Beach jacquemontia
(Jacquemontia reclinata)

5-Year Review:
Summary and Evaluation

Photo by James Lange

June 2021

U.S. Fish and Wildlife Service
South Atlantic-Gulf Region
Florida Ecological Services Field Office
Vero Beach, Florida

5-YEAR REVIEW
Beach jacquemontia (*Jacquemontia reclinata*)

I. GENERAL INFORMATION

A. Methodology used to complete the review: In conducting this 5-year review, we relied on the best available information pertaining to historical and contemporary distributions, life histories, genetics, habitats, and threats of this species. This review includes information from the previous 5-year review (U.S. Fish and Wildlife Service [Service] 2007) that is still applicable to the species, with updated or new information incorporated, as appropriate. We announced initiation of this review and requested information in a published *Federal Register* notice with a 60-day comment period in 2018 (83 FR 38320). We received no public comments during the open comment period. We used a variety of information resources, including monitoring reports, surveys, and other scientific and management information. Specific sources included the final rule listing this plant under the Endangered Species Act (ESA) (58 FR 62046); the Recovery Plan (Service 1999); the last 5-year review (Service 2007), peer reviewed scientific publications, and unpublished field observations by Federal, State, and other experienced biologists. The review was contracted to a Fairchild Tropical Botanic Garden (FTBG) botanist and finalized by a biologist in the Florida Ecological Services Field Office (FEFSO), Vero Beach. Literature and documents used for this 5-year review are on file at the FEFSO. All recommendations resulting from this review are a result of thoroughly reviewing the best available information on the beach jacquemontia. The Service did not seek additional peer review for this updated 5-year review.

B. Reviewers

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C. Background:

1. **Federal Register Notice citation announcing initiation of this review:** August 6, 2018, 83 FR 38320

2. **Listing history**
   Original Listing
   FR notice: 58 FR 62046
   Date listed: December 27, 1993
   Entity listed: Species
   Classification: Endangered

3. **Associated rulemakings:** There are no associated rulemakings for this species.

4. **Review History:** Each year, the Service reviews and updates listed species information to benefit the required Recovery Report to Congress. Through 2013, we performed a yearly recovery data call. The last review conducted in 2007 showed this species as declining with no change recommended to the species' status due to the few remaining, small populations that face a high degree of threats.

   Recovery Plan: May 18, 1999
   Previous Five-Year Reviews: 2007 (70 FR 35689)

5. **Species' Recovery Priority Number at start of review (48 FR 43098): 2**
   Degree of Threat: High
   Recovery Potential: High
   Taxonomy: Species

6. **Recovery Plan**
   Name of Plan: South Florida Multi-Species Recovery Plan (MSRP)
   Date Issued: May 18, 1999
   Date of previous plan: December 1, 1996 (Recovery Plan for Beach Jacquemontia) (original plan)

II. REVIEW ANALYSIS

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

1. **Is the species under review listed as a DPS?** No. The ESA defines species as including any subspecies of fish or wildlife or plants, and any distinct population segment of any species of vertebrate wildlife. This definition limits listing DPSs to only vertebrate species of fish and wildlife. Because the species under review is a plant, the DPS policy is not applicable.

B. Recovery Criteria

1. **Does the species have a final, approved recovery plan containing objective, measurable criteria?** Yes. However, the criteria included in the 1999 recovery plan require modification to reflect more updated habitat information for criterion 3 (see below).

2. **Adequacy of recovery criteria.**

   a. **Do the recovery criteria reflect the best available and most up-to-date information on the biology of the species and its habitat?** No. Criterion 3 refers specifically and only to coastal strand habitat in terms of target areas for beach jacquemontia habitat. Monitoring data of natural populations and more importantly experimental translocations have demonstrated that not only does beach jacquemontia naturally occur in non-strand coastal dune habitats, but also displays highest recruitment rates in openings of coastal grassland (Lange et al. 2018). Austin (1979) lists habitats as crest and lee side of coastal dunes. This is

slightly modified when referenced in the beach jacquemontia section of the MSRP (Service 1999) as "*Jacquemontia reclinata* requires open areas that are typically found on the crest and lee sides of stable dunes (Austin 1979)." This latter document, specifying "open areas," and not restricting habitat to coastal strand, provides a habitat description that is at once both more broad by including non-strand areas of stabilized dune, but also more specific in terms of habitat conditions by specifying the requirement for open areas. Based on monitoring data and past descriptions, "open areas of stabilized dunes" would be a broader habitat definition that would be more accurate since populations have been found to be extremely successful on the windward (or fore) side of stabilized dunes (Lange et al. 2018). This broader definition also encompasses coastal strand, as this is a habitat of stabilized dunes, but allows for more opportunities for plantings and restorations. In addition, this definition offers a far less bleak picture for the future of the species since coastal strand is relatively limited within the species' range, can be rather difficult to delineate clearly, and can be more difficult to manage relative to other more herbaceous or naturally open dune communities.

b. Are all of the 5 listing factors that are relevant to the species addressed in the recovery criteria (and is there no new information to consider regarding existing or new threats)? Yes

3. List the recovery criteria as they appear in the recovery plan and discuss how each criterion has or has not been met, citing information. The recovery criteria as presented in the 1999 recovery plan are broken down into four parts ([1-4] in bold below) for clarity purposes. These criteria address factors A) the present or threatened destruction, modification, or curtailment of its habitat or range; D) inadequacy of existing regulatory mechanisms; and E) other natural or manmade factors affecting its survival. Factors B (overutilization) and C (disease or predation) are not relevant to this species.

Beach jacquemontia will be considered for reclassification from endangered to threatened when the following criteria are met:

[1] Enough demographic data are available to determine the appropriate numbers of self-sustaining populations and sites needed to ensure 20 to 90 percent probability of persistence for 100 years.
This criterion has not been met. Limited demographic data have been collected on beach jacquemontia. Satisfying this criterion would require collection of detailed demographic data (*sensu* Menges and Gordon 1996) through monitoring large samples of marked individuals in multiple populations over several years. These studies provide quantitative assessments of survivorship, growth, and fecundity. Population viability analysis (PVA) models can be a powerful tool to predict population trends in the future and can help to determine the appropriate number of self-sustaining populations needed to ensure the survival of this species. However, some factors that inform these models are still unknown for beach jacquemontia. For example, to date there is no information on the percentage of seedlings that survive

and become reproductive adults in the wild. The only existing estimate was derived from greenhouse experiments in which seedling survival was most likely much higher than that in the wild (Maschinski et al. 2013). In addition, to provide adequate guidelines for managing beach jacquemontia, PVA models will require data drawn from populations with differing management/disturbance histories since the ideal disturbance regime for regeneration of beach jacquemontia has not been identified. Any PVA models will need to include models for habitat conditions under different sea-level rise (SLR) and storm scenarios. For example, the Florida Fish and Wildlife Conservation Commission (FWC) predicts that at 1 meter (3.3 feet) and 3 meters (9.8 feet) of SLR, approximately 32 and 75 percent of coastal strand habitat in Florida will be lost, respectively (FWC 2016). Storm impacts and other more stochastic factors likely confound these losses.

Detailed demographic data are not being collected from any populations and there have been no studies to determine how many individuals are needed for a population to be self-sustaining. Extant and introduced populations are monitored intermittently for number of individuals and general plant and habitat health. At the time of the previous 5-year review (Service 2007), there were 10 extant natural populations and 5 extant introduced populations. Currently, there are 8 extant natural populations and 12 extant introduced populations (Tables 1 and 2). Only two of these populations (Crandon Park and Bill Baggs Cape Florida State Park) have over 500 individuals, which is a rough minimum estimate of the number needed for a self-sustaining population (Possley 2021a). There has been promising success in the plant survivability (with a rate of about 50 percent; Maschinski et al. 2015) at introduced beach jacquemontia populations, which currently support a greater number of individual plants than do the natural populations (Tables 1 and 2; Appendix A and B). In addition to these known introductions, the Service recently became aware that several private property owners have planted beach jacquemontia over the last few decades throughout and just outside the historic range (Barron 2021). These plantings have not been verified and their status have not yet been assessed, so they are not reported in Table 2. Despite augmentations and introductions, only 3 of the 20 extant populations are considered stable or increasing, 3 are declining, and 14 are unknown due to lack of recent survey data or being recently introduced (Tables 1 and 2; Appendix A and B).

[2] When these sites, within the historical range of beach jacquemontia, are adequately protected from further habitat loss, degradation, and fragmentation. (Factors A, D, and E)

This criterion has been partially met. The majority (19 out of 20) of the documented extant beach jacquemontia populations occur on public lands generally protected from development or habitat conversion. However, monitoring of these sites shows that the stabilized dune habitats are not being adequately managed to maintain openings required by beach jacquemontia, resulting in shading out plants and extirpation of the species from at least 6 sites (Table 1). Effective maintenance of these lands to support these endemic habitats and species (via exotic removal, hardwood clearing, prescribed burns, protection from public use) is paramount to

prevent further degradation of habitat and population loss (Maschinski and Wright 2006).

[3] When these sites are managed to maintain the coastal strand to support beach jacquemontia. (Factors A and E)
While 19 of the 20 populations are located on public land, the proper management for suitable coastal strand and other stabilized open dune habitat is currently inadequate in many sites. The most significant cause of beach jacquemontia decline is the encroachment of woody trees and shrubs resulting in increased canopy cover and shading of beach jacquemontia (Maschinski et al. 2015; Lange et al. 2018; Possley et al. 2020). Prescribed fire is not currently an active management strategy at any beach jacquemontia populations, and in its absence, manual thinning and/or removal of vines and woody species is necessary to create open space. Inadequate management for a healthy coastal dune system in public lands can be attributed to inadequate numbers of staff to physically remove hardwoods, local policies that prevent the use of herbicide for removing exotic hardwoods, planting non-native ornamentals (for aesthetics), and not pruning sea grapes (*Coccoloba uvifera*) or Australian pine (*Casuarina equisetifolia*) to reduce light pollution for sea turtles (Service biologist observations 2018; Lange 2021).

[4] When monitoring programs demonstrate that populations of beach jacquemontia on these sites support the appropriate numbers of self-sustaining populations, and those populations are stable throughout the historical range of the species. (Factors A and E)
Few, if any, beach jacquemontia populations are monitored on a routine basis. Intermittent monitoring efforts of documented populations have assisted in partially fulfilling this criterion by providing long-term data about the size and condition of populations. This initial baseline information on individual plant counts at specific natural and introduced sites can be used to assess population trends over time (Appendix A and B).

Currently, the monitoring data do not demonstrate that populations on these sites support the appropriate numbers of self-sustaining populations and that these populations are stable. The monitoring efforts indicate there are currently 20 extant documented populations (8 natural and 12 introduced) (Tables 1 and 2). This is compared to 12 extant populations identified at time of listing (Service 1993) and 15 extant populations (10 natural and 5 introduced) in the previous status review (Service 2007). Despite an increase in total number of populations and overall plant numbers (Tables 1 and 2), the majority of recently monitored populations are declining and only two are large enough to be considered self-sustaining (over 500 individuals; Possley 2021a), Crandon Park and Bill Baggs Cape Florida State Park, though they still rely on habitat management for persistence (Lange 2020, 2021). Routine monitoring of all populations is needed to track the self-sustainability and stability of the species.

Beach jacquemontia may be considered for delisting when:

[1] There is an adequate number of geographically distinct, self-sustaining populations throughout its historic range to ensure 95 percent probability of persistence for 100 years.
This criterion has not been met. No demographic studies have been conducted that are sufficient to produce a PVA to determine the number of populations needed to meet the probability of persistence stated in this criterion. Overall, demographic data on this species are extremely limited.

C. Updated Information and Current Species Status

1. Biology and Habitat

a. New information of species' biology and life history:

General information on the biology and life history of beach jacquemontia (also called beach clustervine), a perennial vine of the morning glory family (Convolvulaceae), is summarized in the final listing rule (58 FR 62046; Service 1993), the Recovery Plan for Beach Jacquemontia (Service 1996), and the MSRP (Service 1999). New information pertinent to this review is presented below.

Pinto-Torres and Koptur (2009) found evidence of a "generalist" pollination system for beach jacquemontia, with at least twenty species of insects observed visiting flowers at six populations (Carlin, Loggerhead, Red Reef, and South Beach Parks in Palm Beach County and Crandon Park and Bill Baggs Cape Florida State Park in Miami-Dade County). Pollinators were primarily from the orders Hymenoptera (bees and wasps; 94 percent), Diptera (files; 4 percent) and Lepidoptera (butterflies and skippers; 2 percent). This generalist system is an advantage for survival compared to a more specialized dependence on one or a few pollinator species. In the hand pollination study (Pinto-Torres and Koptur 2009), crosses between different populations had greater pollination success (related to greater genetic diversity) than self-crossing. Plant out-crossings may be dependent upon relatively rare flower visitors (such as butterflies) that travel between populations. A decrease in the relatedness between beach jacquemontia plants occurred with an increase in distance between the plants, due to limited distances travelled by most pollinators.

The *Jacquemontia* species (group) have physically dormant seeds, caused by the water-impermeable nature of the seed. Increased temperatures and moisture were observed to break seed dormancy in the closely related oval-leaf clustervine (*J. ovalifolia*) (Jayasuriya et al. 2009). Therefore, it is predicted that oval-leaf clustervine seeds only germinate in the summer after rain. Following this concept and researching the environmental conditions that beach jacquemontia seeds need to germinate could help to improve germination success of seed introductions and to predict when the highest recruitment of seedlings should be expected in wild/reintroduced populations.

A study by Pascarella et al. (2011) showed beach jacquemontia has peak seed abundance in late spring and early summer, at the beginning of the rainy season. Results of the nearly 10-year study found very few seedlings despite high seed outputs from populations at the study sites (Crandon Park in Miami-Dade County and South Beach, South Inlet, Loggerhead, and Carlin Parks in Palm Beach County). The study also showed that seed survivability was greater at (5 centimeters (cm) (2 inches [in]) than at 10 cm (4 in) depths. Burial to 10 cm (4 in) or more can occur from storms or accumulation of sand by overgrown invasive or native plants. There is variability in the persistence (viability) of seeds, but it is possible that seeds can persist from year to year (Pascarella et al. 2011). Lastly, findings support that land management of exotic plant removal may stimulate seed germination and recolonization of sites with extirpated plant populations.

Maschinski et al. (2013) studied the effect of breeding history on population viability of beach jacquemontia. The authors reported on results of introductions in 2004 and 2005 at three sites (Delray Beach in Palm Beach County and Haulover Beach Park and Virginia Key Coastal Hammock in Miami-Dade County) with adult plants germinated from seeds collected at Crandon Park in Palm Beach County and South Beach Park in Miami-Dade County. Results indicated that plant survival was greatest for progeny from mixed-populations with greater resilience to stochastic disturbance than single-source introductions. The progeny from mixed-populations were also projected to have more growth than those from single-source introductions. The geographic distance from the maternal site as well as the maternal site ecology should be considered in selecting areas for introductions. Local genetic material did not always yield the greatest reintroduction survival. Mixed-populations as sources of plant material can assist in decreasing the negative consequences of inbreeding that can occur from single-source material.

Lange et al. (2018) observed record high recruitment for beach jacquemontia in stabilized dune habitat at Bill Baggs Cape Florida State Park resulting from an experimental introduction in 2001. The dunes at this site have remained naturally open over relatively large areas, and plants in these areas have generated hundreds of recruits between 2018 and 2021. These results provide strong evidence that openings on stabilized dunes characterized by sparse herbaceous vegetation and low shrub cover (outside the definitions of coastal strand), should be considered primary habitat based on demographic trends. High recruitment rates in 2018 may have been influenced by storm surges from Hurricane Irma in 2017, which inundated the population and stimulated germination. However, the trend of high recruitment continued in this area in 2021 (Lange 2021).

b. Abundance, population trends, demography:

Few, if any, beach jacquemontia populations are monitored on a routine basis. Intermittent monitoring at known natural and introduced beach jacquemontia populations has taken place since 2001 (Maschinski and Wright 2006; Wright 2008; Maschinski et al. 2009, 2012, 2013, 2014; 2015; Maschinski, Ross, et al.

2011; Maschinski, Wright, et al. 2011; Lange et al. 2016, 2018; Possley et al. 2020; Lange 2021). Individual plant counts, and observations of plant and habitat health were documented during these surveys. However, since populations are not surveyed regularly, and some have not been surveyed for many years (Table 1), population trends over time are difficult to determine and mostly unknown.

Natural Populations

There are currently eight extant natural populations with an estimated 734 beach jacquemontia individuals. The majority of populations are showing steady declining trends, and some populations (Lake Worth Inlet, Atlantic Dunes, Red Reef, South Inlet, and Oakland Park) have been extirpated since the last review (Service 2007) due to hardwood encroachment, lack of management, and development (Table 1; Maschinski et al. 2010; Lange 2021). Many of the current populations consist of low individual counts (fewer than 10 plants). In fact, six of the remaining nine natural populations had six or fewer plants at last survey and are likely to be unsustainable, though four of these six populations are in need of updated surveys (Table 1; Maschinski et al. 2010, 2013, 2015; Lange 2021). Population declines are attributed to lack of management and recruitment of new plants not exceeding the losses of older plants in most natural and introduced populations over several years (Maschinski et al. 2009, 2010, 2013, 2014). Only one natural population (Crandon Park) showed an increase with positive recruitment (Table 1 and Appendix A; Lange 2021).

Crandon Park is the largest natural population and contains roughly 80 percent of the species' total wild plants with an approximate population size of 589 plants (Lange 2021). The persistence of individuals at Crandon Park can be attributed to augmentations and the active hardwood and exotic removal in the stabilized dune habitat by Miami-Dade County Natural Areas Management crews. Portions of the site where crews have been unable to treat remain overgrown and many beach jacquemontia have been lost (Lange 2021).

Red Reef and South Beach Parks were once the largest intact natural populations documented for beach jacquemontia. The previous 5-year review (Service 2007) and subsequent reporting relied on the 2001 survey data and continued to report these populations with high plant counts of 177 and 245, respectively. These sites were not surveyed again until 2014 at which time the complete to near-complete loss of these populations was documented (Maschinski et al. 2015). Surveys indicated the Red Reef Park population was extirpated, and the South Beach Park population had approximately 50 plants (Appendix A). A 2018 site visit at both populations again observed 0 plants at Red Reef Park and less than 50 at South Beach Park (individuals not counted) (Lange et al. 2018). In 2020, 6 plants were reintroduced at Red Reef Park as part of restoration work conducted by FTBG and the Institute for Regional Conservation (IRC), of which 4 remained in 2021 (Table 2; Lange 2021). A 2021 census at South Beach Park recorded 6 individuals remaining (Table 1; Lange 2021).

The losses at Red Reef and South Beach were attributed primarily to the lack of proper habitat management of the coastal habitats at these sites. Large invasive plants such as beach naupaka (*Scaevola taccada*) and Brazilian peppertree (*Schinus terebinthifolia*) became increasing prevalent throughout these sites over the years (Maschinski et al. 2015). These invasive plants, combined with growth and encroachment of native sea grape (*Coccoloba uvifera*), have led to shading and increased moisture that has altered the microhabitat in areas of historical beach jacquemontia populations (Lange 2021). Restoration work by FTBG and IRC began in 2019 has been focusing on both invasive and native woody biomass removal to create conditions favorable for beach jacquemontia and will continue at least through 2024 (Service 2019; Lange 2020; IRC 2020).

Other populations exhibit a similar story of decline over time (Table 1 and Appendix A). For example, Dr. Von D. Mizell-Eula Johnson (formerly John U. Lloyd) State Park had 187 newly discovered individual plants in 2009 (Maschinski et al. 2009). In 2010, 112 plants remained. A 2013 survey observed 38 plants and a 2015 site survey recorded approximately 100 individual plants, 45 of which were new recruits (Appendix A; Maschinski et al. 2011b, 2015). The most recent survey in 2020 documented 37 plants (Possley et al. 2020). Overgrowth and encroachment on beach jacquemontia were noted in the 2015, 2018, and 2020 surveys (Maschinski et al. 2015; Lange et al. 2018; Possley et al. 2020). Park staff is currently planning multiple augmentations in southern areas of the Park in collaboration with FTBG (Lange 2021).

The Hugh Taylor Birch State Park site has shown a cyclic pattern of plant counts since the previous 5-year review (Service 2007). Ninety (90) adult plants were found at this site in 2015 compared to 25 plants in 2013, though many of these plants were seedlings (Maschinski et al. 2015). Park staff conducted hardwood reduction around the beach jacquemontia population in winter 2019 but an updated census is needed (Lange 2021).

Four natural sites have been augmented by FTBG with individuals or seeds between 1990 and 2010 (Loggerhead, Carlin, and Crandon, and Red Reef Parks), though records were not well kept so exact dates and number of plants installed are largely unknown (Table 1; Possley 2021b). Other than Red Reef Park, now considered an introduced population since the natural population is known to be extirpated and thus all surviving plants are reintroduced, it is unclear at other sites which surviving individuals are natural or from augmentations.

Table 1. Summary of the status and trends of the extant and extirpated beach jacquemontia natural populations. Extirpated populations are italicized. Table organized geographically from north to south.

Natural Population Site Name	County	Ownership	Most Recent Survey	Most Recent Population Estimate	Augmented	Trend
Carlin Park *	Palm Beach	County	2014[a]	6	Yes	Unknown
Radnor Park/Juno Beach Park (listed as two populations in Service 1996)	*Palm Beach*	*County*	*2004*[b]	*0*	*No*	*Extirpated*
Loggerhead Park	Palm Beach	County	2013[c]	2	Yes	Unknown
Lake Worth Inlet *	*Palm Beach*	*Private*	*2009*[d]	*0*	*No*	*Extirpated*
Gulfstream Park *	*Palm Beach*	*County*	*2002*[b]	*0*	*No*	*Extirpated*
Atlantic Dunes	*Palm Beach*	*City*	*2021*[e]	*0*	*No*	*Extirpated*
Spanish River Park	Palm Beach	City	2010[f]	1	No	Unknown
Red Reef Park	*Palm Beach*	*City*	*2018*[g]	*0*	*Yes*	*Extirpated*
South Beach Park	Palm Beach	City	2021[e]	6	No	Declining
South Inlet Park	*Palm Beach*	*County*	*2021*[e]	*0*	*No*	*Extirpated*
Hillsboro Beach	Broward	City	2013[c]	3	No	Unknown
Oakland Park **	*Broward*	*Private*	*2018*[e]	*0*	*No*	*Extirpated*
Hugh Taylor Birch State Park	Broward	State	2015[a]	90	No	Unknown
John U. Lloyd State Park (now Dr. Von D. Mizell-Eula Johnson State Park) **	Broward	State	2020[h]	37	No	Declining
Virginia Key	*Miami-Dade*	*City*	*Unknown*[i]	*0*	*No*	*Extirpated*
Crandon Park	Miami-Dade	County	2021[e]	589	Yes	Increasing
Total Natural Plants				**734**		

* Discovered after listing in 1993.
** Discovered after previous status review (Service 2007).
[a] Maschinski et al. 2015, [b] Maschinski et al. 2005, [c] Maschinski et al. 2015, [d] Maschinski et al. 2009, [e] Lange 2021, [f] Maschinski et al. 2010, [g] Possley et al. 2020, [h] Lange 2020, [i] Maschinski et al. 2013

Introduced Populations

Over the years, FTBG has introduced 2,255 beach jacquemontia plants to 13 sites (12 extant remaining) within its historic range (Martin County to Miami-Dade County) and there are now more introduced populations than there are natural populations (Table 2 and Appendix B). These introduced populations consist of

an estimated 1,611 individuals (surviving introduced plants plus recruits) and therefore exceed the plant count of natural populations by far (Table 2; Maschinski and Wright 2006; Wright 2008; Maschinski et al. 2009, 2012, 2013, 2014; 2015; Maschinski, Ross, et al. 2011; Maschinski, Wright, et al. 2011; Lange et al. 2016; Lange 2020, 2021; Possley et al. 2020; Possley 2021b). The average survival rate of introduced beach jacquemontia plants has been approximately 50 percent over the years (Maschinski et al. 2015). However, only two introduced populations (Bill Baggs Cape Florida State Park and Virginia Key Beach Park) showed an increase with positive recruitment over the last few surveys (Table 2 and Appendix B; Lange 2020; Lange 2021).

In addition to the known introductions by FTBG, beach jacquemontia has been planted at dozens of sites during dune restoration projects for private homeowners, condominiums, and companies from St. Lucie County to Monroe County (Barron 2021). The location, number, and status of these private introductions are unknown since there is no monitoring or reporting program and they are not included in Table 2 or Appendix B. Some of these introductions occur outside the known range of the species and may be assessed in the future by FTBG (Lange 2021).

The largest known introduced population is located at Bill Baggs Cape Florida State Park on Key Biscayne with 865 plants in 2021 (Table 2; Lange 2021). After the initial planting of 195 plants in 2001, the population had reached as few as 37 plants by 2009 (Appendix B; Maschinski et al. 2010). The site contains naturally open coastal grassland habitat behind the active dune that experienced a major surge in recruitment following Hurricane Irma, with over 500 individuals counted in 2018 (Lange et al. 2018). High survival and further recruitment across multiple patches have brought the population to its current size, despite some losses to woody encroachment.

Two populations were introduced on Virginia Key, which historically supported beach jacquemontia (Service 1996; Maschinski et al. 2013). The Virginia Key Coastal Hammock population was introduced in 2003 with 264 plants and 2005 with 171 plants and currently consists of 229 plants (Table 2; Lange 2020; Possley 2021b). This population has been experiencing woody encroachment, and a FTBG workday with students from Florida International University in February 2020 focused on removing large amounts of woody biomass, which led to increased cover of beach jacquemontia and 14 new recruits just months later (Lange 2020). The Virginia Key Beach Park population was introduced in 2008 with 162 plants and consisted of 81 remaining as of 2013 (Table 2; Maschinski et al. 2013; Possley 2021b). An updated population census is needed at this site.

The population at Renaissance on the Ocean condominium was over washed with several feet of sand during Hurricane Sandy in 2012 and was confirmed extirpated shortly thereafter (Maschinski et al. 2013). The Haulover Beach Park population was surveyed in 2019 and appears to be declining due to shading and

encroachment from shrubs and other dense vegetation (Table 2; Possley et al. 2020). A recent introduction of 12 beach jacquemontia plants took place at Hollywood North Beach in 2020 and a site visit in 2021 showed all 12 plants remained (Table 2; Lange 2020, 2021). The other introduced populations (Juno Dunes Natural Area, Delray Beach Public Beach, Sea Watch Restaurant, Dania Beach, Harry Berry Park, and North Beach Oceanside Park) are believed to be extant but need updated surveys. FTBG plans to resurvey all populations by 2022 (Lange 2021).

Table 2. Summary of the status and trends of the introduced beach jacquemontia natural populations. Extirpated populations are italicized. Table organized geographically from north to south.

Introduced Population Site Name	County	Ownership	Year(s) Introduced (# planted)	Last Observation	Most Recent Population Estimate	Trend
Juno Dunes Natural Area *	Palm Beach	County	2006 (32)[a] 2007 (34)[a]	2015[b]	21	Unknown
Delray Beach Public Beach	Palm Beach	City	2005 (132)[a]	2011[c]	34	Unknown
Red Reef Park *	Palm Beach	City	2020 (6)[a]	2021[d]	4	Too soon to tell
Sea Watch Restaurant *	Broward	Private	2011 (85)[a]	2012[c]	51	Unknown
Dania Beach *	Broward	City	2009 (41)[a]	2012[c]	19	Unknown
*Renaissance on the Ocean *	*Broward*	*Private*	*2008 (58)*[a]	*2013*[e]	*0*	*Failed*
Hollywood North Beach *	Broward	County	2020 (12)[f]	2021[d]	12	Too soon to tell
Harry Berry Park *	Broward	City	2013 (220)[d]	2015[b]	17	Unknown
Haulover Beach Park	Miami-Dade	County	2004 (143)[a] 2007 (324)[a]	2019[g]	89	Declining
North Beach Oceanside Park	Miami-Dade	City	2006 (157)[a] 2010 (126)[a]	2014[b]	189	Unknown
Virginia Key Coastal Hammock	Miami-Dade	City	2003 (264)[a] 2005 (171)[a]	2020[f]	229	Increasing
Virginia Key Beach Park *	Miami-Dade	City	2008 (162)[a]	2013[e]	81	Unknown
Bill Baggs Cape Florida State Park	Miami-Dade	State	1997 (93)[a] 2001 (195)[a]	2021[d]	865	Increasing
***Total Introduced**			**2,255**		**1,611**	

* Introduced after previous status review (Service 2007).
[a] Possley 2021b, [b] Maschinski et al. 2015, [c] Maschinski et al. 2012, [d] Lange 2021, [e] Maschinski et al. 2013, [f] Lange 2020, [g] Lange et al. 2019

At the time of last range-wide census in 2000, approximately 733 individuals existed within 7 known populations (Lane et al. 2001). Currently, an estimated 2,345 individuals are documented within 8 natural and 12 introduced populations (Tables 1 and 2). A fluctuating trend in population sizes over time can be anticipated for species like beach jacquemontia that exist in the dynamic coastal dune system and are occasionally impacted by storms and extreme high tides. Sustainable, resilient populations of adequate size and growth are able to

accommodate fluctuations of individual plant counts and persist over time in this dynamic environment. However, the majority of populations are most likely not self-sustainable (over 500 individuals; Possley 2021a) and are either declining or in need of recent surveys. Without continued habitat management, introductions, and augmentations many beach jacquemontia populations would become extirpated.

c. Genetics:

Beach jacquemontia is most closely related to the *Jacquemontia havanensis* (Havana clustervine) clade, which consist of three other species that occur in south Florida and the Caribbean (*J. cayensis* [sandypine clustervine], *J. curtissii* [pineland clustervine or pineland jacquemontia], *and J. havanensis*) (Namoff et al. 2007). Beach jacquemontia is morphologically very similar to pineland clustervine (another south Florida species which occurs only in pine rocklands) and it is likely that the two species diverged in recent geologic history (Namoff et al. 2007). Further analysis is needed on morphological traits and the use of single sequence repeat markers to further discriminate differences and the taxonomic status of beach jacquemontia within the Havana clustervine clade (Namoff et al. 2007).

Thornton et al. (2008) found that beach jacquemontia has relatively low genetic diversity when compared to other rare species. Larger populations of beach jacquemontia have substantially more genetic diversity than smaller populations and the genetic diversity within populations is greater than among populations (Thornton et al. 2008). Genetic differences between populations were not explained by geographic distances but may be explained by habitat differences. The study sampled eight of the natural populations extant at the time (at least three have since become extirpated). One population (Hugh Taylor Birch Sate Park) was genetically different than the other seven sampled and was the only population occurring backdune/maritime hammock habitat rather than interdunal habitats where the other populations occurred (Thornton et al. 2008). Thornton et al. (2008) suggested the development of two distinct management units for use in the beach jacquemontia recovery efforts: 1) the genetically distinct population of Hugh Taylor Birch State Park, and 2) that of the other seven populations sampled. The authors expressed concern that habitat fragmentation and reductions in population size can lead to reductions in population genetic diversity and recommended focusing efforts on maintaining habitat quality to preserve remaining individuals.

Based on the Thornton et al. 2008 study and those described in section II.C.1.a. above (Pinto-Torres and Koptur 2009; Maschinski et al. 2013), any new beach jacquemontia introductions should use mixed-population source material from sites with similar habitat characteristics to ensure greatest survival. However, for augmentations, Thornton et al. 2008 recommended using mixed-population source material (from a genetically diverse population and the population being augmented) only to augment populations with low levels of genetic diversity (Carlin Park, Atlantic Dunes, and South Inlet Park). Augmenting the most

genetically diverse populations (South Beach and Crandon Parks) with outside source material was not recommended (Thornton et al. 2008). Also, since there is a decrease in the relatedness between beach jacquemontia plants occurred with an increase in distance between the plants, due to limited distances travelled by most pollinators, interplant spacing should be carefully considered during introductions and augmentations (Pinto-Torres and Koptur 2009).

Range-wide, the number of introduced beach jacquemontia plants is more than double that of the number of wild plants; however, information is lacking about whether the introduced plants are equivalent in viability and genetic diversity to the wild plants. In addition, the potential loss of historically large populations such as Red Reef Park and South Beach Park (which currently have extremely low plant counts; Tables 1 and 2; Appendix A and B), means the loss of the genetic diversity they provided.

d. Taxonomic classification or changes in nomenclature:
None. The Integrated Taxonomic Information System (2021) and Atlas of Florida Vascular Plants (Wunderlin et al. 2021) were checked while conducting this review and both indicate *Jacquemontia reclinata* is the accepted name for beach jacquemontia and that it is a distinct taxon.

e. Distribution and trends in spatial distribution:
Beach jacquemontia continues to occur throughout most of its historical range. It historically occurred in Miami-Dade, Broward, Palm Beach, and Martin counties (Service 1993). The Martin and northern Palm Beach county occurrences were extirpated by the time of listing (Service 1993). The Service recently became aware of introductions of beach jacquemontia populations during dune restoration projects at several private properties ranging from Monroe to St. Lucie counties (Barron 2021). Although the status of these populations has not yet been assessed, this would extend the range of beach jacquemontia outside the historical range by one county to the north and one county to the south.

Trends in the known spatial distribution have shifted based on the extirpation of natural populations at some Palm Beach County sites (e.g. Lake Worth Inlet, Atlantic Dunes, South Inlet Park) and the introduction of the plant in new locations within its historical range, the largest being in Miami-Dade County (e.g. Virginia Key Coastal Hammock, Bill Baggs Cape Florida State Park). Most populations, for which we have fairly recent data, are showing a declining trend (Tables 1 and 2), which is exhibited by the loss of individual plants and a decrease in spatial distribution due to habitat encroachment by invasive and hardwood vegetation and plants being shaded-out, buried, or displaced (Maschinski et al. 2015; Lange et al. 2018; Possley et al. 2020). Populations on Virginia Key and adjacent Key Biscayne (Crandon Park and Bill Baggs Cape Florida State Park) in Miami-Dade County now represent 73 percent of the total range-wide population (Tables 1 and 2), skewing the overall spatial distribution southwards.

f. Habitat or ecosystem conditions:

The existing coastal strand and other stabilized open dune habitats within the known range of the beach jacquemontia is exceedingly rare, under private ownership, and/or at high risk of development or conversion away from a natural habitat (i.e., into parks, golf courses, buildings, or parking lots). By the time beach jacquemontia was listed, only 240 acres of coastal strand habitat (not counting patches smaller than 10 acres) was estimated to remain in southeast Florida (Service 1993). High land values make the purchase of remaining habitat by public entities unlikely, however opportunities for private landowner agreements can continue to be considered in recovery actions.

Habitat degradation continues in the coastal strand and dune habitats either occupied or historically occupied by beach jacquemontia. Much of the existing coastal strand habitat has shifted to hardwood understory, primarily due to lack of proper management. This degraded condition is specifically due to the lack of fire and/or the lack of manual and mechanical hardwood or other invasive plant removal methods. The abundance of invasive plants and the use of ornamental garden plants in park properties also displaces beach jacquemontia. At some sites, the conversion of natural coastal strand to monocultures of Australian pine shades out beach jacquemontia or buries the plants with small needle-like leaves.

Despite the drastic, yet currently unquantified decline in both quality and spatial extent of coastal strand habitat in southeast Florida, there appears to be ample opportunity for restoration in other areas of stabilized dune habitats. In 2019, FTBG received funding from the Service's Coastal Program and IRC received funding from the Impact 100 Palm Beach County program to restore coastal dune habitat in Miami-Dade, Broward, and Palm Beach counties. The FTBG project focuses on 1) habitat management actions in collaboration with County and State Park land managers and 2) continued augmentation of natural populations and introduced populations. To date, as part of this project, significant hardwood reduction activities to expand open habitat for beach jacquemontia have been conducted by park staff and volunteers at Virginia Key, Red Reef Park, South Beach Park, Crandon Park, and Hollywood North Beach Park (Lange 2020, 2021). Additionally, outplantings have been conducted in restoration sites at Red Reef Park and Hollywood North Beach Park. The IRC project aims to "restore the incredible diversity of native plants and animals native to coastal beaches and dunes in southeastern Florida, along the historic Gold Coast from Miami-Dade to Palm Beach County" (IRC 2020). As part of this project, the IRC has led restoration efforts in occupied and unoccupied beach jacquemontia habitat at several sites in Palm Beach County.

g. Other:

Beach jacquemontia seeds can be stored using various methods, and the species is being maintained in a few Center for Plant Conservation (CPC) *ex situ* collections

(Botanic Gardens Conservation International 2021). However, most collections are over a decade old and have been shown to have variable germination rates after short-term freezing, but very low rates after more than 10 years (Roncal et al. 2006).

2. **Five-Factor Analysis (threats, conservation measures, and regulatory mechanisms):** The purpose of a 5-Year Review is to recommend whether a listed taxon continues to warrant protection under the ESA and, if so, whether it should be reclassified (from threatened to endangered or from endangered to threatened). This task requires that the analysis of the threats to the species be performed while assuming that the species is not receiving the regulatory protections, funding, recognition, and other benefits of ESA listing. Summaries of ongoing applications of ESA protections may shed light on some future activities that constitute threats to the species. However, the analysis under Factor D (Inadequacy of Existing Regulatory Mechanisms) focuses on the adequacy of existing alternative (i.e., non-ESA) mechanisms to address the continuing and foreseeable threats.

   a. **Present or threatened destruction, modification or curtailment of its habitat or range:**
   Habitat loss, fragmentation, and changes in land use continue to threaten beach jacquemontia and conversion of coastal dune habitat to urban or recreational use in South Florida is likely to continue (Carr and Zwick 2016). Remaining populations of beach jacquemontia are either on public land or east of the Coastal Construction Control Line, an area designated by the Florida Department of Environmental Protection (FDEP; 2021) to regulate development on beaches and dune habitats, which requires special siting and design criteria but does not prohibit development. Past and ongoing development of barrier islands in southeast Florida has extirpated many populations and left habitats and populations deeply fragmented, limiting dispersal potential, and other ecosystem processes such as fire that serve to maintain open habitat. However, recent declines and extirpations of beach jacquemontia populations are mostly due to insufficient management of coastal strand and other dune habitats (Maschinski et al. 2009, 2010, 2014, 2015; Lange et al. 2018; Possley et al. 2020). The habitat is increasingly overgrown with hardwoods and exotic species that shade, displace, and prevent the growth and dispersion of beach jacquemontia. These conditions cause a direct loss of plants and contribute to the lack of self-sustainability and persistence of these populations.

   In 2018, the Greater Boca Raton Beach and Parks District of Palm Beach County began experimenting with not applying chemical herbicides and pesticides, particularly glyphosate (Roundup®) and triclopyr (Garlon®), at their barrier island parks (Kalvort and Nieratka 2018). Two of these parks had been historically the largest natural populations of beach jacquemontia: Red Reef Park and adjacent South Beach Park. This decision is a proactive, beneficial action to help reduce input of toxic and harmful chemicals to the environment. Alternatives being used in place of chemical herbicides for invasive and hardwood removal

efforts include organic herbicides, hand and mechanical removal, and implementing Florida Friendly Landscaping. Hand-removal (cutting, sawing, physical removal of vegetation) is highly labor-intensive and reportedly there are not enough staff to accomplish this land management need through hand-removal alone. Results of a study performed by the Boca Raton Recreation Services found that organic herbicide treatments were less effective and more costly than chemical herbicides (Kalvort and Nieratka 2018).

The decision to stop the use of chemical herbicides has indirectly contributed greatly to the habitat declines and beach jacquemontia losses at these sites because the alternatives are either not implemented (hand removal of vegetation) or are found to not be as successful (organic herbicides) in the control of invasive and hardwood plants. The City of Boca Raton has begun working with the IRC and FTBG to implement restoration, but the need is extensive and will likely require other pools of funding (Lange 2021).

b. Overutilization for commercial, recreational, scientific, or educational purposes:
This was not identified as a potential threat in the original listing package (Service 1993), the recovery plan (Service 1999), or the previous five-year review (Service 2007) and is not known to be a current threat.

c. Disease or predation:
This was not identified as a potential threat in the original listing package (Service 1993), the recovery plan (Service 1999), or the previous five-year review (Service 2007) and is not known to be a current threat.

d. Inadequacy of existing regulatory mechanisms:
The ESA prohibits the removal of federally listed threatened and endangered plants or the malicious damage of such plants on areas under federal jurisdiction, or the destruction of endangered plants on non-federal areas in violation of state law or regulations or in the course of any violation of a state criminal trespass law. The ESA does not provide protection for plants on non-Federal lands unless it is in violation of state law.

Beach jacquemontia is also listed by the Florida Department of Agriculture and Consumer Services (FDACS) as State-endangered (5B-40.0055 Regulated Plant Index). Listing by the State is not reliant on ESA protections, but this legislation does not provide any direct habitat protection. State regulations require both written permission from the owner or legal representative and a permit issued by FDACS to collect or remove plants or parts of plants listed as endangered on the Florida Regulated Plant Index from any property. Additionally, Title 62D-2.013 of the Florida Administrative Code prohibits the removal, destruction, or damage of plants from FDEP, Division of Recreation and Park properties. This regulation provides protection for the populations occurring on state park lands but relies on public adherence to the Code since monitoring is limited.

Existing regulatory mechanisms do not adequately prevent the development of sites, as at least one private property with beach jacquemontia has been developed, and the only option for the plants was to rescue them prior to clearing. Rescue efforts can only take place if the Service, FTBG and/or IRC are made aware of impending development. Because this plant occurs in habitat along the beach, which is desirable for development and recreation, it remains vulnerable to development pressures where it occurs on private property. The Coastal Construction Control Line program has specific siting and design criteria but does not prohibit coastal development (FDEP 2021). Where the species occurs on public land, there is protection from development but not necessarily from habitat degradation.

In the past, public access has been an issue for populations at public parks, with people trespassing on dunes and damaging or destroying the low-profile plants (Bradley 2006). Posting signs, installing trails, limiting dune access, and prohibiting the collection of dune vegetation has reduced this threat, though it relies on public adherence since enforcement is difficult with few staff (Bradley 2006; Lange et al. 2021).

In conclusion, there are no existing regulatory measures that reduce or remove the threat or loss of populations or removal/destruction of plants on private property, and there are only limited protections if the species was not protected under the auspices of the ESA; therefore, existing regulatory mechanisms are inadequate to protect this species.

e. Other natural or manmade factors affecting its continued existence:
The 20 populations of beach jacquemontia occur within a very limited geographic range in south Florida. The limited geographic range in combination with the loss of habitat has resulted in a highly fragmented landscape where the remaining areas that provide habitat for the beach jacquemontia have become more and more isolated from each other, thereby making resiliency, redundancy, and representation more challenging to achieve. Also, habitat fragmentation and declining trends in population sizes (Tables 1 and 2) can lead to reductions in population genetic diversity.

Climate change presents a variety of threats to the beach jacquemontia and its habitat. While the strong influence of ocean currents make projecting regional climate in Florida difficult (Kirtman et al. 2017), estimates project that Florida's average annual temperatures will increase approximately 1.5 to 5.5°F (0.8 to 3.1°C) by 2050 and from 2.0 to 11.5°F (1.1 to 6.4°C) by 2100 depending on the greenhouse gas emission rates and the region in Florida (Runkle et al. 2017). Lange (2021) noted that a lack of freezes in recent years, due to warmer winter temperatures, has contributed to increased growth of sea grapes throughout beach jacquemontia's range. Without the seasonal die back during winter frosts, sea grapes can become large and shade out beach jacquemontia plants (Lange 2021). In addition to temperature increases, it is predicted that Florida will experience

drier wet seasons and wetter dry seasons (Sun et al. 2015). Since sensitivity cycling in beach jacquemontia seeds is related to alternating wet/dry periods with coinciding changes in temperature, it is possible that wetter dry seasons could negatively impact dormancy breaking (Jayasuriya 2009).

Sea level rise (SLR) and storm intensification are also anticipated consequences of climate change. A recent acceleration in SLR suggests that over the next century, sea levels are more likely to rise at the medium to extreme-high SLR scenarios (1.0 to 2.5 meters [3.3 to 8.2 feet]) than the low to intermediate-low scenarios (0.3 to 0.5 meters [1.0 to 1.6 feet]) (Sweet et al. 2017). Under this assumption, the majority of beach jacquemontia populations will likely become completely or partially inundated by 2100 and experience impacts from high tide coastal flooding and saltwater intrusion sooner. For example, FWC predicts that at 1.0 meters (3.3 feet) and 3.0 meters (9.8 feet) of SLR, approximately 32 and 75 percent of coastal strand habitat in Florida will be lost, respectively (FWC 2016). Storm impacts and other more stochastic factors likely confound these losses.

Hurricane frequency, as well as rainfall and intensity, has been increasing since 1970, and will continue to increase as the climate warms (Sweet et al. 2018). The coastal dune and strand habitat of beach jacquemontia is the "front line" to these threats. Maschinski et al. (2009) found that more seaward beach jacquemontia plants suffered negative impacts (salt spray, tidal surge, burial) compared to plants that were further inland. Impacts from storms to this species and habitat are part of the natural processes in the coastal dune system, and hurricanes have historically been beneficial for beach jacquemontia populations by creating open areas and dispersing seeds (Pinto-Torres et al. 2004). As a coastal strand species (located back dune/behind the beach berm) some form of protection from the sea's direct impacts is provided by the fore dune and the geographic distance the plants are located from the sea. As the sea level rises however, effects to the plants from salt spray, tidal surge, and burial become an increasing threat to plant health and habitat. Additionally, the opportunity for the dune system to adapt and shift landward is unlikely in highly developed, urban south Florida.

The combined stressors of climate change like sea level rise, storm events, and shifting regional precipitation and temperature patterns pose a severe threat to the long-term survival and recovery capabilities of the currently small and fragmented populations of beach jacquemontia. Threats from these climate impacts, particularly combined with habitat destruction and alteration threats, are becoming synergistic threats to the species' habitat and population health. As a narrow-ranging species that exists across only a relatively small global range (now just three south Florida counties), the species will become increasingly vulnerable to these range-wide threats.

D. Synthesis:

Beach jacquemontia is a narrow ranging species, with populations documented in just three south Florida counties (Palm Beach, Miami-Dade, and Monroe). Currently there are

20 populations (8 natural and 12 introduced) (Tables 1 and 2). This is a slight increase from the previous status review (Service 2007), which reported 15 populations (10 natural and 5 introduced). Despite recovery efforts and the increase in number of introduced populations, only two of the populations (Crandon Park and Bill Baggs Cape Florida State Park) would be considered self-sustaining with over 500 individuals (Tables 1 and 2). Many of the populations are declining due to habitat loss through development and habitat degradation from lack of appropriate management. The impending threat of climate change will only exacerbate habitat loss and degradation.

Where habitat remains intact, beach jacquemontia depends upon active management to persist. Land management practices, especially the reduction of hardwoods and removal of invasive plants, are extremely important for maintaining the habitat needed for the species. Existing regulatory mechanisms are inadequate to protect the species on private lands. Habitat loss, fragmentation, and changes in land use continue, and conversion of coastal dune habitat to urban or recreational use in South Florida is projected to continue. The species' restriction to specialized habitat, limited distribution, and isolated populations also renders it vulnerable to SLR and increased storm surge and tides from climate change. Due to the above ongoing threats and documented declines in populations, this species continues to meet the definition of endangered under the ESA.

III. RESULTS

A. Recommended Classification:

_____ Downlist to Threatened
_____ Uplist to Endangered
_____ Delist
__X__ No change needed

IV. RECOMMENDATIONS FOR FUTURE ACTIONS

A detailed discussion of recovery actions and criteria are presented in the Recovery Plan (Service 1999). In the course of this status review new and/or targeted potential recovery activities were identified and are included below.

Recovery Activities

- Conduct hardwood reduction and invasive species removal to maintain or restore suitable habitat at all populations.
- During invasive species (e.g. beach naupaka, Brazilian pepper) removal on dunes, efforts should be made to remove biomass off-site and shift toward open habitat rather than focus on dense replanting.
- Increase the smaller populations (less than 30 plants; Tables 1 and 2) through augmentation using the appropriate genetic guidelines and source materials as described in Thornton et al. 2008 and Maschinski et al. 2013 (see section II.C.1.c.) to help ensure preservation of genetic diversity.
- Prioritize restoring and maintaining the habitat quality of extant natural and introduced populations over establishing new introduced populations.

- Prior to introducing new experimental populations or augmenting extant populations, ensure that a habitat management plan is in effect and being implemented.
- Seed collections for long-term storage should be made continuously following CPC guidelines to not harvest more than 10 percent of the annual seed crop of a given population. Seeds should be separated by maternal line to maximize ability to utilize genetic diversity into future research and introduction efforts.

Monitoring/Research Activities

- Develop survey metrics that are more easily collected and can serve as indicators of population condition, such as patch size, total area occupied, estimated plants counts, shoot counts (quadrat system), or stem density.
- Continue to assess, document, and study the impacts sea level rise (shoreline shift, king tide, storm surge, and saltwater intrusion) on this coastal dune species and its habitat.
- Promote and increase partnerships to evaluate the current protection status and management needs at each park and to develop cooperative assistance and information sharing plans between parks.
- Re-survey populations that do not have recent site visits or are considered extirpated (see Tables 1 and 2). Consider possible habitat management or restoration actions at these sites.
- Public access should continue to be managed to prevent trespassing on the dunes and enforce "no trespassing" regulations. Public education should be implemented to educate visitors about this rare species and help control public access to the dunes.
- Continue work on genetics (single sequence repeat markers) to further determine degree of genetic differentiation within the *J. havanensis* clade, to which *J. reclinata* belongs, and the species' taxonomic status in that clade (Namoff et al. 2008).
- Conduct a population viability analysis when enough demographic data are available. Data need to be collected on survival of seedlings in the wild (current data are based on seedlings in a nursery setting).
- The role of fire should continue to be explored and understood. On sites where prescribed fire may be used, develop appropriate methods to use fire in small areas in the coastal dune system.

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U.S. FISH AND WILDLIFE SERVICE
5-YEAR REVIEW of Beach jacquemontia (*Jacquemontia reclinata*)

Current Classification: Endangered

Recommendation resulting from the 5-Year Review:

_____ Downlist to Threatened
_____ Uplist to Endangered
_____ Delist
_X_ No change needed

Review Conducted By: Heather Hitt, Florida Ecological Services Field Office, Vero Beach

FIELD OFFICE APPROVAL:

Field Supervisor, Florida Ecological Services Field Office, Fish and Wildlife Service

ROXANNA HINZMAN Digitally signed by ROXANNA HINZMAN
Date: 2021.06.25 10:09:58 -04'00'

Approve: _____ Date: _____

* Since 2014, South Atlantic-Gulf Region Field Supervisors have been delegated authority to approve 5-year reviews that do not recommend a status change.

Appendix A. Beach jacquemontia natural populations monitoring data. Populations are listed from north to south.

Population/Site Name	**County**	Beach jacquemontia population estimates from 2001 to 2021 (Maschinski and Wright 2006; Wright 2008; Maschinski et al. 2009, 2012, 2013, 2014; 2015; Maschinski, Ross, et al. 2011; Maschinski, Wright, et al. 2011; Lange et al. 2016, 2018; Possley et al. 2020; Lange 2021). Total number of individual plants per population by year reported, 0 = surveyed, no plants. Note: Years are not consecutive. Missing year = no survey that year.													
		2001	2002	2004	2006	2008	2009	2010	2011	2013	2014	2015	2018	2020	2021
Carlin Park	Palm Beach	32					12				6				
Radnor Park/Juno Beach Park	Palm Beach	0		0											
Loggerhead Park	Palm Beach	12					3		2	2					
Lake Worth Inlet/Palm Beach Harbor	Palm Beach	2		1			0								
Gulf Stream Beach Park	Palm Beach	0	0												
Atlantic Dunes	Palm Beach		26			10	0								0
Spanish River Park	Palm Beach	0		0			0	1							
Red Reef Park	Palm Beach	177								17		0	0		See Appendix B
South Beach Park	Palm Beach	245									50				6
South Inlet Park	Palm Beach	17					0				0				0
Hillsboro Beach	Broward	2					0			3					
Oakland Park	Broward						50 (newly discovered)		20	17	43		0 (site developed)		
Hugh Taylor Birch State Park	Broward	96			60			32		25		90			
John U. Lloyd/Mizell-Eula Johnson State Park	Broward						187 (newly discovered)	112	87	38		100	47	37	
Crandon Park	Miami-Dade	144					244				384				589

Appendix B. Beach jacquemontia introduced populations monitoring data. Populations are listed from north to south.

Introduced Population/Site Name	**County**	Beach jacquemontia population estimates from 1997 to 2021 (Maschinski and Wright 2006; Wright 2008; Maschinski et al. 2009, 2012, 2013, 2014; 2015; Maschinski, Ross, et al. 2011; Maschinski, Wright, et al. 2011; Lange et al. 2016; Lange 2020, 2021; Possley et al. 2020; Possley 2021b). Total number of individual plants per population by year reported, 0 = surveyed, no plants. Note: Years are not consecutive. Missing year = no survey that year. * Indicates the year introductions occurred and the number represents the number of plants introduced.																
		1997	**2001**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2018**	**2020**	**2021**
Juno Dunes Natural Area	Palm Beach						32*	34*	32	30		27		10		21			
Delray Beach	Palm Beach					132*			74			34							
Red Reef Park	Palm Beach																	6*	4
Sea Watch Restaurant	Broward											85*	51						
Dania Beach	Broward									41*		20	19						
Renaissance on the Ocean	Broward								58*			50		0					
Hollywood North Beach	Broward																	12*	12
Harry Berry Park	Broward													220*		17			
Haulover Beach Park	Miami-Dade				143*			324*	96	225					45		89		
North Beach Oceanside Park/North Shore Open Space Park	Miami-Dade						157*		140		126*	101			189				
Virginia Key Coastal Hammock	Miami-Dade			264*		171*				60			31						229
Virginia Key Beach Park	Miami-Dade								162*	148				81					
Bill Baggs Cape Florida State Park	Miami-Dade	93*	195*		51					37	53			52	162		454		865