Antipodia atralba
(Diamond Sand Skipper Butterfly)

A Consolidation of Population and Distribution Reports

Adelaide Metropolitan and Fleurieu Coast Region

Report Prepared for Green Adelaide Board
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Summary

This report is a consolidation of *Antipodia atralba* (Diamond Sand Skipper Butterfly) population and distribution documents and specific population monitoring in Marino Conservation Park from 2021 to 2024.

The distribution of *Antipodia atralba* has increased, with a population discovery (2022) at Myponga Beach on the Fleurieu coast including a translocation to Aldinga Beach, however one known population at Carrickalinga North appears to have become extinct.

The butterfly is known from six coastal metropolitan sites; Marino Conservation Park, Hallett Cove Conservation Park, Hallett Cove Headland Reserve, Port Stanvac Coastal heath, Tingira Reserve and Moana South and four coastal Fleurieu sites; Myponga beach, Cape Jervis, Land's End and Newland Head Conservation Park.

This report provides an updated coastal mini Management Plan (Appendix 1) and Sedgeland Management Plan for the butterfly (Appendix 2).

Introduction

The Metropolitan Adelaide and Northern Coastal Action Plan (2009) and the Southern Fleurieu Coastal Action Plan (2007) both identify the butterfly *Antipodia atralba* as a species of conservation significance. The Adelaide Metropolitan and Fleurieu Coast Rapid Butterfly Assessment (Stolarski 2020), further identifies and discusses *Antipodia atralba* at sites across coastal metropolitan Adelaide and the Fleurieu Peninsula. Whilst the knowledge and information available in these reports is relatively comprehensive, it may not identify all current populations and distributions of this species across coastal metropolitan Adelaide and Southern Fleurieu coast.

The surveys undertaken for *Antipodia atralba* during 2021 found that the butterfly has variable population densities and patchy distributions across its range confined to areas containing *Gahnia lanigera* plants. Intra-site use of *Gahnia lanigera* plants is variable and inter-site connectivity is limited or absent due to habitat alterations and urban developments.

Historic records of the butterfly were examined, and the following locations were surveyed; Kingston Park, Seaford, Maslin's Beach, Port Willunga, Snapper Point, Aldinga Beach, Silver Sands and Sellick's Beach, however the butterfly was not found present.

Furthermore, due to habitat alterations through urban developments, *Gahnia lanigera* plants were not found at Seaford, Maslin's Beach, Port Willunga, Snapper Point, Silver Sands and Sellick's Beach (Fig. 1).

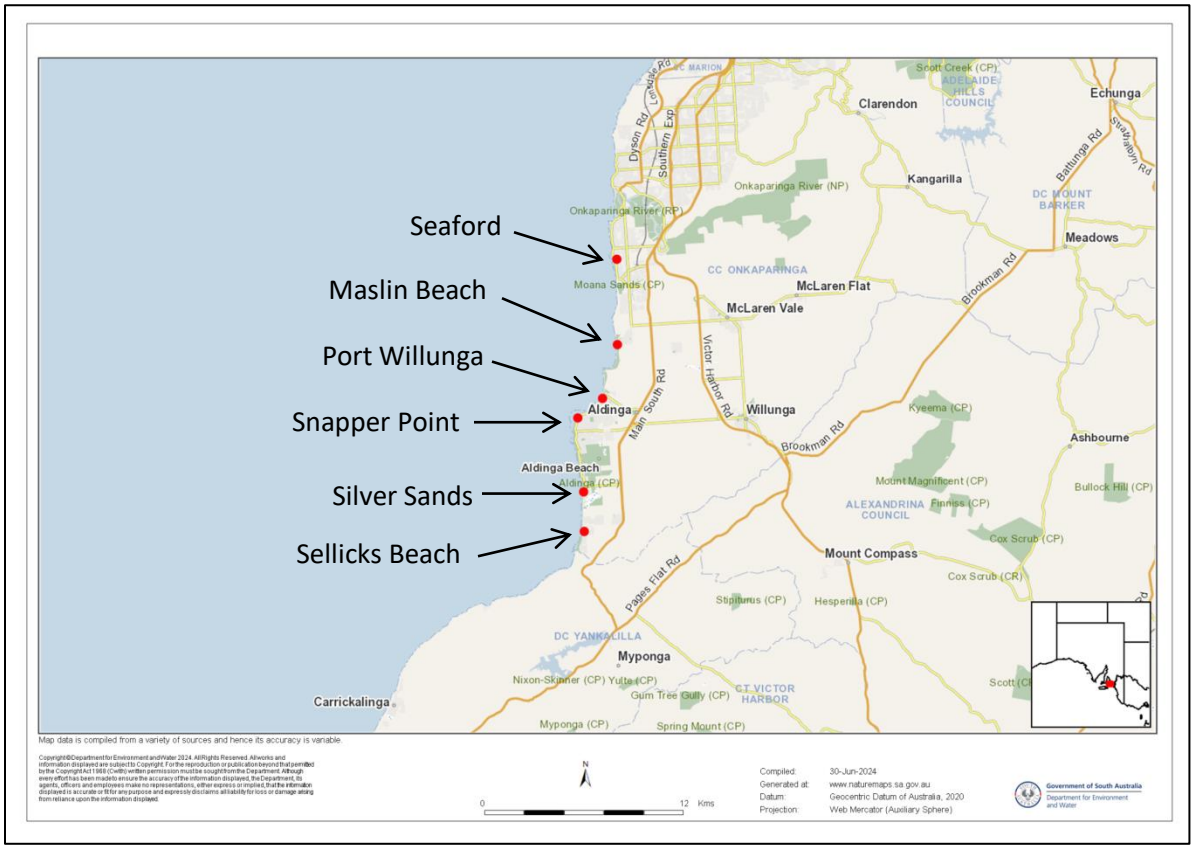

Figure 1. Historic *Antipodia atralba* metropolitan sites.

Additional *Antipodia atralba* surveys undertaken post 2021 now provide evidence of the butterfly at the following locations: Marino Conservation Park, Hallett Cove Conservation Park, Hallett Cove Headland Reserve, Port Stanvac Coastal Reserve, Tingira Reserve and Moana South in Adelaide's southern metropolitan coast. Additionally Kingston Park and Aldinga Beach supports *G. lanigera* habitat (Fig. 2).

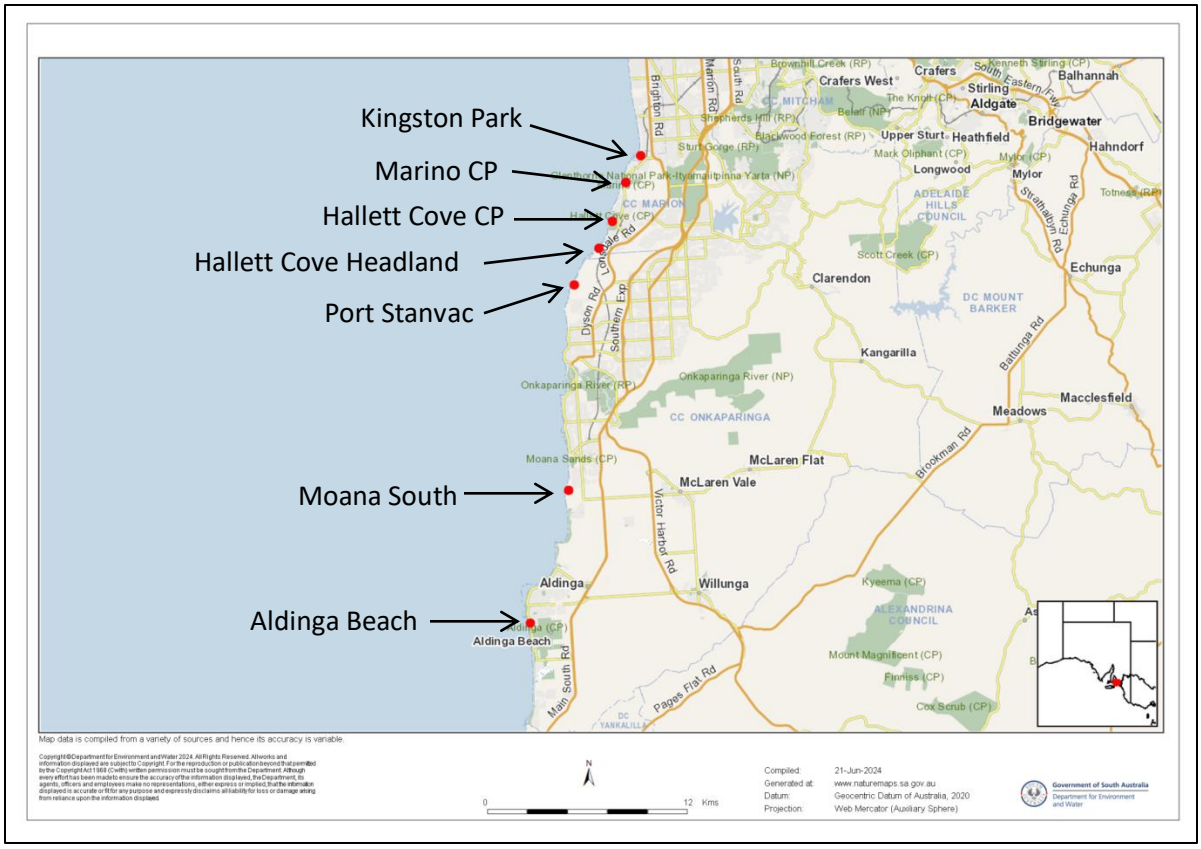

Figure 2. Metropolitan sites supporting *Gahnia lanigera*.

The coastal Fleurieu Peninsula occupancy areas now include Myponga Beach, Carrickalinga North, Cape Jervis, Land's End and Newland Head Conservation Park.

Marino Conservation Park butterfly populations have been subject to bi-annual surveys post December 2020 fires that reduced the habitat by approximately 50%. The post fire *Gahnia lanigera* regrowth and subsequent habitat use by *A. atralba* is being monitored.

A. atralba utilises *Gahnia lanigera* (Desert Saw-sedge) as its larval host plants in coastal areas. This means that the butterfly species is totally dependent upon the presence of this plant for its survival.

G. lanigera propagation by the South Australian Seed Conservation Centre has proven to be quite difficult with very low success rates of approximately 10. The propagation techniques need to be better understood in order to increase germination rates to provide sufficient plants for habitat maintenance and restoration as this is the key to securing the future of the butterfly.

Antipodia atralba (Diamond Sand Skipper)

Antipodia atralba (Diamond Sedge Skipper Butterfly) (Fig. 3 & 4) has a disjunct distribution along the southern half of the metropolitan coastline from Marino Conservation Park to Moana South and Fleurieu Peninsula from Myponga Beach to New Headlands Conservation Park.

The adult butterfly is dark brown with several white spots on each fore wing. There is a suffused cream patch on each hind wing. The males also have a black line near the centre of the upper surface of each forewing. The butterfly has two distinct flight periods and can be observed flying during spring and autumn. Butterflies nectar on flowers mid-morning and late afternoon and are likely to be encountered at that time. The average wingspan is 30 mm. This butterfly is very localized and restricted to coastal heath areas where its larval food plant, *G. lanigera*, grows in sufficient densities. Populations within and between sites fluctuate in densities as a response to the availability of fresh *G. lanigera* leaves on which the butterfly's larvae feed. The butterfly is very responsive to post fire plant growth and often attains large population numbers following such events. (A. Stolarski, *pers. obs*.).

Figure 3. Female upperside. Photo: Matt Endacott

Figure 4. Female underside. Photo Matt Endacott

Methodology

The presence of the butterfly at sites is ascertained by locating larval shelters that either contain larvae, pupae or fresh exuviae (empty pupa cases) on *G. lanigera*, the larval food plant (Fig. 5 & 6).

After initial site inspections to establish *G. lanigera* presence, a general search of the area was conducted to determine locality of the larval shelters. Sites with larval shelters present were surveyed using quadrants measuring approximately 1000 m^2 in which systematic and detailed searches of the *Gahnia lanigera* plants were carried out to determine the number of active shelters present. Located shelters were carefully opened to examine contents and to determine if such would form part of the count. The survey focused on shelters containing mature pre-pupal larvae, pupae and fresh exuviae with eggs and live adults being noted. GPS coordinates of the quadrants using WSG84 datum were recorded for mapping and data analysis. The location of GPS points is central to each quadrant and chosen to encompass the greatest density of *G. lanigera* plants.

Figure 5. Mature larval/pupal shelter.

Figure 6. Empty pupa in shelter.

Metropolitan Survey Sites

Kingston Park Reserve

Kingston Park Reserve survey site is located within a small, secluded gully area containing small numbers of remnant *G. lanigera* plants. The site faces west to St. Vincent's Gulf and is otherwise surrounded by suburban development with no coastal connectivity to other sites containing *G. lanigera* (Fig. 7 & 8).

Figure 7. Kingston Park Reserve.

Figure 8. Kingston Park Reserve habitat.

The survey on the 25th March 2021 found no evidence of the butterfly. Kingston Park contains only a small number of mature *G. lanigera* plants. The small numbers of plants present in the more open habitat of the site are unlikely to sustain a butterfly population. Further opportunistic site visits during 2022-2023 did not find any evidence of the butterfly's presence. The site provides an opportunity to increase *G. lanigera* plantings and enhance the exiting habitat by reducing the volume of vegetation encroachment onto existing larval host plants.

Table 1: *Kingston Park A. atralba data, June 2021.*

Kingston Park	GPS Coordinate	Larvae shelters	Pupae shelters	Old shelters	Exuviae shelters
Site A	35 02 21S, 138 30 60E	-	-	-	-

Marino Conservation Park

The survey on the 24th March 2021, within the park found to contain the most extensive *G. lanigera* stands in the western heath area (Fig. 9). This heath area suffered a fire during December 2020 that resulted in the main body of this section being burnt (Fig 15). The remaining heath sections must remain unburnt until such time as the burnt area recovers adequately for the butterfly to breed again. The butterfly is very responsive to post fire plant growth and often attains large population numbers following such events, however the time taken for this to occur depends on the plant regrowth quality. All quadrant survey areas displayed a uniform dispersion of active shelters containing pupae and no area seemed to be favoured. The presence of the butterfly was

in site D and site E containing 5 shelters each and site B containing 6 shelters.

Additional bi-annual *A. atralba* population surveys have been undertaken to track population numbers and their movements in the post fire regrowth *G. lanigera* plants. Detailed information is presented in the "*Marino Conservation Park Monitoring"* section of this report (Page 28).

Figure 9. Marino Conservation Park survey sites map.

Site A: Located in the eastern part of the conservation park, this area supports scattered *G. lanigera* plants growing in an open grass setting. Because of post fire, high grass overgrowth has occurred amongst *Gahnia* plants creating an unsuitable environment for *A. atralba* butterflies. Post fire slashing was implemented resulting in some *G. lanigera* plants being damaged. The survey found no larval shelters in this area (Fig. 10).

Site B: Located in the northwestern part of the conservation park, this area supports scattered *G. lanigera* plants present in mixed heath type vegetation. This area avoided being burnt in December 2020 with 5 larval shelters found during the survey (Fig. 11). This area continues to support the butterfly with seasonal population fluctuation observed.

Figure 10. Site A, Marino Conservation Park.

Figure 11. Site B, Marino Conservation Park

Site C: Located in the central west part of the conservation park, this area was burnt in December 2020. Basal *G. lanigera* regrowth was evident during the time of survey on the 24th March 2021 (Fig. 12). The quality of *G. lanigera* regrowth is noted as variable across this area with some plants being more suitable for use by the butterfly.

Site D: Located in the southwest part of the conservation park this area avoided the December 2020 fire. The area supports good stands of *Gahnia lanigera* plants (Fig. 13). The surveyed quadrant area found 5 active shelters containing pupae.

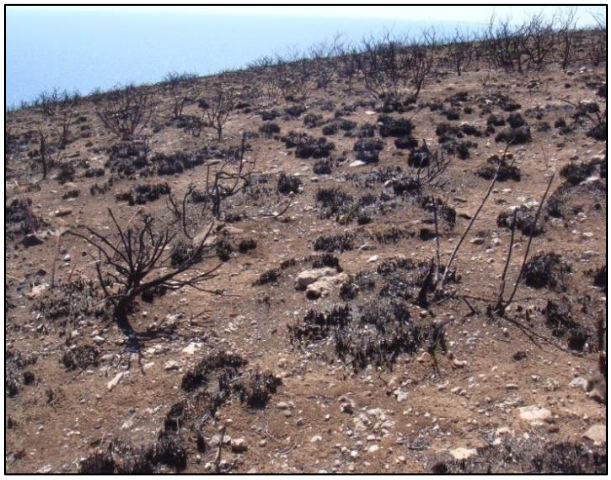

Figure 12. Site C, Marino Conservation Park.

Figure 13. Site D, Marino Conservation Park.

Site E: Located in the southwest part of the conservation park this area avoided the December 2020 fire. The surveyed quadrant area found 5 active shelters containing pupae. This area encompasses a variety of heath vegetation encroached by grasses to the east of the site that may overgrow the *G. lanigera* plants in the future (Fig.14).

Figure 14. Site E, Marino Conservation Park.

Figure 15. Burnt area marked red.

Table 2: *Marino Conservation Park A. atralba data, June 2021.*

Marino Conservation Park	GPS Coordinates	Larvae shelters	Pupae shelters	Old shelters	Exuviae shelters
Site A	35 03 06S, 138 30 55E	-	-	-	-
Site B	35 03 05S, 138 30 29E	-	5	-	1
Site C	35 03 10S, 138 30 29E	-	-	-	-
Site D	35 03 13S, 138 30 26E	-	5	-	-
Site E	35 03 16S, 138 30 26E	-	5	-	-

Hallett Cove Conservation Park

Surveyed on the 24th March 2021, Hallett Cove Conservation Park was found to support good stands of *G. lanigera* plants throughout, growing in group formations and restricted to areas of heavier soils. Site A, although containing healthy stands of *G. lanigera* plants contained no evidence of the butterfly's larval activity. Site B displaying similar plant attributes contained one mature larval shelter and 6 old shelters indicating a higher previous use presence of the butterfly (Fig. 16).

Site A: Site A located at the northern area of the conservation park, was found to support *G. lanigera* plants in group formations scattered amongst coastal heath vegetation. Plants groupings are restricted to areas of heavier soils surrounded by sandier areas (Fig. 17).

Figure 16. Hallett Cove Conservation Park.


Figure 17. Site A, Hallett Cove Conservation Park.

Site B: Site B in the central west area of the conservation park, displays similarities to site A. The site contains mature *G. lanigera* stands found in group formations being restricted to heavier soils (Fig. 18).


Figure 18. Site B, Hallett Cove Conservation Park

Table 3: *Hallet Cove Conservation Park A. atralba data, June 2021.*

Hallett Cove Conservation Park	GPS Coordinates	Larvae shelters	Pupae shelters	Old shelters	Exuviae shelters
Site A	35 04 13S, 138 29 55E	-	-	-	-
Site B	35 04 25S, 138 29 49E	1	-	6	-

Hallett Cove Headland Reserve

Surveyed on the 17th March 2021, Hallett Headland Reserve was found to support patchy distributions of *G. lanigera* stands in various coastal exposure positions (Fig. X). Site B, being the largest and most protected from coastal winds, contained 12 pupal shelters within the survey quadrant and is the main population site within the reserve. Site A and Site F both resulted in old shelters being found. All sites within the reserve are located within the butterfly's ability to transect and hence the butterfly may breed in any area provided that the host plants are suitable.

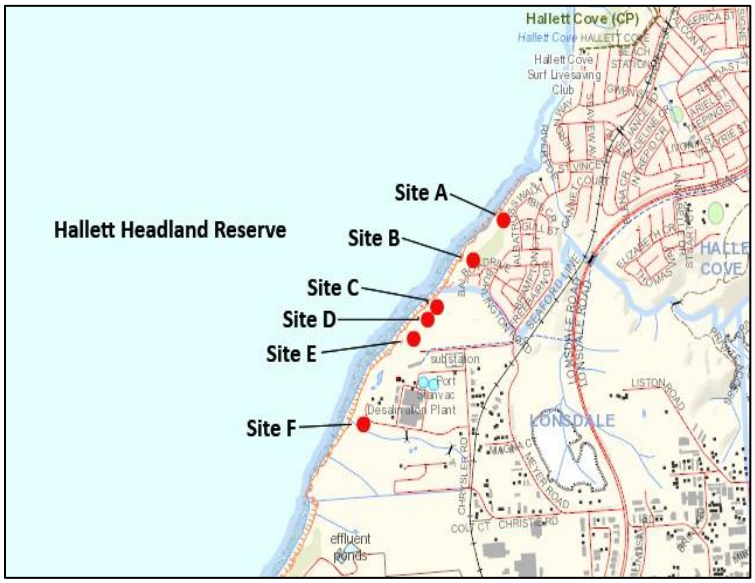

Figure 19. Hallett Cove Headland Reserve.

Site A: Located at the northern end of the reserve, this site contains scattered *G. lanigera* plants growing amongst taller vegetation. Plants grow in heavy, rocky soils and display well-hydrated foliage. No shelters were found in this area (Fig. 20).

Site B: Located central north of the reserve, this site is a narrow strip located between housing to the east and the boardwalk to the west. Good stands of *G. lanigera* are

present growing amongst other low vegetation types. This site contained 12 pupal shelters (Fig. 21).

Figure 20. Site A, Hallett Cove Headland Reserve.

Figure 21. Site B, Hallet Cove Headland Reserve.

Site C: Located in the central part of the reserve, the site displays an isolated small stand of *Gahnia lanigera* plants growing on a slight escarpment facing west. Previous use of the area was evident with one old shelter being found (Fig. 22).

Site D: Located in the central part of the reserve adjacent to site C, site D displays an isolated small stand of *Gahnia lanigera* plants growing on a slightly rocky escarpment facing west. Plants display well-hydrated foliage and low dry leaf matter, however no larval shelters were found (Fig. 23).

Figure 22. Site C, Hallett Cove Headland Reserve.

Figure 23. Site D, Hallett Headland Reserve.

Site E: The site known as the "knoll" within the reserve is an exposed site subjected to coastal elements (Fig. 24). The site contains good stands of *G. lanigera* plants both on

the slopes of the knoll as well as the knoll plateau. Plants are restricted to the heavier soils within the site and decline to the east of the area due to sandier soils. The site contains low wind-swept vegetation cover, with *G. lanigera* plants scattered throughout. No shelters were found.

Site F: Located at the southern end of the reserve and to the south of Adelaide's desalination plant, the site is exposed to coastal elements (Fig. 25). The site contains good stands of *G. lanigera* within the wind-swept low heath vegetation with one old shelter found.

Figure 24. Site E, Hallett Headland Reserve.

Figure 25. Site F, Hallett Headland Reserve.

Table 4: *Hallett Cove Headland Reserve A. atralba data, June 2021.*

Hallett Cove Headland Reserve	GPS Coordinates	Larvae shelters	Pupae shelters	Old shelters	Exuviae shelters
Site A	35 05 16S, 138 29 27E	-	-	-	-
Site B	35 05 22S, 138 29 17E	-	12	-	-
Site C	35 05 31S, 138 29 09E	-	-	1	-
Site D	35 05 32S, 138 29 09E	-	-	-	-
Site E	35 05 36S, 138 29 03E	-	-	-	-

Hallett Cove Headland Reserve	GPS Coordinates	Larvae shelters	Pupae shelters	Old shelters	Exuviae shelters
Site F	35 05 51S, 138 28 50E	-	-	1	-

Port Stanvac Coastal Reserve

Surveys of Port Stanvac Coastal Reserve were undertaken during 2022-2023 for *G. lanigera* and *A. atralba* (Fig. 26). This relatively intact remnant coastal heath system was found to support the largest *G. lanigera* stands and *A. atralba* population in the metropolitan coast (Fig. 27 & 28).

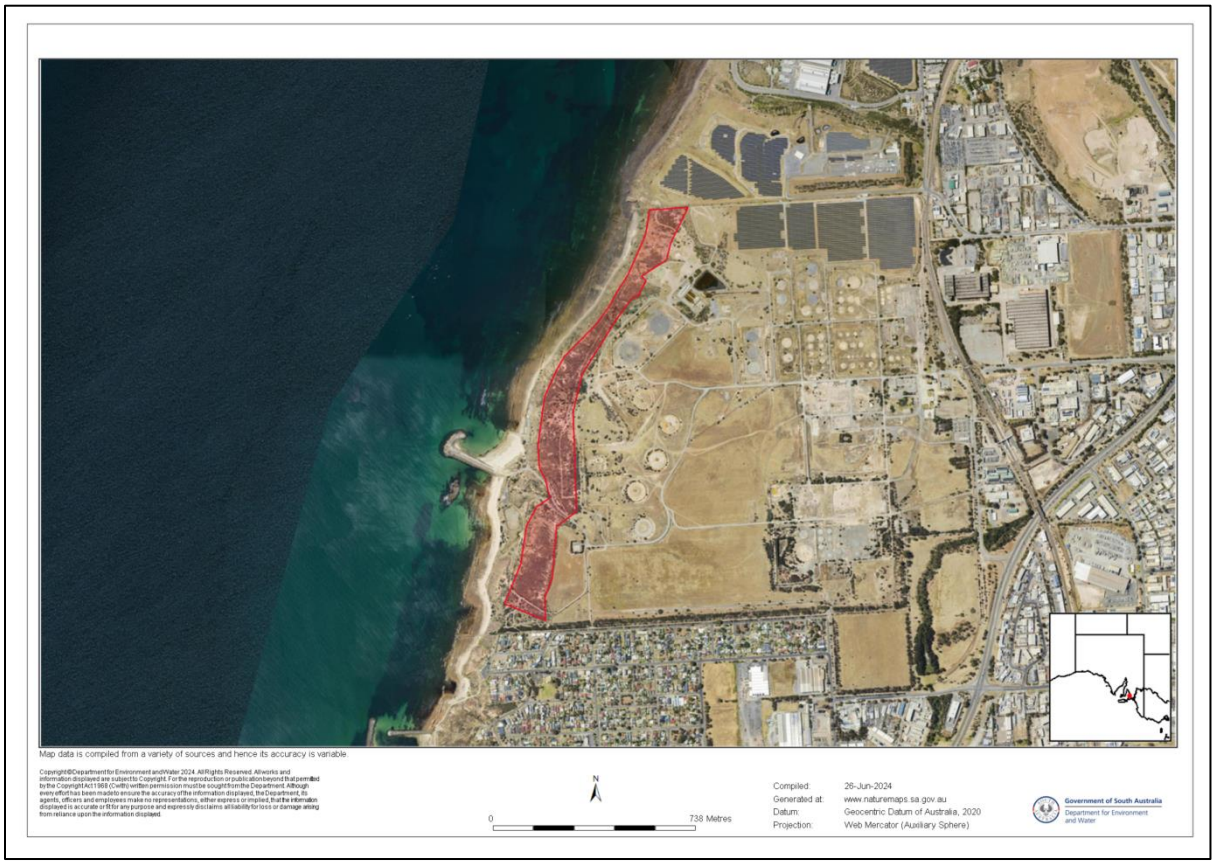

Figure 26. Port Stanvac coastal heath, outlined in red.

The *A. atralba* population size provided an opportunity for translocations of the butterfly to Aldinga Beach which was undertaken in April 2024 with outcomes yet to be determined.

The heath area also supports *Neolucia agricola agricola* (Fringed Heath Blue) butterfly, an dditional species of coastal conservation significance in the metropolitan coast.

Formal habitat protection is recommended for ensuring the butterfly species protection.

Figure 27. *Gahnia lanigera* habitat, Port Stanvac Heath.

Figure28. *Gahnia lanigera* habitat, Port Stanvac Heath.

Tingira Reserve

Tingira reserve is located at O'Sullivan's Beach and contains patchy distributions of *G. lanigera* stands growing in the heavier soil areas of the site. The site is exposed to coastal elements (Fig. 29).

Surveyed on the 17th March 2021, Tingira Reserve area contained 2 mature larval shelters and 5 old shelters. The shelters within the quadrant were in areas protected from the coastal elements (Fig. 30).

The site provides suitable soil parameters for *G. lanigera* plantings to occur to enlarge the habitat and strengthen the local population.

Figure 29. Tingira Reserve.

Figure 30. Site A. Tingira Reserve.

Table 5: *Tingira reserve A. atralba data, June 2021.*

Tingira Reserve	GPS Coordinate	Larvae shelters	Pupae shelters	Old shelters	Exuviae shelters
Site A	35 13 05S, 138 28 12E	2	-	5	-

Moana South

Site A was surveyed on the 17th April 2021 with 40 shelters being located all containing fresh exuviae. The extensive and suitable quality *G. lanigera* stands in this area result in the highest shelter numbers being located. Sites B and C were surveyed on the 25th March 2021 with 33 shelters located containing pupae at Site B and 25 shelters located containing pupae at Site C. Moana South coastal reserve area support the second highest butterfly population numbers along the Adelaide metropolitan coast. Multiple shelters were located on many single plants at all three sites with the highest count being 14 shelters found on a single plant in Site A (Fig. 31).

Figure 31. Moana South.

Site A: Located to the south of Moana Sands Conservation Park, this narrow stretch of coastal reserve contains very extensive *G. lanigera* stands. Although located between the coastal escarpment and suburban housing, and exposed to coastal elements the survey quadrant contained 40 shelters (Fig 32).

Site B: Located to the south of site A, this site contained patchy *G. lanigera* stands within the more protected confines of the gully. *G. lanigera* plants were also found growing in an open position of grassy settings surrounded by sparse heath vegetation (Fig 33).

Figure 32. Site A, Moana South.

Figure 33. Site B, Moana South.

Site C: Located adjacent to site B, *G. lanigera* plants were also found growing in an

open position of grassy settings surrounded by sparse heath vegetation (Fig 34).

Figure 34. Site C, Moana South

Table 6: *Moana South A. atralba data, June 2021.*

Moana South	GPS Coordinates	Larvae shelters	Pupae shelters	Old shelters	Exuviae shelters
Site A	35 12 56S, 138 28 18E	-	-	-	40
Site B	35 13 06S, 138 28 11E	-	25	-	-
Site C	35 13 05S, 138 28 12E	-	33	-	-

Aldinga Beach

Surveyed on the 25th March 2021 (Fig 35), site A displayed extensive stands of *G. lanigera* plants growing in an exposed coastal environment. Plants displayed burnt leaf tips and high volumes of dry leaf matter. No shelters were located. Site B displayed sporadic occurrences of *G. lanigera* plants and no shelters were located.

Figure 35. Aldinga Beach

Site A: Located to the north of the boat ramp, this site is fully exposed to coastal elements. The *G. lanigera* stand is extensive and forms the dominant vegetation type in this area. Plants are found to be growing in shallow sand over heavier soils (Fig. 36).

Site B: Located to the south of the boat ramp, this site is fully exposed to coastal elements. *G. lanigera* has a sporadic presence along the western facing escarpment associated with wind swept low heath vegetation fully exposed to coastal elements (Fig. 37).

Figure 36. Site A, Aldinga Beach.

Figure 37. Site B, Aldinga Beach.

Table 7: *Aldinga Beach A. atralba data, June 2021.*

Aldinga Beach	GPS Coordinates	Larvae shelters	Pupae shelters	Old shelters	Exuviae shelters
Site A	35 16 18S, 138 26 42E	-	-	-	-
Site B	35 17 27S, 138 26 45E	-	-	-	-
Site C	35 17 19S, 138 26 43E	-	-	-	-

Fleurieu Peninsula Survey Sites

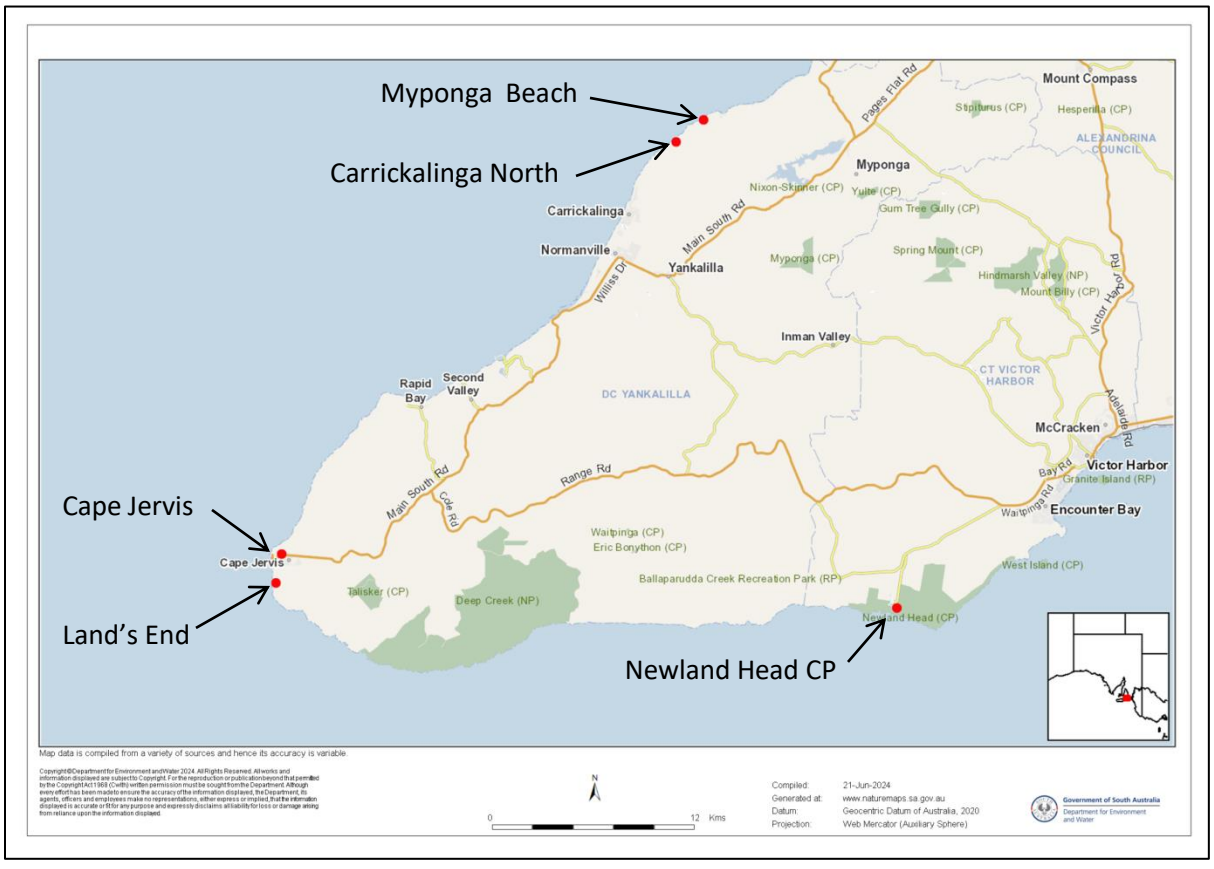

Figure 38. Fleurieu Peninsula sites.

Myponga Beach

During November 2022 surveys of the greater Myponga Beach area for the butterfly *Lucia limbaria* (Chequered Copper), *G. lanigera* stands were found present along the crown land coastal section (Fig 39). These stands were located on Stacey's property at site A (-35.37454, 138.37484) and site B (-35.37576, 138.37278). This coastal section is subject to stock and kangaroo grazing pressures, however these appear to be patchy and isolated allowing for the majority of *G. lanigera* plants to remain in suitable condition for butterfly use.

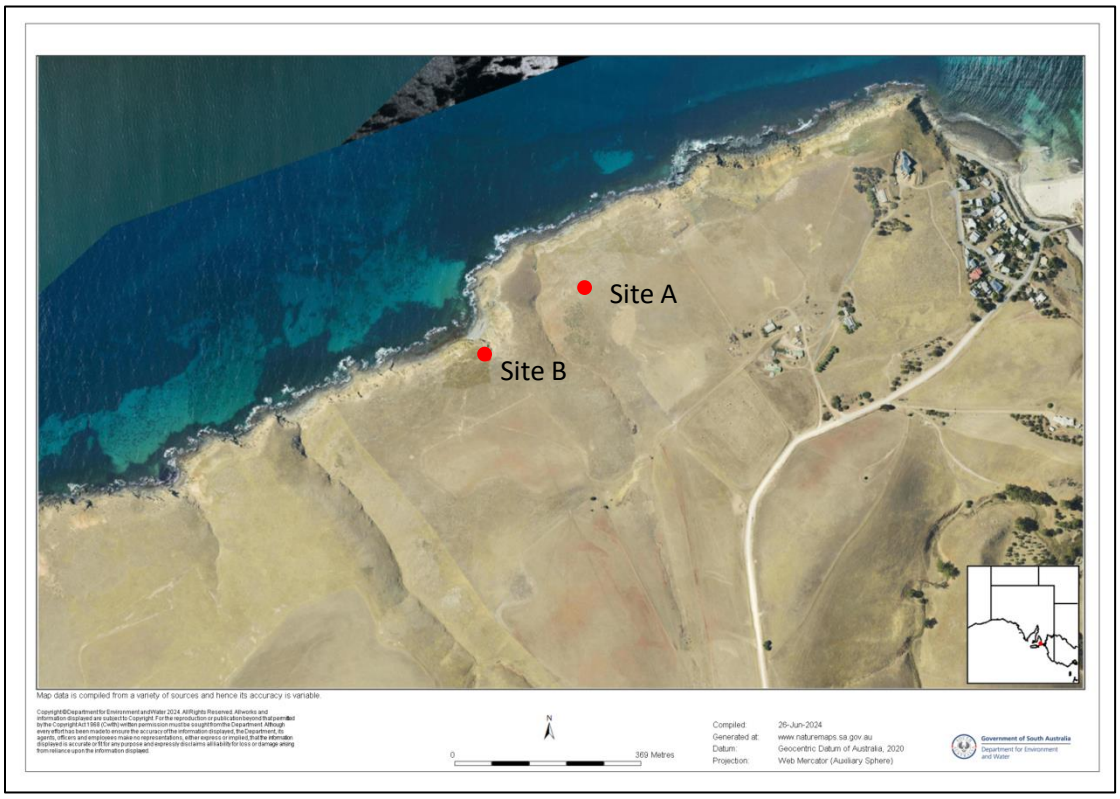

Figure 39. *Gahnia lanigera* areas, Stacey property, Myponga Beach.

Site A was found to support a small number of *G. lanigera* as isolated patches in heavily altered grassland system (Fig. 40). No evidence of the butterfly was found.

Site B was found to support extensive areas of suitable *G. lanigera* stands with numerous active larval shelters of the butterfly *A. atralba*. This site represents another isolated *A. atralba* population along the coastal Fleurieu Peninsula (Fig. 41).

Figure 40. Site A, *Gahnia lanigera* habitat.

Figure 41. Site B, *Gahnia lanigera* habitat.

Carrickalinga North

During November 2022 surveys for *L. limbaria* the known population and habitat of *A. atralba* on Carri property was assessed. The survey found *G. lanigera* stands at site A (-35.38602, 138.35602) and Site B (-35.38711, 138.35324) with evidence suggesting that *A. atralba* is not present, despite suitable habitat (Fig 42 - 45). This finding indicates that a population has likely diminished. A follow up survey is recommended in the near future to determine if this outcome has been temporary or permanent.

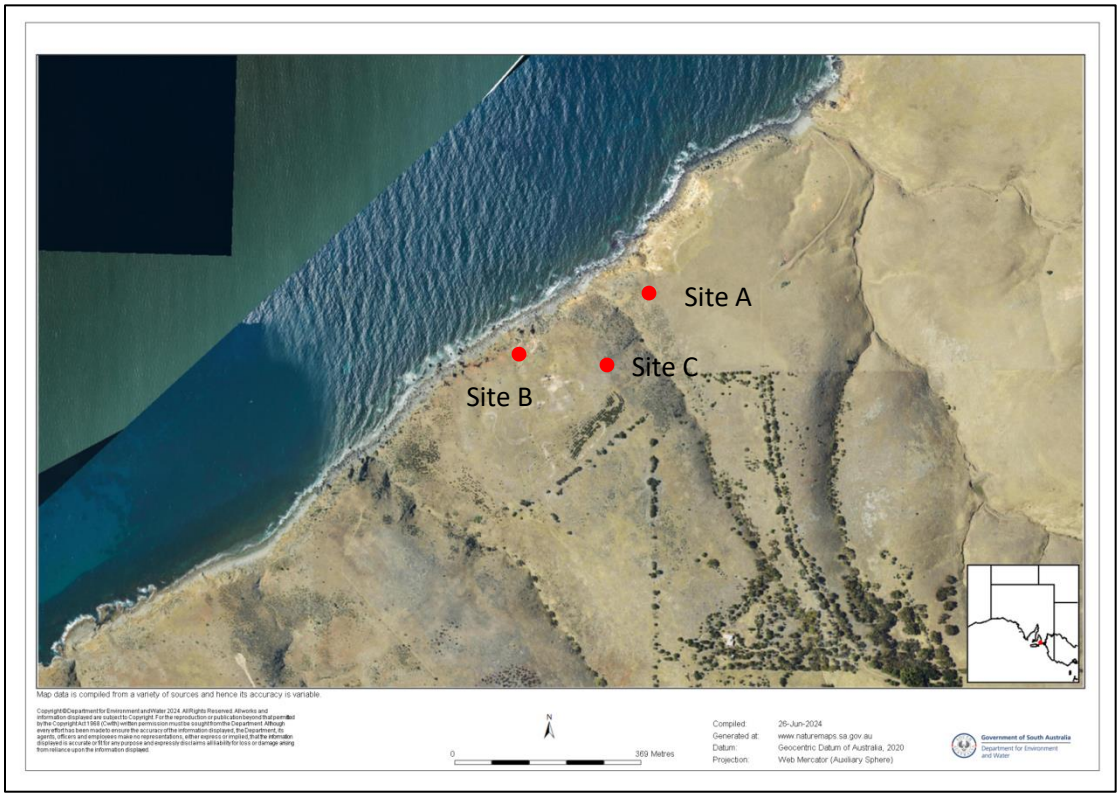

Figure 42. *Gahnia* areas, Carri property, Carrickalinga North.

The same surveys undertaken during November 2022 for *L. limbaria* also found *Gahnia deusta* stands in one section on Carri property at site C (-35.38732, 138.35509). *Gahnia deusta* a larval host plant used extensively in the mallee areas of South Australia by *A. atralba* was not found to support larval shelters (Fig. 45).

Figure 43. Site A, *Gahnia lanigera* habitat.

Figure 44. Site B, *Gahnia lanigera* habitat.

Figure 45. Site C, *Gahnia deusta* habitat.

Cape Jervis and Land's End

Cape Jervis sites were surveyed on the 19th April 2021. All survey sites were found to support the butterfly (Fig 46). Site A and B both contained lower numbers of shelters, and this is attributed to small *G. lanigera* plant numbers present. Site A is subject to revegetation works and suffers from grazing and trampling pressures by native animals such as Kangaroos. Site C and D both contained good numbers of shelters, and this is a reflection of extensive *G. lanigera* plants present.

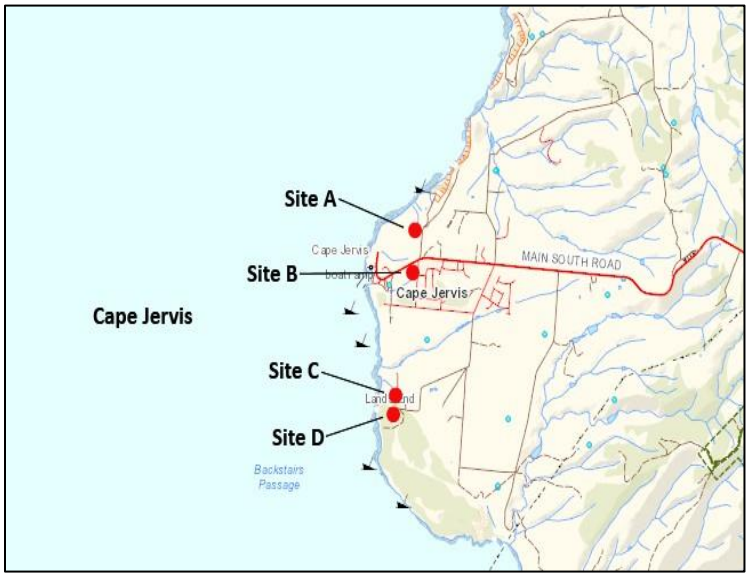

Figure 46. Cape Jervis and Land's End.

Site A: Located to the north of the township, this site contains small stands of *Gahnia lanigera* growing in association with *Lepidosperma sp*. in an open grassland setting (Fig. 47). The survey located 8 shelters.

Site B: Located on the boundary of the township along Fleurieu Avenue, this site faces west and contains small stands of *G. lanigera* plants growing in an open grassland setting (Fig. 48). The survey located 3 shelters.

Figure 47. Site A, Cape Jervis.

Figure 48. Site B, Cape Jervis.

Site C: Located in the Land's End area of Cape Jervis, this site contains extensive healthy *G. lanigera* stands growing in limestone clay and rocky soils (Fig. 49). A semi protected coastal exposure site with low weed invasion was found to support 17 shelters.

Site D: Located adjacent to site C in the Land's End area and displaying same site attributes as site C was found to support 12 shelters (Fig. 50).

Figure 49. Site C, Land's End.

Figure 50. Site D, Land's End.

Table 8: *Cape Jervis and Land's End A. atralba data, June 2021.*

Cape Jervis and Land's End	GPS Coordinate	Larvae shelters	Pupae shelters	Old shelters	Exuviae shelters
Site A	35 36 07S, 138 06 01E	-	-	-	8
Site B	35 36 16S, 138 06 04E	-	-	-	3
Site C	35 37 08S, 138 05 53E	-	-	-	17
Site D	35 37 09S, 138 05 53E	-	-	-	12

Marino Conservation Park Monitoring

Monitoring Summary

Marino Conservation Park supported a strong *A. atralba* population until a fire in December 2020 removed majority of the prime heath, containing the colony. This adverse activity has shown the vulnerability of isolated populations.

Marino Conservation Park heath area was first surveyed in March 2021 post the December 2020 fire and subsequently has been surveyed bi-annually since August 2022.

Unburnt areas located to the north and south within this heathland continue to support majority of the population. *A. atralba* is very responsive to post fire plant growth and will recolonise the burnt areas, however *G. lanigera* regrowth rates and foliage density will determine *A. atralba* recolonization rapidity.

The availability of post-fire *G. lanigera* regrowth is slowly increasing as plants reach suitability for butterfly use. The plants are found variable due to seasonal influences and larval host use is reflected in shelter densities and distributions.

Monitoring results August 2022

The survey undertaken on the 25th August 2022 found the majority of larval shelters (51 out of 54) active within the unburnt *G. lanigera* stands located to the north and south of the regrowth areas (Fig. 51 & 52).

Post-fire regrowth *G. lanigera* is yet to attain suitable foliar density for the ease of larval shelter construction especially by the first instar larvae. It is thought that female butterflies may have oviposited on the regrowth plants and larvae failed to develop due to the inability of silking leaves together. Only three active larval shelters were noticed on the regrowth plants.

As a general observation, *G. lanigera* regrowth plants display sparse and rigid leaves (Fig. 53 & 54). Until such time when higher percentages of larval shelters are found on

regrowth *G. lanigera* plants, remnant areas will require protection from further disturbances.

Overall, the burnt area displays very little weed infestation especially annual grasses creating a well-balanced regrowth site.

Figure 51. Mature *G. lanigera* shelter in red.

Figure 52. Mature vegetation at site (unburnt).

Figure 53. Regrowth *G. lanigera* shelter marked red.

Figure 54. Regrowth vegetation at site.

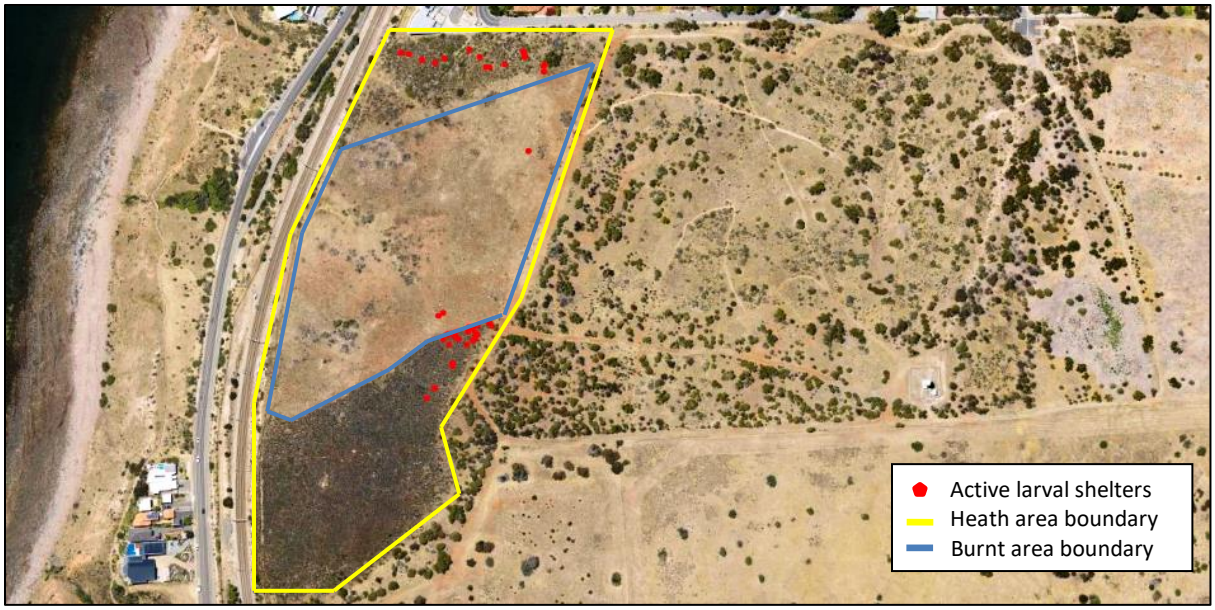

Figure 55. Marino Conservation Park heathland area.

Table 9: *Larval active shelter GPS locations, March 2023.*

Latitude	Longitude	Active shelters	Latitude	Longitude	Active shelters
-35.05377	138.50754	1	-35.05151	138.50853	1
-35.05370	138.50760	2	-35.05206	138.50840	1
-35.05370	138.50761	1	-35.05145	138.50761	2
-35.05355	138.50776	1	-35.05142	138.50769	1
-35.05353	138.50776	1	-35.05136	138.50790	1
-35.05340	138.50788	1	-35.05141	138.50799	1
-35.05337	138.50793	1	-35.05148	138.50804	1
-35.05336	138.50795	1	-35.05148	138.50807	1
-35.05333	138.50797	2	-35.05146	138.50820	5
-35.05327	138.50809	1	-35.05137	138.50836	1
-35.05325	138.50807	1	-35.05138	138.50836	1
-35.05327	138.50797	1	-35.05140	138.50837	2
-35.05332	138.50795	1	-35.05141	138.50837	1
-35.05329	138.50793	1	-35.05147	138.50853	1
-35.05328	138.50790	1	-35.05146	138.50854	1
-35.05331	138.50789	2	-35.05333	138.50777	1
-35.05340	138.50773	1	-35.05333	138.50772	1
-35.05336	138.50768	1	-35.05318	138.50768	1

Latitude	Longitude	Active shelters	Latitude	Longitude	Active shelters
-35.05336	138.50781	1	-35.05320	138.50764	1
-35.05335	138.50779	1	-35.05138	138.50732	1
-35.05332	138.50778	1	-35.05138	138.50733	1
-35.05143	138.50750	2	-35.05139	138.50739	1

Monitoring results March 2023

The survey undertaken on the 15th March 2023 found most of the active shelters (51 out of 58) (Table 10) present within the unburnt *G. lanigera* stands located to the north and south of the regrowth areas.

Post-fire regrowth *G. lanigera* is yet to achieve suitable foliar density for the ease of larval shelter construction, especially by the first instar larvae. It is thought that female butterflies may oviposit on the regrowth plants however larvae failed to develop due to the inability of silking leaves together. Only six active larval shelters were found on the central ridgeline area and one on the southern unburnt boundary.

The unburnt *G. lanigera* stands continue to provide suitable habitat and are favoured as larval host plants (Fig. 56 & 57).

As a general observation, *G. lanigera* regrowth plants are displaying sparse and rigid leaves. Majority of plants are displaying significant water stress (Fig. 58 & 59).

Until such time as higher numbers of larval shelters are found on regrowth *G. lanigera* plants remnant areas will require protection from further disturbances.

Overall, the burnt area displays very little weed infestation, especially annual grasses which are creating a well-balanced regrowth site.

Figure 56. Unburnt *G. lanigera* shelters circled red.

Figure 57. Mature vegetation at site (unburnt).

Figure 58. Regrowth *G. lanigera* shelters circled red.

Figure 59. Regrowth vegetation at site.

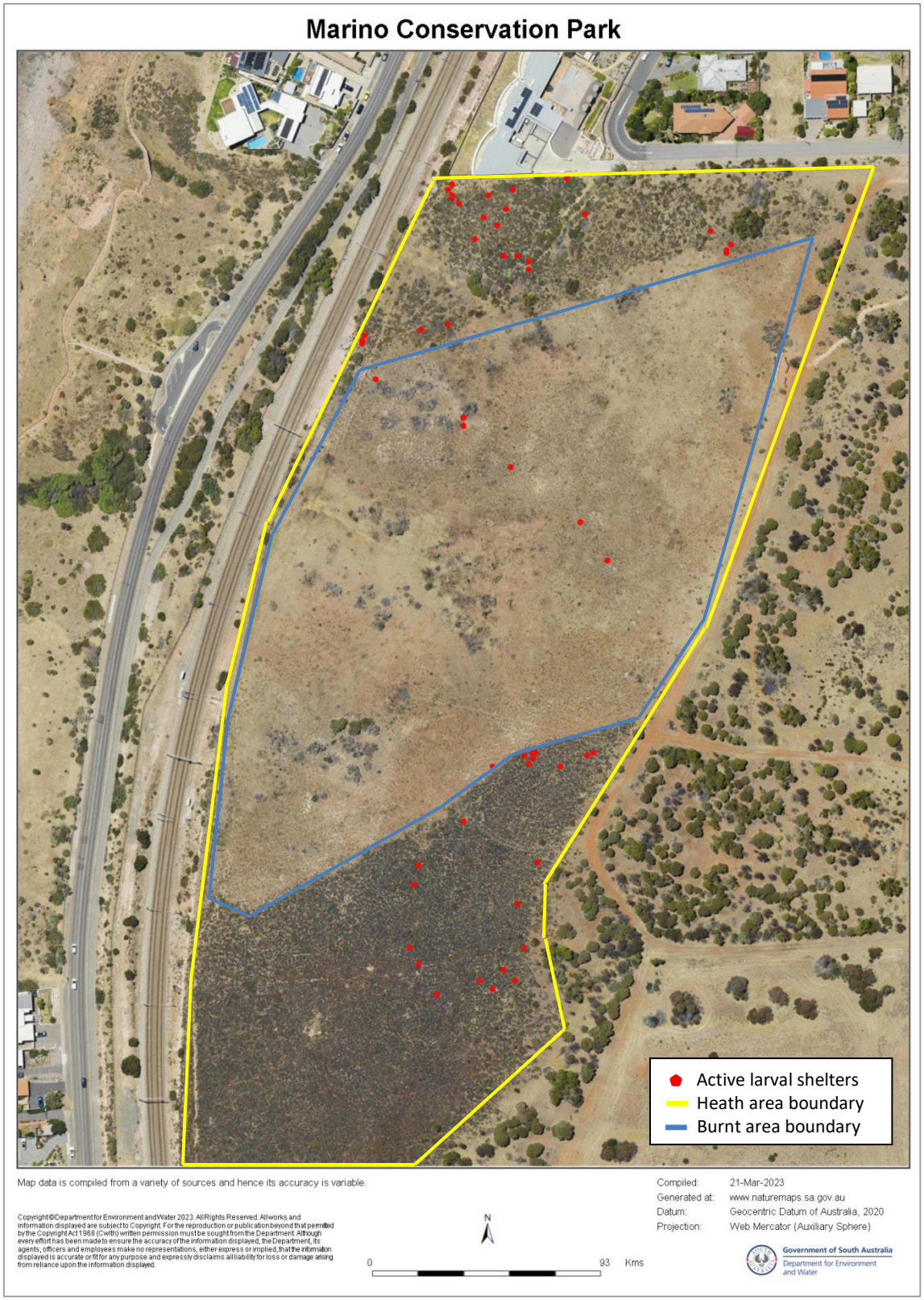

Figure 60: Marino Conservation Park heathland area.

Table 10: *Larval active shelter GPS locations, March 2023.*

Latitude	Longitude	Developmental Stage	Latitude	Longitude	Developmental Stage
-35.0515	138.50853	Pupa	-35.05265	138.50798	Larva
-35.05153	138.50851	Pupa	-35.05335	138.50792	Larva
-35.05152	138.50851	Pupa	-35.05336	138.50789	Pupa
-35.05145	138.50844	Pupa	-35.0534	138.50777	Pupa
-35.05139	138.50788	Pupa	-35.05335	138.50766	Pupa x2
-35.05126	138.5078	Pupa	-35.05335	138.50765	Pupa
-35.0513	138.50756	Pupa	-35.05337	138.50765	Pupa
-35.05137	138.50753	Pupa x2	-35.05339	138.50763	Pupa
-35.05143	138.50749	Pupa	-35.0534	138.50747	Pupa
-35.05148	138.50739	Pupa	-35.0536	138.50734	Pupa
-35.0514	138.50743	Pupa	-35.05376	138.50714	Pupa
-35.05132	138.50745	Pupa	-35.05383	138.50712	Pupa
-35.0513	138.50727	Pupa	-35.05406	138.5071	Pupa
-35.05132	138.50729	Larva	-35.05412	138.50714	Pupa
-35.05135	138.50732	Pupa	-35.05423	138.50722	Pupa
-35.05133	138.50729	Pupa	-35.05418	138.50741	Pupa
-35.05128	138.50729	Larva	-35.05421	138.50747	Pupa
-35.05154	138.50752	Larva	-35.05414	138.50752	Pupa
-35.05154	138.50758	Larva	-35.05418	138.50757	Pupa
-35.05159	138.50763	Larva	-35.05406	138.50761	Pupa
-35.05156	138.50763	Pupa	-35.0539	138.50758	Pupa
-35.05179	138.50727	Larva	-35.05375	138.50767	Pupa
-35.05181	138.50715	Larva	-35.05199	138.50695	Pupa x2
-35.05183	138.5069	Pupa	-35.05213	138.50734	Pupa
-35.05185	138.50689	Larva	-35.05216	138.50734	Pupa
-35.05185	138.50689	Pupa	-35.05231	138.50755	Larva
-35.05186	138.50689	Pupa	-35.05251	138.50786	Pupa

Monitoring results September 2023

The survey undertaken on 1st September 2023 found most of the active shelters (Table 11), which included 37 out of 64 present within the unburnt *G. lanigera* stands located to the north and south of the regrowth areas.

Post-fire regrowth *G. lanigera* has achieved suitable foliar density in most parts with the ease of larval shelter construction especially by the first instar larvae. It is thought that female butterflies may oviposit on the regrowth plants, however larvae failed to develop due to the inability to silk leaves together.

Twenty-seven active larval shelters were found in the post-fire regrowth area, a substantial increase from 7 during the previous survey. These shelters have been found on the mature and suitable larval host plants.

The unburnt *G. lanigera* stands continue to provide suitable habitat and are the favoured larval host plants, however, this survey found that only the northern section of heath supported the majority of active shelters.

As a general observation, *G. lanigera* regrowth plants are displaying good growth for being suitable to use by *A. atralba* (Fig. 61).

The burnt area continues to display very little weed infestation, especially annual grasses, creating a well-balanced clean regrowth site (Fig. 62).

For the first time, evidence of parasitic activity has been noticed with two different wasp species found present. Evidence of a *Chalcididae* sp., can be seen with typical multiple exit holes present in pupa (Fig. 63). The other unidentified wasp species, most probably from the *Ichneumonidae* family, based on the single wasp larva, was found within the pupa (Fig. 64). The wasps from these two families can typically attack Lepidoptera species and are known parasites of *A. atralba*.

The increased active larval shelter presence of *A. atralba* on post-fire regrowth plants is a positive indicator of recolonization at the site. This increase in the regrowth area, distributing the population across the heathland allows for ecological burns to be undertaken if deemed necessary. The southern section of the heath can be burnt without detrimental outcomes to the population based on the current survey. Survey and larval translocations are recommended prior to burns being undertaken.

Figure 61. Regrowth of *Gahnia lanigera*.

Figure 62. Regrowth of vegetation at site.

Figure 63. A species of wasp from *Chalcididae* family.

Figure 64. A species of wasp from *Ichneumonidae* family.

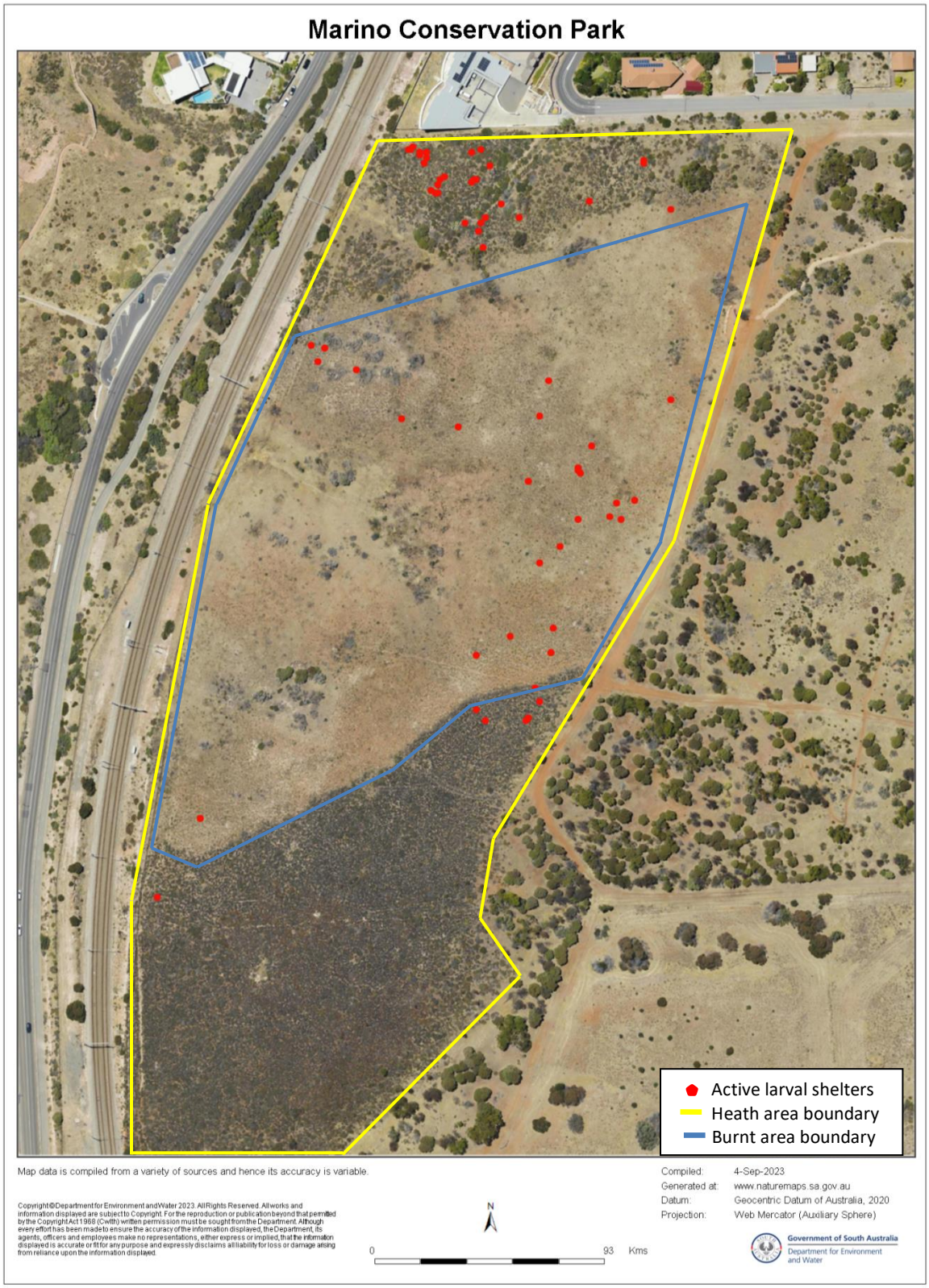

Figure 65. Marino Conservation Park heathland active larval shelters, September 2023.

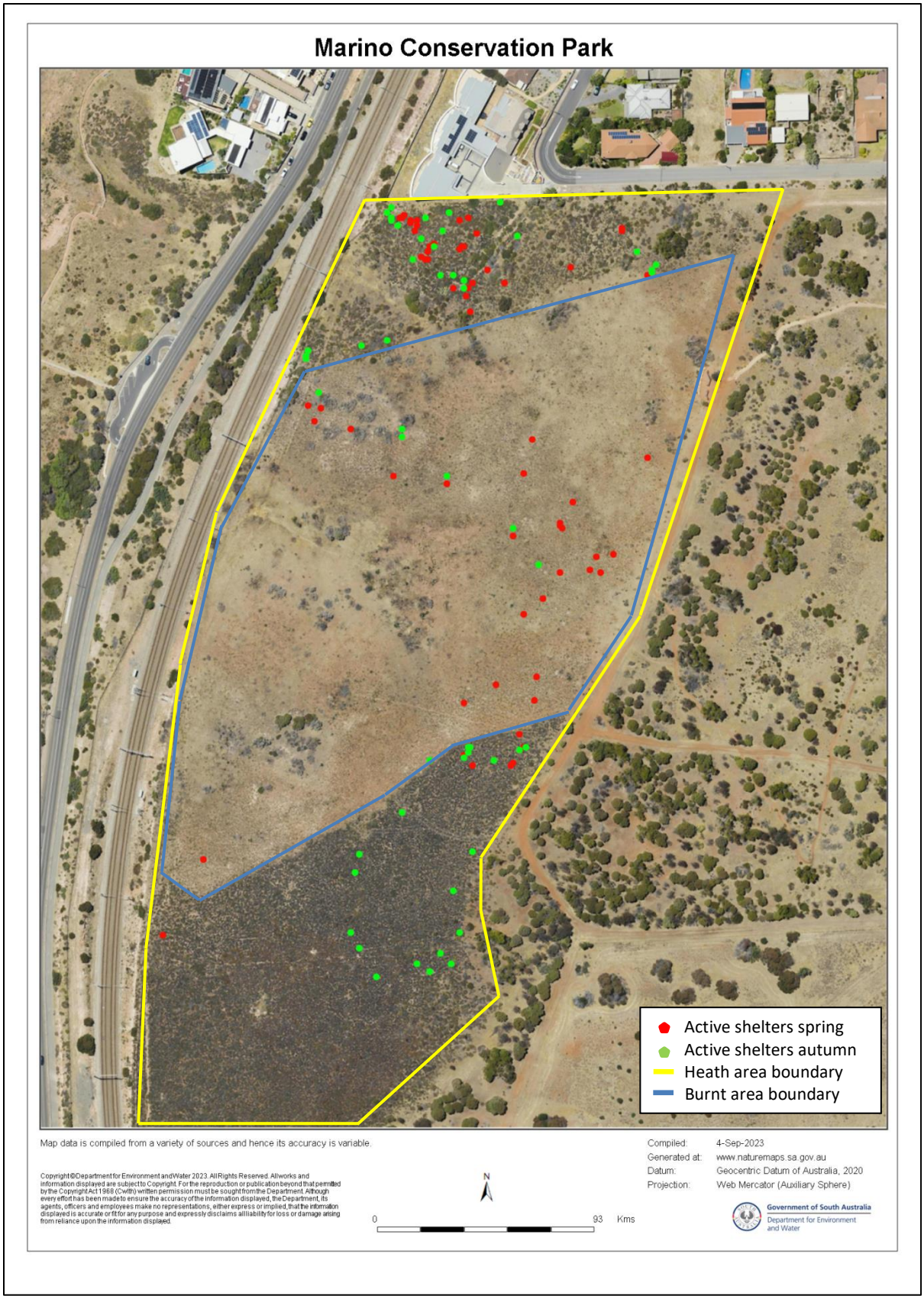

Figure 66. Marino Conservation Park heathland, active larval shelters comparison March and September 2023.

Table 11. *Larval active shelter GPS locations, September 2023.*

Latitude	Longitude	Latitude	Longitude
-35.05224	138.50849	-35.05342	138.50785
-35.05261	138.50833	-35.05342	138.50767
-35.05268	138.50827	-35.05137	138.50837
-35.05317	138.50796	-35.05136	138.50837
-35.05308	138.50797	-35.05151	138.50813
-35.05267	138.50822	-35.05157	138.50782
-35.05262	138.50825	-35.05152	138.50774
-35.05154	138.50849	-35.05157	138.50767
-35.05241	138.50814	-35.05159	138.50765
-35.05251	138.50809	-35.05138	138.50769
-35.0525	138.50808	-35.05132	138.50765
-35.05249	138.50808	-35.05133	138.50761
-35.05268	138.50808	-35.05143	138.50763
-35.05278	138.508	-35.05143	138.50762
-35.05311	138.50778	-35.05144	138.50761
-35.05318	138.50763	-35.05142	138.50749
-35.05284	138.50791	-35.05143	138.50747
-35.05217	138.50795	-35.05145	138.50746
-35.0523	138.50791	-35.05148	138.50746
-35.05254	138.50786	-35.05148	138.50745
-35.05213	138.5071	-35.05147	138.50743
-35.05205	138.50696	-35.05137	138.5074
-35.05204	138.5069	-35.05135	138.50741
-35.0521	138.50693	-35.05133	138.50741
-35.05231	138.5073	-35.05134	138.50738
-35.05234	138.50755	-35.05133	138.50738
-35.05378	138.50641	-35.05131	138.50735
-35.05407	138.50622	-35.05132	138.50734
-35.05338	138.50763	-35.05132	138.50733
-35.0533	138.50789	-35.05159	138.50758
-35.05335	138.50791	-35.05162	138.50764
-35.05341	138.50786	-35.05168	138.50766

Monitoring results March 2024

The survey undertaken on the 21st March 2024 found most of the active shelters (Table 12), which included 29 out of 47 present within the unburnt *G. lanigera* stands located to the north and south of the regrowth areas.

Post-fire regrowth *G. lanigera* has achieved suitable foliar density for the ease of larval shelter construction, especially by the first instar larvae.

Eighteen active larval shelters were found in the post-fire regrowth area, a decrease by 9 from 27 during the previous survey. These shelters have been found on the mature and suitable larval host plants.

The post-fire regrowth *G. lanigera* stands continue to provide suitable habitat and are usually the favoured larval host plants, however, this survey found that both northern and southern unburnt section of heath supported the majority of active shelters.

As a general observation, *G. lanigera* regrowth plants are displaying good growth for being suitable to use by *A. atralba* (Fig. 67).

The burnt area continues to display very little weed infestation, especially annual grasses, creating a well-balanced clean regrowth site (Fig. 68).

Figure 67. Regrowth of *Gahnia lanigera*.

Figure 68. Regrowth of vegetation at site.

Parasitic activity has been noticed with several pupae displaying characteristics of wasp species infestation.

The decreased in active larval shelters of *A. atralba* on post-fire regrowth plants is an indicator of seasonal variability of plant suitability. The increased presence in the southern section area is likely an outcome of seasonal plant variability and female butterfly selectivity.

The previous survey results indicated that population across the heath was at the stage of allowing for ecological burns to be undertaken in the southern section if deemed necessary. This survey shows the dynamics of population distributions and requires surveys and larval and pupal translocations prior to burns being undertaken (Fig 69).

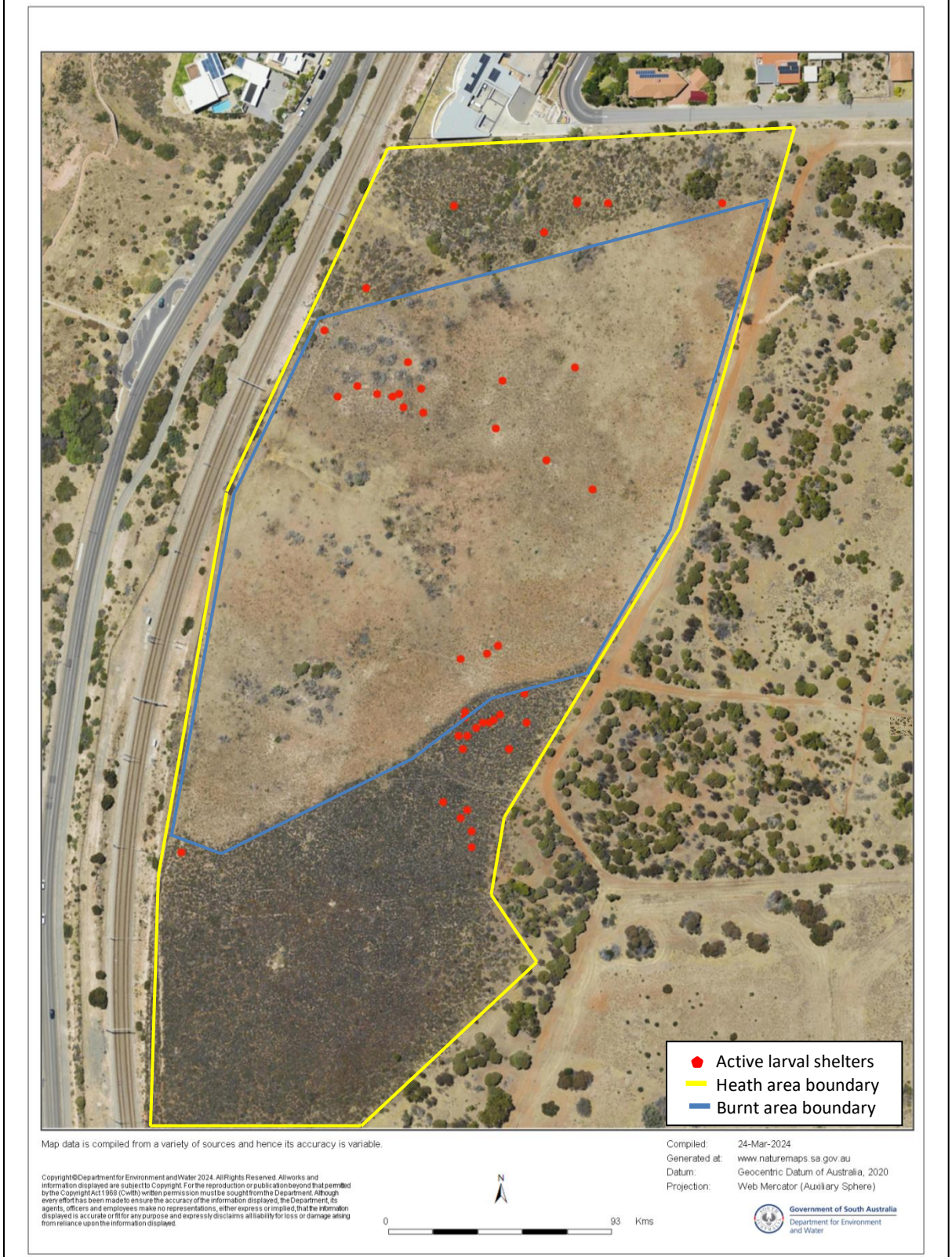

Figure 69. Marino Conservation Park heathland active larval shelters, March 2024.

Table 12. *Larval active shelter GPS locations, March 2024.*

Latitude	Longitude	Latitude	Longitude
-35.05149	138.50870	-35.05319	138.50763
-35.05149	138.50818	-35.05321	138.50751
-35.05148	138.50804	-35.05350	138.50750
-35.05149	138.50804	-35.05345	138.50950
-35.05160	138.50789	-35.05343	138.50753
-35.05150	138.50748	-35.05341	138.50753
-35.05181	138.50708	-35.05334	138.50780
-35.05197	138.50689	-35.05342	138.50769
-35.05209	138.50727	-35.05344	138.50766
-35.05221	138.50723	-35.05345	138.50764
-35.05222	138.50720	-35.05345	138.50761
-35.05222	138.50695	-35.05347	138.50758
-35.05218	138.50704	-35.05350	138.50754
-35.05221	138.50713	-35.05355	138.50752
-35.05226	138.50725	-35.05375	138.50743
-35.05219	138.50733	-35.05394	138.50624
-35.05228	138.50734	-35.05392	138.50756
-35.05234	138.50767	-35.05386	138.50756
-35.05216	138.50770	-35.05381	138.50751
-35.05246	138.50790	-35.05378	138.50754
-35.05211	138.50803	-35.05355	138.50773
-35.05257	138.50811	-35.05345	138.50781
-35.05316	138.50768		

Antipodia atralba translocation

To further aid in the conservation of the species along the southern metropolitan coastal areas, and in-line with the Diamond Sand Skipper mini management plan recommendations, translocation of adult butterflies, eggs and larvae was undertaken in Aldinga Beach coastal heath.

The nearest *A. atralba* population to Aldinga Beach is north at Moana South, approximately 8.5 km (coastal linear) away, a distance the butterfly is unlikely to fly. With

no intermediate *G. lanigera* habitat, natural recolonization of Aldinga Beach area is not possible.

Port Stanvac coastal heath supports Adelaide's largest *A. atralba* population. Surveys of the coastal heath undertaken in 2022 and 2023 (A. Stolarski) found that population numbers are high to allow for removal of individuals for translocations without detrimental outcomes.

The collection of *A. atralba* butterfly species was undertaken on 20th March 2024 from Port Stanvac coastal heath.

Four adult butterflies, sixty pupae, eighteen mature larva and two eggs were transferred to Aldinga Beach coastal heath (Fig. 70).

Figure 70. Aldinga Beach coastal heath release area.

A post-release active larval shelter survey in early August 2024 is recommended to establish the success rate of translocations. If successful, additional, larval and pupal translocations are recommended during early September 2024 to increase the population numbers.

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