# U.S. FISH AND WILDLIFE SERVICE
# SPECIES ASSESSMENT
# AND LISTING PRIORITY ASSIGNMENT FORM

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SCIENTIFIC NAME: *Cyanoramphus malherbi*

COMMON NAME: Orange-fronted parakeet

HQ CONTACT: Rachel London, Acting Chief, Branch of Delisting and Foreign Species, 703–358–2464, elizabeth_maclin@fws.gov.

DATE INFORMATION CURRENT AS OF: July 2022

STATUS/ACTION

___Species petitioned for listing which we have determined is not a listable entity

___ Species petitioned for listing which we have determined does not warrant listing (does not meet the definition of a threatened or endangered species)

___Non-listed species for which we have not received a petition but for which we have undertaken a species status assessment on our own initiative and which we have determined does not warrant listing (does not meet the definition of a threatened or endangered species)

___Listed species petitioned for delisting which we have determined does not warrant delisting

___ Listed species petitioned for downlisting which we have determined does not warrant downlisting

___ Listed species petitioned for uplisting for which we have made a warranted-but-precluded finding for uplisting (this is part of the annual resubmitted-petition finding)

___ Listed species petitioned for uplisting which we have determined does not warrant uplisting

___ New candidate
_X_ Continuing candidate
Date when the species first became a candidate (as currently defined): May 21, 2004

___ Listing priority number change
Former LPN: ___
New LPN: ___

___ Candidate removal: Former LPN: ___

___ Taxon does not meet the Act's definition of "endangered species" or "threatened species" because it is more abundant or widespread than previously believed or not subject to the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status.

___Taxon does not meet the Act's definition of "endangered species" or "threatened species" because it is not subject to the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status due, in part or totally, to conservation efforts that remove or reduce the threats to the species.

___ Taxon does not meet the Act's definition of "species."

___ Taxon mistakenly included in past notice of review.

___ Taxon believed to be extinct.

Petition Information:

___ Non-petitioned

_X_ Petitioned; Date petition received: November 28, 1980

90-day "substantial" finding FR publication date; citation: May 12, 1981 (46 FR 26464)

12-month "warranted but precluded" finding FR publication date; citation: May 21, 2004 (69 FR 29353)

FOR PETITIONED CANDIDATE SPECIES

A. Is listing warranted? Yes
B. To date, has publication of a proposal to list been precluded by other higher priority listing actions? Yes
C. Why is listing precluded at this time? Higher-priority listing actions—including court-approved settlements, and court-ordered and statutory deadlines, for petition findings and listing determinations—continue to preclude the proposed and final listing rules for this species. We continue to monitor populations and, if necessary, will change the status of the species or implement an emergency listing. The "Progress on Revising the Lists" section of the current CNOR (*https://endangered.fws.gov/*) provides information on listing actions taken during the last 12 months.

PREVIOUS FEDERAL ACTIONS:

On November 28, 1980, we received a petition from the International Council for Bird Preservation to list 79 bird species, of which 60 were foreign species and 19 were occurring on U.S. territory, including orange-fronted parakeet (*Cyanoramphus malherbi)*, as endangered or threatened species under the Act. On May 12, 1981, we published in the Federal Register (46 FR 26464) a 90-day finding in which we announced that the petition contained substantial

information indicating that listing may be warranted for 77 of the 79 bird species, including the orange-fronted parakeet. This document constitutes our 12-month finding on the November 28, 1980, petition to list the orange-fronted parakeet under the Act.

[ANIMAL GROUP AND FAMILY/PLANT GROUP, ORDER AND FAMILY]: Birds, Parrots (Aves: Psittacidae)

DISTINCT POPULATION SEGMENT (DPS)
N/A

BIOLOGICAL INFORMATION
To assess the orange-fronted parakeet's viability, we followed the species status assessment (SSA) framework and used the three conservation biology principles of resiliency, redundancy, and representation (Shaffer and Stein 2000, pp. 306–311). Briefly, resiliency supports the ability of the species to withstand environmental and demographic stochasticity (for example, wet or dry, warm or cold years, variation in demographic rates), redundancy supports the ability of the species to withstand catastrophic events (for example, droughts, large pollution events), and representation supports the ability of the species to adapt to both near-term and long-term changes in its physical and biological environment (for example, climate change, disease). A species with a high degree of resiliency, representation, and redundancy is better able to adapt to novel changes and to tolerate environmental stochasticity and catastrophes. In general, species viability will increase with increases in resiliency, redundancy, and representation (Smith et al. 2018, p. 306). Using these principles, we identified the species' ecological requirements for survival and reproduction at the individual, population, and species levels, and described the beneficial and risk factors influencing the species' viability.

We use the SSA framework to assemble the best scientific and commercial data available for this species. The SSA framework consists of three sequential stages. During the first stage, we evaluate the species' needs. The next stage involves an assessment of the historical and current condition of the species' demographics and habitat characteristics, including an explanation of how the species arrived at its current condition (i.e., how threats and conservation actions have influenced the species). The final stage of the SSA framework involves assessing the species' plausible range of future responses to positive and negative environmental and anthropogenic influences. The SSA framework uses the best available information to characterize viability as the ability of a species to sustain populations in the wild over time and is used to inform our regulatory decision.

Species Description
The orange-fronted parakeet is a bright-blue-green parrot, averaging 23 centimeters (cm; 9 inches (in)) in length, with yellow and orange coloring on its head above its bill with some blue wing feathers (BLI 2017, unpaginated). Its appearance is very similar to the yellow-crowned parakeet (*Cyanoramphus auriceps*), but the orange-fronted parakeet has a frontal orange band, a

pale-yellow crown, and orange patches on either side of the rump (del Hoyo *et al.* 1997, p. 372). The birds can be distinguished in the field by the coloration of both the frontal band and the rump patch which are dark red in the yellow-crowned parakeet (Kearvell *et al*. 2014, entire; Higgins 1999, p. 499). Female orange-fronted parakeets are slightly smaller than males and have a proportionally smaller bill (BLI 2017, unpaginated). Young birds have paler green head coloration, and the frontal band appears within 2 to 4 weeks (NZDOC 2017a, unpaginated).

Figure 1: Image of orange-fronted parakeet (ARKive 2017, unpaginated. Photo Credit Luis Ortiz-Catedral).

Taxonomy

The orange-fronted parakeet (*Cyanoramphus malherbi*) is a bird in the parrot or Psittacidae family. It was treated as an individual species until it was proposed to be a color morph of the yellow-crowned parakeet (*C. auriceps*) in 1974 (Taylor 1998, pp. 49–63, citing several sources). Subsequently, it was reestablished as a full species based on mitochondrial sequence data (Kearvell and Steeves 2015, pp. 71–72 citing several sources; Kearvell *et al.* 2003, p. 34). Nuclear microsatellite genotype data, behavioral and ecological analyses, and direct investigations of the frequency of mating between the orange-fronted and yellow-crowned parakeets where they overlapped further support the designation of the orange-fronted parakeet

as a full species (Kearvell *et al.* 2015, pp. 72–74 citing several sources). Given this new information, the Checklist Committee for the Ornithological Society of New Zealand now recognizes the orange-fronted parakeet as a full species (Gill 2010, p. 257). The International Union for the Conservation of Nature (IUCN), BirdLife International (BLI), and the Integrated Taxonomic Information System (ITIS) all recognize *C. malherbi* as a full species (BLI 2017, unpaginated; ITIS 2017, unpaginated; BLI 2016, unpaginated). We have reviewed the available information and conclude that the orange-fronted parakeet (*C. malherbi*) is a full species in a multispecies genus. The common name "orange-fronted parakeet" is used by BLI as the common name for *Aratinga canicularis*, which is native to Costa Rica. Because New Zealand continues to refer to this species as the orange-fronted parakeet, we will use this common name in this document. Other common names for this species include Malherbe's parakeet and the orange-fronted kākāriki, or kākāriki karaka.

Habitat/Life History

Orange-fronted parakeet populations on New Zealand's South Island inhabit subalpine mature beech forests (*Nothofagus* spp.), making their nests within natural cavities of these trees (Kearvell *et al.* 2002, pp. 140–145; Kearvell 2002, pp. 261–262). On the islands where it has been introduced, it is less selective in its nest sites and does not require native mature forested habitat to breed (Ortiz-Catedral *et al.* 2009, p. 437; Ortiz-Catedral and Brunton 2009, p. 153). Orange-fronted parakeets rely heavily on beech seeds as a major component of their diet, but also feed on a range of plant material including buds, sprouts, fruits, blossoms, leaves, ferns and grasses; they also eat invertebrates such as aphids and caterpillars (NZDOC 2017b, unpaginated). While the naturally-occurring (non-introduced) colonies rely on beech seeds as a major component of their diet, the species on the island colonies feed on a wide variety of plants, mostly eating fruits and leaves (Ortiz-Catedral and Brunton 2009, pp. 386–387). Orange-fronted parakeets on Blumine Island have been observed feeding on scale insects, as well as the honeydew that they produce, in addition to beech seeds (Skirrow *et al*. 2021, p. 7). A survey on Chalky Island found parakeets feeding on the flower buds of the mānuka, *Leptospermum scoparium* (Skirrow *et al.* 2021, p. 6).

Breeding on the mainland is linked with the irregular seeding of beech trees when parakeet numbers can increase substantially (BLI 2017, unpaginated). In mast years (years with high levels of seed production), many pairs will lay a second clutch, and some may lay a third clutch (BLI 2017, unpaginated). After a mast in 2019, the parakeets had more than three times the number of nests compared to other years, with some mating pairs producing five clutches (Romo 2019, unpaginated). Breeding begins in summer (December/January) and may continue through the austral winter (BLI 2017, unpaginated; NZDOC 2017b, unpaginated). Females typically lay between 5 and 8 eggs per clutch; the largest clutch found contained 10 eggs (NZDOC 2017a, unpaginated). Incubation takes 21-26 days and chicks fledge when they are 40–50 days old (NZDOC 2017b, unpaginated). Birds on Maud Island formed pairs at about 7 years of age (Kearvell *in litt*. 2011 and 2012 as cited in BLI 2017, unpaginated). Lifespan in the wild is unknown, but the maximum observed lifespan for a captive bird was over 16 years (Galla 2019,

p. 44).

Historical and Current Range/Distribution

During the 19th century, the species was well distributed on the South Island of mainland New Zealand and a few offshore islands (Harrison 1970, pp. 117–120) including Stewart Island (NZDOC 2017b, unpaginated). Although a handful of historical reports indicate it may have also occurred on the North Island, the accuracy of these records has been questioned (Harrison 1970, pp. 116–117). While the species primarily resided in beech forest-covered valleys, historical records suggest that in the late 1800s, during mast years, the parakeets would experience an increase in their breeding rates and disperse onto the Canterbury Plains (NZDOC 2017a, unpaginated).

The species' range contracted when its population was severely reduced in the late 1800s and early 1900s, for reasons unknown (Harrison 1970, pp. 116–120). By the late 1900s, the orange-fronted parakeet was restricted to an extremely small area of the South Island where its habitat is fragmented (BLI 2017, unpaginated). From 1999 to 2000, the population severely declined further from around 500 to 700 birds to around 100 to 200 birds as a result of intense ship rat (*Rattus rattus*) predation during two successive summers (van Hal *in litt.* 2008, 2009, as cited in BLI 2017, unpaginated).

The orange-fronted parakeet is now considered the rarest parakeet in New Zealand and the remaining naturally occurring colonies are restricted to a small area on the South Island (NZDOC 2017a, unpaginated). These natural populations are all within a 30-kilometer (18.6-mile) radius of one another in the beech forests of the upland valleys (BLI 2017, unpaginated NZDOC 2017a, unpaginated) of North Canterbury. These include two valleys located in Arthur's Pass National Park (Hawdon Valley and Poulter Valley), and the South Branch of the Hurunui Valley located in Lake Sumner Forest Park (BLI 2017, unpaginated; NZDOC 2017a, unpaginated; Figure 2). Recent surveys suggest that the population in Hawdon Valley has likely been extirpated, and there are only a few individuals remaining in the Poulter Valley (Galla 2019, p. 18). The population in the South Branch of the Hurunui Valley maintains active breeding pairs, as it is the release site for captive-bred birds and contains predator-controlled areas (Galla 2019, p. 40). In 2021, three orange-fronted parakeets were sighted in the Hurunui North Branch, although it is unclear if they were part of a formerly unknown population or if they had expanded there from the nearby South Branch (NZDOC 2021b, unpaginated).

Beginning in 2005, captive-bred orange-fronted parakeets have also been translocated to four predator-free islands: (1) Maud Island, (2) Blumine Island, and (3) Chalky Island off the South Island, and (4) Mayor Island off the North Island (BLI 2016, unpaginated). Breeding has been observed on every island (Farley 2014, p. 2; Ortiz-Catedral 2012, p. 149; NZDOC 2011, unpaginated), though as of 2018, breeding pairs are only active on Blumine Island (Galla 2019, p. 41). The best available information indicates Blumine Island has an estimated population of about 193 individuals, and although no nests or eggs were found, one pair was observed breeding

(Skirrow *et al.* 2021, p. 7). In 2009, Maud Island had maximum population estimated at 126 individuals (Ortiz-Catedral *et al.* 2012, p. 56); however, by 2016, surveys found no evidence of any orange-fronted parakeets on Maud Island, possibly due to post-fledgling dispersal (Skirrow *et al.* 2021, pp. 6, 8). The population decline on Maud Island may also be due to herbicide treatments of a non-native pine plantation, while Blumine Island's population may benefit from the presence of a mature beech forest (Skirrow *et al.* 2021, p. 7). Surveys on Chalky Island found 5 orange-fronted parakeets, 3 of which were part of a mixed flock of both yellow-crowned and orange-fronted parakeets (Skirrow *et al.* 2021, p. 6). Figure 2 indicates the wild distribution on both the main islands and offshore islands, as well as the sites of breeding facilities and release sites current as of 2018 (Galla *et al.* 2020, p. 994).

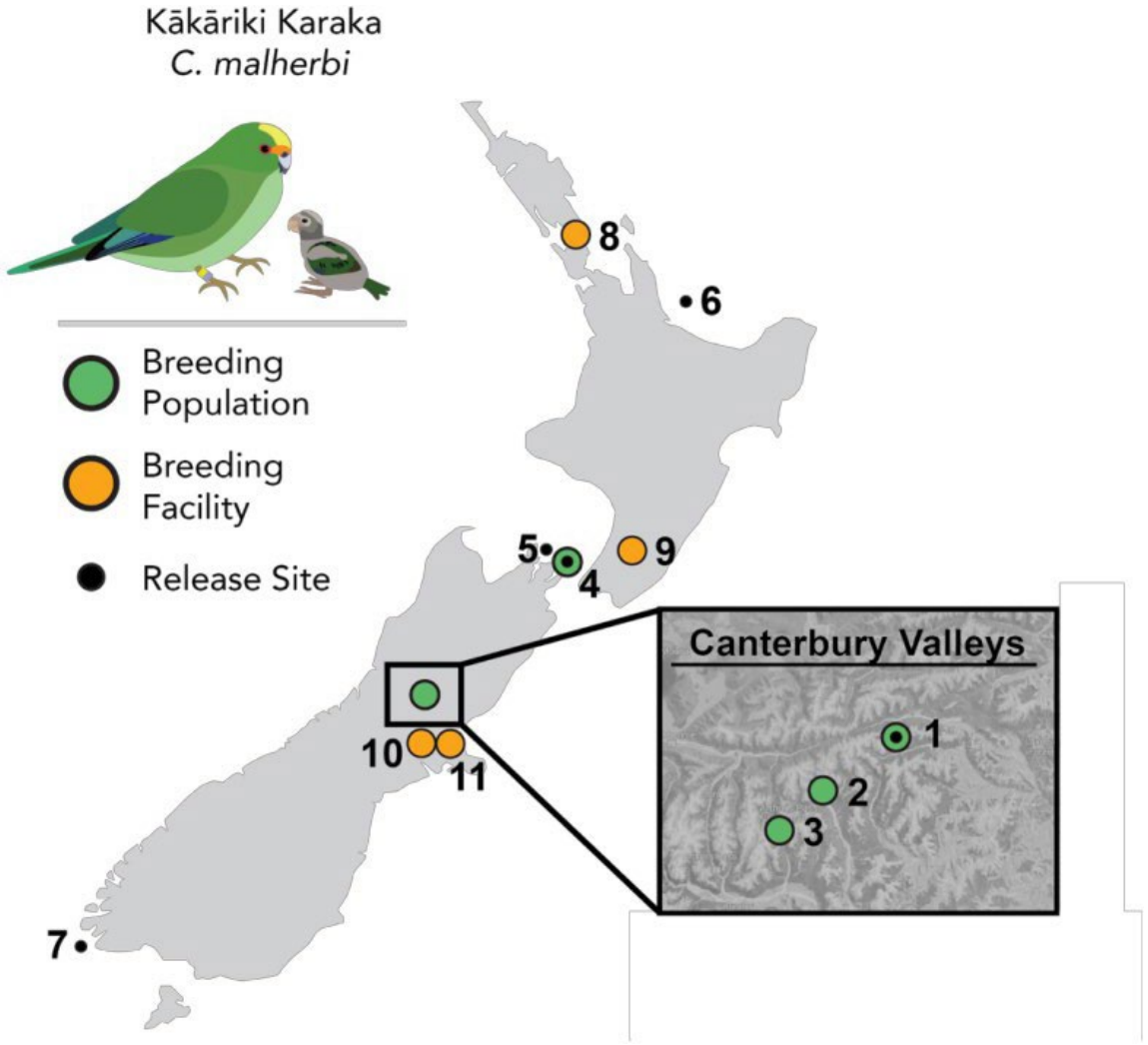


Figure 2: Breeding distribution of orange-fronted parakeets in New Zealand and breeding facility

and release sites, current as of 2018. Locations are as follows: 1) Hurunui Valley South Branch, 2) Poulter Valley, 3) Hawdon Valley, 4) Blumine Island / Oruawairua, 5) Maud Island / Te Pākeka, 6) Mayor Island / Tuhua, 7) Chalky Island / Te Kākahu-o-Tamatea, 8) Auckland Zoo, 9) Pūkaha Wildlife Centre, 10) Orana Wildlife Park, and 11) Isaac Conservation and Wildlife Trust. (Galla 2019, p. 41).

Population and Species Needs

The orange-fronted parakeet needs subalpine mature beech forests to breed and forage. Breeding on the mainland is linked with the irregular seeding of beech trees when parakeet numbers can increase substantially. However, on the islands where it has been introduced it is less selective in its nest sites and does not require native mature forested habitat to breed. Orange-fronted parakeets rely heavily on beech seeds as a major component of their diet, but also feed on a range of plant material and invertebrates. The range and population of the species has severely decline because of reduction of habitat that provides the species' needs.

## SUMMARY OF BIOLOGICAL INFORMATION

The orange-fronted parakeet is the rarest parakeet in New Zealand and the remaining naturally occurring colonies are restricted to three valleys on the South Island in the Canterbury Mountains. Beginning in 2005, captive-bred orange-fronted parakeets have been translocated to four predator-free islands; however, more recent surveys suggest that breeding is now only occurring on Blumine Island, which is the only one of the four islands that contains the mature beech forest habitat that the species primarily relies on. In 2021, captive-bred orange-fronted parakeets were introduced in Brook Waimārama Sanctuary on the South Island, as well as new areas of Arthur's Pass National Park in the Canterbury Mountains. The most recent population estimate by the New Zealand Department of Conservation is around 300 individuals in the wild.

Orange-fronted parakeet populations on New Zealand's South Island inhabit subalpine mature beech forests (*Nothofagus* spp.), making their nests within natural cavities of these trees and relying heavily on beech seeds as a major component of their diet. The species feeds on a range of plant material including seeds, buds, sprouts, fruits, blossoms, leaves, ferns and grasses; they also eat invertebrates such as aphids and caterpillars. Breeding is linked with the irregular seeding of beech trees when parakeet numbers can increase substantially.

## FACTORS INFLUENCING THE STATUS

The Act directs us to determine whether any species is an endangered species or a threatened species because of any factors (or threats) affecting its continued existence (i.e., whether it meets the definition of a threatened species or an endangered species). We use the term "threat" to refer in general to actions or conditions that are known to or are reasonably likely to negatively affect individuals of a species. The term "threat" includes actions or conditions that have a direct impact on individuals, as well as those that affect individuals through alteration of their habitat or

required resources. The term "threat" may encompass—either together or separately—the source of the action or condition, or the action or condition itself.

However, the mere identification of any threat(s) does not necessarily mean that the species meets the statutory definition of an "endangered species" or a "threatened species." In determining whether a species meets either definition, we must evaluate all identified threats by considering the expected response by the species, and the effects of the threats—in light of those actions and conditions that will ameliorate the threats—on an individual, population, and species level. We evaluate each threat and its expected effects on the species, then analyze the cumulative effect of all of the threats on the species as a whole. We also consider the cumulative effect of the threats in light of those actions and conditions that will have positive effects on the species—such as any existing regulatory mechanisms or conservation efforts. The Secretary determines whether the species meets the definition of an "endangered species" or a "threatened species" only after conducting this cumulative analysis and describing the expected effect on the species now and (if evaluating whether a species is a threatened species) in the foreseeable future.

The Act does not define the term "foreseeable future," which appears in the statutory definition of "threatened species." Our implementing regulations at 50 CFR 424.11(d) set forth a framework for evaluating the foreseeable future on a case-by-case basis. The term foreseeable future extends only so far into the future as the Services can reasonably determine that both the future threats and the species' responses to those threats are likely. In other words, the foreseeable future is the period of time in which we can make reliable predictions. "Reliable" does not mean "certain"; it means sufficient to provide a reasonable degree of confidence in the prediction. Thus, a prediction is reliable if it is reasonable to depend on it when making decisions.

It is not always possible or necessary to define foreseeable future as a particular number of years. In some instances, defining foreseeable future as a particular number of years may even be confusing, since the time period within which we can make reliable predictions—that is, the foreseeable future—may vary by threat. Analysis of the foreseeable future uses the best scientific and commercial data available and should consider the timeframes applicable to the relevant threats and to the species' likely responses to those threats in view of its life-history characteristics. Data that are typically relevant to assessing the species' biological response include species-specific factors such as lifespan, reproductive rates or productivity, certain behaviors, and other demographic factors.

Threats

The most prominent factors affecting the species on the mainland are predation by nonnative species such as the stoat (*Mustela erminea*) and rats (*Rattus* spp.), as well as habitat destruction (NZDOC 2017a, unpaginated). Stoats and rats are excellent hunters on the ground and in trees and exploit the fact that orange-fronted parakeets nest and roost in tree cavities (NZDOC 2017a,

unpaginated). During beech mast years, which occur every 2–6 years, rats and stoats breed prolifically – fueled by an abundant food source – and prey on native birds, including the orange-fronted parakeet (NZDOC 2014, pp. 1, 3). In particularly large mast years, some native bird species are at risk of local extinctions if extra monitoring and protection measures are not implemented (Morton 2019, unpaginated). When rat tracking rates (the percentage of monitored tunnels in which rats are detected) exceed 5%, orange-fronted parakeets can suffer significantly from predation (Elliot *et al* 2016, p. 203). Additionally, some trapping efforts designed to reduce the populations of individual predators have had counterproductive effects on the orange-fronted parakeet. For example, stoat trapping within two of the naturally occurring parakeet colonies on the South Island (Hurunui and Hawdon Valleys) was followed by rat plagues and declines in orange-fronted parakeet populations (Pollard 2016, p. 8). Nonnative brush-tailed possums (*Trichosurus vulpecula*) have also been reported to prey on the orange-fronted parakeet, taking chicks, eggs, and adults in recent years (NZDOC 2017b, unpaginated).

Habitat loss and degradation is another factor that has affected the orange-fronted parakeet on the mainland (NZDOC 2017b, unpaginated). Historically, large areas of native forest were cut down or burned – decreasing available habitat (NZDOC 2017b, unpaginated). Before humans arrived at New Zealand, about 80% of the North and South Islands was forested. By about 1840, forest destruction by Polynesians reduced the forest cover from 80% to 50%, and European settlement further reduced forest cover to about 24% (Hammond 1997, p. 46). In addition, silviculture (care and cultivation) of beech forests in the past had removed trees in a manner that did not facilitate the development of mature trees with suitable nest cavities for species such as the orange-fronted parakeet (Kearvell 2002, p. 261). Presently, natural forests cover a quarter of New Zealand's land area and are managed by the NZDOC; forests are almost entirely protected by statute and are tightly controlled (Hammond 1997, p. 48). Additionally, the species' habitat is currently being degraded by browsing or over-browsing of vegetation by brush-tailed opossum, cattle (*Bos taurus*), and deer (family Cervidae), which changes the forest structure in a way that reduces available feeding habitat of the orange-fronted parakeet (NZDOC 2017a, unpaginated; Kearvell 2002, p. 261).

Resource managers have been reluctant to introduce orange-fronted parakeets to areas that are already occupied by yellow-crowned parakeets because of the potential for hybridization (Kearvall and Steeves 2015, p. 72). A study of the three naturally occurring orange-fronted parakeet populations indicated very low incidence (1%) of mixed pairing with the yellow-crowned parakeet (Kearvall and Steeves 2015, p. 73). However, a mixed flock of orange-fronted and yellow-crowned parakeets has been observed on Chalky Island, a predator-free island where orange-fronted parakeets have been introduced (Skirrow *et al.* 2021, p. 6). Although more work is needed to understand factors such as the appropriate numbers of individuals to be introduced, total absence of yellow-crowned parakeets at release sites may not be required for successful reintroductions or introductions of orange-fronted parakeets to mainland or island sites (Kearvall and Steeves 2015, p 74).

A recent study found that genetic diversity was overall low for the species, despite efforts made by the captive-breeding program to augment genetic diversity with eggs from different wild-sourced populations (Magid 2021, pp. 50-56). These genes play a role in the immune system, and the low genetic diversity could make the parakeet population more susceptible to disease outbreaks, especially in the close confines of a captive-breeding program (Magid 2021, p. 44). To minimize the threat of inbreeding, pedigrees are maintained for the captive-breeding population of parakeets, and genetic sequencing has confirmed that these efforts have maximized the genetic variability that exists in the population (Galla 2019, p. 45; Galla *et al.* 2020, p. 998). The best available information does not indicate whether the captive-breeding pedigrees have helped to avoid the impacts of low baseline genetic diversity in the species.

The species' small population is a concern. Small populations are subject to both demographic and unpredictable environmental events that can contribute to extirpations. Small populations are generally at greater risk of extinction from habitat loss, predation, disease, loss of genetic diversity, and stochastic (random) environmental events (Davies *et al.* 2004, pp. 265–271). We considered specific stressors that may affect or exacerbate the small population size for the orange-fronted parakeet and conclude that the stressors noted above (e.g., predation by nonnative species and ongoing habitat degradation due to browsing) can exacerbate risks to this small population.

Conservation Measures and Existing Regulatory Mechanisms

The orange-fronted parakeet is protected under the Wildlife Act of 1953 and no one may kill or possess a parakeet without a permit (NZDOC 2017d, unpaginated). The NZDOC closely monitors all known populations of the orange-fronted parakeet and inspects nest cavities (NZDOC 2017a, unpaginated). NZDOC also conducts surveys for evidence of any new nesting sites (NZDOC 2017a, unpaginated). Each orange-fronted parakeet nest found is individually protected from predator access by tin tree wraps, ground predator traps and opossum traps (van Hal *in litt.* 2008, 2009, as cited in BLI 2016, unpaginated). During mast years, in which predator populations spike, extra monitoring and pest control is prioritized for the orange-fronted parakeet (Morton 2019, unpaginated). Despite these controls, predation by nonnative species is still a factor affecting the species.

NZDOC's "Operation ARK" program ran from 2004 to 2010, to respond to predator problems in mainland beech forests (NZDOC 2017e, entire). Operation ARK used intensive predator management and monitoring to protect four key species (including orange-fronted parakeets), from stoats, rats and opossums, and to control pest plagues resulting from beech seed masting (NZDOC 2017c, entire; Elliot and Suggate 2007, entire). Predators were controlled with traps, bait stations, bait bags, aerial application of bait (for rats), when necessary, and individual nest protection (NZDOC 2017c, entire; Elliot and Suggate 2007, entire). Lessons learned included: (1) successful trapping methods to control stoat populations; and (2) the realization that aerial application may be needed to effectively control rats in plague years (NZDOC 2017c, entire;

Elliot and Suggate 2007, pp 15-16). Funding for pest control in these areas is now provided directly to the sites and a new contingency fund was established for plague years (NZDOC 2017c, entire).

Additionally, a landscape-scale pest control program ("Battle for Our Birds") was initiated in 2014 to control rodent and stoat booms in beech forests during the 2014 mast year (Elliot and Kemp 2016, entire). This effort was successful at reducing rat tracking rates at Hawdon, Poulter and Huruni (Elliot and Kemp 2016, p. 206); however, appropriate timing may have been an issue because there was another decline in the mainland population of the orange-fronted parakeet in the 2014/2015 mast year (NZDOC 2017f, unpaginated; Robertson *et al.* 2016, p.5). NZDOC is planning another, even larger scale aerial application of rat bait, building on the lessons learned in 2014 (Elliot and Kemp 2016, p. 208). During the 2019 beech seed mast, NZDOC spent $38 million on predator control traps and aerial 1080 poison drops covering over 1 million hectares (ha), with a public awareness and education campaign to combat anti-poison sentiment among New Zealand residents (Morton 2019, unpaginated).

As noted above, the NZDOC initiated a captive-breeding program for the orange-fronted parakeet and established self-sustaining populations on four predator-free islands; although recent information indicates that persistence of these populations appears to still be tenuous (Grant *in litt.* 2016 as cited in BLI 2017, unpaginated). Additionally, in 2016, a second captive breeding population was initiated at the Auckland Zoo to start a fifth offshore sanctuary on Rotoroa Island on the North Island (Greene *in litt.* 2016, as cited in BLI 2017, unpaginated). The Isaac Conservation and Wildlife Trust (ICWT) in Christchurch, New Zealand, also operates a captive-breeding program for orange-fronted parakeets (NZDOC 2021c, unpaginated). In November 2021, 20 parakeets raised by ICWT were released into the Brook Waimārama Sanctuary (NZDOC 2021a, unpaginated). The sanctuary, located in Nelson, New Zealand, has 700 ha of pristine beech forest with no introduced predators, and is regularly monitored to prevent rats, stoats, and possums from establishing (NZDOC 2021a, unpaginated). The 2021 ICWT breeding season was so successful that 17 parakeets were released into new areas in Arthur's Pass National Park (NZDOC 2021c, unpaginated). The captive-breeding program collaborates with Indigenous Māori conservationists who care for the species as well (Galla *et al.* 2022, p. 49).

NZDOC uplisted the orange-fronted parakeet in 2016 from "Nationally Endangered" to "Nationally Critical" (most severely threatened, facing an immediate high risk of extinction; Robertson *et al*. 2016, p. 5; NZDOC 2017c, unpaginated). Qualifiers for this classification include that it is conservation dependent, range restricted, and experiences extreme fluctuations (Robertson *et al.* 2016, pp. 7, 9). The species is also listed as "Critically Endangered" on the IUCN's Red List due to its very small population that has declined throughout the last decade (BLI 2017, unpaginated). It is listed in Appendix II under the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES; CITES 2015, p. 22).

Cumulative Effects

On the South Island and offshore islands, interactions between the stressors associated with small population size and limited geographic range (e.g., low genetic diversity), continued habitat loss (due to over-browsing) and predation by nonnative species (stoats, rats, and possums) will lead to further declines of the orange-fronted parakeet throughout its range. Conservation measures include protective New Zealand legislation, individual nest protections (tin tree wraps and predator traps), and captive breeding and reintroduction programs. Despite these controls, predation by nonnative species is still a factor affecting the species. After analyzing the factors that affect the species, including the ongoing conservation measures, we have determined that the interactions and combinations of factors decrease the viability of this species and further warrant listing.

CURRENT CONDITION

Resiliency: The wild population size of the orange-fronted parakeet is approximately 300 individuals. The species forms pairs around 7 years old. Their longevity is unknown in the wild but up to 16 years in captivity. We do not have information on reproductive output or fledging rate. However, in mast years (years with high levels of seed production from beech trees), many pairs will lay a second clutch, and some may lay a third clutch (BLI 2017, unpaginated). The captive-breeding program has been successful, and captive-bred birds have been translocated into the South Island population and predator-free offshore islands. However, only one of the four offshore island populations appears to be breeding, in addition to the main population in the Canterbury Mountains. A new mainland population has been established on the South Island in the Brook Waimārama Sanctuary, which is predator-free and contains the species' preferred mature beech forest habitat. Predation by nonnative mammals is an ongoing threat and the species' range is limited, even though the species is actively managed by the New Zealand Department of Conservation. Because of the active conservation measures, resiliency is low to moderate.

Redundancy: The remaining naturally occurring colonies are restricted to three valleys in a small area of the Canterbury Mountains on the South Island. Captive-bred orange-fronted parakeets have been translocated to four predator-free islands, and a wildlife sanctuary on the South Island. However, only one of the island populations appears to be breeding. Therefore, the species has moderate redundancy because there are several populations spread throughout New Zealand. The captive-breeding and reintroduction program ensures that these populations persist.

Representation: The geographic range of the orange-fronted parakeet is limited to predator-free mature beech forests. These areas are restricted to three subalpine mountain valleys, one offshore island, and a wildlife sanctuary. Limited available habitat restricts the size of these orange-fronted parakeet populations, potentially leading to inbreeding and reduced genetic diversity. Genetic analysis found overall low diversity in the species; however, the captive-breeding program has kept careful pedigrees and has conducted genetic sequencing to maintain genetic

diversity. Thus, the orange-fronted parakeet has low to moderate representation.

FUTURE CONDITION

The condition of the orange-fronted parakeet is expected to decline in the future because stressors associated with small, isolated populations (e.g., low genetic diversity), habitat loss (due to over-browsing), and predation by nonnative species (stoats, rats, and possums) on the mainland will continue to limit the population. However, New Zealand implements conservation measures to help slow and mitigate the impacts of the primary threats with varying success. Individual nest protections (tin tree wraps and predator traps) and captive breeding programs have been used to introduce individuals to the mainland and predator-free offshore islands. Predation by nonnative species will continue to be a factor affecting the species on the South Island, especially in beech mast years, though 1080 poison drops are conducted to help mitigate this.

FINDING

Regulatory Framework

Section 4 of the Act (16 U.S.C. 1533) and its implementing regulations (50 CFR part 424) set forth the procedures for determining whether a species is an "endangered species" or a "threatened species." The Act defines an endangered species as a species that is "in danger of extinction throughout all or a significant portion of its range," and a threatened species as a species that is "likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range." The Act requires that we determine whether any species is an "endangered species" or a "threatened species" because of any one or a combination of the following factors:

(A) The present or threatened destruction, modification, or curtailment of its habitat or range;
(B) Overutilization for commercial, recreational, scientific, or educational purposes;
(C) Disease or predation;
(D) The inadequacy of existing regulatory mechanisms; or
(E) Other natural or manmade factors affecting its continued existence.

These factors represent broad categories of natural or human-caused actions or conditions that could have an effect on a species' continued existence. In evaluating these actions and conditions, we look for those that may have a negative effect on individuals of the species, as well as other actions or conditions that may ameliorate any negative effects or may have positive effects.

Status Assessment

After evaluating threats to the species and assessing the cumulative effect of the threats under the section 4(a)(1) factors, we determine that the orange-fronted parakeet experiences present and

threatened habitat loss (due to over-browsing), predation by nonnative species (stoats, rats, and possums), tenuous captive breeding introduction results, and stressors associated with small, isolated populations (e.g., low genetic diversity). New Zealand has implemented conservation measures to increase the population and habitat of the orange-fronted parakeet with varying success. Thus, after assessing the best available information, we conclude that listing the orange-fronted parakeet is warranted, but precluded by other higher-priority actions.

RECOMMENDED CONSERVATION MEASURES

- Increase eradication efforts for invasive mammal (stoat, rat, and possum).
- Continue operating captive-breeding programs for wild release.
- Supplement declining populations on the four predator-free islands with additional captive-bred individuals.
- Source wild founders from Blumine Island population to increase genetic diversity in captive-breeding population.
- Prioritize reintroduction on predator-free islands that have mature beech forests.
- Increase public accessibility to information about the importance of conserving the orange-fronted parakeet and its habitat, partially through keeping pet cats indoors.
- Restore areas that have been deforested or degraded from deer, cattle, and opossum browsing, with help from private landowners.
- Introduce orange-fronted parakeets to the most safe and suitable areas with low or no yellow-crowned parakeets within its historical range.
- Closely monitor nests and chicks.

LISTING PRIORITY

| THREAT | | | |
|---|---|---|---|
| Magnitude | Immediacy | Taxonomy | Priority |
| High | Imminent | Monotypic genus | 1 |
| | | Species | 2 |
| | | Subspecies/population | 3 |
| | Non-imminent | Monotypic genus | 4 |
| | | Species | 5 |
| | | Subspecies/population | 6 |
| **Moderate to Low** | **Imminent** | Monotypic genus | 7 |
| | | **Species** | **8*** |
| | | Subspecies/population | 9 |
| | Non-imminent | Monotypic genus | 10 |

| | | | |
|---|---|---|---|
| | | Species<br>Subspecies/population | 11<br>12 |

Rationale for listing priority number:

*Magnitude:* Predation from nonnative rats and stoats, habitat degradation and competition for food and nesting cavities, combined with stressors associated with the orange-fronted parakeet's small population size threaten the species. We find these threats are moderate in magnitude because the NZDOC is actively involved in conservation measures to manage the threats and aid the recovery of the species.

*Imminence:* Predation from the nonnative rats and stoats, habitat degradation and competition for food and nesting cavities, combined with stressors associated with the parakeet's small population size (e.g., lack of genetic variability) are ongoing, and therefore, imminent.

In the previous Assessment (87 FR 26165), the orange-fronted parakeet was assigned an LPN of 8. After reevaluating the threats to the orange-fronted parakeet, we have determined that no change in LPN for the species is warranted at this time. The orange-fronted parakeet does not represent a monotypic genus. The current population is small, and the species' distribution is extremely limited. The species is subject to predation by nonnative mammals, particularly stoats and rats, and habitat degradation by invasive grazers. However, because the NZDOC is actively involved in measures to aid the recovery of the species, including introductions to predator-free islands, we find the threats are moderate in magnitude. Despite conservation efforts, the threats are ongoing and, therefore, imminent. Thus, the LPN remains an 8 to reflect imminent threats of moderate magnitude.

Rationale for Change in Listing Priority Number
N/A

Is **Emergency Listing** Warranted?
No; There is currently no emergency posing a significant risk to the conservation of the orange-fronted parakeet.

DESCRIPTION OF MONITORING

The candidate notice of review (CNOR) and accompanying species assessment forms constitute the Service's system for monitoring and making annual findings on the statis of petitioned species under sections 4(b)(3)(c)(i) and 4(b)(3)(c)(ii) of the Act. We review all new information on candidate species as it becomes available, prepare annual species assessments that reflect monitoring and research results and any other new information.

The species is actively monitored at all sites where it is known to occur by NZDOC (NZDOC

2017a, unpaginated).

COORDINATION WITH STATES

No countries provided information or comments on the species or latest assessment.
The range country, **New Zealand**, did not provide information or comments.

LITERATURE CITED

ARKive (2017). Malherbe's parakeet (Cyanoramphus malherbi). Image. Retrieved from http://www.arkive.org/malherbes-parakeet/cyanoramphus-malherbi/image-G126189.html. Accessed June 07, 2017.

BirdLife International (2017). Species factsheet: *Cyanoramphus malherbi*. Retrieved from http://www.birdlife.org. Accessed on March 30, 2017.

BirdLife International. (2016). *Cyanoramphus malherbi. The IUCN Red List of Threatened Species 2016*: e.T22724562A94871843. Retrieved from http://dx.doi.org/10.2305/IUCN.UK.2016-3.RLTS.T22724562A94871843.en. Accessed March 30, 2017.

BirdLife International. (2015). Species factsheet: *Cyanoramphus malherbi*. Retrieved from http://www.birdlife.org. Accessed September 30, 2015.

CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora). (2015). Appendices I, II, and III. Valid from 5 February 2015. Retrieved from: *https://www.cites.org/sites/default/files/eng/app/2015/E-Appendices-2015-02-05.pdf*. Accessed October 1, 2015.

Davies, K. F., Margules, C. R., & Lawrence, J. F. (2004). A synergistic effect puts rare, specialized species at greater risk of extinction. *Ecology*, *85*(1), 265-271.

del Hoyo, J., A. Elliot, and J. Sargatal (eds.) (1997). Page 372 in Handbook of the birds of the world. Vol. IV: Sandgrouse to cuckoos. Lynx Ediciones, Barcelona.

Elliott, G., & Kemp, J. (2016). Large-scale pest control in New Zealand beech forests. *Ecological Management & Restoration*, *17*(3), 200-209.

Elliot, G., & Suggate, R. (2007). Operation Ark. A three year progress report. Department of Conservation, Christchurch.

Farley, M. (2014). Orange-fronted parakeet monitoring on Blumine Island. New Zealand

Department of Conservation. November 10, 2014. Retrieved from: *http://blog.doc.govt.nz/2014/10/11/parakeet-bluemine-island/*. Accessed September 30, 2015.

Galla, S. J., Brown, L., Couch-Lewis, Y., Cubrinovska, I., Eason, D., Gooley, R. M., Hamilton, J. A., Heath, J. A., Hauser, S. S., Latch, E. K., Matocq, M. D., Richardson, A., Wold, J. R., Hogg, C. J., Santure, A. W. & Steeves, T. E. (2022). The relevance of pedigrees in the conservation genomics era. *Molecular Ecology*, *31*, 41-54.

Galla, S. J., Moraga, R., Brown, L., Cleland, S., Hoeppner, M. P., Maloney, R. F., Richardson, A., Slater, L., Santure, A. W. & Steeves, T. E. (2020). A comparison of pedigree, genetic and genomic estimates of relatedness for informing pairing decisions in two critically endangered birds: Implications for conservation breeding programmes worldwide. *Evolutionary Applications*, *13*(5), 991-1008.

Galla, S. J. (2019). Conservation genomic management of two critically endangered New Zealand birds. Thesis submitted for the degree of Doctor of Philosophy in Biological Sciences. University of Canterbury. Christchurch, New Zealand. http://hdl.handle.net/10092/17759.

Gill, B.J., Bell, B.D., Chambers, G.K., Medway, D.G., Palma, R.L., Scofield, R.P., Tennyson, A.J.D. & Worthy, T.H. (2010). Checklist of the birds of New Zealand, Norfolk and Macquarie Islands, and the Ross Dependency, Antarctica. Fourth Edition. Te Papa Press (in association with the Ornithological Society of New Zealand, Inc.), Wellington, NZ.

Hammond, D. (1997). Asia-Pacific forestry sector outlook study: Commentary on forest policy in Asia-Pacific region (A Review for Indonesia, Malaysia, New Zealand, Papua New Guinea, Philippines, Thailand and Western Samoa). Working Paper No: APFSOS/WP/22 FAO Website, Available at: http://www. fao. org/DOCREP/W7730E/w7730e0a. htm [Cited: June 2007].

Harrison, M. (1970). The orange-fronted parakeet (*Cyanoramphus malherbi*). *Notornis*, *17*(2), 115-125.

Higgins, P. J., Peter, J. M., & Steele, W. K. (1999). Handbook of Australian, New Zealand and Antarctic Birds.

ITIS (Integrated Taxonomic Information System). (2017). *Cyanoramphus malherbi*. Retrieved from http://www.itis.gov. Accessed March 30, 2017.

Kearvell, J. C. (2002). Short note. Nest sites of sympatric orange-fronted (*Cyanoramphus malherbi*) and yellow-crowned parakeets (*C. auriceps*). *Notornis*, *49*, 261-263.

Kearvell, J. C., & Steeves, T. E. (2015). Evidence for assortative mating in sympatric populations of orange-fronted (Cyanoramphus malherbi) and yellow-crowned (*C. auriceps*) kakariki. *Notornis*, *62*, 71-75.

Kearvell, J. C., Connor, C.O., & Farley, M. E. (2014). Field identification of the orange-fronted parakeet (*Cyanoramphus malherbi*): pitfalls for the unwary. *Notornis*, *61*, 200-204.

Kearvell, J. C., Grant, A. D., & Boon, W. M. (2003). The orange-fronted parakeet (*Cyanoramphus malherbi*) is a distinct species: a review of recent research into its taxonomy and systematic relationship within the genus *Cyanoramphus*. *Notornis*, *50*, 27-35.

Kearvell, J. C., Young, J. R., & Grant, A. D. (2002). Comparative ecology of sympatric orange-fronted parakeets (*Cyanoramphus malher*bi) and yellow-crowned parakeets (*C. auriceps*), South Island, New Zealand. *New Zealand Journal of Ecology*, 139-148.

Knafler, G. J., Ortiz-Catedral, L., Jackson, B., Varsani, A., Grueber, C. E., Robertson, B. C., & Jamieson, I. G. (2016). Comparison of beak and feather disease virus prevalence and immunity-associated genetic diversity over time in an island population of red-crowned parakeets. Archives of virology, 161(4), 811-820.

Magid, M. C. (2021). A novel bioinformatic approach to characterise toll-like receptor gene diversity in threatened birds. Thesis submitted for the degree of Master of Science in Biology. University of Canterbury. Christchurch, New Zealand. https://hdl.handle.net/10092/101832.

Massaro, M., Ortiz-Catedral, L., Julian, L., Galbraith, J. A., Kurenbach, B., Kearvell, J., Kemp, J., van Hal, J., Elkington, S., Taylor, G., Greene, T., van de Wetering, J., van de Wetering, M., Pryde, M., Dilks, P., Heber, S., Steeves, T.E., Walters, M., Shaw, S., Potter, J., Farrant, M., Brunton, D.H., Hauber, M., Jackson, B., Bell, P., Moorhouse, R., McInnes, K., & Varsani, A. (2012). Molecular characterisation of beak and feather disease virus (PBFD) in New Zealand and its implications for managing an infectious disease. *Archives of virology*, *157*(9), 1651-1663.

Morton, J. (2019, April 13). DoC: Forest 'mega-mast' may spell local extinctions. *New Zealand Herald*. Retrieved from https://www.nzherald.co.nz/nz/doc-forest-mega-mast-may-spell-local-extinctions/LCIKWB3HZT5RZJB77TLSLCEAJ4/. Accessed June 9, 2022.

NZDOC (New Zealand Department of Conservation). (2021a). New home for rare kākāriki in Brook Sanctuary. Retrieved from https://www.doc.govt.nz/news/media-releases/2021-media-releases/new-home-for-rare-kakariki-in-brook-sanctuary/. Accessed June 8,

2022.

NZDOC (New Zealand Department of Conservation). (2021b). Jobs For Nature project finds rare parakeets. Retrieved from https://www.doc.govt.nz/news/media-releases/2021-media-releases/jobs-for-nature-project-finds-rare-parakeets/. Accessed June 8, 2022.

NZDOC (New Zealand Department of Conservation). (2021c). The dedicated team rearing our vulnerable species. Retrieved from https://www.doc.govt.nz/news/media-releases/2021-media-releases/the-dedicated-team-rearing-our-vulnerable-species/. Accessed June 8, 2022.

NZDOC (New Zealand Department of Conservation). (2017a). Orange-fronted parakeet/kakariki karaka. Retrieved from http://www.doc.govt.nz/orange-fronted-parakeet. Accessed March 30, 2017.

NZDOC (New Zealand Department of Conservation). (2017b). Orange-fronted parakeet/ kakariki. Retrieved from http://www.doc.govt.nz/Documents/about-doc/concessions-and-permits/conservation-revealed/orange-fronted-parakeet-kakariki-lowres.pdf. Accessed April 6, 2017.

NZDOC (New Zealand Department of Conservation). (2017c). Conservation status of plants and animals. Retrieved from http://www.doc.govt.nz/nature/conservation-status/. Accessed September 8, 2017.

NZDOC (New Zealand Department of Conservation). (2017d). Wildlife Act 1953: Legislation. Retrieved from http://www.doc.govt.nz/about-us/our-role/legislation/wildlife-act/. Accessed September 8, 2017.

NZDOC (New Zealand Department of Conservation). (2017e). Operation Ark. Retrieved from http://www.doc.govt.nz/our-work/operation-ark/. Accessed April 21, 2017.

NZDOC (New Zealand Department of Conservation). (2017f). Orange-fronted parakeet. Retrieved from http://nzbirdsonline.org.nz/species/orange-fronted-parakeet. Accessed September 18, 2017.

NZDOC (New Zealand Department of Conservation). (2017g). Wildlife Act 1953. Retrieved from http://www.doc.govt.nz/about-us/our-role/legislation/wildlife-act/. Accessed September 8, 2017.

NZDOC (New Zealand Department of Conservation). (2014). The science behind the Department of Conservation's beech mast response and predator control. Battle for our birds, NZDOC, Wellington, NZ. July 2014.

NZDOC (New Zealand Department of Conservation). (2011). Tuhua welcomes first baby orange-fronted parakeet. Retrieved from http://www.doc.govt.nz/news/media-releases/2011/tuhua-welcomes-first-baby-orange-fronted-parakeet/. Accessed September 11, 2017.

Ortiz-Catedral, L. (2012). Habitat use by the critically endangered orange-fronted parakeet (*Cyanoramphus malherbi*) on Maud Island: its relevance for future translocations. *Notornis*, *59*, 148-152.

Ortiz-Catedral, L., & Brunton, D. H. (2009). Notes on the diet of the critically endangered orange–fronted parakeet (*Cyanoramphus malherbi*) on Maud Island. *New Zealand Journal of Zoology*, *36*(4), 385-388.

Ortiz-Catedral., L., Kearvell, J. C., & Brunton, D. H. (2012). Population Increase of Critically Endangered Malherbe's Parakeet (*Cyanoramphus malherbi)* introduced to Maud Island, New Zealand. *Conservation Evidence, 9*, 54-57.

Ortiz-Catedral, L., Kurenbach, B., Massaro, M., McInnes, K., Brunton, D. H., Hauber, M. E., Martin, D.P., & Varsani, A. (2010). A new isolate of beak and feather disease virus from endemic wild red-fronted parakeets (*Cyanoramphus novaezelandiae*) in New Zealand. *Archives of virology*, *155*(4), 613-620.

Ortiz-Catedral, L., Kearvell, J. C., Hauber, M. E., & Brunton, D. H. (2009). Breeding biology of the critically endangered Malherbe's parakeet on Maud Island, New Zealand, following the release of captive-bred individuals. *Australian Journal of Zoology*, *57*(6), 433-439.

Pollard, J. C. (2016). Aerial 1080 poisoning in New Zealand: Reasons for concern. *1080Science.*

Robertson, H. A., Barid, K., Dowding, J. E., Elliott, G. P., Hitchmough, R. A., Miskelly, C. M., McArthur, N., O'Donnell, C. F., Sagar, P.M., Scofield, R.P., & Taylor, G. A. (2016). Conservation status of New Zealand birds, 2016. New Zealand threat classification series, 19.

Romo, V. (2019, July 18). Rare New Zealand parakeet population doubles after 'epic' breeding season. *National Public Radio*. Retrieved from https://www.npr.org/2019/07/18/743137333/rare-new-zealand-parakeet-population-doubles-after-epic-breeding-season. Accessed June 9, 2022.

Skirrow, M. J. A., Smith, A. N., & Ortiz-Catedral, L. (2021). Estimating the population size of orange-fronted parakeets (*Cyanoramphus malherbi*) on offshore islands of New Zealand. *New Zealand Journal of Zoology*, 1-11.

Snyder, N., P. McGowan, Gilardi, J., & Grajal, A. (eds.). (2000). Orange-fronted parakeet. Page 54 in Parrots. Status survey and conservation action plan 2000–2004. IUCN, Gland, Switzerland, and Cambridge, UK.

Taylor, R. H. (1998). A reappraisal of the Orange-fronted Parakeet (*Cyanoramphus* sp.) species or colour morph? *Notornis*, *45*, 49-63.

All SAFs supporting 12-month findings or candidate notices of review will be signed by the Director. SAFs should continue to be surnamed by Regional and Headquarters staff and leadership.

Martha Williams, Director
U.S. Fish and Wildlife Service

June 20, 2023
Date