Species at Risk Act
Recovery Strategy Series

Report on the Progress of Recovery Strategy Implementation for the Pink Sand-verbena (*Abronia umbellata*) in Canada (2018 – 2022)

Pink Sand-verbena

January 2024

Parks Canada Parcs Canada

Canada

Recommended Citation

Parks Canada. 2024. Report on the Progress of Recovery Strategy Implementation for the Pink Sand-verbena (*Abronia umbellata*) in Canada (2018 – 2022). Species at Risk Act Recovery Strategy Report Series. Parks Canada, Ottawa. i + 18pp

For copies of the progress report, or for additional information on species at risk, including Committee on the Status of Endangered Wildlife in Canada (COSEWIC) Status Reports, recovery strategies, residence descriptions, action plans, and other related recovery documents, please visit the Species at Risk Public Registry.

Photo Credits:
All photos, unless otherwise stipulated, are copyright of Parks Canada (PC).

Cover: Pink Sand-verbena, M. Collyer, PC. **Figure 3 from left to right**: M. Collyer, PC; J. Demoskoff, PC; R. Vennesland, PC; J. Demoskoff, PC. **Figure 8, 9, 10 and 11**: M. Collyer, PC.

Également disponible en français sous le titre : Rapport sur l'état d'avancement de la mise en œuvre du Programme de rétablissement de l'abronie rose (*Abronia umbellata*) au Canada (2018-2022).

ISBN: En3-4/369-1-2024E-PDF
Catalogue No. 978-0-660-69372-9

Acknowledgments

We respectfully acknowledge the Nuu-chah-nulth First Nations in whose traditional territories Pacific Rim National Park Reserve is situated, the Tla-o-qui-aht First Nation, Yuułuʔiłʔatḥ Government, Toquaht Government, Hupacasath First Nation, Uchucklesaht Tribe, Tseshaht First Nation, Huu-ay-aht First Nations, Ditidaht First Nation, and Pacheedaht First Nation.

Pacific Rim National Park Reserve works with these Nuu-chah-nulth First Nations through cooperative management boards and working groups. Our working relationships are guided by the Nuu-chah-nulth principles of ʔiisaak (respect), hišukʔiš cawaak (everything is one), and ʔuʔaałuk (taking care of), all of which are integral to the management and operations of the national park reserve. Thanks are extended to employees and representatives of Tla-o-qui-aht First Nation, Yuułuʔiłʔatḥ, Huu-ay-aht First Nations and Ditidaht First Nation for their contributions to the restoration and protection of coastal sand ecosystems, and recovery of associated species at risk including Pink Sand-verbena.

Introduction

The final *Recovery Strategy for the Pink Sand-verbena (Abronia umbellata) in Canada* was posted on the Species at Risk Public Registry on 14 February 2007. Under section 46 of the *Species at Risk Act* (SARA), the competent minister must report on implementation of the recovery strategy, progress towards meeting its goals and objectives, within five years after its inclusion on the public registry and in every subsequent five-year period. Reporting continues until the objectives have been achieved or the species' recovery is no longer feasible. A first implementation report (2007 – 2017) was published in 2018. This document reports on the implementation of the Recovery Strategy for the Pink Sand-verbena (*Abronia umbellata*) in Canada from 2018 through 2022 and the progress towards meeting is goals and objectives.

Pink Sand-verbena was included in the *Multi-species Action Plan for Pacific Rim National Park Reserve of Canada* (MSAP)*,* which was published in 2017. The MSAP applies to lands and waters within the boundaries of Pacific Rim National Park Reserve of Canada (PRNPR). Where it has been determined that a site such as PRNPR can conduct management activities to help recover and/or manage a species, site-specific recovery measures and population and distributions objectives are identified in the action plan and represent the site's contribution to goals and objectives presented in federal recovery strategies. In addition, whenever practicable, the recovery measures of the action plan integrate the recovery strategy objectives and goals of multiple SARA listed species that regularly occur within the site (PRNPR).

In the case of Pink Sand-verbena, the only populations in Canada occur within the site (PRNPR). Consequently, the site-based population and distribution objectives and recovery measures of the action plan that are associated with Pink Sand-verbena more closely mirror the objectives and goals of the recovery strategy than for species that occur both within and outside of the site. However, the recovery measures identified in the MASP will provide additional

quantitative summary metrics whereas this report provides specific detail addressing the recovery strategy goals and objectives.

An Implementation Report for the Multi-species Action Plan for Pacific Rim National Park Reserve of Canada between 2017 and 2022 will include the status of the recovery measures, additional narrative descriptions of the related activities and an assessment of the progress towards meeting site-based population and distribution objectives for Pink Sand-verbena. In addition, the implementation report will provide an evaluation of the socio-economic impacts of the action plan.

Implementation of the Recovery Strategy and Progress towards Meeting its Goals & Objectives

The *Recovery Strategy for Pink Sand-verbena (Abronia umbellata) in Canada* identified two short-term and two long-term recovery goals (see table 3 of the recovery strategy) and seven recovery objectives (see table 4 of the recovery strategy).

Recovery Goal 1: Conserve Pink Sand-verbena throughout its historical range of occurrence in Canada including an extant Clo-oose Bay population and at least two more populations (re)introduced by 2015 near/within the historic range.
Status: ongoing

Recovery objectives that address this goal include 3, 4, 5, 6 and 7. Progress towards each of these objectives is discussed in the following sections of this report. In summary, goal 1 has been partially met through actions to support establishment of two new populations within the Pacific Rim National Park Reserve (PRNPR) at Schooner Cove and Wickaninnish Beach, as well as one new population partially within the PRNPR and an adjacent Huu-ay-aht First Nation Treaty settlement land enclave at Keeha Beach (**Figure 1**). Augmentation of the historic population at Clo-oose Bay was also undertaken.

Figure 1. Distribution of Pink Sand-verbena (*Abronia umbellata*) in Canada. The red circle represents the extant population at Clo-oose Bay, triangles represent other historic populations at Ahousaht and Pachena Bay. Squares represent the sites where efforts to establish new populations have been implemented.

Starting in 2006, Pink Sand-verbena plants were propagated from seed collected from the extant population at Clo-oose in 2000 and 2001 and grown in greenhouse settings. These plants were planted at four sites (Clo-oose, Keeha, Wickaninnish, Schooner). Selection of the sites is detailed under objective 6 (below).

Annual surveys began in 2009 and were conducted in late summer or early fall, including throughout the 2018-2022 reporting period. The precise location and condition of wild plants (i.e. progeny of the greenhouse-grown translocated plants) was recorded. Although Pink Sand-verbena is characterized as a perennial herb (COSEWIC 2004), there is only one documented case of over-winter survival at these sites (M. Collyer, personal communication, 2022-08-02). The use of high accuracy real time kinematic (RTK) global navigation satellite system (GNSS) survey methods ensured that wild plants were not confused with greenhouse grown plants.

Initially (2008-2010), the success of these plantings was low (**Figure 2**). The number of wild plants in the year following the plantings was less than 10% of the translocated plants. Improvements in propagation and translocation methods resulted in an increase over 250% in the wild plants occurring from later plantings (2012-2017). Habitat restoration and the accumulation of ungerminated seed stored in the seed bank may also have contributed to the increase in wild plants in these later years.

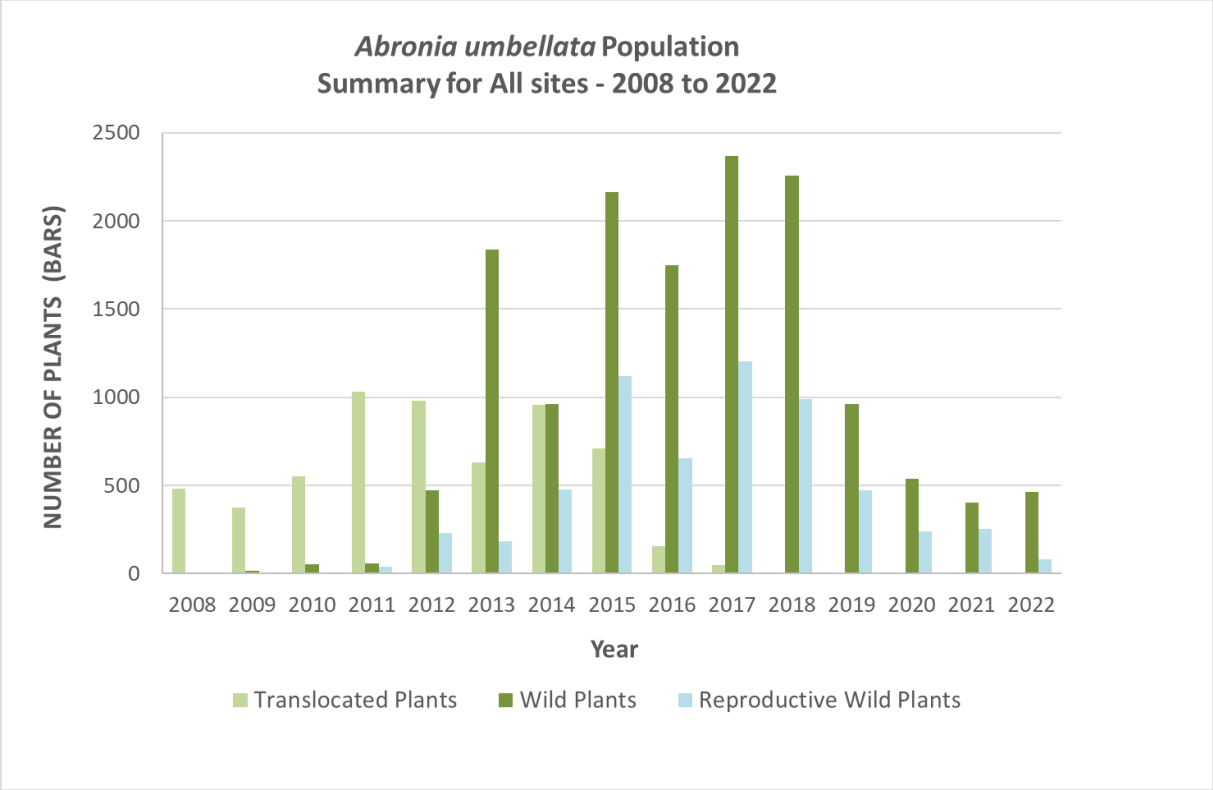

Figure 2: Time series of *Abronia umbellata* population in Canada since translocation and habitat restoration efforts began in 2008. Shown are the number of greenhouse-grown (translocated) plants (light green bars), the number of naturally regenerated (wild) plants (dark green bars), and the number of the wild plants that exhibited reproductive success (light blue bars). 1518 wild plants were not differentiated based on reproductive success and are not represented in the reproductive wild plant bars. This primarily had an impact in 2013 (1489 plants not differentiated).

Between 2008 and 2017, almost 6000 seedlings were eventually grown and planted and over 11,000 seeds were scattered or planted. Based on studies of greenhouse seed production, and surveys of the fecundity of wild and translocated plants, it is estimated that wild plants have released over 1,240,000 and greenhouse grown plants have released over 1,000,000 seeds as of 2022.

In most years (2011-2022), approximately 50% of the wild plants exhibited some reproductive success. This success varied greatly (from 10 to several thousand seeds, averaging approximately 210) and thus is an imprecise metric, but the large decline in this ratio to approximately 18% in 2022 is alarming.

Population numbers were high (over 2000 wild plants annually) at the beginning of the current reporting period but since 2019 there has been a consistent decline. Between 2020 and 2022 the population appears to have stabilized between 400 – 500 plants per year. Although the population has declined, it still represents at least 3000% more wild plants than ever recorded in Canada prior to implementation of this recovery strategy. Although preliminary work has

been conducted to assess population viability, it remains unknown whether current conditions and amount of habitat will support sustainable populations (Schwarz, 2019).

Recovery Goal 2: Extant population at Clo-oose Bay.
Status: ongoing

Recovery objectives that address this goal include 1, 2, 3 and 5. Progress towards each of these objectives is discussed in the following sections of this report. In summary, goal 2 has not been met. Between 2008 and 2010 a total of 1087 greenhouse-grown plants and 650 seeds were planted at three locations within the Clo-oose site, specifically the upper beach near the area identified as critical habitat, in the small dune adjacent to the beach and on the beach in front of the dune. These plantings included experiments to assess the influence of supplemental fertilization on seedlings, and of ecosystem morphology on population viability, looking at beach versus dune habitats (Fairbarns 2011). By 2011, only 71 wild plants had occurred although over 60,000 seeds were produced by the translocated and wild plants. The low productivity was thought to be primarily due to threats from beach logs and winter storms (on the beach), and a lack of natural sand ecosystem dynamics (in the dune area). After 2010, population recovery efforts at Clo-oose Bay were temporarily put on hold until habitat restoration work could improve the suitability of the dune area.

Between 2013 and 2016 forest vegetation and drift logs that were isolating the dune from marine influence were removed (**Figure 3**). Additional plantings in the dune and on the newly restored foredune habitat were implemented with 603 plants being translocated between 2015 and 2017.

Figure 3. Photographs documenting the restoration of dune habitat at Clo-oose.

Although results from the 2016 planting was the best at the Clo-oose site, wild plants subsequently declined rapidly, and no plants have been observed since 2019 (**Figure 4**).

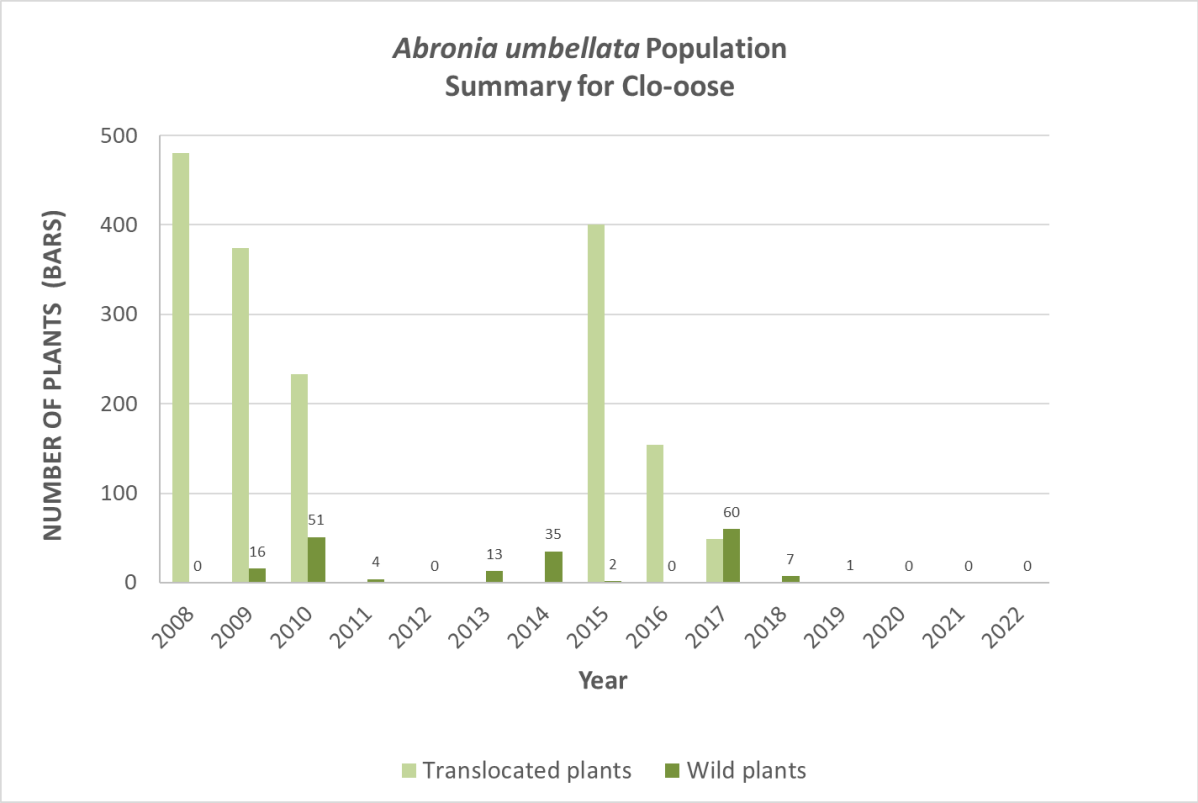

Figure 4. Time series of *Abronia umbellata* population at Clo-oose. Shown are the number of greenhouse -grown (translocated) plants (light green bars), and the number of naturally regenerated (wild) plants (dark green bars), since translocation efforts began in 2008. Labels indicating the number of plants for the wild plant bars have been added for clarity.

The Clo-oose site is relatively remote and transportation of plants, personal, equipment and supplies involve boating, hiking and/or transport by helicopters.

The poor results at Clo-oose are likely linked to several factors including: increased damage to plants from transportation to the site and less effort allocated to post planting watering as compared to more easily accessed sites; project management difficulties, particularly for the 2015 planting meant relatively immature plants were translocated too late in the season; re-accumulation of drift logs in front of the restored dune which likely reduced sand and marine transport into the restored area; the unmitigated threat represented by drift logs occupying beach habitat (see the section on Objective 2 below).

Recovery Goal 3: Protect all existing populations and manage each to ensure it doesn't fall below a minimum viable population size.
Status: ongoing

Recovery objectives that address this goal include 3, 4, 5, 6 and 7. Progress towards each of these objectives is discussed in the following sections of this report. In summary, goal 3 has been partially implemented through translocation, habitat restoration and protection initiatives

(see the preceding sections on goals 1 & 2 and the following on objectives 3, 4, 5, 6, and 7). Although recent population declines appear to have plateaued for the entire population (**Figure 2**) and at Wickaninnish (**Figure 5**), low and declining populations at most sites (**Figure 4**, **Figure 6** and **Figure 7**) suggest that viable populations have not been achieved, however available data and stochasticity of this data has not been sufficient to define the viable population size (Schwarz, 2019).

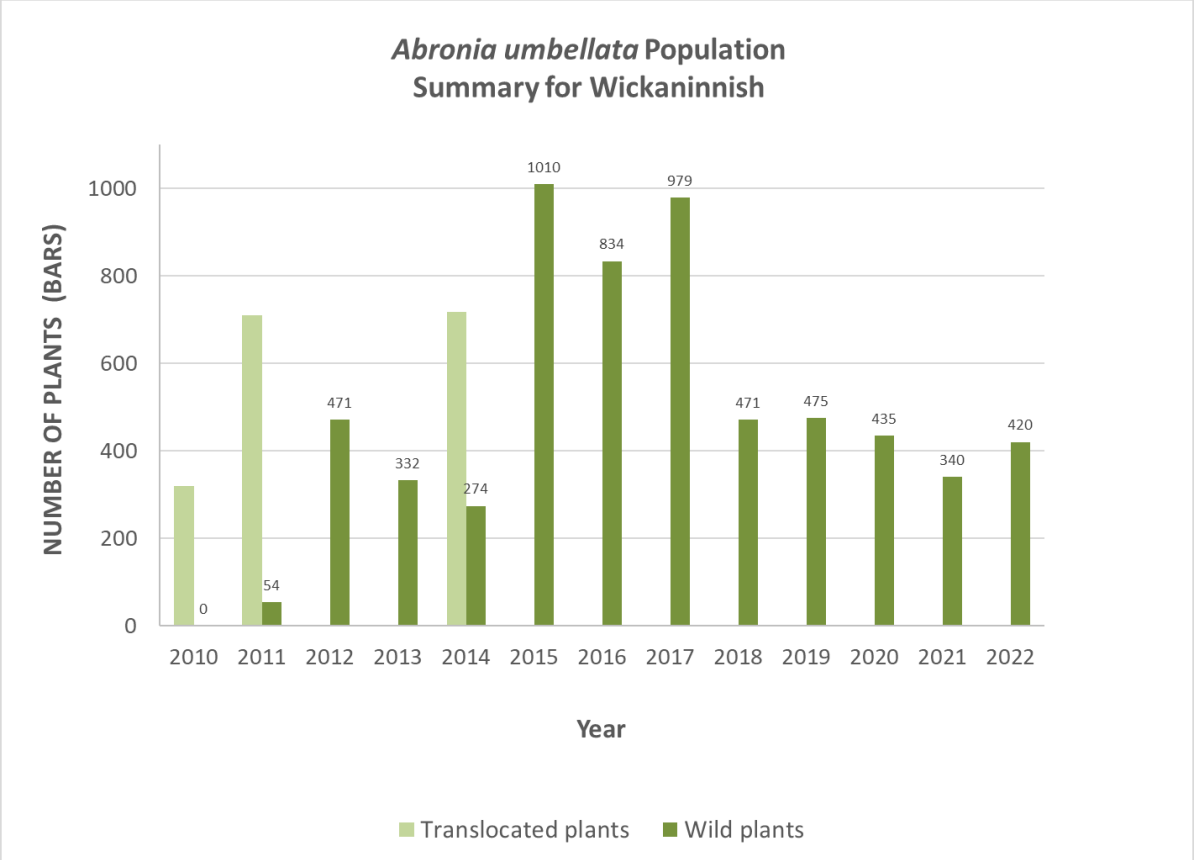

Figure 5. Time series of *Abronia umbellata* population at Wickaninnish. Shown are the number of greenhouse-grown (translocated) plants (light green bars), and the number of naturally regenerated (wild) plants (dark green bars), since translocation efforts began at this site in 2010. Labels indicating the number of plants for the wild plant bars have been added for clarity.

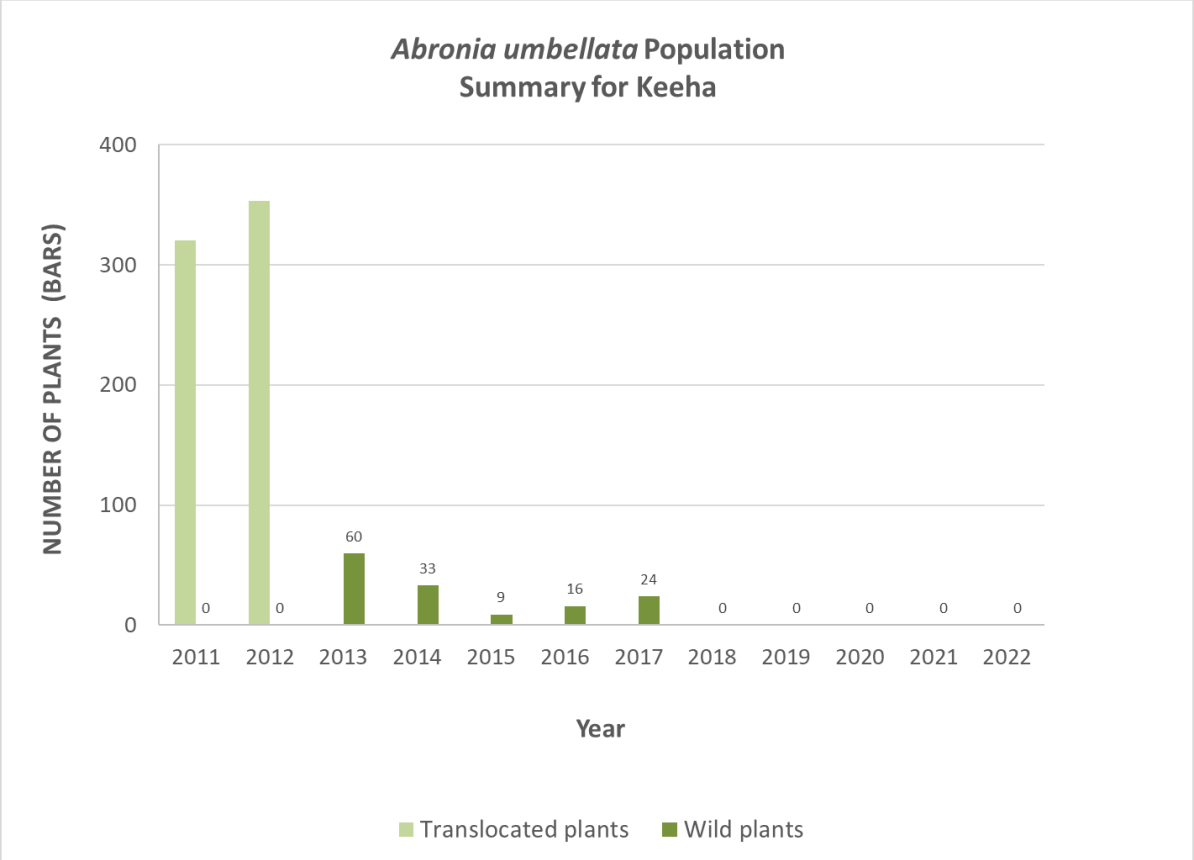

Figure 6. Time series of *Abronia umbellata* population at Keeha. Shown are the number of greenhouse-grown (translocated) plants (light green bars), and the number of naturally regenerated (wild) plants (dark green bars), since translocation efforts began at this site in 2011. Labels indicating the number of plants for the wild plant bars have been added for clarity.

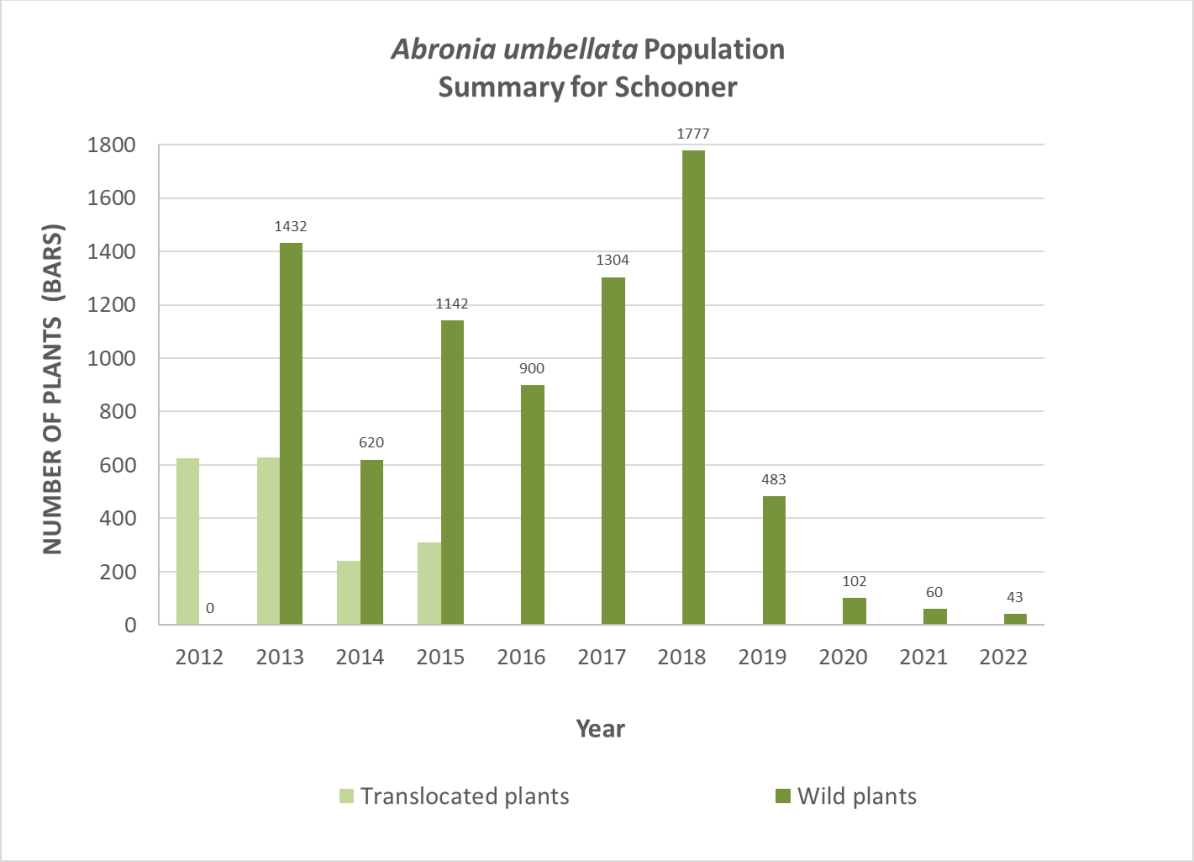

Figure 7. Time series of *Abronia umbellata* population at Schooner. Shown are the number of greenhouse-grown (translocated) plants (light green bars), and the number of naturally regenerated (wild) plants (dark green bars), since translocation efforts began at this site in 2012. Labels indicating the number of plants for the wild plant bars have been added for clarity.

Recovery Goal 4: The Clo-oose Bay population is at least a minimum viable population size. Status: ongoing

Recovery objectives that address this goal include 1, 2, 3 and 5. Progress towards each of these objectives is discussed in detail in the following sections of this report. In summary, goal 4 has not been met. Although efforts to augment the population, restore and protect habitat have been implemented (**Figure 4**, the preceding sections on goals 1 & 2 and the following on objectives 1, 2, 3 and 5) the population remained low and no plants have been seen at the Clo-oose site since 2019. This suggests that a viable population has not been achieved, however available data and stochasticity of this data has not been sufficient to define the viable population size (Schwarz, 2019).

Recovery Objectives:

Recovery Objective 1: Grow plants from a genetically appropriate seed source and introduce to the wild at Clo-oose Bay.
Status: completed

Recovery objective 1 has been achieved by propagating plants using seed collected from the beach adjacent to Clo-oose Bay in 2000 and 2001 when the species re-appeared after being absent for half a century (Fairbarns 2007) followed by translocations and seed dispersal (natural and human facilitated). However, no wild plants have been observed at the site since 2019.

During the period of this implementation report (2017-2022), Parks Canada provided field, logistical and administrative support for a study of the genetics of Pink Sand-verbena (Parks Canada, 2016). Genetic analyses revealed that Canadian populations of *Abronia umbellata* var. *breviflora* are similar to populations found in the other disjunct Washington populations and the more contiguous core populations in Oregon and northern California and vary considerably from the var. *umbellata* populations further south (Van Natto, 2020). Canadian populations contain little variation and thus, likely arose from a recent long-distance dispersal event as opposed to being a relic of a range fragmentation process. Additional gene analysis may reveal increased variation (A. Van Natto, personal communication, 2020-06-25).

Recovery Objective 2: Mitigate threats to habitat and survival at Clo-oose Bay by removing beach logs derived from harvesting operations on the west coast.
Status: Ongoing

Efforts to maintain the restored habitat free of drift logs and exposed to marine influences were implemented annually from 2016 through 2018 (**Figure 8**). Difficulties accessing the site and complications associated with Covid-19 pandemic mitigations prevented continued maintenance of the restored habitat in subsequent years.

Figure 8. Photographs of (a) Ditidaht First Nation crew removing drift logs from the restored habitat in 2016 and (b) Accumulation of drift logs in front of the restored habitat restricting marine influence in 2019.

No additional efforts have been made to mitigate threats to habitat and Pink Sand-verbena on the beach beyond the dune or within the critical habitat zone at Clo-oose. However, since 2018 annual aerial surveys have facilitated an assessment of the amount of critical habitat occupied by drift logs (**Figure 9**), which was identified as a high priority in table 5 of the recovery strategy.

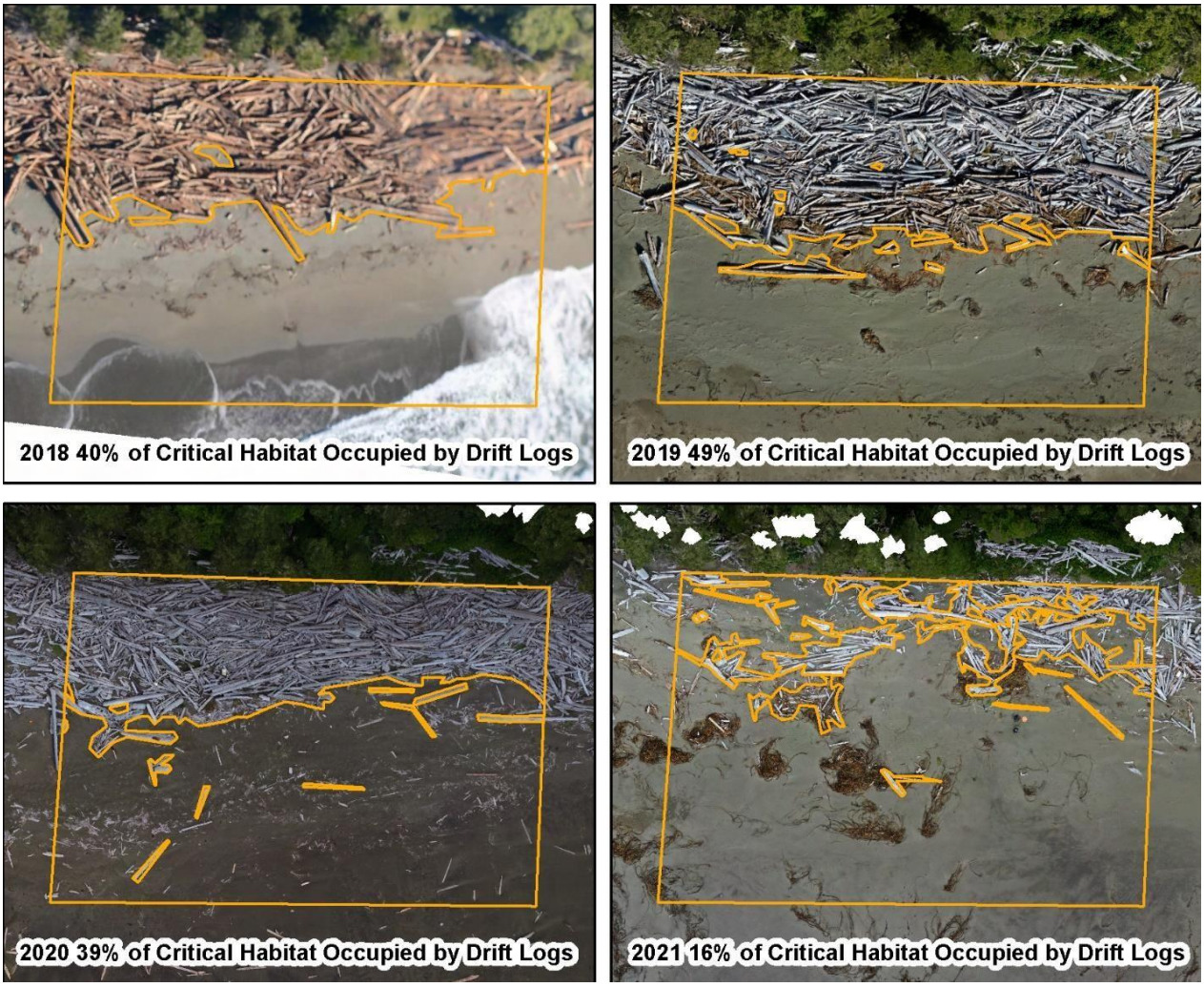

Figure 9. Aerial imagery of the Pink Sand-verbena critical habitat with the portion occupied by drift logs identified.

Recovery Objective 3: Increase public awareness of the existence and conservation value of Pink Sand-verbena, associated species at risk, and sand dune habitats.
Status: ongoing.

Increased public awareness of sensitive coastal sand ecosystems and associated species is an ongoing priority for PRNPR. Initiatives undertaken during the reporting period have fostered a sense of connection and stewardship in visitors to PRNPR as well as to reduce harmful visitor behaviour such as trampling of dune plants, campfires, and illegal camping in the dune systems.

Volunteers from around the world have devoted over 3300 hours over the period of this report to restoring coastal sand ecosystems and recovering associated species at risk. These

volunteers have amplified PCA efforts to foster public awareness of Pink Sand-verbena and maintain restored habitat by removing invasive plants, beach logs and other vegetation that re-established in the restored areas. Due to the COVID-19 pandemic, volunteer activities were stopped, which likely resulted in the degradation of restored habitat and in turn contributed to the decline in Pink Sand-verbena populations, particularly at the Schooner site.

During the period of this implementation report, outreach and interpretive programs were established and promoted to PRNPR visitors. Prior to the 2020 season on average over 350 visitors a year attended interpretive programs focused on coastal sand ecosystems and associated species at risk. However, due to COVID-19 pandemic mitigations, in-person interpretive programming was not permitted for most of 2020.

Parks Canada published two short documentary videos in 2018 and 2019 (Parks Canada 2018b, Parks Canada 2019) and contributed to two commercial documentaries distributed in 2020 (Blue Ant Media 2020) and soon to be released in 2023 (FlorianFlim 2023). All of these video and documentary products address public awareness of the existence and conservation value of Pink Sand-verbena, associated species at risk, and coastal sand ecosystems. PRNPR updated web site content for Pink Sand-verbena in 2021 (Parks Canada Agency 2021) and made contributions to a local non-profit's webpage related to restoration work they performed at the Schooner Pink Sand-verbena recovery site in 2022 (Redd Fish Restoration Society 2022).

In February 2018 Parks Canada held a symposium on the restoration of coastal sand ecosystems in British Columbia (Baker et al 2018). Members of First Nations, academic institutions, non-government organizations, local, provincial, and federal governments along with independent subject matter experts were invited. Presentations included work conducted to restore coastal sand ecosystems and recover Pink Sand-verbena and other associated species at risk.

Recovery Objective 4: Secure permanent protection (legal or through stewardship) for sites of historic occurrences.
Status: ongoing.

As described above (see Goal 1) sites of historic occurrences of Pink Sand-verbena were identified in the recovery strategy as Clo-oose, Pachena and Ahousaht. Of these three, only Clo-oose has received recovery efforts, however, three additional sites (Wickaninnish, Schooner and Keeha) without historic occurrences have been established through recovery actions implemented to date.

Legal protection for Pink Sand-verbena includes the critical habitat established on the beach at Clo-oose and the location of most recovery sites within the Pacific Rim National Park Reserve (PRNPR) which provides legal protection under both the Canada National Parks Act and the Species at Risk Act. Initiatives to protect Pink Sand-verbena critical habitat at Clo-oose Bay include area closures to camping, habitat restoration of the dune site, interpretive signage and a program (established in 2007 and continued throughout the period of this report) to educate West Coast Trail hikers on Pink Sand-verbena and its need for protection. Additional outreach

and educational initiatives (see Objective 3 above and 5 below) have been implemented and contribute to the protection of all four sites and occurrences of Pink Sand-verbena.

In 2022 additional signs with both educational and compliance-related messaging were installed at each of the recovery sites (**Figure 10**). These signs are tri-lingual featuring Indigenous translations and were developed in consultation and engagement with the First Nation within whose territory the site occurs (Ditidaht for Clo-oose, Huu-ay-aht for Keeha, Yuułuʔiłʔatḥ for Wickaninnish and Tla-o-qui-aht for Schooner).

Figure 10. Huu-ay-aht First Nations staff and a Parks Canada archaeologist assessed the site for cultural features prior to installing tri-lingual educational and compliance signage at the Kiixa (Keeha) translocation site on Huu-ay-aht lands adjacent to the PRNPR.

Involvement of the Nations in habitat restoration through employment, contracts, and the establishment of advisory groups to guide the development of the interpretive signs and engage the Nations in ongoing discussions about how to maintain habitat quality contributed to a higher profile for and stewardship of Pink Sand-verbena and its habitat with the Nation members.

Recovery Objective 5: Engage the cooperation of all implicated landholders in habitat protection.
Status: ongoing.

Since its reappearance at Clo-oose beach in the year 2000, Pink Sand-verbena in Canada is known to occur within two primary jurisdictions, a) Parks Canada lands and b) after translocation efforts in 2011 and 2012, Huu-ay-aht Treaty Settlement lands at Keeha. It should however be noted, that the Tla-o-qui-aht, Yuułuʔiłʔatḥ, Huu-ay-aht and Ditidaht First Nations have Treaty and/or Indigenous Rights at each of these sites (respectively, Schooner, Wickaninnish, Keeha and Clo-oose). During the period of this implementation report Parks

Canada engaged frequently with each of these Nations on projects to protect Pink Sand-verbena habitat and contribute to its recovery (see the section on Recovery Objectives 2, 3 and 4).

Recovery Objective 6: Identify and rank 5–10 potential recovery (translocation) sites.
Status: completed.

During the previous implementation reporting period (2007 – 2017), 76 coastal sand ecosystem locations along the west coast of Vancouver Island (from Port Renfrew to Nootka Island) were surveyed in search of undiscovered occurrences of Pink Sand-verbena and to assess potential restoration sites for recovery of the species (Blight et al. 2010, Fairbarns 2009). No additional populations of Pink Sand-verbena were discovered (Fairbarns 2011), but 17 sites were rated as medium to high suitability for recovery and were considered as potential restoration sites. Of these sites and those which were also within a federally protected area, Clo-oose, Wickaninnish and Keeha were rated highest with Schooner, Florencia, Tsusiat and Bonilla second highest. Selection of Schooner as the fourth site was based on easier access, and a larger off beach dune than the other three.

Recovery Objective 7: Restore habitat to functioning condition at or near proposed sites for restored/new populations.
Status: Ongoing

In 2010, habitat restoration work began to establish two additional populations to meet the goals of the recovery strategy (for details refer to Parks Canada Agency, 2018a). Pink Sand-verbena seedlings were subsequently planted at Wickaninnish and Keeha. Pink Sand-verbena results at Keeha Beach were not as successful as at Wickaninnish, (**Figure 5** and **Figure 6**), and the Wickaninnish site had been closed on the recommendation of the Department of National Defence after an UXO (unexploded explosive ordinance) was found at the site. Consequently, in 2012 Parks Canada redirected restoration efforts to establish a population at Schooner Cove (see the section on Objective 6 in this report for site selection rationale).

Since the last implementation report, surveys for Pink Sand-verbena have been conducted annually at all sites (see **Figure 4, Figure 5, Figure 6** and **Figure 7**). Maintenance of restored habitat by removing recolonizing invasive grasses (*Ammophila* spp.) was implemented successfully at Wickaninnish throughout this reporting period. However, difficulty accessing the more remote sites at Keeha and Clo-oose and restrictions related to COVID-19 pandemic mitigations resulted in these sites not being fully maintained every year.

At Schooner, a community of scouring rush (*Equisetum hyemale*) and invasive hairy cat's ear (*Hypochaeris radicata*) established in high densities within restored areas that were initially very productive for Pink Sand-verbena, supporting over a thousand plants in both 2017 and 2018 (**Figure 7**). These plant communities produce a significant litter layer that will accelerate the re-establishment of conifers and other forest vegetation. Along with invasive grasses, these plants also reduce natural aeolian sand and marine nutrient transport that Pink Sand-verbena

relies upon. In addition, the leaves of the hairy cat's ear are very effective at covering the surface of the sand and completely excluding Pink Sand-verbena (**Figure 11**). Although annual habitat maintenance work between 2018 and 2020 at Schooner removed most of the recolonizing invasive grasses from the restored areas, no work was done to address the scouring rush / hairy cat's ear community until February 2021. This was because the establishment and density of this community was unanticipated, scouring rush is a native species with a reputation for benefiting from disturbance and any initiative to remove additional species required updates to our impact assessment including engagement of the Tla-o-qui-aht First Nation. Since 2021, Parks Canada has been active in removing this community along with invasive grasses that have re-established in the previously restored areas.

Although Pink Sand-verbena populations have declined (**Figure 2**), occurrences of the species continue to be observed at Schooner (**Figure 7**) and Wickaninnish (**Figure 5**) where work has been performed regularly to maintain restored habitat. At Clo-oose and Keeha where maintenance work has been less frequent, Pink Sand-verbena has not been observed since 2019 and 2017 respectively (**Figure 4** and **Figure 6**).

Figure 11. Photographs of the community of scouring rush (*Equisetum hyemale*) and invasive hairy cat's ear (*Hypochaeris radicata*) that established within the restored habitat at Schooner and has excluded Pink Sand-verbena from areas that were initially highly productive. (a) A photo from fall 2017 with dense community of scouring rush, invasive hairy cat's ear and beach grass in the foreground with the sandy and newly restored area in the background that supported over 700 Pink Sand-verbena. (b), (c) & (d) Typical dense patches of scouring rush community. (e) Hairy cat's ear

leaves spreading on the sand surface and excluding any opportunity for Pink Sand-verbena to germinate.

Multi-Species Action Plan for Pacific Rim National Park Reserve of Canada

In 2017, Parks Canada published the *Multi-species Action Plan for Pacific Rim National Park Reserve of Canada.* The plan took a holistic approach, incorporating all species at risk in Pacific Rim National Park Reserve that required an action plan under s.49 of SARA. Actions that are beneficial to multiple species at risk were identified and prioritized, to maximize the effectiveness of species at risk recovery efforts in PRNPR. This action plan addresses SARA-listed species, including the Pink Sand-verbena plant, that regularly occur in Pacific Rim NPR and require an action plan under SARA (s.47). It also includes other species of conservation concern. Progress towards meeting recovery actions can be found in the *Implementation Report: Multi-species Action Plan for Pacific Rim National Park Reserve of Canada (2017 – 2022)*.

References and Literature Associated with implementation of the Recovery Strategy for the Pink Sand-verbena (*Abronia umbellata*) in Canada

Baker, T., R.G. Vennesland, P. Lawn, and M. Collyer (Eds.). 2018. Restoration of Coastal Sand Ecosystems on the Coast of British Columbia – Symposium Proceedings. February 27, 2018. Victoria, B.C. Report prepared for the Parks Canada Agency, Vancouver, B.C. 14 pp. + Appendix (115 pp.). http://www.sccp.ca/sites/default/files/species-habitat/documents/Baker%20et%20al.%202018.%20Restoration%20of%20CSE%20on%20the%20Coast%20of%20BC%20-%20Symposium%20proceedings%20-%2017April2019.pdf

Blue Ant Media. 2020. "Vancouver Island." Undiscovered Vistas, Season 2 (2020), Episode 6, Vancouver Island. Love Nature, Retrieved 2023-01-25 from Prime Video https://www.primevideo.com/detail/0JTDRFX9UFJT6Z4MK31H3K9HOY/ref=atv_dp_season_select_s2

COSEWIC 2004. COSEWIC assessment and status report on the pink sand-verbena *Abronia unbellata* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vii + 19 pp. https://species-registry.canada.ca/index-en.html#/documents/502

Fairbarns, M.D., C. Webb, L.K. Blight, N. Page, B. Costanzo, T. Kaye, T. Lea and J. McIntosh. 2007. Recovery Strategy for the Pink Sand-verbena (*Abronia umbellata*) in Canada (Final). *Species at Risk Act* Recovery Strategy Series. Parks Canada Agency. Ottawa. v + 21 pp. https://species-registry.canada.ca/index-en.html#/consultations/1121

Fairbarns, M. 2007. Pink Sand-verbena (*Abronia umbellata*) - 2006-7 Recovery Activities. Unpublished report to the Parks Canada Agency, Vancouver, BC

FlorianFlim. 2023. CANADAS NATIONALPARKS SEASON 3. https://florianfilm.de/en/films/kanadas-nationalparks-staffel-3

Maslovat, C. 2007. Translocation Plan for Pink Sand-verbena (*Abronia umbellata*) in Canada. Unpublished report to the Parks Canada Agency, Vancouver, BC.

Page, N., P. Lilley, I.J. Walker and R.G. Vennesland. 2011. Status report on coastal sand ecosystems in British Columbia. Report prepared for the Coastal Sand Ecosystems Recovery Team. vii + 83 pp.

Parks Canada Agency. 2016. Explanation for issuing permit (PRN-2016-23157) pursuant to the provisions of section 74 of SARA - Pink Sand-verbena. https://species-registry.canada.ca/index-en.html#/permits/2264-1

Parks Canada Agency. 2017. Multi-species Action Plan for Pacific Rim National Park Reserve of Canada - Species at Risk Act Action Plan Series. Parks Canada Agency, Ottawa. v + 29 pp. https://species-registry.canada.ca/index-en.html#/consultations/3059

Parks Canada Agency. 2018a. Report on the Implementation of the Recovery Strategy for the Pink Sand-verbena (Abronia umbellata) in Canada (2007 – 2017). Parks Canada Agency, Ottawa. 5 pp. https://species-registry.canada.ca/index-en.html#/documents/3312

Parks Canada Agency. 2018b. "Cheewhat Sand Dune Restoration - Pacific Rim National Park Reserve". *YouTube,* uploaded by Parks Canada Agency, Feb. 21, 2018, https://www.youtube.com/watch?v=0UQ7-0QtYMQ

Parks Canada Agency. 2019. "Coastal sand dune restoration in Pacific Rim National Park Reserve" . *YouTube,* uploaded by Parks Canada Agency, May 4, 2019, https://www.youtube.com/watch?v=EgHCHbk-EjE

Parks Canada Agency. 2021. Pink Sand-verbena (Abronia umbellata), Pacific Rim National Park Reserve. https://parks.canada.ca/pn-np/bc/pacificrim/nature/~/link.aspx?_id=143389AE9AE247FCAE0277034DE440B5&_z=z

Redd Fish Restoration Society. 2022. Schooner Cove. https://reddfish.org/schooner

Rutherford, A. 2019. Sand Dune Interpretive Signs Design Report. Unpublished draft report. Parks Canada Agency, Ucluelet, BC. 45 pp.

Schwartz, C. 2019. Pink Sand-verbena Population Viability Modeling. Unpublished draft report. Parks Canada Agency, Ucluelet, BC. 11 pp.

Van Natto, A. C. 2020. Effects of peripherality and hybridization on range-wide genetic structure of the coastal dune plant Abronia umbellata (Nyctaginaceae). Masters thesis, Queen's University. 104 pp.