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# Sea spurge biocontrol release in Tasmania: November 2023 update



*Monitoring the Duck Creek site in the Four Mile Beach Regional Reserve,  
November 2023.*

## Sea Spurge Remote Area Teams

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## 1. Summary

This update summarises the monitoring of the Tasmanian rollout of the biocontrol blight fungus *Venturia paralias* which aims to control the highly invasive weed sea spurge (*Euphorbia paralias*). This biocontrol agent has been developed by CSIRO with funding from the NSW government's Environmental Trust and approved for release Australia wide.

Across southern Australia, sea spurge is a significant environmental threat. In Tasmania, south of a line between about Scamander and Macquarie Harbour, sea spurge is still in its expansion phase. In this region it has either not established large infestations or is being controlled by volunteer groups using intensive weeding. However, north of this line sea spurge forms numerous very large ecosystem-transforming infestations, which often contain tens to hundreds of millions of plants. In these very large infestations, the resources and previously utilised sea spurge control strategies such as spraying and hand weeding are not practical or economically viable.

The aim of this project is to test under Tasmanian conditions the effectiveness of the sea spurge biocontrol agent. This work is being performed on Parks and Wildlife Service (PWS) land by volunteers from the SPRATS group. Technical support and the biocontrol are being provided by the CSIRO. Transport and logistics support is being provided by the PWS.

If this biocontrol testing indicates that it is an effective control agent, then the next stage will be to apply for funding to grow large amounts of the biocontrol in order to do broad-scale application. This funding application may be performed in conjunction with mainland states so that sea spurge control can be targeted across its entire range.

A total of 18 sea spurge biocontrol test and monitoring sites were established in October 2021, November 2023 and April 2023. These sites have been set up on Tasmania's northern east coast (Abbotsbury Beach), north coast (Cape Portland, Tomahawk, Waterhouse Conservation Area, Low Head, Bakers Beach, Doctors Rocks and Peggs Beach), northern west coast (Bluff Hill Point, Bottle Creek and Temma) and on the central west coast (4 Mile Beach, Duck Creek and Ocean Beach). All sites have been monitored at six month intervals with this report detailing the results following the November 2023 monitoring.

The primary aims of this monitoring are to address four main issues related to the effectiveness of the biocontrol under Tasmanian conditions. These are, will the biocontrol:

- Survive on sea spurge plants between seasons;
- Kill sea spurge plants and reduce its coverage;
- Spread beyond the original release locations;
- Examine how variation in seasonal conditions affects the biocontrol's effectiveness.

The monitoring is indicating that active biocontrol is present in all of the sites showing that it is persisting under Tasmanian conditions. On average, the biocontrol has resulted in a halving of sea spurge cover along with killing of the majority of multi-year old plants. The biocontrol has spread beyond the original release locations at all sites.

Information on variation in seasonal conditions is more uncertain due to the sites only having been established for between six and 24 months. Initial indications are that the above average rainfall conditions that prevailed between October 2021 and April-May 2023 allowed the biocontrol to get established and have marked impacts. Over the past three months, major reductions in rainfall which has probably resulted in a reduction in the amount of active biocontrol along with some recovery of the sea spurge.

It is proposed that the biocontrol release sites be monitored in October-November for the next two years. If dry conditions persist over the current summer, it may also be advisable to perform a monitoring trip in late summer 2023-24. Each of these monitoring trips and associated write-up will require about eight days work for two people, about four days report writing, a high clearance 4wd and about 2020 km of travel. To date, the equipment and travel cost of performing this monitoring has been covered by the PWS and is estimated to be about \$2000 per monitoring trip. In addition, per year the SPRATS group is putting in about \$7350 of volunteer labour, the PWS is putting in about \$500 of in-kind accommodation support and the CSIRO is providing considerable technical and logistical support.

## 2. Introduction

### 2.1 Background

This report summarises the results of the test releases in Tasmania of the sea spurge biocontrol fungus *Venturia paralias* and updates the results from the previous reports:

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Jul 2021	Sea spurge biocontrol: Tasmanian site survey.
Jul 2022	Sea spurge biocontrol release in Tasmania stage 2 - spring 2022 to autumn 2025.
Dec 2022	Sea spurge biocontrol release in Tasmania: December 2022 update.
Jun 2023	Sea spurge biocontrol release in Tasmania: June 2023 update

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This work is being performed by the WildCare<sup>1</sup> group, SPRATS (Sea sPurge Remote Area Teams)<sup>2</sup>. This group is a self-managing volunteer group working in partnership with the Parks and Wildlife Service (PWS). For the last 18 years the group has been controlling and then working towards eradicating the ecosystem-transforming weeds sea spurge (*Euphorbia paralias*), marram grass (*Ammophila arenaria*) and blackberry (*Rubus fruticosus* aggregate). The group works in coastal parts of the Tasmanian Wilderness World Heritage Area (TWWHA) and its adjacent buffer areas on Tasmania's west and south coasts between Macquarie Harbour and Cockle Creek (see Map 1).

### 2.2 Scope of the problem

Across the coastline of southern Australia, between Geraldton in Western Australia and the Central Coast of New South Wales, the highly invasive weed sea spurge has formed extensive infestations. In Tasmania, sea spurge has been identified as a major coastal environmental threat due to its adverse impacts on geodiversity values, Aboriginal cultural sites, herbfields, grasslands and shrublands, and shorebird habitat. Sea spurge also has a toxic sap, making infested areas much less suitable for use by native animals and people.

In southern Tasmania, south of a line between Scamander and Macquarie Harbour (see Map 1), sea spurge is still in its expansion phase. In this zone it has either not yet established large scale infestations or is being controlled by intensive efforts by volunteer groups. However, due to the frequent occurrence of new seedlings in areas with no previous record of sea spurge, it is probable that if left unmanaged, that there will be a major increase in sea spurge in this zone in the near future.

The situation along the coastline in northern Tasmania is very different. In northern Tasmania there are a large number of massive ecosystem-transforming infestations containing tens to hundreds of millions of plants. These infestations will be producing very large numbers of seeds which float and can invade new areas, probably explaining the increase in sea spurge in southern Tasmania.

The resources required and the previously utilised strategies for treating sea spurge are not practical or economically viable in the large infestations that occur across northern Tasmania. These strategies would require annual and on-going input from hundreds of people and tens of millions of dollars in order to be effective.

### 2.3 Sea spurge biocontrol

A potential biological control agent has recently been approved for release Australia-wide<sup>3</sup> which has the potential to assist with controlling sea spurge. This biocontrol has been developed and tested by CSIRO and consists of the blight fungus *Venturia paralias* which

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<sup>1</sup> WildCare Incorporated. Volunteer arm of the Tasmanian Parks and Wildlife Service. See: <http://wildcasetas.org.au/>.

<sup>2</sup> SPRATS: Sea Spurge Remote Area Teams. Contact: [sprats.tas@gmail.com](mailto:sprats.tas@gmail.com).

<sup>3</sup> Final risk analysis report for the release of *Venturia paralias* for the biological control of *Euphorbia paralias*. Available from: <https://www.agriculture.gov.au/biosecurity/risk-analysis/biological-control-agents/risk-analyses/completed-risk-analyses/ra-release-venturia-paralias>.

has been demonstrated to be highly sea spurge specific (and weakly infective to one other introduced weedy spurge)<sup>4</sup>.

The biocontrol was isolated from sea spurge's native range on the Atlantic coast of France. The biocontrol normally infects sea spurge through leaf lesions which then spread and girdle the stem and causing leaf death and stem collapse<sup>5</sup>. Sea spurge has no closely related species in Australia, with all native Australian *Euphorbia* spp. being in a different sub-genus to sea spurge. This means that it is extremely unlikely that the biocontrol will spread to and infect native species.

Current indications are that the biocontrol will be quick and easy to spread. The biocontrol is supplied in dried form which can be added to water and a wetting agent then sprayed onto plants using a hand sprayer.

The biocontrol is unlikely to completely eradicate sea spurge. By their nature, when highly host-specific biocontrol agents reduce the coverage and number of their hosts, they also reduce their own coverage and number. However, assuming the biocontrol is effective at controlling sea spurge, it has the potential to reduce infestations and their impacts to non-significant levels. In addition, where suitable resources are available, such as volunteer weeding groups, the remaining plants could be hand weeded, resulting in local eradication.

#### 2.4 Project aims and objectives

The main aims and objectives of this project are to determine if, under Tasmanian conditions, the biocontrol will:

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- 1 kill sea spurge plants under field conditions.
  - 2 survive between seasons.
  - 3 spread to new sea spurge plants in sufficient amounts to result in sea spurge control.
  - 4 examine the effects of variation in seasonal conditions on the biocontrol's level of activity.
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In order to address these questions, 18 biocontrol release sites have been set up with it being planned to monitor these sites for four or five years.

In October 2021, three sites were set up at Low Head and Bakers Beach on the north coast and Duck Creek of the central west coast. In the second stage of the project, in November 2022, six additional release sites were established on the west coast. In the third stage of the project, in April 2023, nine sites were set up on the northern east coast, north coast and central west coast (Map 1). Site monitoring has been performed in April 2022, November 2022, April-June 2023 and November 2023. Annual future monitoring is planned for October-November 2024 and 2025. If deemed necessary, monitoring will be extended to October-November 2026.

The project is being performed by volunteers from the SPRATS group. Technical support and the biocontrol agent is being supplied free-of-charge by the CSIRO. Support with transport and logistics is being supplied by the Parks and Wildlife Service (PWS). The current release sites are on land managed by the PWS. There have also been releases of the biocontrol in elsewhere in Tasmania on private land, PWS land and land managed by other agencies.

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<sup>4</sup> Lead researcher: Gavin Hunter, Health and Biosecurity, CSIRO. GPO Box 1700 Canberra 2601.

<sup>5</sup> Hunter GC, Zeil-Rolfe I, Jourdan M, Morin L 2019. Information package to support application to release the fungus *Venturia paralias* for the biological control of sea spurge (*Euphorbia paralias*) in Australia. CSIRO.

### 3. Sea spurge biocontrol release strategy in Tasmania

The sea spurge biocontrol monitoring work programme is as follows:

Jul-Aug 2021	Identify release sites, submit PWS Reserve Activity Assessment.
Oct 2021	Set up Stage 1 sites at Low Head, Bakers Beach and Duck Ck.
Apr 2022	Monitor biocontrol at all sites.
Nov 2022	Set up Stage 2 sites on the west coast. Monitor biocontrol at all sites.
Apr-Jun 2023	Set up Stage 3 sites on the east coast, north coast and west coast. Monitor biocontrol at all sites.
Nov 2023	Monitor biocontrol effectiveness and establishment at all sites.
Oct-Nov 2024, 2025, 2026	Monitor biocontrol effectiveness and establishment at all sites. Document and write up results detailing biocontrol effectiveness.

Note that additional release sites have been established by other groups in Tasmania.

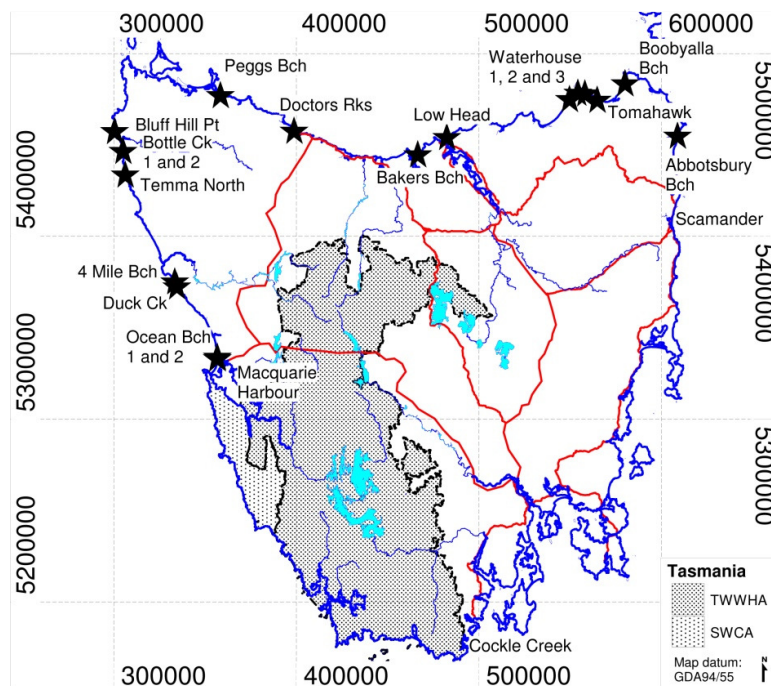
At each of the sites, transects have been set up to record the number, coverage and health of sea spurge plants along with the number of biocontrol stem and leaf lesions. The cover of monocots, herbs and shrubs on transects has also been recorded.

If this testing of the biocontrol indicates that it is an effective sea spurge control agent, then the next stage will be to apply for funding to grow large amounts of the agent so that broad-scale application can be performed. This application for funding may be made in conjunction with mainland states so that sea spurge control can be targeted across its entire range.

### 4. Sea spurge biocontrol monitoring results

#### 4.1 Site establishment and biocontrol application

The Stage 1 sites were set-up in October 2021 at Low Head, Bakers Beach and Duck Creek. In November 2022, the Stage 1 sites were surveyed and the six Stage 2 sites set-up. In April and June 2023 all of the Stage 1 and 2 sites were surveyed and the nine Stage 3 sites established. All of the sites were monitored in November 2023. The site locations are shown in Map 1 and Table 1 with the site data being shown in Appendix 1.



Map 1. Biocontrol release site locations.



**Table 1. Sea spurge biocontrol site establishment and scoring dates.**

Region	Site	Set-up	Scoring
<i>Stage 1: October 2021</i>			
North coast	Low Head	26/10/21	28/04/22, 15/11/22, 01/06/23, 20/11/23
North coast	Bakers Beach	27/10/21	28/04/22, 14/11/22, 01/06/23, 20/11/23
West coast	Duck Creek	28/10/21	30/04/22, 15/11/22, 25/04/23, 22/11/23
<i>Stage 2: November 2022</i>			
West coast	Bluff Hill Point	13/11/22	24/04/23, 21/11/23
West coast	Bottle Creek 1	14/11/22	25/04/23, 21/11/23
West coast	Bottle Creek 2	14/11/22	25/04/23, 21/11/23
West coast	Temma North	14/11/22	25/04/23, 22/11/23
West coast	Ocean Beach 1	16/11/22	26/04/23, 23/11/23
West coast	Ocean Beach 2	16/11/22	26/04/23, 23/11/23
<i>Stage 3: April 2023</i>			
East coast	Abbotsbury Beach	22/04/23	07/11/23
North coast	Boobyalla Beach, Cape Portland	23/04/23	07/11/23
North coast	Tomahawk	23/04/23	07/11/23
North coast	Waterhouse 1: Ransons Beach	23/04/23	08/11/23
North coast	Waterhouse 2: Blizzards Landing	23/04/23	08/11/23
North coast	Waterhouse 3: Waterhouse Beach	23/04/23	08/11/23
North coast	Doctors Rocks	24/04/23	21/11/23
North coast	Peggs Beach	24/04/23	21/11/23
West coast	Four Mile Beach	25/04/23	22/11/23

The Stage 1 sites were each set up using three 10 m long transects with five one by one metre plots on each transect. The transects were two metres apart and parallel to the beach. In each of the Stage 1 plots, a sea spurge plant was tagged and sprayed with the biocontrol and wetting agent. The biocontrol agent was supplied by CSIRO in vials with the contents of one vial being used for each plot.

The Stage 2 and 3 sites were set up using 10 one by one metre plots with the transect length being determined by the site conditions. At each site, the biocontrol and wetting agent were pooled, added to water. This was then evenly applied to the ten plots on the transect using a two litre hand sprayer.

At each site, the attributes in Table 2 were recorded.

**Table 2. Information collected at each site.**

Attribute	Notes
sea spurge cover and height	foliage projective cover, %, average height, cm.
sea spurge health	0 = proportion dead; 1 = proportion very unhealthy: <10 live foliage; 2 = proportion unhealthy, 10-50% live foliage; 3 = proportion healthy, 50-75% live foliage; 4 = proportion very healthy, >75% live foliage.
sea spurge reproductive status	1 = proportion non-reproductive; 2 = proportion flowering; 3 = proportion immature seeds; 4 = proportion fully mature.
number of sea spurge stems/m <sup>2</sup>	1 = <~25; 2 = ~25 to 50; 3 = ~50 to 75; 4 = >~75.
sea spurge with mature foliage	0 = no spurge present; 1 = juveniles only present; 2 = <25% mature foliage; 3 = 25 to 50% mature foliage; 4 = >50% mature foliage.
stem and leaf lesions/m <sup>2</sup>	number of stems with lesions, total number of stem and leaf lesions
other grasses, sedges, herbs, shrubs	foliage projective cover, % and height, cm.

4.2 Sea spurge biocontrol results: October 2021 to November 2023

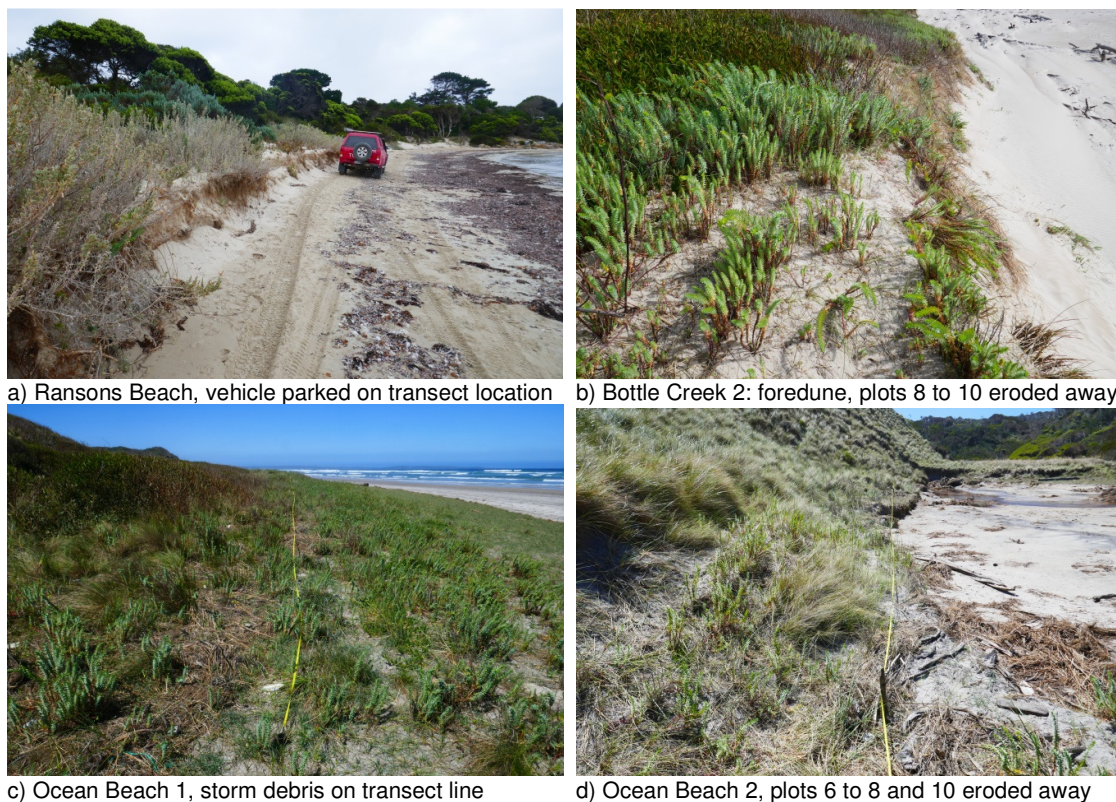
The data for sea spurge cover, height, health status, reproductive status, number of stems, proportion of mature foliage along with the number of stem and leaf lesions has been collated and analysed with averaged plot data being in Table 3. Note that the different sites were established at different times.

**Table 3. Sea spurge cover, height, health status, reproductive status, stem number, proportion of mature foliage, stem and leaf lesion number at each site and scoring time.**

	Oct 21	Apr 22	Nov 22	Apr 23	Nov 23	Oct 21	Apr 22	Nov 22	Apr 23	Nov 23	Oct 21	Apr 22	Nov 22	Apr 23	Nov 23	Oct 21	Apr 22	Nov 22	Apr 23	Nov 23
	Cover, %					Height, cm					Health					Reproductive				
Bakers B	29.2	36.6	18.7	21.3	24.9	32.7	44.3	28.7	36.7	44.7	3.6	2.7	1.6	1.5	2.9	1.0	3.9	1.0	3.4	1.2
Low Head	32.1	54.1	22.3	10.7	13.9	47.1	62.7	46.0	51.3	55.7	3.7	3.0	1.1	0.7	1.4	1.5	3.9	1.4	2.0	1.8
Duck Ck	14.6	11.7	15.1	15.3	9.7	28.7	32.7	28.7	34.0	30.7	4.0	2.5	1.8	1.9	2.5	1.0	2.3	1.0	2.4	1.0
Bluff Hill Pt	-	-	37.9	25.0	22.5	-	-	40.0	44.0	39.0	-	-	3.8	2.2	2.6	-	-	1.0	3.1	1.0
Bottle Ck 1	-	-	33.8	32.5	40.0	-	-	40.0	55.0	61.5	-	-	3.7	3.2	2.2	-	-	1.1	3.8	1.3
Bottle Ck 2	-	-	29.8	25.0	27.5	-	-	31.5	39.5	38.1	-	-	3.9	2.0	1.5	-	-	1.1	3.3	1.0
Temma N	-	-	29.0	14.5	23.0	-	-	46.5	55.5	57.5	-	-	3.7	3.0	1.4	-	-	1.1	3.9	1.4
Ocean B 1	-	-	27.3	24.5	6.9	-	-	46.0	55.0	27.0	-	-	3.6	1.5	2.4	-	-	1.0	3.8	1.0
Ocean B 2	-	-	20.5	17.9	2.5	-	-	36.5	37.8	20.8	-	-	4.0	2.3	2.8	-	-	1.0	2.5	1.0
Abbotsbury B	-	-	-	20.0	24.5	-	-	-	46.5	42.5	-	-	-	3.0	2.8	-	-	-	3.8	1.6
Cape Portland	-	-	-	37.5	21.0	-	-	-	46.0	44.0	-	-	-	3.4	2.6	-	-	-	3.6	1.3
Tomahawk	-	-	-	26.5	15.0	-	-	-	51.0	35.0	-	-	-	3.8	2.7	-	-	-	3.1	1.3
Ransons B	-	-	-	31.5	-	-	-	-	37.5	-	-	-	-	4.0	-	-	-	-	3.8	-
Blizzards L	-	-	-	34.0	21.0	-	-	-	42.0	29.5	-	-	-	3.1	2.2	-	-	-	3.7	1.0
Waterhouse B	-	-	-	38.0	32.0	-	-	-	39.0	37.0	-	-	-	3.4	1.7	-	-	-	3.2	1.1
Doctors Rks	-	-	-	21.7	21.0	-	-	-	58.3	43.0	-	-	-	3.4	3.3	-	-	-	3.5	1.8
Peggs B	-	-	-	8.0	8.6	-	-	-	35.0	31.0	-	-	-	3.9	3.6	-	-	-	2.2	1.1
4 Mile B	-	-	-	23.6	13.6	-	-	-	38.0	21.5	-	-	-	3.8	1.6	-	-	-	3.3	1.0
	Stem number					Mature foliage					Stem lesions					Leaf lesions				
Bakers B	1.7	1.1	2.1	2.5	2.3	2.9	3.5	2.1	3.1	2.1	-	2.0	1.1	1.3	0.9	-	2.4	25.0	17.1	11.1
Low Head	1.9	1.6	2.1	1.6	1.3	3.7	3.9	3.3	2.5	2.5	-	4.6	1.4	1.8	2.2	-	5.5	6.3	7.3	3.0
Duck Ck	2.7	1.7	1.8	2.3	2.1	2.8	3.0	1.3	2.3	1.5	-	4.2	0.5	0.2	0.1	-	4.2	2.4	18.7	1.5
Bluff Hill Pt	-	-	2.2	2.9	2.6	-	-	2.9	3.8	2.0	-	-	-	0.6	0.0	-	-	-	0.2	1.2
Bottle Ck 1	-	-	2.9	2.7	2.6	-	-	3.5	3.7	2.3	-	-	-	0.6	0.2	-	-	-	1.5	2.9
Bottle Ck 2	-	-	2.3	2.3	2.3	-	-	3.6	3.2	2.0	-	-	-	0.4	0.0	-	-	-	1.5	2.0
Temma N	-	-	2.5	1.5	2.1	-	-	3.8	3.9	2.6	-	-	-	0.2	0.2	-	-	-	2.5	1.4
Ocean B 1	-	-	2.2	1.7	1.3	-	-	3.4	3.4	1.8	-	-	-	0.0	0.0	-	-	-	11.0	1.6
Ocean B 2	-	-	1.4	1.3	1.0	-	-	3.6	2.8	1.0	-	-	-	0.1	0.1	-	-	-	5.3	0.3
Abbotsbury B	-	-	-	2.5	2.0	-	-	-	4.0	2.1	-	-	-	-	0.2	-	-	-	-	14.7
Cape Portland	-	-	-	3.7	2.4	-	-	-	4.0	2.2	-	-	-	-	0.2	-	-	-	-	8.5
Tomahawk	-	-	-	1.9	1.4	-	-	-	3.0	1.5	-	-	-	-	0.6	-	-	-	-	7.6
Ransons B	-	-	-	2.4	-	-	-	-	3.7	-	-	-	-	-	-	-	-	-	-	-
Blizzards L	-	-	-	2.5	2.0	-	-	-	3.8	1.3	-	-	-	-	1.4	-	-	-	-	1.1
Waterhouse B	-	-	-	3.7	3.3	-	-	-	3.9	1.5	-	-	-	-	0.0	-	-	-	-	7.6
Doctors Rks	-	-	-	1.8	1.4	-	-	-	3.9	2.2	-	-	-	-	0.1	-	-	-	-	2.7
Peggs B	-	-	-	1.4	1.0	-	-	-	2.7	1.1	-	-	-	-	0.0	-	-	-	-	1.7
4 Mile B	-	-	-	2.0	1.3	-	-	-	2.8	1.4	-	-	-	-	0.2	-	-	-	-	0.8

Note: the categories for health, reproductive status, stem number and mature foliage are in Table 2.

Note that since being established, several of the sites have been subjected to significant storm impact and sand erosion. This was particularly the case at the Ransons Beach site in the Waterhouse Conservation Area where the entire transect has been removed by beach erosion (Figure 1a). Significant erosion has also occurred at the Bottle Creek 2: foredune (Figure 1b) and the Ocean Beach 2 (Figure 1d). The Ocean Beach 1: Horse Track and Ocean Beach 2 sites have also been impacted by storm surges (Figures 1c and 1d).



**Figure 1. Storm damage at the Ransons Beach, Bottle Creek and Ocean Beach sites.**

The data has been analysed for changes in sea spurge cover, height, health, reproductive status, stem number and proportion of mature foliage at different times since the sites were established (Table 4; Figure 2).

The data in Table 4 and Figure 2 needs to be interpreted with caution due to the different sites having been established for different time periods.

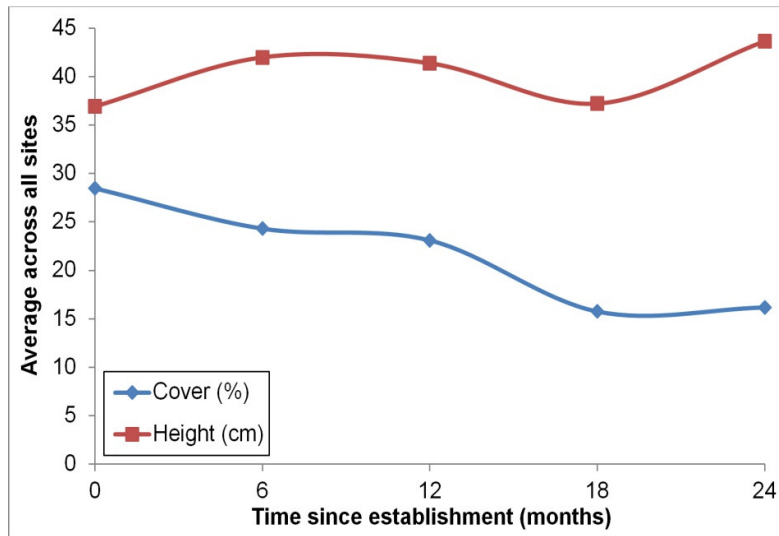
However, the data shows that, on average, there have been major decreases in sea spurge cover, health and proportion of mature foliage. The data also indicates there has been a minor increase in average height. The data for reproductive status reflects the time of year with a larger proportion of sea spurge plants reproductively active in autumn than in spring. There was no consistent change in the number of sea spurge stems per square metre.

**Table 4. Average sea spurge cover, height, health status, reproductive status, stem number, proportion of mature foliage, stem and leaf lesion number at times since site establishment.**

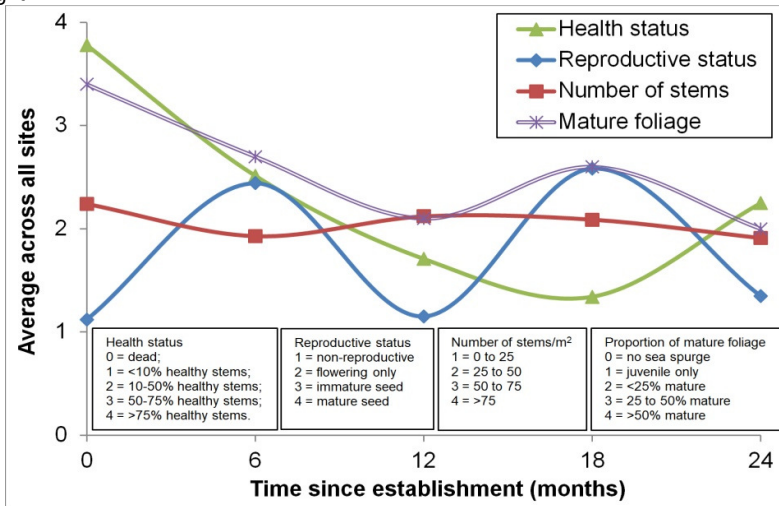
Time period	Cover		Height		Health		Reproductive		Stem num		Mature foliage		Stem lesions	Leaf lesions
	%	p	cm	p	category	p	category	p	category	p	category	p		
Start	28.5	-	36.9	-	3.8	-	1.1	-	2.2	-	3.4	-	-	-
6 months	24.3	0.47	42.0	0.00	2.5	0.00	2.4	0.00	1.9	0.30	2.7	0.00	0.9	4.6
12 months	23.1	0.01	41.4	0.00	1.7	0.00	1.2	0.33	2.1	0.33	2.1	0.00	0.4	4.8
18 months	15.8	0.00	37.2	0.34	1.3	0.00	2.6	0.00	2.1	0.88	2.6	0.00	1.1	14.4
24 months	16.2	0.00	43.7	0.020	2.2	0.00	1.4	0.12	1.9	0.33	2.0	0.00	1.1	5.2

Note: the categories for health, reproductive status, stem number, mature foliage, stem and leaf lesions from Table 2; t-test p values are for differences between pre-application of the biocontrol versus different sampling times.

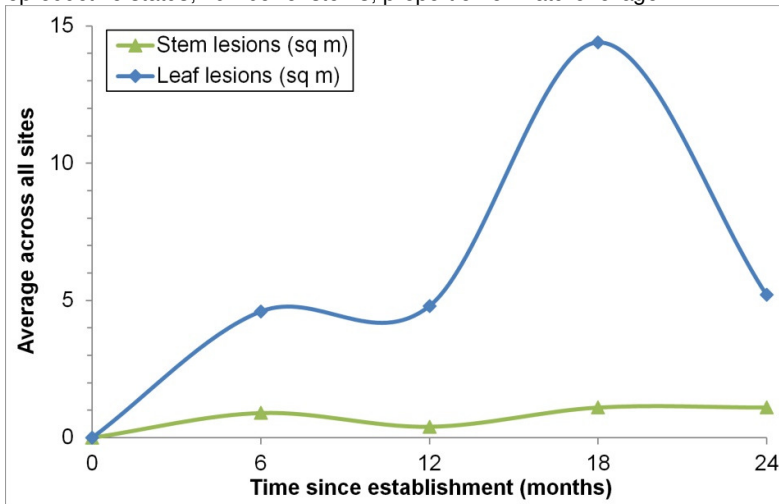




a) cover and height



b) health status, reproductive status, number of stems, proportion of mature foliage



c) number of stem and leaf lesions

**Figure 2. Average sea spurge cover, height, health status, reproductive status, stem number, proportion of mature foliage, stem and leaf lesion number at times since site establishment.**

The reduction in the proportion of mature foliage (Table 4; Figure 2) is reflected in the transformation of many of the sites from being multi-age with large mature sea spurge plants to mostly containing young and/or juvenile sea spurge (for example, see Figure 3). Similar transformations have been reported from other biocontrol release sites in Tasmania (eg on Flinders Island, Karen Ziegler personal communication).

Due to >95% (and probably >99%) of seed being produced by older sea spurge plants, this transformation in sites from being multi-aged to being mostly young has the potential to result in large reductions in seed production. It is not known at the present time if the sea spurge regeneration observed at the sites is from the seed bank or from new seed produced prior to adult plants being killed by the biocontrol. However, from a large number of observations made during the SPRATS weeding program, it is probable that the majority of this regeneration is from the seed bank. If this is the case, there should be a marked reduction in sea spurge over the next few years once the seed bank is exhausted.



a) July 2021 (prior to release of the biocontrol)



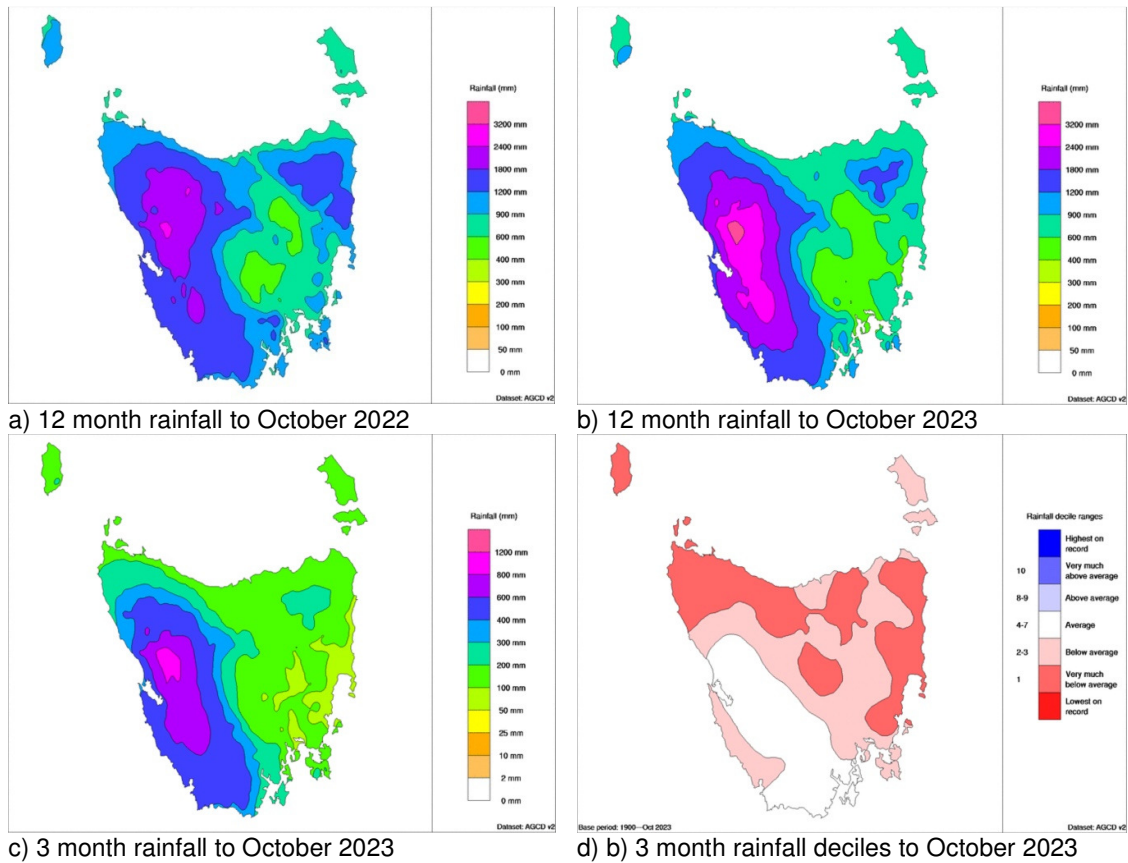
b) November 2023 (about 24 months after release of the biocontrol)

**Figure 3. Sea spurge about 250 m south of the Low Head site in July 2021 and November 2023.**

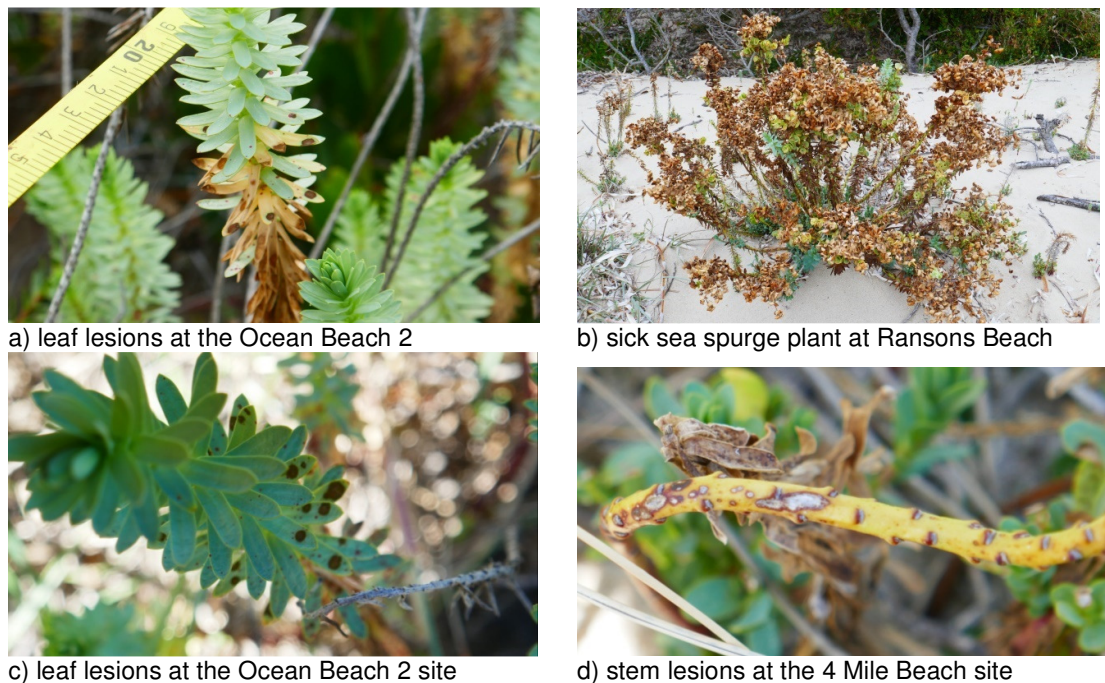
During November 2023 a reduction in the biocontrol's level of activity was observed, reflected in the minor increase in sea spurge cover and health status and a large reduction in the number of leaf lesions (Table 4; Figure 2c). This reduction in activity is probably the result of the dry conditions that have prevailed at the sites during the preceding three months (Figure 4). Similar reductions in the level of the biocontrol's activity have also been observed in sites located in Victoria (G Hunter personal communication).



However, it needs to be noted that active biocontrol stem and/or leaf lesions were observed at all of the sites (Table 3; Figure 5). This means that the biocontrol is persisting and should be able to increase its activity once moister conditions reoccur.



**Figure 4. Rainfall in between November 2021 and October 2023.** Source: Bureau of Meteorology.



**Figure 5. Biocontrol lesions observed in November 2023.**

The biocontrol has also spread beyond its application location at all of the sites. These spread distances vary between about 20 m at the Abbotsbury Beach, 75 m at the Bakers Beach, 100 m at Duck Creek, 250 m at Low Head and at least 30 m at the remaining sites. There is also a report of a seven kilometre downwind spread over six months on Flinders Island (Karen Ziegler personal communication).

## 5. Future work

### 5.1 Monitoring

To date, monitoring has been performed five times over 24 months at the Stage 1 sites, three times over about 12 months at the Stage 2 sites and twice over six months at the Stage 3 sites.

In order to provide a comprehensive assessment of the utility of the biocontrol, it is proposed to perform annual monitoring in October-November at the 18 sites for a further two or three year period (ie during October-November 2024, 2025 and possibly 2026).

It may also be advisable to perform an additional monitoring trip in late summer 2023-24 if dry conditions persist in order to examine the impacts of dry seasons on the level of biocontrol activity.

### 5.2 Budget

Due to this project being run using volunteer labour, almost the entire out-of-pocket cost of running the monitoring and report write-up is for vehicle travel. In addition, during the set-up phase of the project there were some minor costs for plot markers.

Each of the monitoring trips require eight days field work for two people, followed by about four days report writing, a high clearance 4wd with tyre pump (there are extensive areas of deep soft sand requiring low tyre pressures on the Cape Portland, Waterhouse, Duck Creek and Four Mile Beach access tracks) and about 2020 km of travel.

To date, these equipment and travel cost have been covered by the PWS.

The future out-of-pocket annual travel cost of performing each monitoring trip is estimated to be between \$1750 and \$2000<sup>6</sup>.

In addition, for each monitoring trip the SPRATS group is putting in at least \$7350<sup>7</sup> of volunteer labour, the PWS is putting in about \$500 of in-kind accommodation support at Bakers Beach, Arthur River and Strahan and the CSIRO is providing considerable technical and logistical support.



*Penguin nest at the Doctors Rocks site.*

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<sup>6</sup> Costed at the ATO vehicle rate for 2023-24 of \$0.85 per kilometre.

<sup>7</sup> Based on eight hours per day at \$46 per hour. In reality, most of the days in the field average 10 to 12 hours.



### Appendix 1. Site locations and set-up.

All transects have black steel pegs bashed down so that less than 10 cm is exposed.

Grid references have been put in using an averaging GPS resulting in an accuracy of  $\sim\pm 2\text{m}$ .

#### Bakers Beach, central north coast

Site location: on dune about 30 m east of the beach access 2 sign.

Transect and plot details: 3 by 10 m transects, 5 plots on each transect at 1 m intervals.

Peg	Location	Easting	Northing	Peg	Location	Easting	Northing
1	southeast	466476	54452684	east centre	466477	5445270	
2	southwest	466468	54452635	northeast	466476	5445272	
3	west centre	466468	54452656	northwest	466469	5445266	



Bakers Beach in November 2023.

#### Low Head, central north coast

Site location: about 2/3 of the way towards the northern end of the beach.

Transect and plot details: 3 by 10 m transects, 5 plots on each transect at 1 m intervals.

Peg	Location	Easting	Northing	Peg	Location	Easting	Northing
1	northeast	482339	54547524	north centre	482337	5454755	
2	southeast	482340	54547435	northwest	482335	5454754	
3	south centre	482338	54547446	southwest	482336	5454744	



Low Head in November 2023.

#### Duck Creek, central west coast

Site location: on flat foredune just north of small unnamed creek.

Transect and plot details: 3 by 10 m transects, 5 plots on each transect at 1 m intervals.

Peg	Location	Easting	Northing	Peg	Location	Easting	Northing
1	northeast	334391	53730584	north centre	334388	5373057	
2	southeast	334394	53730485	northwest	334386	5373057	
3	south centre	334393	53730486	southwest	334390	5373049	



Duck Creek in November 2023.

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**Bluff Hill Point, northern west coast**

Site location: on foredune just north of small unnamed creek.

Transect and plot details: 10 plots at 3 m intervals over 30 m (6 m gap between plots 8 and 9).

Peg	Location	Easting	Northing
1	south	300367	5458040
2	north	300365	5458070



Bluff Hill Point in November 2023.

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**Bottle Ck 1: dune, northern west coast**

Site location: on dune 50 m inland from beach.

Transect and plot details: 10 plots at 5 m intervals over 45 m.

Peg	Location	Easting	Northing
1	north	304961	5447139
2	south	304922	5447117



Bottle Creek 1: dune in November 2023.

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**Bottle Ck 2: foredune, northern west coast**

Site location: on foredune just in from beach.

Transect and plot details: 10 plots at 5 m intervals over 50 m (10 m gap between plots 5 and 6).

Peg	Location	Easting	Northing
1	north	304904	5447161
2	south	304885	5447115



Bottle Creek 2: foredune in November 2023.

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**Temma North, northern west coast**

Site location: in dense vegetation about 25 m inland from coastal rocks.

Transect and plot details: 10 plots at 5 m intervals over 45 m.

Peg	Location	Easting	Northing
1	north	306127	5434239
2	south	306112	5434198



Temma North in November 2023.

**Ocean Beach 1: Horse track, central west coast**

Site location: on foredune 5 m inland from beach.

Transect and plot details: 10 plots at 5 m intervals over 45 m.

Note: extensive storm damage and debris on transect.

Peg	Location	Easting	Northing
1	north	356622	5333712
2	south	356608	5333677



Ocean Beach 1: Horse track in November 2023.

**Ocean Beach 2, central west coast**

Site location: on foredune about 3 m north of un-named creek.

Transect and plot details: 10 plots at 3 m intervals over 27 m.

Note: extensive erosion, storm damage and debris on transect.

Peg	Location	Easting	Northing
1	east	356660	5334565
2	west	356633	5334564



Ocean Beach 2 in November 2023.



**Abbotsbury Beach, Ansons Bay, northern east coast**

Site location: on dune about 25 m in from beach.

Transect and plot details: 10 plots at 3 m intervals over 29 m (5 m gap between plots 9 and 10).

Peg	Location	Easting	Northing
1	north	608747	5455511
2	south	608767	5455490



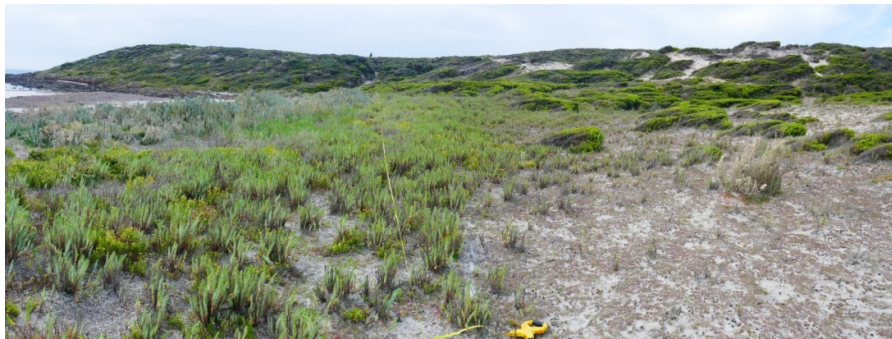
Abbotsbury Beach in November 2023.

**Boobyalla Beach, Cape Portland, northeast coast**

Site location: on dune about 15 m in from beach.

Transect and plot details: 10 plots at 5 m intervals over 45 m.

Peg	Location	Easting	Northing
1	east	579992	5484152
2	west	580000	5484107



Boobyalla Beach, Cape Portland in November 2023.

**Tomahawk, northeast coast**

Site location: on foredune about 3 m in from beach.

Transect and plot details: 10 plots at 5 m intervals over 45 m.

Peg	Location	Easting	Northing
1	west	564735	5475150
2	east	564770	5475121



Tomahawk Beach in November 2023.



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**Waterhouse 1: Ransons beach, northeast coast**

Site location: on foredune about 3 m in from beach.

Transect and plot details: 10 plots at 5 m intervals over 45 m.

Note: transect has been eroded away.

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Peg	Location	Easting	Northing
1	south	558006	5478614
2	north	557992	5478656

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Waterhouse 1: Ransons Beach in November 2023. Note: vehicle is parked where the transect used to be.

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**Waterhouse 2: Blizzards Landing, northeast coast**

Site location: on cobbles about 2 m in from rocks.

Transect and plot details: 10 plots at 3 m intervals over 27 m.

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Peg	Location	Easting	Northing
1	east	554200	5478987
2	west	554171	5478977

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Waterhouse 2: Blizzards Landing in November 2023.

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**Waterhouse 3: Waterhouse Beach, northeast coast**

Site location: on dune about 5 m in from beach.

Transect and plot details: 10 plots at 6 m intervals over 54 m.

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Peg	Location	Easting	Northing
1	east	549615	5475583
2	west	549618	5475528

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Waterhouse 3: Waterhouse Beach in November 2023.

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**Doctors Rocks, northwest coast**

Site location: in coastal vegetation and weeds about 2 m in from beach and 10 from access road.  
Transect and plot details: 10 plots at 5 m intervals over 45 m.

Peg	Location	Easting	Northing
1	west	398668	5458214
2	east	398701	5458182



Doctors Rocks in November 2023.

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**Peggs beach, northwest coast**

Site location: in dune swale about 25 m in from beach, just west of track from campsite 14.  
Transect and plot details: 10 plots at 2 m intervals over 18 m.

Peg	Location	Easting	Northing
1	east	358350	5477655
2	west	358331	5477660



Peggs Beach in November 2023.

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**Four Mile Beach, central west coast**

Site location: on northern side of hummock about 50 m in from beach.  
Transect and plot details: 10 plots at 3 m intervals over 27 m.

Peg	Location	Easting	Northing
1	northwest	333275	5375727
2	southeast	333300	5375721



Four Mile Beach in November 2023.

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