Weed plan for sea lavender

(Limonium companyonis)

CCCEC0 04/11 K McCombs & M von Tippelskirch 6 August 2004





Table of Contents

Table of Contents	1
Introduction	
Taxonomy	1
Description of plant	1
Description of impact	
Associated species	2
Pest status	2
Survey of locations	3
Control	
Monitoring	
Schedule	
Conclusion	
Contacts	
Review Date	
Acknowledgements	
References	
Appendix 1. Location of patches of plants	7
Appendix 2. Detailed map of plant locations.	

Introduction

Sea lavender is newly established in New Zealand salt marsh, where it is showing weedy characteristics. Eradication is believed possible at this stage and is being pursued by the Christchurch City Council.

Taxonomy

Species name: Limonium companyonis (Gren. & Billot) Kuntze (1891)

Common names: sea lavender,

Riviera sea lavender

Family: Plumbaginaceae (statice).

Native to: Europe

Biostatus: Casual Exotic (Allan

Herbarium, 2000)

A sample was sent (via Landcare) to the Botanic Gardens at Kew, who provided the identification. A sample is deposited in the Allan Herbarium at Landcare Research, Lincoln (CHR 518531). The naturalisation of sea lavender was formally reported in the New Zealand Journal of Botany in 1999 (Heenan *et. al.*).

Description of plant

- Leathery leaves, in rosettes.
- Small purple-pink flowers arranged on a sparsely branched flowering stalk that extends above the leaves
- Robust tap root system
- Growing in salt marsh

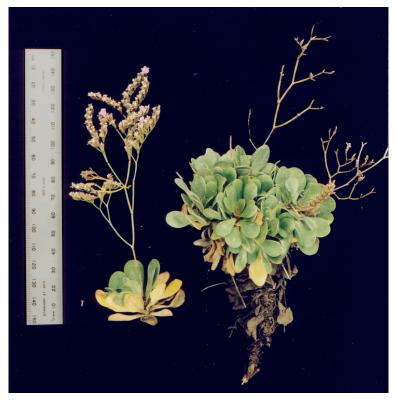


Figure 1. Sea lavender (ruler in mm).

Description of impact

The earliest record is from salt marsh near the Ferrymead Historic Park in 1993 (McC, field data). Since then, the area covered has greatly increased, at the expense of other salt marsh plants. In some locations it occurs as occasional clumps, while in other areas it is the dominant species present.

The sea lavender has probably spread from two islands in the lower Heathcote, radiating out from these to its current extent. The estuary margins and small islands with salt meadow are now affected. Spread may be facilitated by birds, which make use of Stilt Island for roosting (Partridge 2004).

Sea lavender is known to be naturalised in Australia and has been noted as weedy in salt marsh areas (Carr *et al.*, 1992; Delta Environmental Consulting; Hussey *et al.*, 1997).

Associated species

Associated plants observed in the Lower Heathcote salt marsh are glasswort (*Sarcocornia quinqueflora*), buck's horn plantain (*Plantago coronopus*), remuremu (*Selliera radicans*), maakoako (*Samolus repens*) and jointed wire rush (*Leptocarpus similis*).

Pest status

Sea lavender has no formal pest status - it is not listed as an unwanted organism or in either of the Regional Pest Management Strategies. It is recommended that this species be included as a surveillance plant pest in the next review of the Regional Pest Management Strategy.



Figure 2. Sea lavender amongst glasswort.

Survey of locations

The location of most patches of plants was recorded with a GPS¹ on 14 May 2004. The area where plants were found is shown in Figure 3. The details are recorded in Appendix 1 and there is a detailed map in Appendix 2.

On 14 May 2004 both sides of the Lower Heathcote River were searched, from about Devil's Elbow wetland downstream to the Ferry Road bridge. Recent inspection of other nearby wetlands, although focusing on a search for spartina (*Spartina anglica*), failed to find plants further away in Calders Green, McCormacks Bay or Charlesworth Wetland.

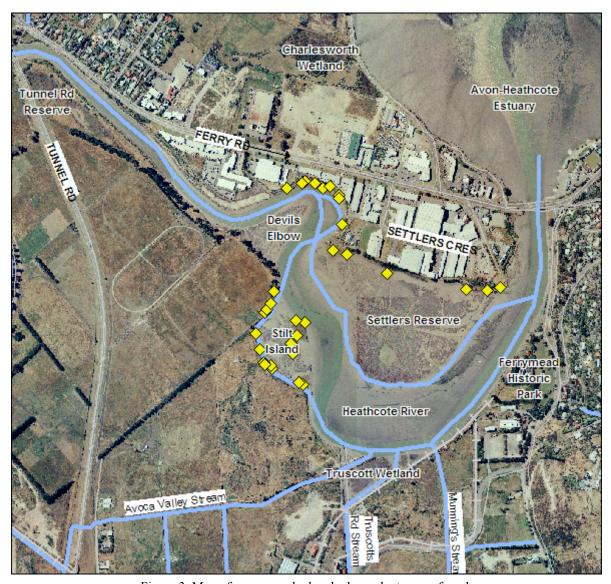


Figure 3. Map of areas searched and where plants were found.

¹ The GPS used was a hand-held Garmin ETrex.

Site	Present	Date	Comment
Tunnel Rd Reserve (true-right)	?		Not yet checked
Between Devils elbow & Tunnel Rd Reserve	Yes		Scattered plants reported by Partridge (2004)
Devils elbow saltmarsh (true-right)	?		Possible scattered plants
Opposite devils elbow (true-left)	Yes	14-May-04	Around bird-hide
Stilt Islands (true-right)	Yes	14-May-04	Main infestation
Settlers Reserve (true-left)	Yes	14-May-04	
Adjacent to Ferrymead Historic Park (true-right)	No	14-May-04	At time of survey it was high tide so not all of the site was checked
Truscott Wetland	No	~ Dec 2003	Checked recently by T. Partridge; not checked during this survey because of high tide
Charlesworth Wetland	No	17-Mar-04	
McCormacks Bay	No	26-May-04	Islands not checked

Control

The objective of control for sea lavender is eradication.

Plants can be easily pulled out, although some of the roots break off. It is not yet known whether plants will regenerate from root fragments in this situation. A trial is underway of some different control methods, in co-operation with the Council nursery and CityCare.

Control so far has been:

Date	Herbicide rate	Amount of herbicide	Time (hours)
14-Jan-03	Roundup G2 @ 200 ml/15 l	200 ml	7
18-Feb-04	Roundup 450 @ 200 ml/15 <i>l</i> & Organo-silicon @ 30 ml/15 <i>l</i>	900 ml Roundup 90 ml Organo-silicon	12.5
18-Mar-04	Roundup 450 @ 200 ml/15 <i>l</i> & Organo-silicon @ 30 ml/15 <i>l</i>	200 mls Roundup 30 ml Organo-silicon	5

It is not yet established whether the addition of Organo-silicon penetrant improved the herbicide effectiveness.

Monitoring

The main flowering period is November-February, and this is the easiest time to find plants. However some flowering plants were still found in May. Low-tide enables searching of the mud flats below the estuary margins, and is required for access to some of the islands.

Schedule

The specific tasks required to implement this plan are presented in a schedule below, including the production of some identification and educational material.

	Staff	Timing
Web page included in the online Canterbury Weed Guide ²		Completed
Inclusion of sea lavender on the (informal) Regional Surveillance List		Completed
Scheduled to be the "Weed of the Month" for November 2004 (information will be sent to City Council, Environment Canterbury, Department of Conservation and Ngai Tahu staff)	K McCombs, Jenny Williams, Anna Paltridge	Nov 2004
Information requesting reports of sightings circulated to the Avon-Heathcote Estuary Ihutai Trust and the Bexley Wetland Trust	K McCombs	Nov 2004
Article to Canterbury Botanical Society	K McCombs	
Article to New Zealand Botanical Society Newsletter	K McCombs	
Preliminary trial of control options	Brian Keown, Joe Cartman	Jul 2004
2004/05 control work	Rodney Chambers	Nov 2004
2004/05 monitoring	K McCombs	Nov 2004
Review plan	K McCombs	Jul 2006

Conclusion

It is expected that the sea lavender in the lower Heathcote River can be eradicated because the area where it is established is still relatively small. Education of interested groups will help to ensure additional plants are found.

The control work that has started should continue and be extended to include some investigation into effective control methods. Monitoring will be required for several years after eradication appears to have been successful.

Contacts

Current contacts at the Christchurch City Council are Kate McCombs (Botanist) and Rodney Chambers (Area Head Ranger, Coastal Parks).

Review Date

This plan should be updated in July 2006.

Acknowledgements

Thanks especially to Dr Trevor Partridge for assistance in the field and for useful comments and discussion about this species. Thanks also to Rodney Chambers for organising the control work so far and for Arthur Harrison (WaiOra) for providing details on the control work undertaken to date.

² www.ccc.govt.nz/parks/TheEnvironment/weedguide/LimoniumCompanyonis.asp

References

- Allan Herbarium (2000) *New Zealand Plant Names Database*. Landcare Research, New Zealand. Available http://nzflora.landcareresearch.co.nz/ (Accessed 22 June 2004) Landcareresearch.co.nz/PS1/NK/232454
- Carr, G.W., Yugovic, J. V. and Robinson, K.E. (1992). *Environmental Weed Invasions in Victoria*. Department of Conservation and Environment Melbourne
- Delta Environmental Consulting. *Common coastal weeds in the Gulf St Vincent area.* www.deltaenvironmental.com.au/archives/weeds/weeds.htm
- Heenan PB, de Lange PJ, Glenny DS, Breitwieser I, Brownsey PJ, Ogle CC (1999) Checklist of dicotyledons, gymnosperms, and pteridophytes naturalised or casual in New Zealand: additional records 1997-1998. *New Zealand Journal of Botany* 37:629-642
- Hussey BMJ, Keighery GJ, Cousens RD, Dodd J, Lloyd SG (1997) Western weeds, a guide to the weeds of Western Australia. The Weeds Society of Western Australia, Incorporated.
- Partridge T (2004) Weed problems in the Avon-Heathcote Estuary and options for their management Draft. CECS04/06. Canterbury Ecology Consultancy Services.
- Western Australian Herbarium, Department of Conservation and Land Management. *FloraBase*. http://florabase.calm.wa.gov.au/

Appendix 1. Location of patches of plants.

Co-ordinates are in New Zealand Map Grid.

Point Comment Date Easting Northing State 14-May-04 2,485,852 5,738,268 Sprayed, dead plants, but indistation ongoing all over island. Size of infestation app. 500 m². Plants scattered in salt meadow + app. 100m² monospecific stand. This island and island 107/108 14-May-04 2,485,825 5,738,268 App. opposite end of island starting with waypoint 107 14-May-04 2,485,825 5,738,373 App. opposite end of island starting with waypoint 107 14-May-04 2,485,825 5,738,373 App. opposite end of island starting with waypoint 107 14-May-04 2,485,825 5,738,394 App. opposite end of island starting with waypoint 107 14-May-04 2,485,825 5,738,394 App. opposite end of island starting with waypoint 107 14-May-04 2,485,835 5,738,394 App. opposite end of island starting with waypoint 107 14-May-04 2,485,835 5,738,394 App. opposite end of island starting with waypoint 107 14-May-04 2,485,834 5,738,394 App. opposite end of island starting with waypoint 107 14-May-04 2,485,834 5,738,394 App. opposite end of island starting with waypoint 107 14-May-04 2,485,834 5,738,394 11 Part of 109 island. One monospecific patch app. 120m². 14-May-04 2,485,834 5,738,436 11 15 pig plant (3 plants with seed heads, 2 small plants. 14-May-04 2,485,768 5,738,310 13 big plant (3 plants with seed heads, 1 almost falling into water, due to bank crosion. 14-May-04 2,485,766 5,738,314 14-May-04 2,485,766 5,738,314 14-May-04 2,485,766 5,738,314 14-May-04 2,485,766 5,738,322 14-May-04 2,485,766 5,738,346 14-May-04 2,485,766 5,738,366 14-May-04 2,485,767 5,738,466 14-May-04 2,485,767 5,738,466 14-May-04 2,485,767 5,738,466 14-May-04 2,485,767 5,738,466 14-May-04 2,485					
1 plant (2 rosettes) with seed head Sprayed, dead plants, but infestation ongoing all over island. Size of infestation app. 500 m². Plants scattered in salt meadow + app. 100m² monospecific stand. This island and island 107/108 14-May-04 2,485,825 5,738,345 3,	Point	Comment			
Sprayed, dead plants, but infestation ongoing all over island.	105	4 small plant + 2 plants with seed heads	14-May-04	2,485,852	5,738,262
Size of infestation app. 500 m². Plants scattered in salt meadow + app. 100m² monospecific stant. This island and island 107/108	106		14-May-04	2,485,842	5,738,268
Adjacent island to 107/108. Scattered <i>Limonium</i> clumps mainly and the edge of the island Part of 109 island. Some sprayed or possibly senescent plants with seed heads. Some clumps *1m*. Some plants found in between jointed wire rush. 110 between jointed wire rush. 111 Part of 109 island. One monospecific patch app. 120m*. 112 Small island, 3 plants with seed heads, 2 small plants. 113 1 big plant (3 rosettes) + seed heads on riverbank. 114 May-04 2,485,768 5,738,306 115 1 Sing, dying plants + seed heads, 1 almost falling into water, due to bank erosion. 116 1 big plant (1 rosettes), still in buds, 1 dead plant with seed heads. 117 1 plant weeded by hand from bank. 118 1 big plant (-6 rosettes) + seed heads, 2 small plants. 119 1 big plant (-6 rosettes) + seed heads, 2 small plants. 110 1 big plant (-6 rosettes) + seed heads, 2 small plants. 110 1 big plant (-6 rosettes) + seed heads, 2 small plants. 111 2 big plants (-6 rosettes) + seed heads, 2 small plants. 112 1 Several scattered clumps over app. 20m*. 112 1 big dead clump, 1 small plant (hand weeded). 11 big plant (-6 rosettes) hand weeded. Approximate end of infestation on true right, but should be searched a bit further upstream. 110 1 big plant (-16 rosettes) hand weeded). 110 1 big plant (-16 rosettes) hand weeded). 110 1 big hand (-16 rosettes) hand weeded). 111 big dead clump, 1 small plant (hand weeded). 112 1 big the seed heads (hand weeded). 113 1 big dead clump, 1 small plant (band weeded). 114 May-04 2,485,785 5,738,806 5,738,808 5,738,808 5,738,808 5,738,808 5,738,808 5,738,808 5,738,808 5,738,808 5,738,808 5,738,808 5,738,808 5,738,808 5,738,808 5,738,808 5,738,808 5,738,808 5,738,808 5,738,808 5,738,80	107	Size of infestation app. 500 m ² . Plants scattered in salt meadow + app. 100m ² monospecific stand. This island and island 107/108	14-May-04	2,485,825	5,738,345
Adjacent island to 107/108. Scattered <i>Limonium</i> clumps mainly and the edge of the island Part of 109 island. Some sprayed or possibly senescent plants with seed heads. Some clumps *1m*. Some plants found in between jointed wire rush. 110 between jointed wire rush. 111 Part of 109 island. One monospecific patch app. 120m*. 112 Small island, 3 plants with seed heads, 2 small plants. 113 1 big plant (3 rosettes) + seed heads on riverbank. 114 May-04 2,485,768 5,738,306 115 1 Sing, dying plants + seed heads, 1 almost falling into water, due to bank erosion. 116 1 big plant (1 rosettes), still in buds, 1 dead plant with seed heads. 117 1 plant weeded by hand from bank. 118 1 big plant (-6 rosettes) + seed heads, 2 small plants. 119 1 big plant (-6 rosettes) + seed heads, 2 small plants. 110 1 big plant (-6 rosettes) + seed heads, 2 small plants. 110 1 big plant (-6 rosettes) + seed heads, 2 small plants. 111 2 big plants (-6 rosettes) + seed heads, 2 small plants. 112 1 Several scattered clumps over app. 20m*. 112 1 big dead clump, 1 small plant (hand weeded). 11 big plant (-6 rosettes) hand weeded. Approximate end of infestation on true right, but should be searched a bit further upstream. 110 1 big plant (-16 rosettes) hand weeded). 110 1 big plant (-16 rosettes) hand weeded). 110 1 big hand (-16 rosettes) hand weeded). 111 big dead clump, 1 small plant (hand weeded). 112 1 big the seed heads (hand weeded). 113 1 big dead clump, 1 small plant (band weeded). 114 May-04 2,485,785 5,738,806 5,738,808 5,738,808 5,738,808 5,738,808 5,738,808 5,738,808 5,738,808 5,738,808 5,738,808 5,738,808 5,738,808 5,738,808 5,738,808 5,738,808 5,738,808 5,738,808 5,738,808 5,738,808 5,738,80	108	App. opposite end of island starting with waypoint 107	14-May-04	2,485,820	5,738,373
with seed heads. Some clumps >1m². Some plants found in between jointed wire rush. 110 between jointed wire rush. 111 Part of 109 island. One monospecific patch app. 120m². 112 Small island, 3 plants with seed heads, 2 small plants. 113 1 big plant (3 rosettes) + seed heads, 2 small plants. 114 May-04 2,485,764 5,738,310 115 3 big, dying plants + seed heads, 1 almost falling into water, due to bank erosion. 116 tall flowering plant (1 rosette), still in buds, 1 dead plant with seed heads. 117 3 clumps with seed heads, 1 of which is nearly falling into the water, due to bank erosion. 118 water, due to bank erosion. 119 a big plant (-6 rosettes) + seed heads, 2 small plants. 119 plant (-6 rosettes) + seed heads, 2 small plants. 119 plant (-6 rosettes) + seed heads, 2 small plants. 119 plant (-7 rosettes) + seed heads, 2 small plants (hand weeded). 120 meters further upstream 2 small clumps along the estuary edge. 121 Several scattered clumps over app. 20m². 2 small plants (one of them about to flower) + 1 big plant (2 rosettes) hand weeded. Approximate end of infestation on true right, but should be searched a bit further upstream. 122 small plants, 6 seedlings on mud bank (hand weeded). 123 1 big plant (-15 rosettes) between P. divaricatus, just about to flower (hand weeded). No more plants beyond waypoint 125 upriver. 124 1 plant (11 rosettes) (hand weeded). 1 plant (-12 rosettes) (hand weeded). 1 plant (-12 rosettes) (hand weeded). 1 plant (11 rosettes) (hand weeded). 1 plant (2 rosettes) (hand weeded). 1 plant (11 rosettes) (hand weeded). 1 plant (2 rosettes) (hand weeded). 1 plant (2 rosettes) (hand weeded). 1 plant (3 rosettes) (hand weeded). 1 plant (4 - 2 rosettes) (hand weeded). 1 plant (7 - 2 rosettes) (109	Adjacent island to 107/108. Scattered <i>Limonium</i> clumps mainly around the edge of the island	14-May-04	2,485,837	
112 Small island, 3 plants with seed heads, 2 small plants. 14-May-04 2,485,768 5,738,306 113 1 big plant (3 rosettes) + seed heads on riverbank. 14-May-04 2,485,764 5,738,310 114 to bank erosion. 11ate flowering plant (1 rosette), still in buds, 1 dead plant with seed heads, 2 still in buds, 1 dead plant with seed heads, 1 of which is nearly falling into the water, due to bank erosion. 14-May-04 2,485,766 5,738,313 116 Seed heads. 3 clumps with seed heads, 1 of which is nearly falling into the water, due to bank erosion. 14-May-04 2,485,751 5,738,312 116 Water, due to bank erosion. 14-May-04 2,485,751 5,738,316 117 1 plant weeded by hand from bank. 14-May-04 2,485,725 5,738,361 118 1 big plant (-6 rosettes) + seed heads, 2 small plants. 14-May-04 2,485,725 5,738,400 119 weeded) 2 big plants (3-11 rosettes) + seed heads, 3 small plants, a few meters further upstream 2 small clumps along the estuary edge. 14-May-04 2,485,756 5,738,482 2 small plants (one of them about to flower) + 1 big plant (2 rosettes) hand weeded). 14-May-04 2,485,756 5,738,613	110	with seed heads. Some clumps >1m². Some plants found in	14-May-04	2,485,859	5,738,430
112 Small island, 3 plants with seed heads, 2 small plants. 14-May-04 2,485,768 5,738,306 113 1 big plant (3 rosettes) + seed heads on riverbank. 14-May-04 2,485,764 5,738,310 114 to bank erosion. 11ate flowering plant (1 rosette), still in buds, 1 dead plant with seed heads, 2 still in buds, 1 dead plant with seed heads, 1 of which is nearly falling into the water, due to bank erosion. 14-May-04 2,485,766 5,738,313 116 Seed heads. 3 clumps with seed heads, 1 of which is nearly falling into the water, due to bank erosion. 14-May-04 2,485,751 5,738,312 116 Water, due to bank erosion. 14-May-04 2,485,751 5,738,316 117 1 plant weeded by hand from bank. 14-May-04 2,485,725 5,738,361 118 1 big plant (-6 rosettes) + seed heads, 2 small plants. 14-May-04 2,485,725 5,738,400 119 weeded) 2 big plants (3-11 rosettes) + seed heads, 3 small plants, a few meters further upstream 2 small clumps along the estuary edge. 14-May-04 2,485,756 5,738,482 2 small plants (one of them about to flower) + 1 big plant (2 rosettes) hand weeded). 14-May-04 2,485,756 5,738,613	111	Part of 109 island. One monospecific patch app. 120m ² .	14-May-04	2,485,834	5,738,436
113 1 big plant (3 rosettes) + seed heads on riverbank. 14-May-04 2,485,764 5,738,310 114 to bank erosion. 14-May-04 2,485,766 5,738,313 115 so bank erosion. 14-May-04 2,485,767 5,738,313 116 water, due to bank erosion. 14-May-04 2,485,747 5,738,312 116 water, due to bank erosion. 14-May-04 2,485,751 5,738,312 117 1 plant weeded by hand from bank. 14-May-04 2,485,751 5,738,316 118 1 big plant (-6 rosettes) + seed heads, 2 small plants. 14-May-04 2,485,755 5,738,400 119 1 big plant (-6 rosettes) + seed heads, 2 small plants (hand weeded) 14-May-04 2,485,749 5,738,400 120 1 big plant (-7 losettes) + seed heads, 3 small plants, a few meters further upstream 2 small clumps along the estuary edge. 14-May-04 2,485,757 5,738,457 120 Several scattered clumps over app. 20m². 14-May-04 2,485,765 5,738,480 121 Several scattered clumps over app. 20m². 14-May-04 2,485,765 5,738,808 <					
3 big, dying plants + seed heads, 1 almost falling into water, due to bank erosion.			_		
115 seed heads 3 clumps with seed heads 1 of which is nearly falling into the water, due to bank erosion.		3 big, dying plants + seed heads, 1 almost falling into water, due	_		
116 water, due to bank erosion. 14-May-04 2,485,751 5,738,316 117 1 plant weeded by hand from bank. 14-May-04 2,485,736 5,738,357 118 1 big plant (~6 rosettes) + seed heads, 2 small plants. 14-May-04 2,485,736 5,738,357 119 yeing plant (~8 rosettes) + seed heads, 2 small plants (hand weeded) 14-May-04 2,485,749 5,738,450 120 big plants (3-11 rosettes) + seed heads, 3 small plants, a few meters further upstream 2 small clumps along the estuary edge. 14-May-04 2,485,757 5,738,466 121 Several scattered clumps over app. 20m². 14-May-04 2,485,765 5,738,482 2 small plants (one of them about to flower) + 1 big plant (2 rosettes) hand weeded. Approximate end of infestation on true rosettes) hand weeded a bit further upstream. 14-May-04 2,485,765 5,738,482 122 right, but should be searched a bit further upstream. 14-May-04 2,485,858 5,738,813 123 1 big dead clump, 1 small plant (hand weeded). 14-May-04 2,485,858 5,738,808 124 1 big plant (-15 rosettes) between <i>P. divaricatus</i> , just about to flower (hand weeded). 14-May-04 2,485,852	115	seed heads.	14-May-04	2,485,747	5,738,322
118 1 big plant (~6 rosettes) + seed heads, 2 small plants. 14-May-04 2,485,725 5,738,400 119 1 big plant (~8 rosettes) + seed heads, 2 small plants (hand weeded) 14-May-04 2,485,749 5,738,457 120 2 big plants (3-11 rosettes) + seed heads, 3 small plants, a few meters further upstream 2 small clumps along the estuary edge. 14-May-04 2,485,749 5,738,457 120 Several scattered clumps over app. 20m². 14-May-04 2,485,775 5,738,466 121 Several small plants (one of them about to flower) + 1 big plant (2 rosettes) hand weeded. Approximate end of infestation on true right, but should be searched a bit further upstream. 14-May-04 2,485,774 5,738,466 122 1 big dead clump, 1 small plant (hand weeded). 14-May-04 2,485,858 5,738,813 123 1 big dead clump, 1 small plant (hand weeded). 14-May-04 2,485,858 5,738,813 124 small plants, 6 seedlings on mud bank (hand weeded). 14-May-04 2,485,852 5,738,806 125 upriver. 14-May-04 2,485,862 5,738,806 127 1 plant (5 rosettes) (hand weeded). 14-May-04 2,485,965 5,738,794	116		14-May-04	2,485,751	5,738,316
118 1 big plant (~6 rosettes) + seed heads, 2 small plants. 14-May-04 2,485,725 5,738,400 119 1 big plant (~8 rosettes) + seed heads, 2 small plants (hand weeded) 14-May-04 2,485,749 5,738,457 120 2 big plants (3-11 rosettes) + seed heads, 3 small plants, a few meters further upstream 2 small clumps along the estuary edge. 14-May-04 2,485,757 5,738,457 121 Several scattered clumps over app. 20m². 14-May-04 2,485,765 5,738,466 121 Several small plants (one of them about to flower) + 1 big plant (2 rosettes) hand weeded. Approximate end of infestation on true right, but should be searched a bit further upstream. 14-May-04 2,485,774 5,738,513 123 1 big dead clump, 1 small plant (hand weeded). 14-May-04 2,485,858 5,738,813 124 3 heigh plants, 6 seedlings on mud bank (hand weeded). 14-May-04 2,485,852 5,738,806 125 4 big plant (~15 rosettes) between P. divaricatus, just about to flower (hand weeded). 14-May-04 2,485,810 5,738,794 126 1 big + seed heads (hand weeded). 14-May-04 2,485,866 5,738,808 127 1 plant (5 rosettes) (hand weeded). 14-May	117	1 plant weeded by hand from bank.	14-May-04	2,485,736	5,738,357
119 1 big plant (~8 rosettes) + seed heads, 2 small plants (hand weeded) 14-May-04 2,485,749 5,738,457 120 2 big plants (3-11 rosettes) + seed heads, 3 small plants, a few meters further upstream 2 small clumps along the estuary edge. 14-May-04 2,485,757 5,738,466 121 Several scattered clumps over app. 20m². 14-May-04 2,485,765 5,738,482 2 small plants (one of them about to flower) + 1 big plant (2 rosettes) hand weeded. Approximate end of infestation on true right, but should be searched a bit further upstream. 14-May-04 2,485,774 5,738,513 122 1 big dead clump, 1 small plant (hand weeded). 14-May-04 2,485,858 5,738,813 124 Near new bird hide at river mouth, 1 big plant + seed head, 2 small plants, 6 seedlings on mud bank (hand weeded). 14-May-04 2,485,852 5,738,806 125 1 big plant (~15 rosettes) between P. divaricatus, just about to flower (hand weeded). No more plants beyond waypoint 125 upriver. 14-May-04 2,485,886 5,738,794 126 1 big + seed heads (hand weeded). 14-May-04 2,485,886 5,738,794 127 1 plant (5 rosettes) (hand weeded). 14-May-04 2,485,951 5,738,794 128 1	118	1 big plant (~6 rosettes) + seed heads, 2 small plants.	14-May-04	2,485,725	5,738,400
2 big plants (3-11 rosettes) + seed heads, 3 small plants, a few meters further upstream 2 small clumps along the estuary edge. 14-May-04 2,485,757 5,738,466 121 Several scattered clumps over app. 20m². 14-May-04 2,485,765 5,738,482 2 small plants (one of them about to flower) + 1 big plant (2 rosettes) hand weeded. Approximate end of infestation on true right, but should be searched a bit further upstream. 14-May-04 2,485,774 5,738,513 123 1 big dead clump, 1 small plant (hand weeded). 14-May-04 2,485,858 5,738,813 Near new bird hide at river mouth, 1 big plant + seed head, 2 small plants, 6 seedlings on mud bank (hand weeded). 14-May-04 2,485,852 5,738,806 1 big plant (~15 rosettes) between <i>P. divaricatus</i> , just about to flower (hand weeded). 14-May-04 2,485,810 5,738,794 125 upriver. 14-May-04 2,485,810 5,738,794 125 upriver. 14-May-04 2,485,810 5,738,794 126 1 big + seed heads (hand weeded). 14-May-04 2,485,810 5,738,794 127 1 plant (17 rosettes) (hand weeded) 14-May-04 2,485,908 5,738,794 128 1 plant (-27 rosettes) (hand weeded) 14-May-04 2,485,951 5,738,773 129 1 plant (~27 rosettes) (hand weeded) 14-May-04 2,485,951 5,738,786 130 1 dying plant (~20 rosettes) (hand weeded) 14-May-04 2,485,951 5,738,766 14-May-04 2,485,951 5,738,766 14-May-04 2,485,951 5,738,666 14-May-04 2,485,951 5,738,696 14-May-04 2,485,951 5,738,696 14-May-04 2,485,971 5,738,614 14-May-04 2,485,971 5,738,614 14-May-04 2,485,971 5,738,614 14-May-04 2,486,353 5,738,517 136 1 big +1 small isolated plants, last before Ferrymead Bridge. 14-May-04 2,486,396 5,738,525 14-May-04		1 big plant (~8 rosettes) + seed heads, 2 small plants (hand			
121 Several scattered clumps over app. 20m². 2 small plants (one of them about to flower) + 1 big plant (2 rosettes) hand weeded. Approximate end of infestation on true right, but should be searched a bit further upstream. 14-May-04 2,485,774 5,738,513 123 1 big dead clump, 1 small plant (hand weeded). Near new bird hide at river mouth, 1 big plant + seed head, 2 small plants, 6 seedlings on mud bank (hand weeded). 14-May-04 2,485,858 5,738,813 124 small plants, 6 seedlings on mud bank (hand weeded). 14-May-04 2,485,852 5,738,806 1 big plant (~15 rosettes) between P. divaricatus, just about to flower (hand weeded). No more plants beyond waypoint 125 upriver. 14-May-04 2,485,810 5,738,794 125 upriver. 14-May-04 2,485,886 5,738,808 127 1 plant (5 rosettes) (hand weeded). 14-May-04 2,485,986 5,738,794 128 1 plant (11 rosettes) (hand weeded) 14-May-04 2,485,951 5,738,773 129 1 plant (~27 rosettes) + 5 small (hand weeded). 14-May-04 2,485,951 5,738,773 130 1 dying plant (~20 rosettes) (hand weeded) 14-May-04 2,485,951 5,738,766 Several small plants, some with seed heads, between creek and river on riverbank. 14-May-04 2,485,958 5,738,696 Start of salt meadow (walking down river), app. 500 m² in size, with patches of varying coverage of between 10-50%. 14-May-04 2,485,971 5,738,614 133 bird hide. 14-May-04 2,486,296 5,738,521 Several big plants + seed heads + small plants over ~ 2m² and further downstream scattered plants up to waypoint 137. 14-May-04 2,486,396 5,738,525 136 1 big +1 small isolated plants, last before Ferrymead Bridge. 14-May-04 2,486,396 5,738,525		2 big plants (3-11 rosettes) + seed heads, 3 small plants, a few			
2 small plants (one of them about to flower) + 1 big plant (2 rosettes) hand weeded. Approximate end of infestation on true right, but should be searched a bit further upstream. 122 right, but should be searched a bit further upstream. 123 1 big dead clump, 1 small plant (hand weeded). 124 Small plants, 6 seedlings on mud bank (hand weeded). 125 small plants, 6 seedlings on mud bank (hand weeded). 126 1 big plant (~15 rosettes) between <i>P. divaricatus</i> , just about to flower (hand weeded). 127 1 plant (5 rosettes) (hand weeded). 128 1 plant (11 rosettes) (hand weeded). 129 1 plant (11 rosettes) (hand weeded). 120 1 plant (~27 rosettes) + 5 small (hand weeded). 121 1 plant (~27 rosettes) (hand weeded). 122 1 plant (~27 rosettes) + 5 small (hand weeded). 123 1 plant (~27 rosettes) (hand weeded). 124 1 plant (~27 rosettes) + 5 small (hand weeded). 125 1 plant (~27 rosettes) (hand weeded). 126 1 big + a seed heads (hand weeded). 127 1 plant (5 rosettes) (hand weeded). 128 1 plant (10 rosettes) (hand weeded). 129 1 plant (~27 rosettes) + 5 small (hand weeded). 130 1 dying plant (~20 rosettes) (hand weeded). 131 1 dying plant (~20 rosettes) (hand weeded). 132 2 with patches of varying coverage of between creek and river on riverbank. 133 2 with patches of varying coverage of between 10-50%. 134 2 big plants + seed heads, 2 small plants on gravel. 135 2 big plants + seed heads, 2 small plants on gravel. 136 3 5 ceveral big plants + seed heads + small plants over ~ 2m² and further downstream scattered plants up to waypoint 137. 136 1 big +1 small isolated plants, last before Ferrymead Bridge. 14-May-04 2,486,396 5,738,525					
123 1 big dead clump, 1 small plant (hand weeded). Near new bird hide at river mouth, 1 big plant + seed head, 2 small plants, 6 seedlings on mud bank (hand weeded). 1 big plant (~15 rosettes) between <i>P. divaricatus</i> , just about to flower (hand weeded). No more plants beyond waypoint 125 upriver. 125 upriver. 126 1 big + seed heads (hand weeded). 1 plant (5 rosettes) (hand weeded). 1 plant (5 rosettes) (hand weeded). 1 plant (11 rosettes) (hand weeded). 1 plant (~27 rosettes) + 5 small (hand weeded). 1 dying plant (~20 rosettes) (hand weeded). 1 dying plant (>20 rosettes) (hand weeded). 1 dying plants (>20 rosettes) (hand weeded). 1 dying plant (>20 rosettes) (hand weeded). 1 dying plants (>20 rosettes) (hand weeded). 1 dying plant (>20 rosettes) (hand weeded). 1 dying plants (>20 rosettes) (hand weeded). 1 dying plants (>20 rosettes) (hand weeded). 1 dying plants (>20 rosettes) (hand weeded). 1 dying plant (>20 rosettes) (hand weeded). 1 dying plants (>20 rosettes) (hand weeded). 1 dying plant (>20 rosettes) (hand weeded). 1 dying plant (>20 rosettes) (hand weeded). 1 dying plants (>20 rosettes) (hand weeded). 1 dying plant (>20 rosettes) (hand		2 small plants (one of them about to flower) + 1 big plant (2 rosettes) hand weeded. Approximate end of infestation on true			
Near new bird hide at river mouth, 1 big plant + seed head, 2 small plants, 6 seedlings on mud bank (hand weeded). 14-May-04 2,485,852 5,738,806 1 big plant (~15 rosettes) between <i>P. divaricatus</i> , just about to flower (hand weeded). No more plants beyond waypoint 125 upriver. 14-May-04 2,485,810 5,738,794 126 1 big + seed heads (hand weeded). 14-May-04 2,485,886 5,738,808 127 1 plant (5 rosettes) (hand weeded) 14-May-04 2,485,908 5,738,794 128 1 plant (11 rosettes) (hand weeded) 14-May-04 2,485,951 5,738,773 129 1 plant (~27 rosettes) + 5 small (hand weeded). 14-May-04 2,485,926 5,738,798 130 1 dying plant (~20 rosettes) (hand weeded) 14-May-04 2,485,951 5,738,766 Several small plants, some with seed heads, between creek and river on riverbank. 14-May-04 2,485,951 5,738,696 14-May-04 2,485,958 5,738,696 14-May-04 2,485,958 5,738,696 14-May-04 2,485,951 5,738,625 14-May-04 2,486,353 5,738,521 14-May-04 2,486,353 5,738,525 14-May-04 2,486,353 5,738,525 14-May-04 2,486,353 5,738,525 14-May-04 2,486,396 5,73			14-May-04	2,485,774	
1 big plant (~15 rosettes) between <i>P. divaricatus</i> , just about to flower (hand weeded). No more plants beyond waypoint 125 upriver. 125 upriver. 126 1 big + seed heads (hand weeded). 127 1 plant (5 rosettes) (hand weeded) 128 1 plant (11 rosettes) (hand weeded) 129 1 plant (~27 rosettes) (hand weeded) 130 1 dying plant (~20 rosettes) (hand weeded) 14-May-04 2,485,951 5,738,798 130 1 dying plant (>20 rosettes) (hand weeded) 14-May-04 2,485,951 5,738,766 Several small plants, some with seed heads, between creek and river on riverbank. 131 Start of salt meadow (walking down river), app. 500 m² in size, with patches of varying coverage of between 10-50%. 130 End of salt meadow 132, no plants on adjacent island with old bird hide. 131 Several big plants + seed heads, 2 small plants on gravel. 132 Several big plants + seed heads + small plants over ~ 2m² and further downstream scattered plants up to waypoint 137. 135 1 big +1 small isolated plants, last before Ferrymead Bridge. 14-May-04 2,485,810 5,738,794 14-May-04 2,485,810 5,738,794 14-May-04 2,485,986 5,738,794 14-May-04 2,485,981 5,738,766 14-May-04 2,485,951 5,738,614 14-May-04 2,485,951 5,738,614 14-May-04 2,485,951 5,738,614		Near new bird hide at river mouth, 1 big plant + seed head, 2			
125 upriver. 14-May-04 2,485,810 5,738,794 126 1 big + seed heads (hand weeded). 14-May-04 2,485,886 5,738,808 127 1 plant (5 rosettes) (hand weeded) 14-May-04 2,485,908 5,738,794 128 1 plant (11 rosettes) (hand weeded) 14-May-04 2,485,951 5,738,773 129 1 plant (~27 rosettes) + 5 small (hand weeded). 14-May-04 2,485,926 5,738,798 130 1 dying plant (>20 rosettes) (hand weeded) 14-May-04 2,485,951 5,738,766 Several small plants, some with seed heads, between creek and river on riverbank. 14-May-04 2,485,958 5,738,696 Start of salt meadow (walking down river), app. 500 m² in size, with patches of varying coverage of between 10-50%. 14-May-04 2,485,934 5,738,625 End of salt meadow 132, no plants on adjacent island with old bird hide. 14-May-04 2,485,971 5,738,614 134 2 big plants + seed heads, 2 small plants on gravel. 14-May-04 2,486,296 5,738,521 Several big plants + seed heads + small plants over ~ 2m² and further downstream scattered plants up to waypoint 137. 14-May-04 2,486,353 5,738,517 136 1 big +1 small is	124		14-May-04	2,485,852	5,738,806
127 1 plant (5 rosettes) (hand weeded) 14-May-04 2,485,908 5,738,794 128 1 plant (11 rosettes) (hand weeded) 14-May-04 2,485,951 5,738,773 129 1 plant (~27 rosettes) + 5 small (hand weeded) 14-May-04 2,485,926 5,738,798 130 1 dying plant (>20 rosettes) (hand weeded) 14-May-04 2,485,951 5,738,766 Several small plants, some with seed heads, between creek and river on riverbank. 14-May-04 2,485,958 5,738,696 Start of salt meadow (walking down river), app. 500 m² in size, with patches of varying coverage of between 10-50%. 14-May-04 2,485,934 5,738,625 End of salt meadow 132, no plants on adjacent island with old bird hide. 14-May-04 2,485,971 5,738,614 134 2 big plants + seed heads, 2 small plants on gravel. 14-May-04 2,486,296 5,738,521 Several big plants + seed heads + small plants over ~ 2m² and further downstream scattered plants up to waypoint 137. 14-May-04 2,486,353 5,738,517 136 1 big +1 small isolated plants, last before Ferrymead Bridge. 14-May-04 2,486,396 5,738,525	125	' ' ' ' ' ' ' ' ' ' ' ' ' ' ' ' ' ' '	14-May-04	2,485,810	5,738,794
127 1 plant (5 rosettes) (hand weeded) 14-May-04 2,485,908 5,738,794 128 1 plant (11 rosettes) (hand weeded) 14-May-04 2,485,951 5,738,773 129 1 plant (~27 rosettes) + 5 small (hand weeded) 14-May-04 2,485,926 5,738,798 130 1 dying plant (>20 rosettes) (hand weeded) 14-May-04 2,485,951 5,738,766 Several small plants, some with seed heads, between creek and river on riverbank. 14-May-04 2,485,958 5,738,696 Start of salt meadow (walking down river), app. 500 m² in size, with patches of varying coverage of between 10-50%. 14-May-04 2,485,934 5,738,625 End of salt meadow 132, no plants on adjacent island with old bird hide. 14-May-04 2,485,971 5,738,614 134 2 big plants + seed heads, 2 small plants on gravel. 14-May-04 2,486,296 5,738,521 Several big plants + seed heads + small plants over ~ 2m² and further downstream scattered plants up to waypoint 137. 14-May-04 2,486,353 5,738,517 136 1 big +1 small isolated plants, last before Ferrymead Bridge. 14-May-04 2,486,396 5,738,525	126	1 big + seed heads (hand weeded).	14-May-04	2,485,886	5,738,808
128 1 plant (11 rosettes) (hand weeded) 14-May-04 2,485,951 5,738,773 129 1 plant (~27 rosettes) + 5 small (hand weeded) 14-May-04 2,485,926 5,738,798 130 1 dying plant (>20 rosettes) (hand weeded) 14-May-04 2,485,951 5,738,766 Several small plants, some with seed heads, between creek and river on riverbank. 14-May-04 2,485,958 5,738,696 Start of salt meadow (walking down river), app. 500 m² in size, with patches of varying coverage of between 10-50%. 14-May-04 2,485,934 5,738,625 End of salt meadow 132, no plants on adjacent island with old bird hide. 14-May-04 2,485,971 5,738,614 134 2 big plants + seed heads, 2 small plants on gravel. 14-May-04 2,486,296 5,738,521 Several big plants + seed heads + small plants over ~ 2m² and further downstream scattered plants up to waypoint 137. 14-May-04 2,486,353 5,738,517 136 1 big +1 small isolated plants, last before Ferrymead Bridge. 14-May-04 2,486,396 5,738,525			1		
129 1 plant (~27 rosettes) + 5 small (hand weeded). 14-May-04 2,485,926 5,738,798 130 1 dying plant (>20 rosettes) (hand weeded) 14-May-04 2,485,951 5,738,766 Several small plants, some with seed heads, between creek and river on riverbank. 14-May-04 2,485,958 5,738,696 Start of salt meadow (walking down river), app. 500 m² in size, with patches of varying coverage of between 10-50%. 14-May-04 2,485,934 5,738,625 End of salt meadow 132, no plants on adjacent island with old bird hide. 14-May-04 2,485,971 5,738,614 134 2 big plants + seed heads, 2 small plants on gravel. 14-May-04 2,486,296 5,738,521 Several big plants + seed heads + small plants over ~ 2m² and further downstream scattered plants up to waypoint 137. 14-May-04 2,486,353 5,738,517 136 1 big +1 small isolated plants, last before Ferrymead Bridge. 14-May-04 2,486,396 5,738,525					
130 1 dying plant (>20 rosettes) (hand weeded) Several small plants, some with seed heads, between creek and river on riverbank. Start of salt meadow (walking down river), app. 500 m² in size, with patches of varying coverage of between 10-50%. End of salt meadow 132, no plants on adjacent island with old bird hide. 134 2 big plants + seed heads, 2 small plants on gravel. Several big plants + seed heads + small plants over ~ 2m² and further downstream scattered plants up to waypoint 137. 136 1 big +1 small isolated plants, last before Ferrymead Bridge. 14-May-04 2,485,951 5,738,766 14-May-04 2,485,958 5,738,696 14-May-04 2,485,958 5,738,696 14-May-04 2,486,396 5,738,521		1 , , , ,			
Several small plants, some with seed heads, between creek and river on riverbank. Start of salt meadow (walking down river), app. 500 m² in size, with patches of varying coverage of between 10-50%. End of salt meadow 132, no plants on adjacent island with old bird hide. 134 2 big plants + seed heads, 2 small plants on gravel. Several big plants + seed heads + small plants over ~ 2m² and further downstream scattered plants up to waypoint 137. 136 1 big +1 small isolated plants, last before Ferrymead Bridge. 14-May-04 2,485,958 5,738,696 14-May-04 2,485,934 5,738,625 14-May-04 2,485,934 5,738,625 14-May-04 2,486,396 5,738,521		·			
Start of salt meadow (walking down river), app. 500 m² in size, with patches of varying coverage of between 10-50%. End of salt meadow 132, no plants on adjacent island with old bird hide. 14-May-04 2,485,934 5,738,625 14-May-04 2,485,971 5,738,614 134 2 big plants + seed heads, 2 small plants on gravel. Several big plants + seed heads + small plants over ~ 2m² and further downstream scattered plants up to waypoint 137. 135 1 big +1 small isolated plants, last before Ferrymead Bridge. 14-May-04 2,486,396 5,738,525		Several small plants, some with seed heads, between creek and	_		
133 bird hide. 14-May-04 2,485,971 5,738,614 134 2 big plants + seed heads, 2 small plants on gravel. 14-May-04 2,486,296 5,738,521 Several big plants + seed heads + small plants over ~ 2m² and further downstream scattered plants up to waypoint 137. 14-May-04 2,486,353 5,738,517 136 1 big +1 small isolated plants, last before Ferrymead Bridge. 14-May-04 2,486,396 5,738,525	132	with patches of varying coverage of between 10-50%.	14-May-04		5,738,625
2 big plants + seed heads, 2 small plants on gravel. Several big plants + seed heads + small plants over ~ 2m² and further downstream scattered plants up to waypoint 137. 136 1 big +1 small isolated plants, last before Ferrymead Bridge. 14-May-04 2,486,396 5,738,525	133	· • • • • • • • • • • • • • • • • • • •	14-May-04	2,485,971	5,738,614
Several big plants + seed heads + small plants over ~ 2m² and further downstream scattered plants up to waypoint 137. 136 1 big +1 small isolated plants, last before Ferrymead Bridge. 14-May-04 2,486,353 5,738,517 14-May-04 2,486,396 5,738,525					
136 1 big +1 small isolated plants, last before Ferrymead Bridge. 14-May-04 2,486,396 5,738,525		Several big plants + seed heads + small plants over ~ 2m² and			
	137	scattered plants from 133 to 137	14-May-04	2,486,080	5,738,562

