-year Review was conducted by the U.S. Fish and Wildlife Service's (Service) Arcata Fish and Wildlife Office. Data for this Review were solicited from interested parties through a Federal Register notice announcing this Review on August 17, 2023. We contacted lead field offices within the six recovery units of snowy plovers, as well as Point Blue Conservation Science, Coal Oil Point Reserve, Vandenberg Space Force Base and Oregon Biodiversity Information Center (ORBIC) to request data and information we should consider in our Review. Additionally, we conducted a literature search, including a review of snowy plover 10(a)(1)(A) recovery permit annual reports; a literature search on Google Scholar using the keywords: *snowy plover*, *western snowy plover*, and *snowy plover recovery*; and a review of information and literature in our files.

Since the last Status Review there have been annual winter and breeding season window surveys, where snowy plovers are censused at every beach with suitable habitat across the range of the species within a week-long window to index the population, and breeding season surveys at select sites to observe nesting and fledging success, and record threats to the species. New information on existing and emerging threats are addressed in the **Threats** section below.

The American Ornithological Society maintains the Checklist of North American Birds to standardize nomenclature of bird species, and the Service utilizes this document as our taxonomic authority for North American birds. In July 2024, the American Ornithological Society's North American Classification Committee accepted a proposal to change the genus for western snowy plover due to the paraphyletic nature of the genus *Charadrius* (Chesser et al. 2024, p. 5). The updated scientific name for western snowy plover is *Anarhynchus nivosus nivosus*; however, the Service will continue to use the scientific name *Charadrius nivosus nivosus* for the listed entity until we publish a rule revising the name on the list of endangered and threatened species.

Distribution

Current distribution of snowy plover is mostly consistent with that described in the 2019 Review (Service 2019, entire), and the 2007 Recovery Plan (Service 2007, entire). The current U.S. distribution of snowy plover extends from Grays Harbor County, Washington, to San Diego County, California. The 2007 Recovery Plan divides the U.S. range of snowy plover is divided into six Recovery Units (RU; Figure 1), which are discussed below.

Since the 2019 Review, snowy plovers have attempted to nest in historical and novel sites at Copalis Spit and Connor Creek, respectively, in Washington state (RU1), which is the furthest north breeding site of snowy plovers (Ritchie et al. 2022, entire). Nesting on Copalis Spit was

last observed in the early 1960s, and Connor Creek has never had any documented nesting (Richardson 1995, p. 14). Although these recent nesting attempts did not hatch young at either site, they represent a northward range expansion of the species. Furthermore, snowy plovers were reported from Vancouver Island, British Columbia, Canada during the 2023 nonbreeding season (Cruickshank in litt. 2023). This overwintering group of plovers represents the furthest north snowy plovers have been observed on the Pacific Coast.

Within the range of snowy plover, suitable habitat has decreased in RU3, as former salt evaporator ponds are restored to tidal marsh habitat for two other listed species, the California Ridgway's rail (*Rallus longirostris obsoletus*) and salt marsh harvest mouse (*Reithrodontomys raviventris*) (Stralberg et al. 2006, entire; Robinson 2008, entire; Pearl et al. 2021, p. 32). There is evidence that increases in nest density due to reduction in suitable habitat for snowy plovers in the San Francisco Bay may increase predation rates (Pearl et al. 2021, p. 32; Pearl et al. 2022, p. 31; Pearl et al. 2023, pp. 39- 44).

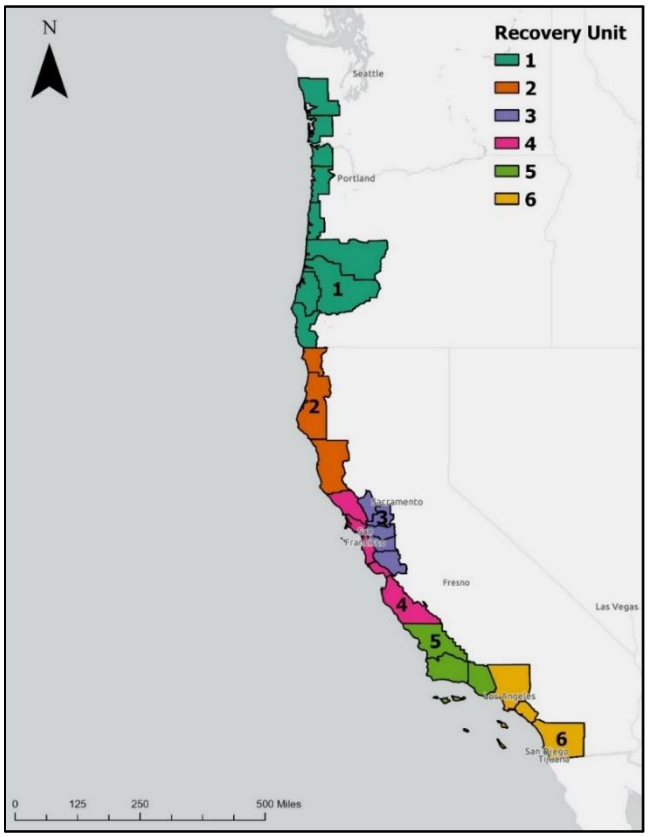

Figure 1. Map of snowy plover recovery unit (RU) locations by county. RU1: Washington and Oregon, RU2: Del Norte to Mendocino Counties, RU3: San Francisco Bay, RU4: Sonoma to Monterey Counties, RU5: San Luis Obispo to Ventura Counties, RU6: Los Angeles to San Diego Counties.

Abundance and Reproduction

In the United States, Snowy plover populations are indexed through twice-yearly window surveys (winter and breeding), in which plovers are counted at all sites across the range of the species. Winter window surveys are conducted in January and show larger snowy plover

numbers because birds from the unlisted interior breeding population also overwinter on the coast (Page et al. 1995, entire). Breeding window surveys are conducted in May and count the breeding population of snowy plovers. Populations have increased since 2007 and have remained stable since the 2019 Review (Table 1, Figure 2). A total of 2,336 breeding adult snowy plovers were counted during the 2023 breeding window survey. Data presented in this Review have not been altered by a correction factor.

Correction factors were first applied in RU4 as window surveys are often undercounts of the breeding population.When correction factors are applied, the population totals are approximately 5 to 30 percent higher than uncorrected window survey counts, but the appropriate correction factor varies depending on recovery unit and year (Neuman et al. 2020, pp. 6-8, 13). Although correction factors can help us better understand the true snowy plover population, when a single correction factor value used for a specific recovery unit or area is applied across the range it can lead to significant overestimates, especially given the annual variation (Neuman et al. 2020, pp. 6-8, 13). Therefore, we left corrected data out of this Review. Further information on uncorrected snowy plover populations is broken down by recovery unit (Table 1, Figure 2).

Table 1. Snowy plover breeding window survey results from 2005 to 2023 in each RU. RU population targets are in parentheses. Data are not altered by a correction factor.

Year	RU1 (250)	RU2 (150)	RU3 (500)	RU4 (400)	RU5 (1200)	RU6 (500)	Total (U.S. Pacific Coast)
2005	137	41	124	337	969	209	**1817**
2006	158	45	102	357	917	298	**1877**
2007	175	26	207	270	676	183	**1537**
2008	147	18	133	257	717	269	**1541**
2009	182	15	147	279	707	257	**1587**
2010	196	19	275	298	686	311	**1785**
2011	202	28	249	311	796	331	**1917**
2012	234	21	147	324	771	358	**1855**
2013	260	23	202	261	754	326	**1826**
2014	269	27	178	374	822	346	**2016**
2015	340	38	195	348	963	376	**2260**
2016	477	45	202	366	820	373	**2283**
2017	342	56	246	369	856	464	**2333**
2018	402	52	235	361	874	451	**2375**
2019	479	41	190	303	807	397	**2217**
2020	469	48	147	308	855	484	**2311**
2021	624	84	263	292	737	358	**2358**
2022	541	71	281	281	804	393	**2371**
2023	487	64	368	308	676	433	**2336**

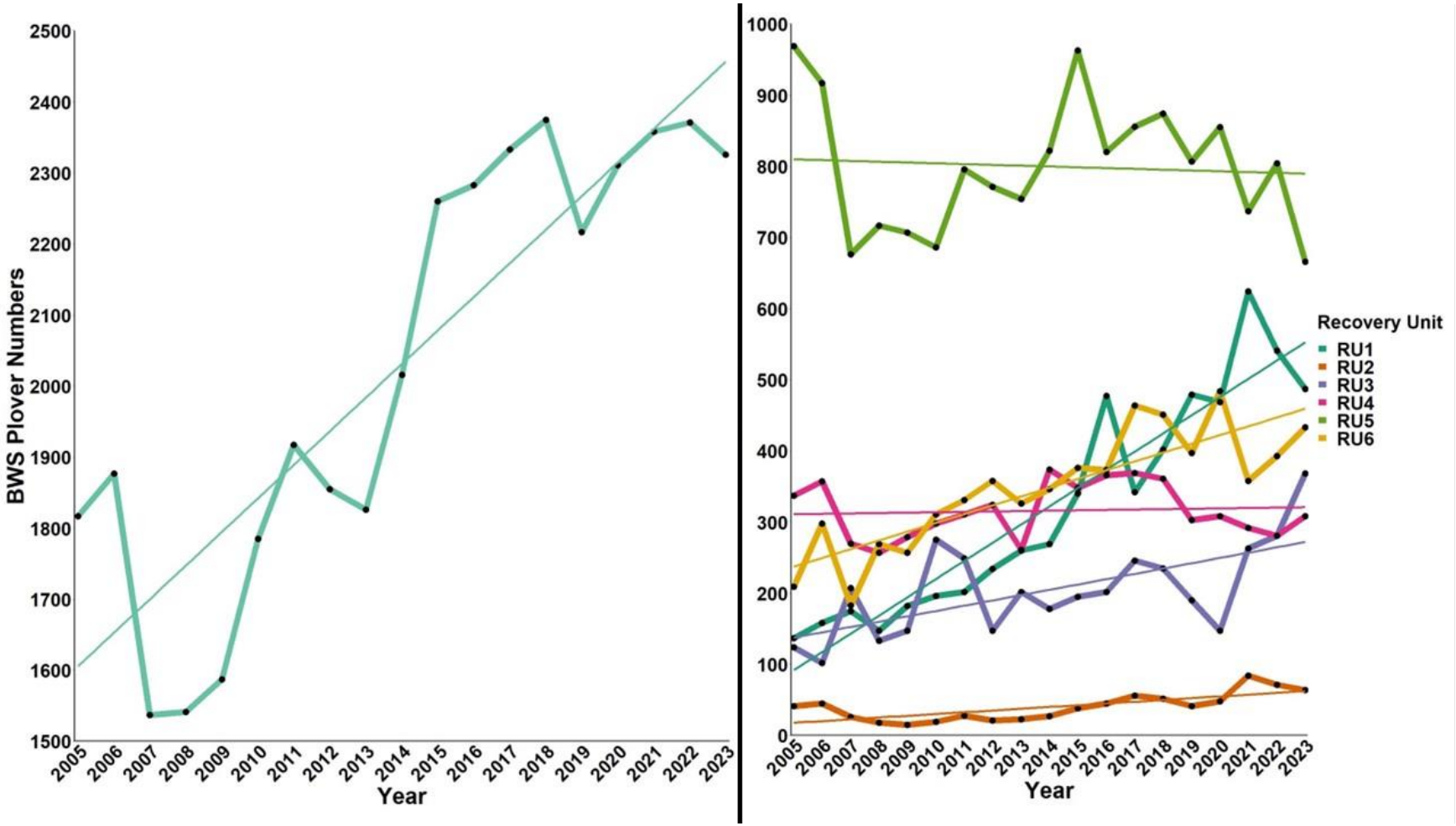

Figure 2. Snowy plover breeding window survey (BWS) results by range (left) and individual recovery unit (RU; right). Straight lines represent trend line.

Recovery Unit 1
The breeding population from the 2023 breeding window survey was 487 breeding adults. The breeding population has reached the recovery criteria of 250 breeding adults for 11 years in a row (Service 2007, p. 142; Service 2023, entire). Breeding adults reached a record high in 2021 with 624 birds observed but have since declined due to predation and unknown factors. RU1 populations have shown a significantly increasing trend since 2005 ($R^2 = 0.8787$, $p < 0.05$).

Reproductive success in RU1 is measured using a sample of the population in central-southern Oregon. Each season, some snowy plovers are banded and the fledge rate of the banded population is then used to infer the number of fledged chicks per male for the sites in this area (Lauten et al. 2020, entire). RU1 reproductive success, derived from the central-southern subset of RU1, exceeded 1.0 fledged chicks per male from 2011 to 2015, and in 2018 and 2019 (1.03 in 2018 and 1.07 in 2019), but has been well below 1.0 during 2020 to 2023 seasons (0.79 in 2020, 0.62 in 2021, and 0.35 in 2022, 0.98 in 2023), largely due to high predation rates from avian predators such as northern harriers (*Circus hudsonius*), American crows (*Corvus brachyrhynchos*), common ravens (*Corvus corax*), and western gulls (*Larus occidentalis*) (Lauten et al. 2020, entire; Lauten et al. 2021, entire; Lauten et al. 2022, entire, Lauten et al. 2023, entire). The current five-year average fledging rate is 0.76 chicks per male. Although RU1 is meeting breeding population number recovery targets, the current reproductive success five-year average does not meet recovery criteria (further detail provided in the **Recovery Criteria** section below).

Recovery Unit 2
A total of 64 breeding adults were counted during the 2023 breeding window survey. RU2's population has shown a statistically significant and increasing trend since 2005 ($R^2 = 0.4922$, $p < 0.05$). Despite the increase in the number of breeding adults since 2005, the recovery criterion of 150 breeding adults has not been met for RU2.

Five-year average reproductive success increased since the 2019 Review. The current rate in RU2 is 1.18 fledged chicks per male (1.71 in 2019, 0.92 in 2021, 0.91 in 2022, and 1.16 in 2023), which currently meets recovery targets. No assessment was conducted in 2020 due to the Covid-19 pandemic.

Recovery Unit 3
Breeding window surveys of RU3 breeding adults observed a record high of 368 breeding adults in 2023. The population trend of RU3 has increased gradually since 2005 ($R^2 = 0.3684$, $p < 0.05$) with substantial variation between years. Despite increases in the number of breeding adults, RU3 is still below the recovery criterion of 500 breeding adults.

Reproductive success in RU3 is measured using a sample of the population. Each season, a number of snowy plovers are banded. The fledge rate of the banded population is then used to measure the number of fledged chicks per male (Pearl et al. 2019, pp. 25-26; Pearl et al. 2021, p. 16; Pearl et al. 2022, p. 16; Pearl et al. 2023, p. 18; Schwarz et al. 2024, p. 21). The five-year average of fledged chicks per male is 0.81 (0.86 in 2019, 0.66 in 2020, 0.82 in 2021, 0.87 in 2022, and 0.82 in 2023), which is well below recovery targets.

Recovery Unit 4
Breeding window surveys in RU4 have shown slight declines since the 2019 Review. However, overall trends since 2005 show the population has remained largely stable (R^2 = -0.0521, p >0.05). The 2023 breeding window survey in RU4 found 308 breeding adults, which is below the recovery criteria of 400 breeding adults.

Reproductive success in RU4 is not calculated across the entire recovery unit as there are multiple agencies that operate snowy plover monitoring. Instead, the weighted five-year average was calculated from end of year reports of larger sites from Sonoma to Monterey counties (Point Reyes National Seashore, selected sites in Sonoma County, Monterey Bay, and Santa Cruz County). Weights are assigned by total population and number of fledged chicks at each site by multiplying the proportion of 5-year average adults in the total population at each of the sites by the average fledged chicks per male value and adding the scores. The five-year population average across sites that provide reports for RU4 is 358 birds. The five-year average for fledged chicks per male is 0.87 which is below the recovery criterion (select sites in Sonoma County: 0.3, Point Reyes National Seashore: 1.08, Monterey Bay and select Santa Cruz County sites: 0.85) (Neuman et al. 2020, pp. 11-13; Neuman et al. 2021a, pp. 5-7; Neuman et al. 2021b, pp. 5-7; Neuman et al. 2022, pp. 10-14; Cummins et al. 2023, pp. 11-15; Erbes 2024, entire; Lau and Press 2024, entire).

Recovery Unit 5
The number of breeding adult snowy plovers counted during breeding window surveys in RU5 have declined since the 2019 Review. Despite this decrease, trends since 2005 show the population has remained largely stable (R^2 = -0.0538 p >0.05). The 2023 breeding window surveys estimate the RU5 snowy plover population to be 676 birds, which is substantially less than the recovery criterion of 1200 breeding adults.

Reproductive success is not calculated across RU5 due to the many reporting jurisdictions within the recovery unit. Some sites are not surveyed with enough frequency to calculate these data and there are still many unbanded populations (California State Parks 2022, entire). However, several larger agencies and groups including Oceano Dunes State Vehicular Recreation Area (Oceano Dunes), Vandenberg Space Force Base (Vandenberg), and Coal Oil Point Reserve (COPR) all submit annual reports to the Service that provide reproductive success data (Iwanicha et al. 2023, entire; Robinette et al. 2023, pp. 29-72; Sandoval et al. 2023, p. 20; Robinette et al. 2024a, pp. 28-71; Sandoval et al. 2024, p. 19). The weighted five-year average of reproductive success for the three sites combined was 1.27 fledged chicks per male, which meets the recovery target (Robinette et al. 2019, pp. 45-125; Robinette et al. 2021, pp. 46-130; Iwanicha et al. 2023, entire; Robinette et al. 2023, pp. 29-72; Sandoval et al. 2023, p. 20; Robinette et al. 2024a, pp. 28-71; Sandoval et al. 2024, p. 19).

Recovery Unit 6
Breeding window surveys in RU6 have shown stable trends since the 2019 Review with a record 484 birds during the 2020 survey. Trends since 2005 show increases in the RU6 population that are statistically significant (R^2 = 0.6966, p <0.05). However, all recorded window survey populations for RU6 fall below the recovery criteria of 500 breeding adults.

Reproductive success has recently been calculated across RU6 at all sites where data are available. Because RU6 includes several areas with high numbers of unbanded snowy plovers, to the RU is now utilizing breeding efficiency (the ratio of chicks fledged to eggs laid) as a metric

for reproductive success, following the methods of Colwell et al. (2018, entire). The five-year average of breeding efficiency in RU6 is 0.23. Based on the results of breeding efficiency studies from RU1 and RU4, this value corresponds to approximately 1.2 fledged chicks per male (Colwell et al. 2018, entire; Cummins et al. 2023, entire; Vissman 2024, entire). Thus, it appears RU6 is meeting the recovery target for reproductive success.

Threats

Threats described in the 2007 Recovery Plan include destruction, modification, or curtailment of habitat; overutilization for commercial, recreational, scientific, or educational purposes; disease; predation; inadequacy of existing regulatory mechanisms; and other natural or manmade factors affecting their existence (Service 2007, pp. 33-78). The 2019 Review noted the same threats as the Recovery Plan and added projected changes in sea level rise and climate change as additional threats to nest survival, overwinter survivorship, and reduced quality of nesting and roosting habitats (Service, 2019, entire). However, Stenzel et al. (2023, entire) found that increased winter temperatures due to climate change may benefit snowy plover populations due to reduced winter mortality. Since the 2019 Review, five new threats have emerged that could negatively impact snowy plover.

Increased Rocket Launches from Spacecraft

Vandenberg Space Force Base leases federal land to SpaceX to support commercial rocket launching. Between 2000-2020, Vandenberg generally supported less than 10 rocket launches a year. In the last three years, Vandenberg has seen a dramatic increase in rocket launching, principally due to SpaceX operations, with SpaceX accounting for 27 of 29 realized rocket launches in 2023. A total of 11 of those rocket launches by SpaceX utilized booster landings that created terrestrial sonic booms, seven of which occurred during the 2023 plover nesting season (Robinette et al. 2024b, entire). Sonic booms are caused by the rocket booster falling to the earth faster than the speed of sound. During the terrestrial sonic boom events plovers exhibit stress responses such as hunkering down over the nest or abandoning the nest, which may have resulted in damage to eggs and embryos. The threat from increased rocket launches from spacecraft is currently localized and site-specific to snowy plover populations in RU5 that are within a limited proximity to and within Vandenberg Space Force Base, and not throughout the range of snowy plover. It is possible that effects could affect a broader range beyond Vandenberg Space Force Base depending on the trajectory of launches, but more data are needed to understand the extent of these effects.

Increased nest abandonment was documented in 2023 during rocket launches at breeding locations on Vandenberg. Two incidents where damage to an egg and embryo were observed that coincided with terrestrial sonic boom events. Robinette et al. (2024b, p. 44) found a nest that had a damaged embryo, and an embryo that stopped developing at an additional nest. In each instance, the adult plover was observed hunkering down over the nest for an extended period. Robinette et al. (2024b, pp. 43-44) also found an increase in abandoned nests closer to rocket launch sites in comparison to those further away during the 2023 season.

Coastal Squeeze of Viable Habitat

Coastal habitats often respond to sea level rise by naturally migrating further inland. However, human development and other barriers can impede and limit beach and coastal habitat migration. This phenomenon is known as ‘coastal squeeze’ (Krosby et al. 2023, entire). Although discussed as a future threat in the 2019 Review, the effects of coastal squeeze on snowy plover habitat in

the last five years have been well documented. In Oregon, Lauten et al. (2023, pp. 3, 9, 15, 18-19) documented loss of habitat from coastal squeeze as a contributing factor in declining plover numbers across RU1 since 2021. In 2023, two heavily monitored sites lost viable nesting habitat to encroachment of European beach grass (*Ammophila arenaria*) and the associated westward movement of large, steep foredunes, and loss of the western slope of the beach due to sea level rise, putting snowy plovers in direct conflict with recreation activities (Lauten et al. 2023, pp. 3, 9, 15, 18-19).

Highly Pathogenic Avian Influenza

The newest strain of highly pathogenic avian influenza (HPAI) has been found in snowy plovers. To date, five snowy plover carcasses have tested positive for HPAI (USDA APHIS 2024, entire). Shorebirds and waterfowl are known reservoirs of HPAI. However, plovers in the family Charadriidae do not appear to test positive for the disease as often as other species of shorebird, such as birds in the genus *Calidris* and *Arenaria* (Araujo et al. 2017, entire; Hanson et al. 2008, entire; Shriner and Root 2020, entire). Snowy plovers do not form dense breeding and wintering flocks like many other shorebird species. Although HPAI incidence may increase in the future, the risk of mortality and morbidity from HPAI may be comparatively low in snowy plovers.

Electric Bicycles

Electronic bicycles (ebikes) have increased in popularity in the United States. Panlasigui et al. (2021, entire) concluded that ebikes have unique consequences to natural systems such as increased visitor use of natural sites, increased speed of cyclists, impacts to soils that are heavily used, and higher noise pollution, which could detrimentally impact wildlife. Additionally, ebikes increase the distance traveled by most visitors (Panlasigui et al. 2021, entire). Increased travel distances and visitation by the public could mean higher disturbance for snowy plovers at sites that traditionally are not exposed to regular human disturbance. Increased disturbance could reduce the overall fitness of snowy plovers due to reductions in time spent foraging, loafing or brooding, and could increase egg, chick, and adult mortality. In addition to disturbance, ebikes could run over nests or chicks, especially if traveling at a high speed.

Unmanned Aerial Vehicles

Unmanned aerial vehicle (drone) use is regulated by federal and state agencies. However, there is concern of detrimental impact to snowy plovers from increasing use (Hartley 2021, entire). A recent study on drone use in the United States found that California is the third highest ranking state in drone violations, with particularly high concentrations of violations along the southern California coast (Mandourah and Hochmair 2022, p. 12). Hartley (2021, pp. 12-14) found that plovers react to drone flights over nesting areas and recorded increased vigilance, ducking behavior, and flushing of nests when drones were in proximity to nests. Increased disturbance from drones could reduce the overall fitness of snowy plovers due to reductions in time spent foraging, loafing or brooding, and could increase egg, chick, and adult mortality.

Recovery Criteria

The Recovery Plan discuses three recovery criteria (Service 2007, pp. 141-147). These recovery criteria include a minimum population of 3,000 birds maintained for 10 years across the range of the species, and an average reproductive success of 1.0 fledged chicks per male for the last five years prior to delisting (Service 2007, pp. 141-147). The minimum population requirement is further broken down by RU (Table 2). Although several RUs are currently meeting reproductive criteria, only RU1 has met minimum population targets.

Table 2. Recovery criteria and current progress of snowy plover across the range.

Recovery Criteria	**2024 Status**
Criterion 1. Monitoring shows that an average of 3,000 breeding adults distributed among six recovery units as specified below have been maintained for a minimum of 10 years: Recovery Unit 1 – 250 breeding adults Recovery Unit 2 – 150 breeding adults Recovery Unit 3 – 500 breeding adults Recovery Unit 4 – 400 breeding adults Recovery Unit 5 – 1,200 breeding adults Recovery Unit 6 – 500 breeding adults	Partially met. This criterion has only been met in RU1. Please see Abundance and Reproduction.
Criterion 1.a. A program is developed and implemented to monitor the western snowy plover breeding population and wintering locations to determine whether recovery unit subpopulation criteria are being achieved.	Met. Biannual surveys are completed every year to monitor progress to snowy plover recovery.
Criterion 1.b. A program is developed and implemented to monitor the site-specific threats identified in Appendix C and monitoring results are used to refine site-specific management actions identified in Appendix C.	Partially met. Some sites across recovery units are not surveyed with enough frequency.
Criterion 1.c. Management activities identified in Appendix C that are necessary to ameliorate threats and achieve increases in reproductive success, survival, and overall population size are incorporated into participation and management plans developed and implemented under Criterion 3.	Partially met. Outreach, predator management, monitoring, and exclusionary measures are active at some sites but not others. There is an increase in the use of predator exclosures across the range in the last few years.

Recovery Criteria	2024 Status
Criterion 1.d. Research actions are completed and incorporated into management and participation plans and into monitoring plans.	Met. Extensive research is ongoing or completed for snowy plover and results from this research has been incorporated into management documents and plans.
Criterion 2. A yearly average productivity of at least one fledged chick per male has been maintained in each recovery unit in the last five years prior to delisting.	Partially met. This criterion is currently being met by RUs 2, 5, and 6. These criteria will be re-evaluated for each recovery unit during the next 5-Year Review. Please see Abundance and Reproduction.
Criterion 3. Mechanisms have been developed and are in place to assure long-term protection and management of breeding, wintering, and migration areas listed in Appendix B to maintain the subpopulation sizes and average productivity specified in Criteria 1 and 2.	Partially met. Mechanisms exist in some parts but not the entirety of the range.
Criterion 3.a. Working groups for each of the six recovery units are established.	Met. The working groups meet regularly throughout the year.
Criterion 3.b. A participation plan for each recovery unit working group has been developed and implemented.	Partially met. Active participation plans have been implemented in some recovery units.
Criterion 3.c. Management plans for all Federal and State lands identified in Appendix C have been developed and implemented.	Partially met. Most sites in Appendix C have management plans in implementation.
Criterion 3.d. Mechanisms to protect and manage western snowy plover breeding and wintering sites identified in Appendices B and C are in place for all areas owned or managed by local governments or private landowners.	Partially met. Most sites in Appendix C have management plans in implementation.
Criterion 3.e. Public information and education programs are developed and implemented.	Partially met. Education and outreach are ongoing across all six recovery units to varying degrees.

Conclusion

After reviewing the best available scientific information, we conclude that the Pacific Coast population DPS of western snowy plover remains a threatened species. The evaluation of threats affecting the species under the factors in 4(a)(1) of the Endangered Species Act and analysis of the status of the species in our 2019 Review remains an accurate reflection of the species' current status.

RECOMMENDATIONS FOR FUTURE ACTIONS:

We propose several conservation, research, and management recommendations that will aid in the recovery and conservation of snowy plover. Some of these recommendations have already been discussed in previous recovery documents (Service 2007, pp. 129-238) and remain valid.

1. Continue to coordinate with partners to conduct analysis of existing snowy plover data to determine trends and monitor population status throughout the range.
2. Continue to restore habitat for snowy plovers while considering snowy plover habitat needs in the San Francisco Bay (RU3).
3. Work to build the partnership between Canada, Mexico, and U.S. nongovernment organizations, scientists, and state and federal agencies on recovery and management actions at nesting and wintering sites in the country.
4. Advance working relationships with partners to create a range-wide database on snowy plover activities to easily analyze range-wide trends and better assess the status of the species.
5. Develop standardized monitoring protocols and data collection to facilitate implementing range-wide studies on snowy plover.
6. Continue to work with partners across the range of the species to implement predator management tools to advance the recovery of snowy plover.
7. Increase monitoring via GPS tags or the MOTUS network on the Pacific Coast to accurately track movement between metapopulations across the range of snowy plover.
8. Update the population viability analysis using updated datasets and technology to examine recovery criteria and ensure those criteria are achievable and accurate.
9. Utilize censuses from largely banded populations to accurately assess population metrics for their respective recovery unit.
10. Continue to utilize breeding efficiency as a method for assessing fledging success in populations with less monitoring and banding.
11. Revise and update Recovery Plan based on the last 17 years of collected data and incorporate efficiencies in monitoring and modeling practices.
12. Continue to collect data on the impacts of increased rocket launches at Vandenberg Space Force Base to snowy plover both locally and across the range. In the event of declines, work with the Space Force to proactively avoid effects on base by decreasing launch frequency to levels of no demonstrated effect.

Assistant Regional Director for Ecological Services, Pacific Southwest Region

MICHAEL SENN Digitally signed by MICHAEL SENN
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Approve _____ **Date** _____

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