

Conservation Themes



Spinifex hirsutus
Photographed by Ron Sandercock



Dianella revolta – Newland Head
Photographed by Ron Sandercock



Xanthorrhoea semiplana – Lands End
Photographed by Alison Eaton

3 CONSERVATION THEMES

3.1 Flora

By Doug Fotheringham

3.1.1 Native Vegetation Cover

Pre European vegetation cover

The Pre- European vegetation map in the Atlas of South Australia (Griffen T and McCaskill M 1986) shows Fleurieu Peninsula covered by Woodland, Forest and Coastal Succession. The term Coastal Succession was used to describe a complex of coastal plant communities occurring on the tidal flats, along beaches, on dunes and behind coastal clifftops exposed to salt spray.

Clearance

Giffen and McCaskill comparing 1945 and 1980 vegetation maps estimated that vegetation cover on Fleurieu Peninsula had been reduced from 240,000 ha to 90,000 ha representing a 60% reduction. A report prepared by the Interdepartmental Committee on Vegetation Clearance in 1976 (Harris C 1976) noted that clearances over small holdings had produced a fragmented complex. Outside of parks vegetation was mainly restricted to steep valleys and hillsides.

Remnant native vegetation cover along the Southern Fleurieu coast

Remnant native vegetation cover along the Fleurieu coastal region has been electronically mapped from aerial photography. The Department for Environment and Heritage is the custodian of this spatial dataset. The dataset title is *Native Vegetation Cover – Agricultural Region*. Information about this dataset is provided in the text box below.

1 DEH DATA SET NATIVE VEGETATION COVER – AGRICULTURAL REGIONS

Description: The dataset provides mapping coverage of the Agricultural Regions of the State, indicating native vegetation cover. The Native Vegetation Cover layer is a composite derived from various regionally based mapping projects. Significantly, native grasslands (with some exceptions) are absent from this mapping.

Dataset Use: The dataset is used as a basis for determining native vegetation statistics for the agricultural region, and is used for native vegetation mapping products. This dataset represents the State Government's key native vegetation mapping layer for the agricultural region of SA. It should not be assumed that this dataset represents all native vegetation cover present in the agricultural region of SA due to the limitations of the mapping methodology.

Limitations: This mapping is based on extrapolation of point based sampling and interpretation of imagery (aerial photography and /or satellite imagery). Sources of error can occur in the extrapolation process and in the interpretation of the imagery. While some field checking is undertaken, it is not feasible to field check all mapping. This mapping does not include areas of grassland and scattered trees. Spatial accuracy is at best +/- 7 metres for the Southern Fleurieu region.

Issues identified for the Southern Fleurieu coast: Some tests were undertaken to measure the accuracy of the vegetation cover mapping along the Southern Fleurieu coast using rectified aerial photography. This revealed several issues:

- Long narrow blocks along dune crests were often not mapped;
- Positional accuracy of block boundaries were often more than 20 metres from agreement;
- Block shapes were not always in agreement; and
- Open shrubland communities on supratidal flats were often not mapped.

The mapping is continually being updated. These difficulties may be overcome with new databases.

Analysis of this dataset has provided the following general information:

- There are 94 individual blocks of native vegetation along the Southern Fleurieu coast greater than 1 hectare in size;
- In total there is 2549 hectares of native vegetation cover, including 205 ha of saltmarsh;

- In terms of area 29% of the Southern Fleurieu coast has native vegetation cover;
- 1235 hectares occur in Conservation Parks;
- 10 hectares are subject to Heritage Agreements; and
- 681 hectares are within a National Park.

Appendix 4 shows the percent remnant vegetation cover within each coastal cell along the Southern Fleurieu coast. Each coastal cell has been classed and colour coded according to percent vegetation cover and a map produced for each. This is shown in Figure 4, which provides a general picture of the distribution of the remnant vegetation. Most of the native vegetation cover is found along the south coast between Cape Jervis and Victor Harbor.

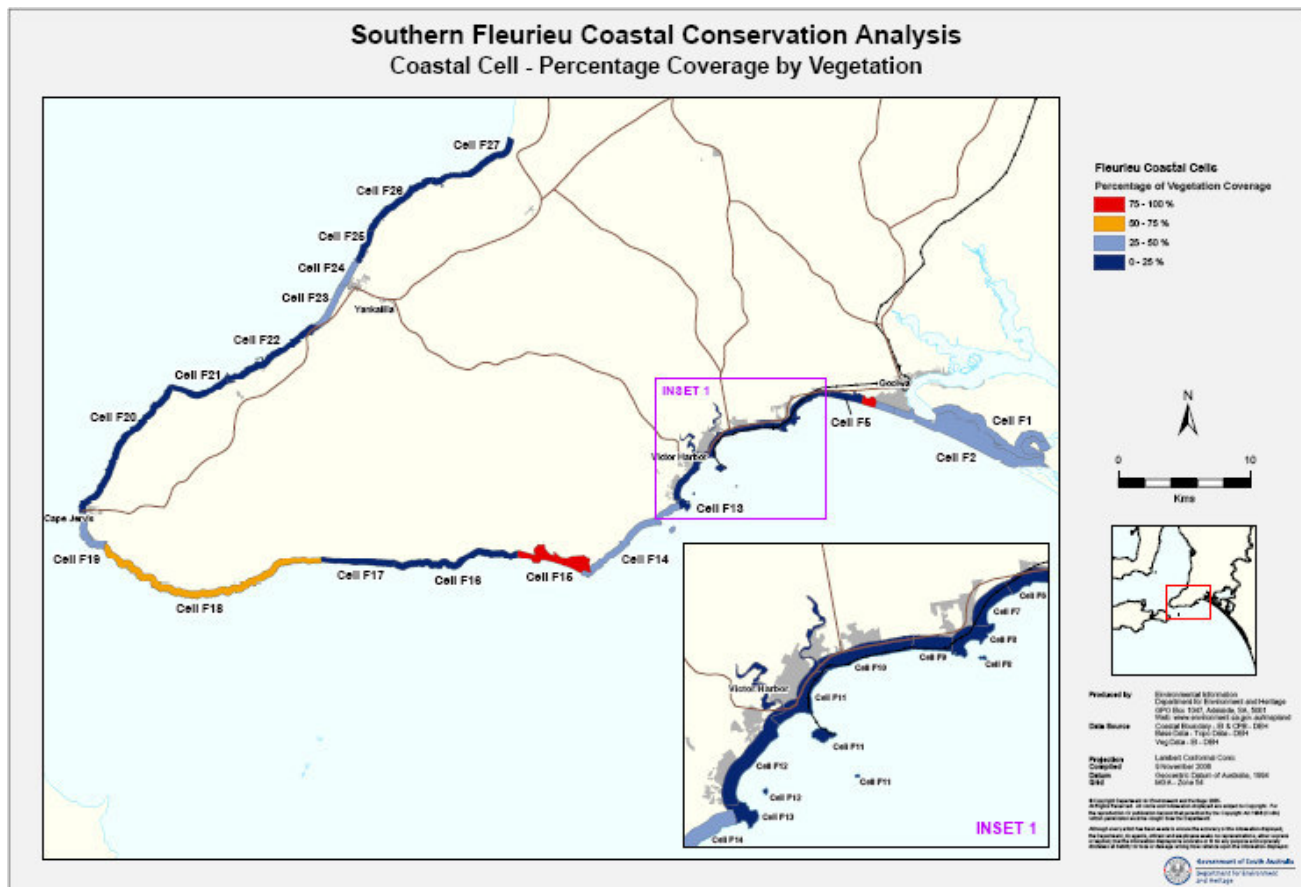


Figure 4. Percent Coverage by Vegetation

3.1.2 Floristic Communities

The Southern Fleurieu coast varies in annual rainfall from 500 to 800 mm. It has varying coastal exposure, landforms and soils. As a result of differences in these factors there is a variety of plant habitats occupied by different plant communities. Floristic mapping of Southern Fleurieu coast has been undertaken as part of the Biological Survey Program of South Australia. Vegetation classes are based primarily on dominant species, and structure. Broad floristic groupings were found in the study area from this mapping.

Oppermann, 1999, described the results of a statewide survey of the coastal dune and clifftop habitats in South Australia. The coastal dune and clifftop surveys were between October 1995 and November 1997. The survey also used site data from previous surveys for the analysis. A major purpose of this survey was to describe and measure the structure and composition of the coastal dune and clifftop communities. Another objective was to identify sites, plants and communities of conservation significance. Survey methodology conformed to the Biological Survey Program standards detailed by Heard and Channon (1997). Forty-five quadrat sites were surveyed within the Southern Fleurieu coastal boundary and a total of 1072 sites were used state wide for the analysis. Cluster analysis was used to determine meaningful floristic groupings.

Floristic groupings were described using a Specht / Muir derived structural table shown in Appendix 16, Glossary (Specht / Muir). No mapping was undertaken.

Table 1. Dominant Floristic Communities in Southern Fleurieu Coast, Coastal Dune and Clifftop Study 1999

Structural Class	Floristic group	SA Total	Fleurieu Total	% SA total
Grassland	<i>Spinifex sericeus / Euphorbia paralias</i>	42	4	9.5
Mallee	<i>Eucalyptus diversifolia/Clematis microphylla</i>	36	2	5.6
Mallee	<i>Eucalyptus diversifolia/Gonocarpus mezianus</i>	9	5	55.6
Sedgeland	<i>Gahnia lanigera/Lepidosperma congestum</i>	18	2	11.1
Sedgeland	<i>Lepidosperma gladiatum</i>	8	1	12.5
Shrubland	<i>Leucopogon parviflorus</i>	16	3	18.8
Shrubland	<i>Acacia paradoxa</i>	13	8	61.5
Shrubland	<i>Beyeria lechenaultii/Acrotriche patula</i>	11	3	27.3
Shrubland	<i>Leucopogon parviflorus/ Olearia axillaris</i>	150	3	2.0
Shrubland	<i>M. lanceolata/A. patula/L. discolor</i>	37	4	10.8
Shrubland	<i>Olearia axillaris/Rhagodia candolleana ssp.candolleana</i>	64	4	6.3
Shrubland	<i>Olearia ramulosa/Calytrix tetragona</i>	5	5	100.0
Trees	<i>Allocasuarina verticillata</i>	11	1	9.1

BOLD = 50 + % sites found in Southern Fleurieu Coast

Shaded = less than 20 sites total in South Australia

Table 1 shows 13 floristic groups identified from the 45 quadrats surveyed in coastal dune and clifftop habitats along the Southern Fleurieu coast. The table also shows for each floristic group the total number of quadrat sites recorded for South Australia. There are 3 floristic communities where greater than 50% of sites are found in the Southern Fleurieu coastal zone. Eight floristic groups have less than 20 site records for South Australia. Management of these floristic communities is particularly important.

Information assembled by Oppermann (1999) provided detail about each of the plant communities. This information has been summarised for 8 vegetation communities that within the Southern Fleurieu coast, show a high degree of endemism and also a degree of rarity for South Australia. These important coastal vegetation communities are listed below with a description, location map, cell locations, and a photograph of each. Extra comments relevant to the Southern Fleurieu coastal region have been added.

***Spinifex hirsutus* / *Euphorbia paralias* Grasslands (Shrublands)**

Description:

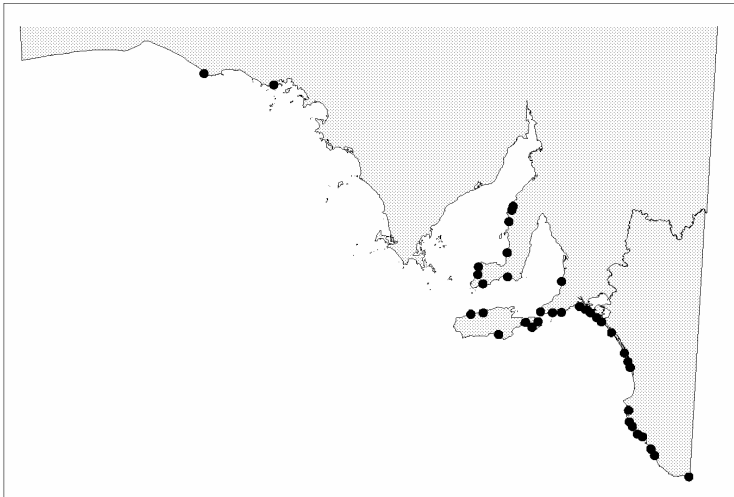
A strong group located mainly on foredunes, predominantly in the south facing coastline. The average number of species is moderately low with an unusually high proportion of herbs and grasses.

Distribution of sites in geomorphic regions: NUL – Nullarbor; HOB – Head of Bight; EPW – Eyre Peninsula, West; EPS – Eyre Peninsula, South; EPE – Eyre Peninsula East; SPG – Spencer Gulf ;YOP – Yorke Peninsula; SVG – St Vincent Gulf; KIS – Kangaroo Island South; KIE – Kangaroo Island East; KIN – Kangaroo Island North; FLP – Fleurieu Peninsula; COO – Coorong; SOE – South East.

HOB	EPW	YOP	SVG	KIN	KIS	KIE	FLP	COO	SOE
1	1	9	1	2	1	3	4	11	9

Number of plant species:

Min	Max	Average
3	19	10.52



Dominant species:

Euphorbia paralias
Spinifex hirsutus

Indicator species:

**Cakile maritima* ssp. *maritima*



Figure 5. *Spinifex sericeus*/*Euphorbia paralias* grassland at Tunkalilla Beach (PID 15953)

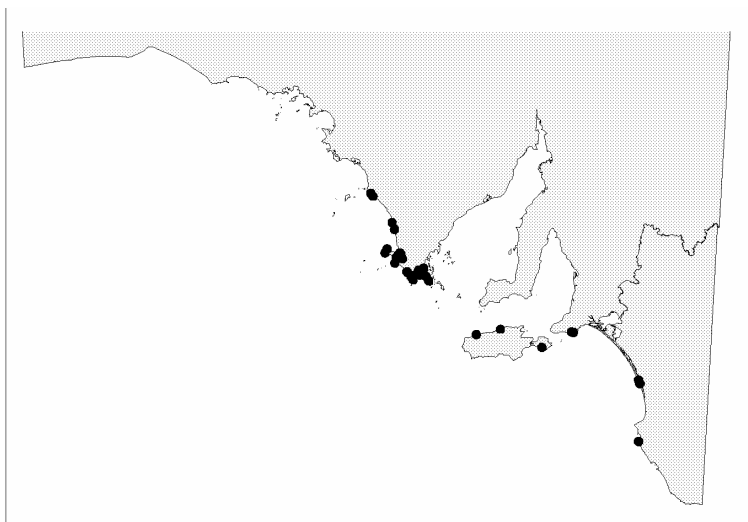
***Eucalyptus diversifolia* / *Clematis microphylla* Mallees**

Description:

A very strong group particularly on southern Eyre Peninsula. Predominantly occurring Quaternary dune fields. There is a distinctive overstorey with few understorey species in common.

Distribution of sites in geomorphic regions: (see under Spinifex above for abbreviations in this table)

EPW	EPS	KIN	KIE	FLP	COO	SOE
5	24	2	1	2	2	1



Number of plant species:

Min	Max	Average
4	38	17.89

Dominant overstorey species:

Eucalyptus diversifolia

Dominant understorey species:

Clematis microphylla

Sub-dominant species:

Melaleuca lanceolata



Figure 6. *Eucalyptus diversifolia*/*Clematis microphylla* Mallee near Newland Head (PID 15964)

Eucalyptus diversifolia / *Gonocarpus megianus* Mallee

Description:

A moderately strong group located predominantly on cliffs. The connecting species is a herb but there are high abundances of Eucalypts throughout the group with a high number of understorey plant species. Five of the 9 sites are found on the Southern Fleurieu coast.

Distribution of sites in geomorphic regions: (see under Spinifex above for abbreviations in this table)

EPS	FLP
4	5

Number of plant species:

Min	Max	Average
21	62	41.78



Dominant overstorey species:

Eucalyptus diversifolia

Dominant understorey species:

Danthonia setacea var. *setacea*

Gonocarpus megianus

Schoenus breviculmis

Sub-dominant Species:

Acacia pycnantha

Acrotriche cordata

Hibbertia riparia (*glabriuscula*)

Xanthorrhoea semiplana ssp.

Indicator Species:

Brachyloma ericoides ssp. *ericoides*



Figure 7. *Eucalyptus diversifolia* / *Gonocarpus megianus*
Mallee near Waitpinga (PID 15990)

***Gahnia lanigera* / *Lepidosperma congestum* Low sedgeland**

Description:

A moderately strong group located in the central part of the coastline on predominantly dunefields.

Distribution of sites in geomorphic regions: (see under Spinifex above for abbreviations in this table)

EPW	EPS	YOP	SVG	FLP
1	1	12	2	2



Number of plant species:

Min	Max	Average
15	40	26.89

Dominant species:

- Gahnia lanigera*
- Helichrysum leucopsideum*
- Lepidosperma congestum*

Sub-dominant species:

- Lomandra effuse*



Figure 8. *Gahnia lanigera* / *Lepidosperma congestum* Low sedgeland near Cape Jervis (PID 15983)

***Lepidosperma gladiatum* Sedgeland**

Description:

A very strong group located in the eastern part of the coastline on dunefields. There are low proportions of many of the life forms in the plant communities

Distribution of sites in geomorphic regions: (see under Spinifex above for abbreviations in this table)

YOP	KIN	FLP	SOE
5	1	1	1



Number of plant species:

Min	Max	Average
8	25	16.63

Dominant species:

Lepidosperma gladiatum

Indicator species:

Acacia nematophylla



Figure 9. *Lepidosperma gladiatum* Sedgeland near Deep Creek (PID 15952)

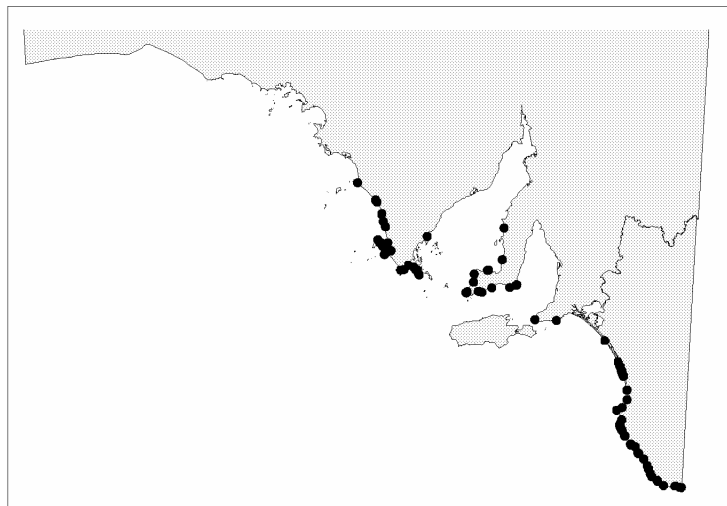
***Leucopogon parviflorus* / *Olearia axillaris* Shrublands**

Description:

A strong group located predominantly on dunefields along the eastern part of the coastline. This is the largest group and includes very common coastal species. There is a distinctive overstorey with a wide distribution of life forms in the understorey.

Distribution of sites in geomorphic regions: (see under Spinifex above for abbreviations in this table)

EPW	EPS	YOP	FLP	COO	SOE
9	30	22	3	24	62



Number of plant species:

Min	Max	Average
8	36	20.59

Dominant overstorey species:

Leucopogon parviflorus

Olearia axillaris

Dominant overstorey species:

Carpobrotus rossii

Clematis microphylla

Rhagodia candolleana ssp. *candolleana*

Sub-dominant species:

Acacia longifolia var. *sophorae*

Lepidosperma gladiatum



Figure 10. *Leucopogon parviflorus* / *Olearia axillaris* Shrublands near Cape Jervis (PID 15969)

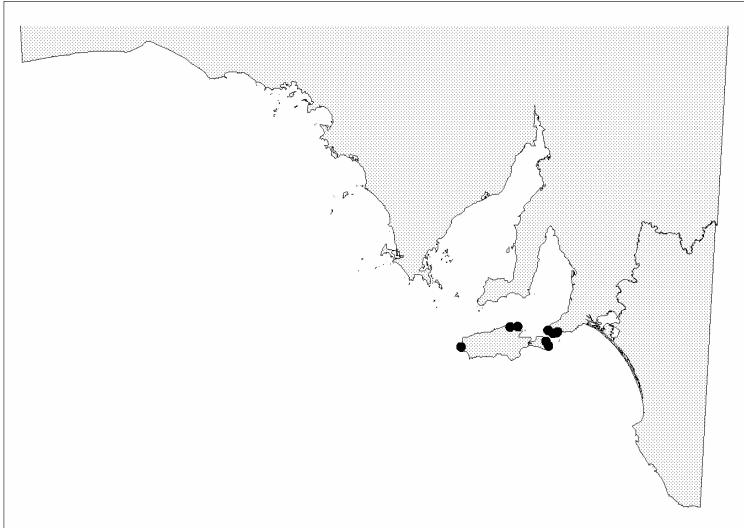
***Acacia paradoxa* Shrublands**

Description:

A very strong group located predominantly on slopes of metasediments. There is a distinctive overstorey with few understorey plants.

Distribution of sites in geomorphic regions: (see under Spinifex above for abbreviations in this table)

KIN	KIS	KIE	FLP
1	1	3	8



Number of plant species:

Min	Max	Average
8	31	17.69

Dominant species:

Acacia paradoxa

Indicator species:

Astroloma humifusum



Figure 11. *Acacia paradoxa* Shrublands near Cape Jervis (PID 15982)

***Beyeria lechenaultii/ Acrotriche patula* Shrublands**

Description:

A moderately strong group located predominantly on cliffs of the adjacent map sheets of Yankallila and Noarlunga. A structurally diverse plant community with a moderately high number of species.

Distribution of sites in geomorphic regions: (see under Spinifex above for abbreviations in this table)

EPS	SVG	FLP
3	5	3



Number of plant species:

Min	Max	Average
20	42	26.82

Dominant species:

Acrotriche patula

Beyeria lechenaultii

Comesperma volubile

Sub-dominant Species:

Danthonia caespitosa

Olearia ramulosa

Pomaderris paniculosa ssp. paniculosa

Indicator Species:

Calytrix tetragona

Gahnia lanigera

Lepidosperma viscidum

Maireana enchylaenoides



Figure 12. *Beyeria lechenaultii/ Acrotriche patula* Shrublands along the Gulf St Vincent coastline (PID 15970)

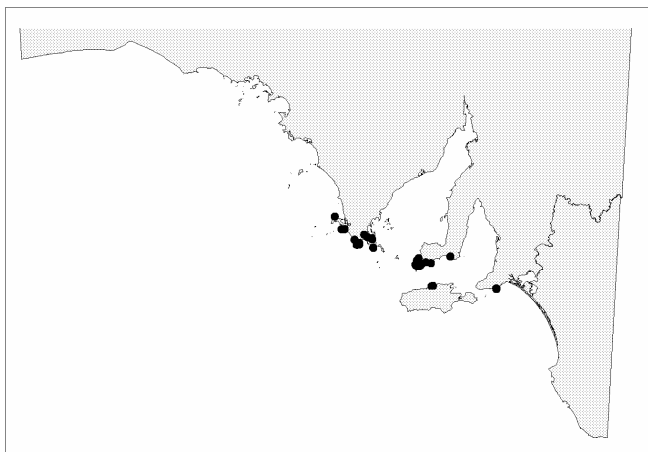
Melaleuca lanceolata / Acrotriche patula / Lasiopetalum discolor Shrublands/Mallees

Description:

A moderately strong group located on dunefields and cliffs. There are a high number of species in a variable plant community with a predominantly low shrub understorey.

Distribution of sites in geomorphic regions: (see under Spinifex above for abbreviations in this table)

EPS	YOP	KIN	FLP
18	13	2	4



Number of plant species:

Min	Max	Average
18	49	30.81

Dominant overstorey species:

Melaleuca lanceolata

Dominant understorey species:

Acrotriche patula

Lasiopetalum discolor

Sub-dominant species:

Beyeria lechenaultii

Eucalyptus diversifolia

Gahnia lanigera

Indicator species:

Acrotriche cordata

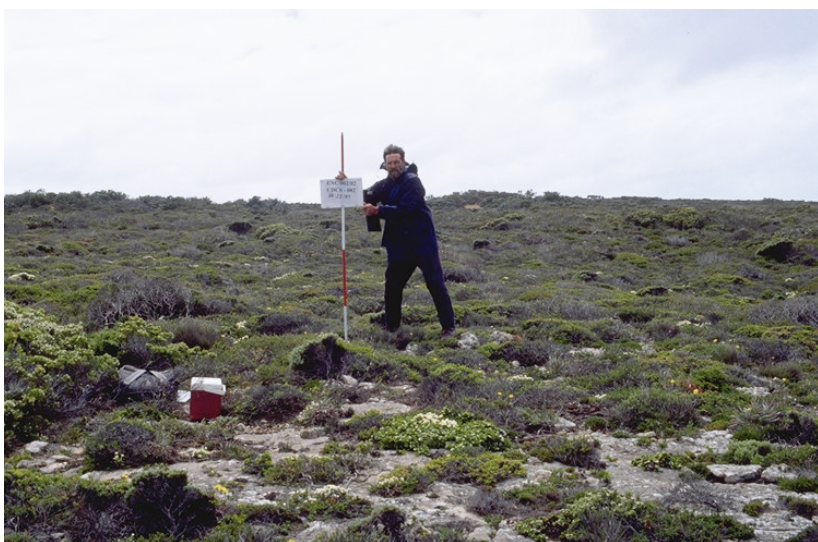


Figure 13. *Melaleuca lanceolata* / *Acrotriche patula* / *Lasiopetalum discolor* Shrublands/Mallees at Newland Head (PID 15929)

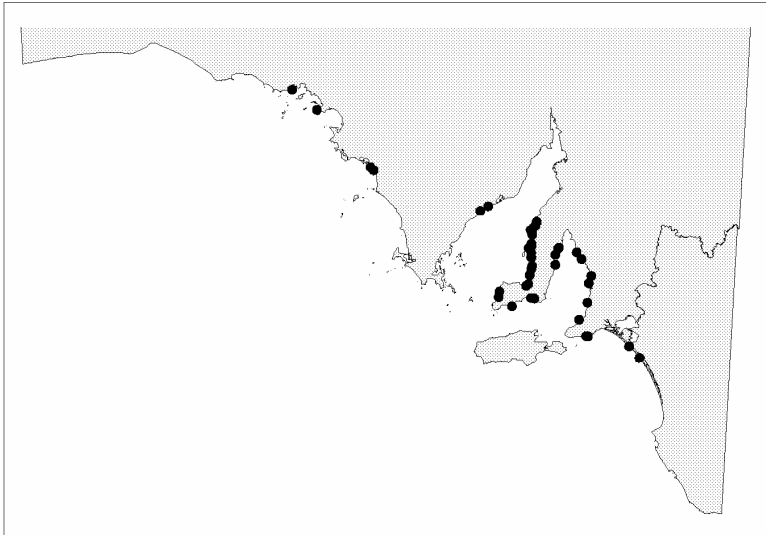
***Olearia axillaris* / *Rhagodia candolleana* ssp. *candolleana* Shrublands**

Description:

A large moderately strong group located along the coastline on predominantly dunefields.

Distribution of sites in geomorphic regions: (see under Spinifex above for abbreviations in this table)

EPW	EPE	YOP	SVG	FLP	COO
4	3	39	11	4	3



Number of plant species:

Min	Max	Average
9	31	19.50

Dominant overstorey species:

Olearia axillaris

Dominant understorey species:

Rhagodia candolleana ssp. *candolleana*

Tetragonia implexicoma

Threlkeldia diffusa

Sub-dominant species:

**Lagurus ovatus*

Indicator species:

Acacia ligulata



Figure 14. *Olearia axillaris* / *Rhagodia candolleana* ssp. *candolleana* Shrublands near Newland Head (PID 15960)

***Olearia ramulosa* / *Calytrix tetragona* Shrubland**

Description:

A moderately strong group in the Cape Jervis area on moderate to steep slopes of Precambrian metasediment cliffs. A mixture of mainly low shrubs with grasses and vines.

Distribution of sites in geomorphic regions:

FLP
5



Number of plant species:

Min	Max	Average
7	27	18.80

Dominant overstorey species:

Olearia ramulosa

Dominant understorey species:

Calytrix tetragona

Danthonia caespitosa

**Lagurus ovatus*

Muehlenbeckia gunnii

Senecio lautus

Indicator Species:

Ptilotus spathulatus forma *spathulatus*



Figure 15. *Olearia ramulosa* / *Calytrix tetragona* Shrubland near Second Valley (PID 15937)

***Allocasuarina verticillata* Forests**

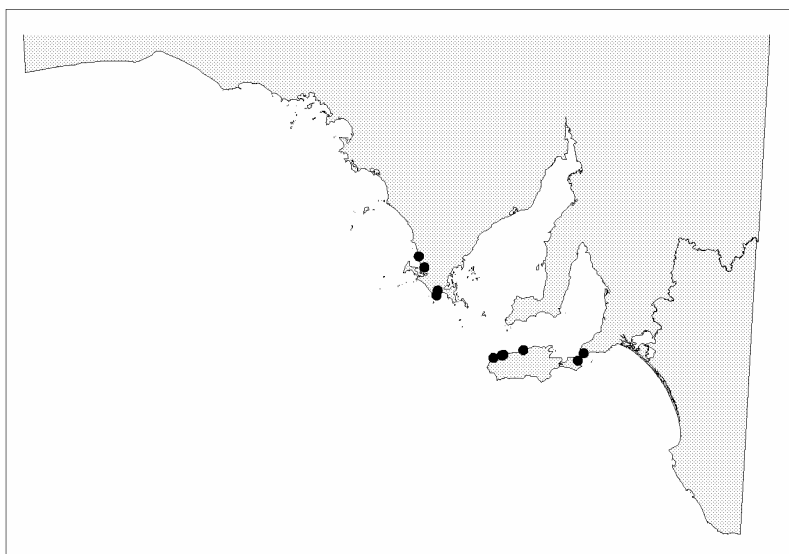
Floristic Group 18: 11 quadrats

Description:

A very strong group which is located on cliffs and hills of metasediments across the central coastline. There is a distinctive overstorey with few common understorey species.

Distribution of sites in geomorphic regions: (see under Spinifex above for abbreviations in this table)

EPS	KIN	KIE	FLP
4	5	1	1



Number of plant species:

Min	Max	Average
2	29	12.55

Dominant overstorey species:

Allocasuarina verticillata

Indicator Species:

Cheilanthes austrotenuifolia



Figure 16. *Allocasuarina verticillata* Forests near Blowhole Beach (PID 15942)

3.1.3 Saltmarshes

Within the Southern Fleurieu study area there are 205 ha of saltmarsh habitat compared with a total of 194,000 ha within South Australia. All of the mapped saltmarsh is located within the residual Murray Mouth estuary, however small areas of marsh too small to be mapped occur at a number of locations. The project to classify and map saltmarshes in South Australia is described by Fotheringham, 2000. The main purpose of the project was to compile a state wide digital coverage of mangrove and saltmarsh habitats. In conjunction with the classification and mapping transect lines were levelled to survey the plant communities occurring within the different habitats. Plant communities were described and surveyed in accordance with Biological Survey Program standards.

The classification and mapping of the saltmarshes and mangroves have been completed and are described by Canty and Hille, 2002. The habitat classification was based on landform, tidal class, estuarine class, vegetation cover and condition. Sixty-nine habitat classes were defined during the mapping process for South Australia. Within the Southern Fleurieu coastal boundary 4 habitat classes have been mapped.

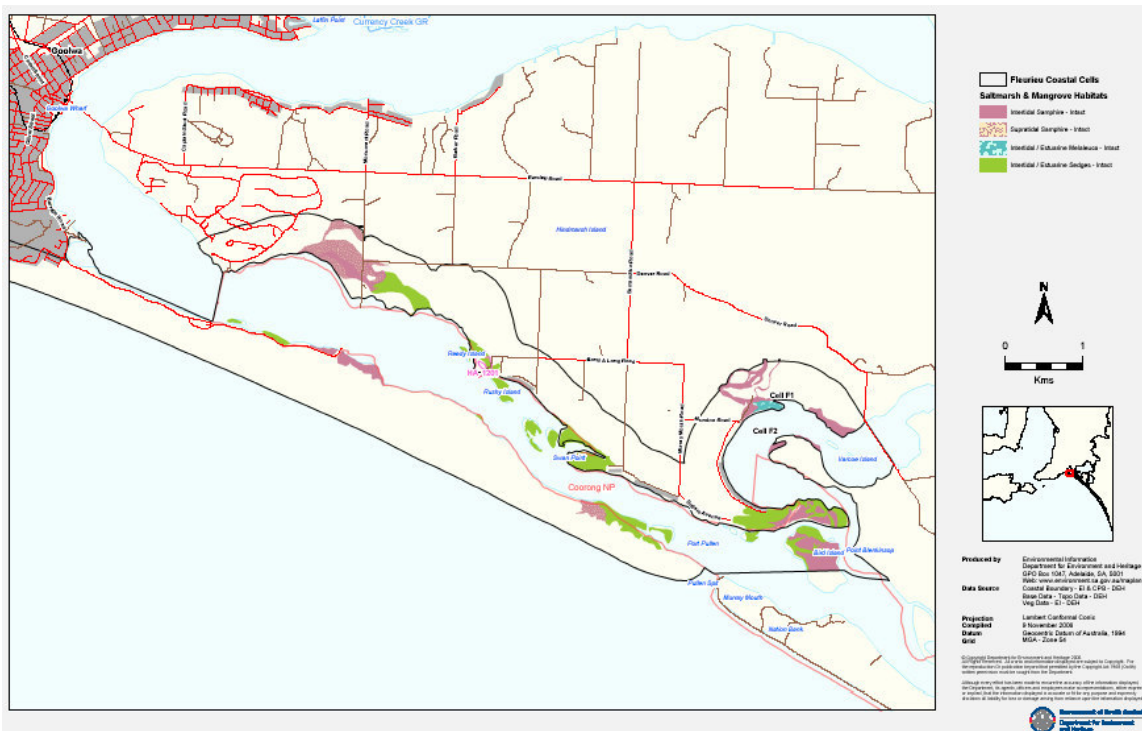


Figure 17. Saltmarsh habitat classes mapped near the Murray Mouth

Intertidal Samphire habitat (Figure 18) – Intertidal flats in sheltered waters occupied by a variety of halophytic plants herbaceous or shrubby forming both dense to sparse herblands and dense to sparse shrublands generally fringing the landward edge of the mangrove zone. Plants in this zone have adaptations to cope with frequent seawater inundation. 22784 hectares have been mapped in South Australia with 69 ha (0.3%) occurring in the study area.



Figure 18. Intertidal Samphire habitat

Intertidal / estuarine Melaleuca habitat (Figure 19) Intertidal flats with a freshwater influence occupied by *Melaleuca halmaturorum* (Swamp Paperbark) mid dense to sparse woodland. 22 hectares have been mapped in SA, 3.5 ha (16%) occurring within the study area. This is a rare habitat in SA.



Figure 19. Intertidal Melaleuca habitat

Intertidal / estuarine Sedges habitat (Figure 20)– Intertidal flats with a freshwater influence occupied by sedges often in association with *Melaleuca halmaturorum* Swamp Paperbark. 431 hectares mapped in South Australia of which 99 ha (23%) occurs in the study area. This is a rare habitat in South Australia.

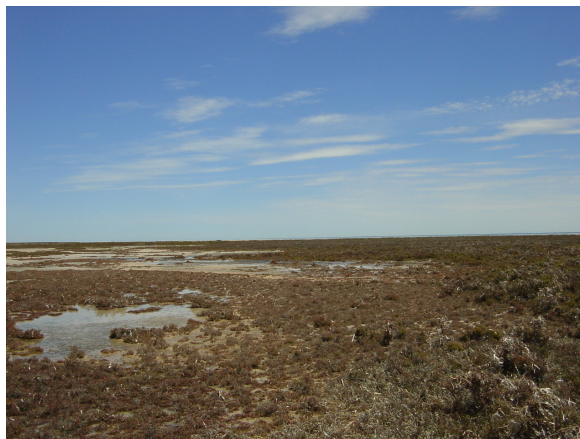


Figure 20. Intertidal / estuarine Sedges habitat

Supratidal Samphire habitat (Figure 21)– Supratidal flats above the reach of astronomical tides but within the zone flooded by storm tides occupied by a variety of halophytic shrubby plants forming mid dense to very sparse shrublands. These plants have to tolerate very high soil salinity and in places long periods of inundation due to ponding during winter months. The halophytes are replaced by saltbush communities at the landward fringe of these habitats. 23906 hectares have been mapped in South Australia but only 33 ha (0.1%) occur in the study area.



Figure 21. Supratidal Samphire habitat

There is good representation of South Australia’s estuarine saltmarsh habitats in the study area. Management of these habitats should be a particular focus of local coastal management.

3.1.4 Coastal Plant Species

Two lists of vascular plants found within the Southern Fleurieu coast boundary are provided and are shown in the appendices. One of the lists containing 608 species (shown in Appendix 7) is derived from the DEH plant record database. The second list, of 614 species (shown in Appendix 9) is from the records of opportunistic collecting by a local plant collector Ron Taylor. These lists compare with a total of 3,519 species known to occur in SA. A large number of species characteristic of the Mt Lofty ranges are present. The species lists also reflect the variation of environmental conditions along the coast such as shelter, soil and rainfall differences.

232 species found within the Southern Fleurieu coast boundary have a conservation status based on a recent review of existing determinations that follow those used by Lang and Kraehenbuehl 1998. Herbarium regions are used for the regional status determinations. The Southern Fleurieu coast study area is located in the Southern Lofty region.

The list of species with a conservation status is shown in Appendix 6. This list is based on both the DEH and Taylor plant records. In addition to the State and regional level determinations which are listed under Section 7, 8 and 9 of the *National Parks and Wildlife Act 1972* there are also national ratings that are listed under the *Commonwealth Environment Protection and Biodiversity Conservation Act 1999*. Four species shown in Table 2 below are listed as nationally endangered or vulnerable. Plants rated nationally as vulnerable or endangered require the preparation of recovery plans under legislative requirements of the *Commonwealth Environment Protection and Biodiversity Conservation Act 1999*.

Table 2. Nationally rated plants recorded within the Southern Fleurieu Coast

Euphrasia collina ssp. Osbornii (Osborn’s Eyebright)	Endangered	A small plant 15-20 cm tall, white to pink or lavender flowers and pale inside.
Olearia pannosa ssp pannosa (Silver Daisy Bush)	Vulnerable	Spreading shrub to undershrub with silver leaves up to 1.5 metres high with white to white/mauve flowers.
Spyridium coactilifolium (Butterfly Spyridium)	Vulnerable	Spreading shrub with rusty tomentose leaves less than 1 metre high.
Glycine latrobeana (Clover Glycine)	Vulnerable	A small perennial herb in the pea family. It grows 10 cm tall and is generally found in grassy woodlands and native grasslands.

Indigenous Fauna



Cunningham's Skink
Photographed by Peter Matejcic



Redcapped Plover
Photographed by Mary Crawford



Painted Dragon
Photographed by Sharie Detmar

3.2 Birds

[This section follows the habitat descriptions used by Haby, (in Caton et al 2006)]

Bird species identified within the Southern Fleurieu coastal region were listed from the 2005 'Atlas of Australian Birds', an exercise which yielded some 190 species. This list was examined by Graham Carpenter from the Department of Water Land & Biodiversity and reduced to those species which are listed as significant at the Commonwealth, State or Local level: a total of 61 species – the majority of threatened species currently detected within the Southern Fleurieu region. These birds are listed, together with the cells where they have been located, in Appendix 1. The habitat of these species within the Southern Fleurieu is briefly discussed below.

3.2.1 Bush Birds

The following threatened species inhabit woodland and dense shrubland within the Southern Fleurieu coastal region.

Painted Button-quail (*Turnix varia*), Brush Bronzewing (*Phaps elegans*), Yellow-tailed Black-Cockatoo (*Calyptorhynchus funereus*), Shining Bronze-cuckoo (*Chrysococcyx lucidus*), Yellow Thornbill (*Acanthiza nana modesta*), Black-chinned Honeyeater (*Melithreptus gularis gularis*), Scarlet Robin (*Petroica multicolor boodang*), Crested Shrike-tit (*Falcunculus frontatus*), Elegant Parrot (*Neophema elegans*).

These species show a variety of habitat. The Painted Button Quail, the Brush Bronzewing and the Elegant Parrot search for food on the ground; the former two for insects and seeds amongst the ground litter, the Elegant Parrot is omnivorous, consuming a mixed diet of seeds, fruits and invertebrates. These birds are ground nesting within wood or heath areas.

The Shining Bronze Cuckoo, Yellow Thornbill, Black Chinned Honeyeater, Scarlet Robin and Crested Shrike tit prefer an arboreal habit and forage for insects above ground. These species also nest above ground. The Yellow-tailed Black Cockatoo consumes seeds and pine cones amongst woodland branches, but is also prepared to ground forage for seeds.

Species occupying woodland associations are at risk from habitat loss by clearance; of predation by foxes, feral cats and dogs; of degradation of habitat from high grazing pressure by stock, rabbits and abundant native herbivores; and herbicide and pesticide drift.

Heathland

The Beautiful Firetail (*Stagonopleura bella bella*), Chestnut-rumped Heathwren (*Calamanthus pyrrhopygius parkeri*), and Southern Emu-wren (*Stipiturus malachurus intermedius*) are found in restricted locations within the Southern Fleurieu coastal area. The Beautiful Firetail is seed eating and prefers water edge sites. The endangered Chestnut-rumped Heathwren and Southern Emu-wren are insectivorous and prefer dense cover. These species are primarily at risk from habitat loss and are the subject of species recovery plans.

3.2.2 Beaches, Dunes and Headlands

The Rock Parrot, *Neophema petrophila*, is a terrestrial species preferring to forage on the ground, low shrubs and among rocks and tidal flats of the coastline for seeds and fruits.

Orange-bellied Parrot, *Neophema chrysogaster*, is a seasonal visitor to the beaches of the eastern end of the Southern Fleurieu foraging for seeds amongst the coastal dune grasslands and low shrublands.

Threats to bush bird species using coastlines are similar to those faced by waders.

3.2.3 Waders

RIVERS, LAKES, SALTMARSH

Little Egret	<i>Egretta garzetta</i>
Cattle Egret	<i>Ardea ibis</i>
White-necked Heron	<i>Ardea pacifica</i>
Intermediate Egret	<i>Ardea intermedia</i>
Nankeen Night Heron	<i>Nycticorax caledonicus</i>
Australasian Bittern	<i>Botaurus poiciloptilus</i>
Glossy Ibis	<i>Plegadis falcinellus</i>
Royal Spoonbill	<i>Platalea regia</i>
Buff-banded Rail	<i>Rallus philippensis</i>
Lewin's Rail	<i>Rallus pectoralis</i>
Baillon's Crake	<i>Porzana pusilla</i>
Spotless Crake	<i>Porzana tabuensis</i>
Latham's Snipe	<i>Gallinago hardwickii</i>
Black-tailed Godwit**	<i>Limosa limosa</i>
Bar-tailed Godwit**	<i>Limosa lapponica</i>
Whimbrel**	<i>Numenius phaeopus</i>
Eastern Curlew**	<i>Numenius madagascariensis</i>
Wood Sandpiper**	<i>Tringa glareola</i>
Sanderling	<i>Calidris alba</i>
Long-toed Stint	<i>Calidris subminuta</i>
Pectoral Sandpiper**	<i>Calidris melanotus</i>
Banded Stilt*	<i>Cladorhynchus leucocephalus</i>
Golden-headedCisticola	<i>Cisticola exilis</i>

ROCKY SHORES, REEFS

Grey-tailed Tattler**	<i>Heteroscelus brevipes</i>
Pied Oystercatcher	<i>Haematopus longirostris</i>
Sooty Oystercatcher	<i>Haematopus fuliginosus</i>
Eastern Reef Egret	<i>Egretta sacra</i>

BEACHES, TIDAL FLATS

Pied Oystercatcher	<i>Haematopus longirostris</i>
Sooty Oystercatcher	<i>Haematopus fuliginosus</i>
Whimbrel**	<i>Numenius phaeopus</i>
Ruddy Turnstone**	<i>Arenaria interpres</i>
Lesser Sand Plover**	<i>Charadrius mongolus</i>
Greater Sand Plover**	<i>Charadrius leschenaultii</i>
Hooded Plover**	<i>Thinornis rubricollis</i>
Common Sandpiper**	<i>Actitis hypoleucos</i>

** N. hemisphere migrant

* N. Australia migrant

Waders require a variety of resources throughout the coast and, in some cases, terrestrial wetlands. Habitats preferred by waders include a combination of sheltered bays, estuaries, lagoons, mudflats, sandflats, spits, banks, near-coastal wetlands, seagrass, saltmarsh, mangroves, rocky coasts, rocky platforms, dunes and / or reef environments.

Preferred roosting sites are predominantly trees near wetlands, and mangroves, beaches, banks, spits, sand / shell bars, dunes, saltmarsh and shrubs, rocky areas, reefs, platforms, artificial structures and cliffs, with preferred nesting sites including trees, sandy areas, such as spits and low islands, among seaweed, vegetation or rocks or sand along beaches, offshore islands, ephemeral saltlakes and fresh, brackish and saline wetlands. Many wader species (approximately 35% of the list above) migrate to Australia during non-breeding season.

Threats to waders include a whole range of catchment and local management actions undertaken for economic or recreational reasons: in particular, modification of tidal flats due to modification of sediment or water movement is significant. Predation by foxes, feral cats and dogs and abundant native species (such as Silver Gulls) and decline in prey abundance due to fishing and human disturbance.

3.2.4 Diving Birds

The Great Crested Grebe (*Podiceps cristatus*) is the only species of threatened diver within the Southern Fleurieu coastal zone. Belonging to the family Podicipedidae, this species prefers freshwater bodies over coastal habitats, but is often located within coastal habitats during non-breeding season. The species dives for fish. Nest sites are constructed in freshwater wetlands with aquatic vegetation and open water. In open water, surface vegetation and edges of well-flooded cover will be used for roosting.

Grebes are susceptible to a decline in prey abundance due to fishing and pollution, loss of habitat for development and recreation, diversion of fresh water from natural coastal water bodies, high grazing pressure by stock in wetland habitats, pesticide and herbicide spray drift.

3.2.5 Seabirds

Five species of Seabirds have been identified within the coast of the Southern Fleurieu. These include the White-bellied Sea-eagle, *Haliaeetus leucogaster*, Pacific Gull, *Larus pacificus*, Kelp Gull *Larus dominicanus*, Fairy Tern, *Sterna neries* and the Common Tern *Sterna hirundo*.

The White-bellied Sea-eagles depend upon a variety of coastal habitats, terrestrial wetlands, water bodies and offshore islands. The White-bellied Sea-eagle prefers to hunt in open terrestrial habitats, inshore waters, islands, coral reefs, cays, bays, inlets, estuaries, mangroves and beaches, to hunt for birds, reptiles, fish, mammals, crustaceans and carrion, while the Osprey prefers large patches of water to locate fish, small terrestrial vertebrates, seabirds and crustaceans.

White-bellied Sea-eagles nest along cliffs, rock pinnacles, escarpments, tall trees, and Osprey on high positions, or positions surrounded by water, rocky headlands, stacks, cliffs, palm trees, dead trees and artificial platforms.

The Pacific Gull, Little Tern and Fairy Tern require coastal habitats, but have some ability to adapt to the changes in landscape and use salt fields, and in the case of the Pacific Gull, sewage ponds, paddocks and dumps. The Little Tern will nest in artificial banks, freshly deposited soil, some vegetation and the Fairy Tern in islands of dredge spoil.

The Pacific Gull forages along the coastline between the high water mark and shallow water, sandy beaches, exposed mudflats and mud banks. Whether the species breeds in South Australia and what habitat requirements are needed are as yet unknown.

The Common Tern and Fairy Tern both forage in shallow water and roost on sandy beaches, spits, banks and bars. The Fairy Tern requires sand spits, bars, banks, ridges, islands of dredge spoil, rocky islands, stacks, bare sand, near vegetation for suitable nest sites.

The seabirds listed above are at risk of predation by foxes, feral cats and dogs, and abundant native species, such as the Silver Gull, are at risk of loss of habitat from development and recreation, human disturbance, management of salt fields and sewage ponds, increasing vegetation cover along beaches, disrupted sand flow, loss of prey through fishing and pollution, and firewood collection. Some species, such as predatory birds, might also be at risk of hunting.

3.2.6 Wildfowl

Seven species of wildfowl have been identified in the Southern Fleurieu coastal zone. These include Brown Quail *Coturnix ypsilophora*, Blue-billed Duck *Oxyura australis*, Musk Duck *Biziura lobata*, Cape Barren Goose *Cereopsis novaehollandiae*, Australasian Shoveler *Anas rhynchos*, Chestnut Teal *Anas castanea*, and the Hardhead *Aythya australasica*.

These species require terrestrial wetlands and coastal habitats; foraging at the edge of wetlands, on mud flats and in shallow water, or in deep water and amongst fringing vegetation, respectively. The fowl roost in a variety of locations including the water's edge, in dead trees and branches, grasslands and mudflats nearby, but require hollows or aquatic vegetation growing above the water and away from the edge of the wetland.

The herbivorous Cape Barren Goose occurs predominantly within grasslands and terrestrial wetlands, foraging in the grasslands, wetlands, mudflats and roosting nearby. The species nests on offshore islands, coming to the mainland to feed, often in paddocks with grazing stock, when feed available on the offshore islands has been depleted.

Wildfowl face a variety of risks including conflict of land use in agricultural areas, high grazing pressure by stock, rabbits and abundant native fauna, pollution, habitat loss from herbicide and pesticide spray drift and firewood collection.

3.3 Reptiles and Amphibians of the Southern Fleurieu Coastal Zone

By Claire Petherick

3.3.1 Identification of Reptile and Amphibian Species Occurring within the Southern Fleurieu Coastal Zone

State biological survey data and museum records show 19 reptile and amphibian species have been documented within the Southern Fleurieu Coastal Zone. One of these species, Cunningham's Skink (*Egernia cunninghami*), is considered vulnerable at the state level.

The data available provides a starting point for analysis of the conservation value of reptiles and amphibians, although there are numerous limitations that affect the ability to reflect true conservation values. For example, one limitation is that records are limited to site survey locations and have not been undertaken across all 27 southern Fleurieu coastal cells, (see Figure 3). The number and location of survey sites selected is usually based upon the distribution of existing sites in the area and local knowledge. Funding, time and access constraints also dictate the number of sites that can be visited.

Another limitation is that fauna surveying is a difficult exercise, as species are mobile by nature. Reptiles also seek protection under rocks, fallen logs and leaf litter which makes surveying a time-consuming exercise.

Given the above limitations, herpetology expert Tim Milne (Nature Conservation Society of South Australia) agreed to examine the available records to determine any other reptile and amphibian species also likely to be present in the Southern Fleurieu coastal zone.

Based upon Tim's knowledge of the region, reptile species and their habitat requirements, the list of reptile and amphibian species likely to occur in the Southern Fleurieu coastal zone was increased to 37. This includes three species considered rare at the state level. Table 3 details reptile and amphibian species of the Southern Fleurieu coastal zone and their corresponding conservation status at the state level (no species of national significance believed to be present). In addition, Table 4 identifies each species level of dependency on the coast, their abundance in the Southern Fleurieu (rare, uncommon or common), and regional coastal distribution (as identified by Tim Milne).

3.3.2 Distribution of Reptiles and Amphibian Species within the Southern Fleurieu Coastal Zone

The distribution of the 37 reptile and amphibian species within the Southern Fleurieu coastal zone can be determined by examining survey location sites and noting cells species are likely to occupy given their specific habitat requirements. Herpetology expert Tim Milne was able to develop a list detailing the habitat(s) each species occupies, which was then used to extrapolate which habitats occur in particular cells and therefore which cells / vegetation blocks may support particular species. The results of this distribution analysis are featured in Table 4 (refer to individual cell analysis for cell-specific species lists).

Table 3. Reptile and Amphibian Species of the Southern Fleurieu Coastal Zone

Common Name	Species	Conservation Status (SA)	Level of Dependency on Coast	Abundance	Regional Coastal Distribution
Adelaide Snake-lizard	<i>Delma mollerii</i>		Not Dependent	Common	Restricted
Black Tiger Snake	<i>Notechis ater</i>				
Bougainville's Skink	<i>Lerista bougainvillii</i>		Not Dependent	Common	Widespread
Brown Toadlet	<i>Pseudophryne bibronii</i>		Not Dependent	Uncommon	Widespread
Brown Tree Frog	<i>Litoria ewingii</i>		Not Dependent	Common	Widespread
Bull Frog	<i>Limnodynastes dumerili</i>		Not Dependent	Common	Widespread
Common Froglet	<i>Crinia signifera</i>		Not Dependent	Common	Widespread
Common Long-necked Tortoise	<i>Chelodina longicollis</i>		Not Dependent		
Common Scaly-foot	<i>Pygopus lepidopus</i>		Not Dependent	Uncommon	Widespread
Cunningham's Skink	<i>Egernia cunninghami</i>	Vulnerable	Partially Dependent	Rare	Restricted
Dwarf Skink	<i>Menetia greyii</i>		Not Dependent	Common	Restricted
Eastern Bearded Dragon	<i>Pogona barbata</i>		Not Dependent	Common	Widespread
Eastern Blue-tounge	<i>Tiliqua scincoides</i>		Not Dependent	Common	Widespread
Eastern Brown Snake	<i>Pseudonaja textilis</i>		Not Dependent	Common	Widespread
Eastern Three-lined Skink	<i>Bassiana duperreyi</i>		Not Dependent	Common	Widespread
Eastern Tiger Snake	<i>Notechis scutatus</i>		Not Dependent	Uncommon	Restricted
Four-toed Earless Skink	<i>Hemiergis peronii</i>		Partially Dependent	Uncommon	Restricted
Garden Skink	<i>Lampropholis guichenoti</i>		Not Dependent	Common	Widespread
Heath Goanna	<i>Varanus rosenbergi</i>	Rare	Partially Dependent	Rare	Restricted
Lined Worm Lizard	<i>Aprasia striolata</i>		Not Dependent	Common	Widespread
Little Whip Snake	<i>Suta flagellum</i>		Not Dependent	Uncommon	Widespread
Loggerhead Turtle	<i>Caretta caretta</i>		Not Dependent		
Mallee Black-headed Snake	<i>Suta spectabilis</i>		Not Dependent	Uncommon	Restricted
Mallee Snake-eye	<i>Morethia obscura</i>		Partially Dependent	Common	Restricted
Marbled Gecko	<i>Christinus marmoratus</i>		Not Dependent	Common	Widespread
Olive Snake-lizard	<i>Delma inornata</i>	Rare	Not Dependent	Uncommon	Restricted
Painted Dragon	<i>Ctenophorus pictus</i>		Dependent	Common	Restricted
Painted Frog	<i>Neobatrachus pictus</i>		Not Dependent	Common	Widespread
Red-bellied Black Snake	<i>Pseudechis porphyriacus</i>		Not Dependent	Common	Widespread
Sleepy Lizard	<i>Tiliqua rugosa</i>		Not Dependent	Common	Widespread
Southern Grass Skink	<i>Pseudemoia entrecasteauxii</i>		Not Dependent	Common	Restricted
Southern Four-toed Slider	<i>Lerista dorsalis</i>		Not Dependent	Uncommon	Restricted
Spotted Grass Frog	<i>Limnodynastes tasmaniensis</i>		Not Dependent	Common	Widespread
Tawny Dragon	<i>Ctenophorus decresii</i>		Not Dependent	Common	Widespread
Three-toed Earless Skink	<i>Hemiergis decresiensis</i>		Not Dependent	Common	Widespread
White's Skink	<i>Egernia whitii</i>		Not Dependent	Common	Widespread
Yellow-bellied Water Skink	<i>Eulamprus heatwolei</i>	Rare	Not Dependent	Common	Restricted

Table 4. Reptile & Amphibian Species Distribution in the Southern Fleurieu

Species	Common Name	Habitat Occupies	Cell Recorded	Cells Species May Occupy
Adelaide Snake-lizard	<i>Delma mollerii</i>	Woodland, Coastal Shrubland, Shrubland, Grassland		F1, F2, F3, F4, F5, F8, F9, F10, F11, F12, F13, F14, F15, F16, F17, F18, F19, F20, F21, F22, F23, F24, F25, F26, F27
Black Tiger Snake	<i>Notechis ater</i>		F1	
Bougainville's Skink	<i>Lerista bougainvillii</i>	Woodland, Coastal Shrubland, Shrubland, Grassland	F15	F1, F2, F3, F4, F5, F8, F9, F10, F11, F12, F13, F14, F15, F16, F17, F18, F19, F20, F21, F22, F23, F24, F25, F26, F27
Brown Toadlet	<i>Pseudophryne bibronii</i>			F1, F2, F10, F11, F12, F14, F16, F17, F18, F19, F20, F22, F23, F24, F25
Brown Tree Frog	<i>Litoria ewingii</i>	Woodland, Shrubland, Grassland, Sedgeland	F20	F1, F2, F4, F5, F8, F10, F11, F12, F13, F14, F15, F16, F17, F18, F19, F20, F22, F23, F24, F25, F26, F27
Bull Frog	<i>Limnodynastes dumerilii</i>	Woodland, Shrubland, Grassland, Sedgeland		F1, F2, F4, F5, F8, F10, F11, F12, F13, F14, F15, F16, F17, F18, F19, F20, F22, F23, F24, F25, F26, F27
Common Froglet	<i>Crinia signifera</i>	Woodland, Shrubland, Grassland, Sedgeland		F1, F2, F4, F5, F8, F10, F11, F12, F13, F14, F15, F16, F17, F18, F19, F20, F22, F23, F24, F25, F26, F27
Common Long-necked Tortoise	<i>Chelodina longicollis</i>	Watercourses		F1, F2, F3, F4, F5, F7, F9, F10, F11, F12, F14, F15, F16, F17, F18, F19, F20, F21, F22, F23, F24, F25, F26, F27
Common Scaly-foot	<i>Pygopus lepidopus</i>	Woodland		F11, F12, F14, F16, F17, F18, F19, F20, F22, F23, F24, F25
Cunningham's Skink	<i>Egernia cunninghami</i>	Coastal Cliffs	F14, F18	F12, F13, F15, F16, F17, F19, F20, F21, F22, F23
Dwarf Skink	<i>Menetia greyii</i>	Woodland, Coastal Shrubland		F2, F3, F4, F5, F9, F10, F11, F12, F14, F15, F16, F17, F18, F19, F20, F21, F22, F23, F24, F25, F26
Eastern Bearded Dragon	<i>Pogona barbata</i>	Woodland, Coastal Shrubland, Shrubland, Grassland	F15	F1, F2, F3, F4, F5, F8, F9, F10, F11, F12, F13, F14, F16, F17, F18, F19, F20, F21, F22, F23, F24, F25, F26, F27
Eastern Blue-tounge	<i>Tiliqua scincoides</i>	Woodland, Coastal Shrubland, Shrubland, Grassland	F12	F1, F2, F3, F4, F5, F8, F9, F10, F11, F13, F14, F15, F16, F17, F18, F19, F20, F21, F22, F23, F24, F25, F26, F27
Eastern Brown Snake	<i>Pseudonaja textilis</i>	Woodland, Coastal Shrubland, Shrubland, Grassland	F7	F1, F2, F3, F4, F5, F8, F9, F10, F11, F12, F13, F14, F15, F16, F17, F18, F19, F20, F21, F22, F23, F24, F25, F26, F27
Eastern Three-lined Skink	<i>Bassiana duperreyi</i>	Woodland, Shrubland		F1, F2, F3, F4, F5, F8, F9, F10, F11, F12, F13, F14, F15, F16, F17, F18, F19, F20, F21, F22, F23, F24, F25, F26, F27
Eastern Tiger Snake	<i>Notechis scutatus</i>	Sedgeland		F1, F2, F3, F4, F5, F7, F9, F10, F11, F12, F14, F15, F16, F17, F18, F19, F20, F21, F22, F23, F24, F25, F26, F27
Four-toed Earless Skink	<i>Hemiergis peronii</i>	Coastal Shrubland	F14, F15	F2, F3, F4, F5, F9, F10, F18, F19, F20, F21, F22, F23, F24, F25, F26
Garden Skink	<i>Lampropholis guichenoti</i>	Woodland	F15, F18	F11, F12, F14, F17, F19, F20, F22, F23, F24, F25
Heath Goanna	<i>Varanus rosenbergi</i>	Woodland, Shrubland, Coastal Shrubland		F1, F2, F3, F4, F5, F8, F9, F10, F11, F12, F13, F14, F15, F16, F17, F18, F19, F20, F21, F22, F23, F24, F25, F26, F27
Lined Worm Lizard	<i>Aprasia striolata</i>	Woodland, Shrubland		F1, F2, F3, F4, F5, F8, F9, F10, F11, F12, F13, F14, F15, F16, F17, F18, F19, F20, F21, F22, F23, F24, F25, F26, F27
Little Whip Snake	<i>Suta flagellum</i>	Woodland, Shrubland	F8	F1, F2, F4, F11, F12, F13, F14, F15, F16, F17, F18, F19, F20, F22, F23, F24, F25, F27
Loggerhead Turtle	<i>Caretta caretta</i>		F20	
Mallee Black-headed Snake	<i>Suta spectabilis</i>	Woodland, Shrubland		F1, F2, F4, F8, F11, F12, F13, F14, F15, F16, F17, F18, F19, F20, F22, F23, F24, F25, F27
Mallee Snake-eye	<i>Morethia obscura</i>	Woodland	F15	F11, F12, F13, F16, F17, F18, F19, F20, F22, F23, F24, F25
Marbled Gecko	<i>Christinus marmoratus</i>	Woodland, Shrubland	F14, F15, F18	F1, F2, F3, F4, F5, F8, F9, F10, F11, F12, F13, F16, F17, F19, F20, F21, F22, F23, F24, F25, F26, F27
Olive Snake-lizard	<i>Delma inornata</i>	Woodland, Grassland		F1, F2, F11, F12, F14, F16, F17, F18, F19, F20, F22, F23, F24, F25
Painted Dragon	<i>Ctenophorus pictus</i>	Coastal Shrubland		F2, F3, F4, F5, F6, F7, F8, F9, F10, F11, F12, F14, F15, F16, F17, F18, F19, F20, F21, F22, F23, F24, F25, F26, F27
Painted Frog	<i>Neobatrachus pictus</i>	Woodland, Sedgeland, Grassland, Coastal Shrubland, Sedgeland		F1, F2, F3, F4, F5, F8, F9, F10, F11, F12, F13, F14, F15, F16, F17, F18, F19, F20, F21, F22, F23, F24, F25, F26, F27

Red-bellied Black Snake	<i>Pseudechis porphyriacus</i>	Woodland, Coastal Shrubland, Shrubland, Grassland		F1,F2,F3,F4,F5,F8.F9,F10,F11,F12,F13, F14,F15,F16,F17,F18,F19,F20,F21,F22, F23,F24,F25,F26,F27
Sleepy Lizard	<i>Tiliqua rugosa</i>	Woodland, Coastal Shrubland, Shrubland, Grassland	F15	F1,F2,F3,F4,F5,F8.F9,F10,F11,F12,F13, F14,F15,F16,F17,F18,F19,F20,F21,F22, F23,F24,F25,F26,F27
Southern Grass Skink	<i>Pseudemoia entrecasteauxii</i>	Woodland, Shrubland	F1	F2,F3,F4,F5,F8.F9,F10,F11,F12,F13,F14, F15,F16,F17,F18,F19,F20,F21,F22,F23, F24,F25,F26,F27
Southern Four-toed Slider	<i>Lerista dorsalis</i>	Woodland, Coastal Shrubland		F2,F3,F4,F5,F9,F10,F11,F12,F14,F16, F17,F18,F19,F20,F21,F22,F23,F24,F25, F26
Spotted Grass Frog	<i>Limnodynastes tasmaniensis</i>	Woodland, Shrubland, Grassland, Sedgeland		F1,F2,F4,F5,F8,F10,F11,F12,F13,F14, F15,F16,F17,F18,F19,F20,F22,F23,F24, F25,F26,F27
Tawny Dragon	<i>Ctenophorus decresii</i>	Woodland	F16, F18	F11,F12,F14,F17,F19,F20,F22,F23,F24, F25
Three-toed Earless Skink	<i>Hemiergis decresiensis</i>	Woodland, Shrubland	F18	F1,F2,F3,F4,F5,F8.F9,F10,F11,F12,F13, F14,F15,F16,F17,F19,F20,F21,F22,F23, F24,F25,F26,F27
White's Skink	<i>Egernia whitii</i>	Woodland, Coastal Shrubland, Shrubland, Grassland	F14, F15, F18	F1,F2,F3,F4,F5,F8.F9,F10,F11,F12,F13, F16,F17,F19,F20,F21,F22,F23,F24,F25, F26,F27
Yellow-bellied Water Skink	<i>Eulamprus heatwolei</i>	Woodland, Shrubland		F1,F2,F3,F4,F5,F7,F9,F10,F11,F12,F14, F15,F16,F17,F18,F19,F20,F21,F22,F23, F24,F25,F26,F27

3.3.3 Conservation Value Allocation

To display reptile and amphibian species as a GIS conservation layer for this study it was necessary for individual species to be allocated a conservation value on a scale of between 1 and 9, with 1 being the lowest and 9 being the highest. Values were assigned based upon species official conservation status, level of dependency on the coast, abundance in the Southern Fleurieu and their regional coastal distribution (as previously outlined in Table 3).

Tables 5a-5d provide a summary of the allocation system used to assign conservation values to reptile and amphibian species. It is important to note that the individual components (GIS layers) of the value allocation system cannot be compared to one another – all are considered equally important in determining the conservation regime and need to be examined separately.

Table 5a. Conservation Value Allocation System (Part 1) - Conservation Status (State)

Value	Conservation Status
9	Endangered
5	Vulnerable
1	Rare

Table 5b. Conservation Value Allocation System (Part 2) - Species Dependency on Coastal Habitats

Value	Level of Coastal Dependency
9	Dependent
5	Partially dependent
0	Not dependent

Table 5c. Conservation Value Allocation System (Part 3) - Species Abundance in the Southern Fleurieu Coastal Region

Value	Abundance
9	Rare
5	Uncommon
1	Common

Table 5d. Conservation Value Allocation System (Part 4) - Regional Coastal Distribution / Species Affinity to the Coast

Value	Regional Coastal Distribution
9	Restricted
1	Widespread

3.3.4 Results

The conservation value allocation system highlights a number important reptile species and significant reptile and amphibian habitats in the Southern Fleurieu coastal zone. A brief discussion of key species, including description, distribution and habitat requirements, is provided in the following section, along with photographs and species specific distribution maps. Information on species with restricted distributions is also provided as impacts upon the habitats they occupy will have direct affects on certain reptile and amphibian species. Significant habitats are discussed in further detail in the conservation analysis component of this Plan.

3.3.5 Species of State Significance Present in the Southern Fleurieu Coastal Zone

Cunningham's Skink (*Egernia cunninghami*)

Cunningham's Skink is a large species that is readily identified by the distinctive spiny keels on each back scale (most pronounced on the tail). It is active during the day and feeds on fruits and seeds, invertebrates, and occasionally small vertebrates. Cunningham's Skink commonly shelters in crevices in rock formations and boulder slopes, from which its spiny scales make its removal by predators almost impossible.

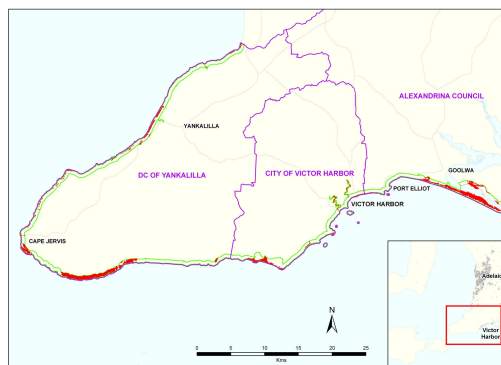
There are two main populations in the Southern Mount Lofty Ranges, one of which is located along the coastal cliffs of the Southern Fleurieu Peninsula from Normanville to Victor Harbor. Cunningham's Skink has a Vulnerable rating at the state level. The species is partially dependent on coastal habitats and is considered rare in the southern Fleurieu coastal zone.



Heath Goanna (*Varanus rosenbergi*)

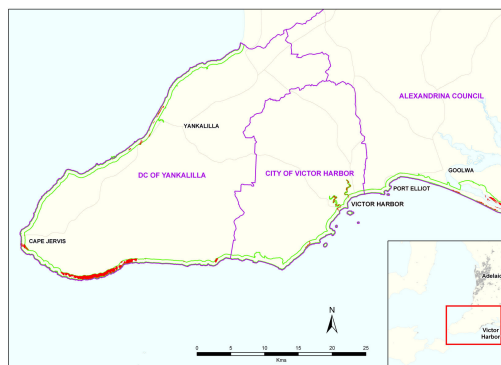
The Heath Goanna can grow to 1.5 metres. It displays a blackish base colour dotted with pale yellow or white, interlaced with a series of black bands. Its belly is pale with reticulated black or grey bands. It has a restricted distribution in the Southern Fleurieu, inhabiting woodlands, shrublands and coastal shrublands where it feeds upon other reptiles, insects, small mammals, and carrion. The species is considered Rare in South Australia and the Southern Fleurieu coastal zone.

It is worthwhile noting that anecdotal evidence from Western Australia suggests young Heath Goanna are vulnerable to predation by foxes with sightings of younger individuals being more common in areas that have been subject to fox-baiting.



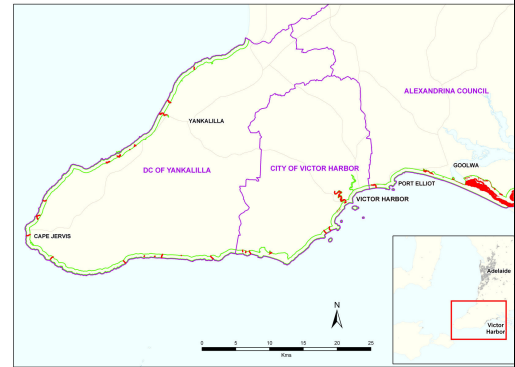
Olive Snake-Lizard (*Delma inornata*)

The Olive Snake-Lizard is a species of legless lizard featuring deep brown colouring on its back, often with a yellow throat. The species is classified as Rare in South Australia. It has a restricted distribution in the Southern Fleurieu, inhabiting woodland and grassy areas where it feeds upon small invertebrates. It is considered uncommon on the coast.



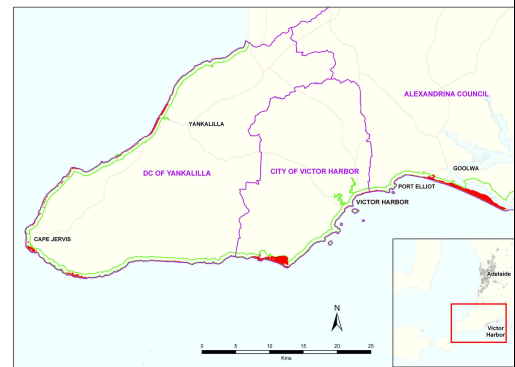
Yellow-bellied Water Skink (*Eulamprus heatwolei*)

The Yellow-bellied Water Skink has an olive-brown base colour on the back with darker flecks, and dark flanks featuring lighter spots. A pale stripe runs from the mouth upwards to the front of the ear opening. The Yellow-bellied Water Skink is a ground dwelling species that feeds on an array of invertebrates and small vertebrates. It is Rare in South Australia. The species is restricted to watercourses and permanent swamps and is common in the southern Fleurieu coastal zone.



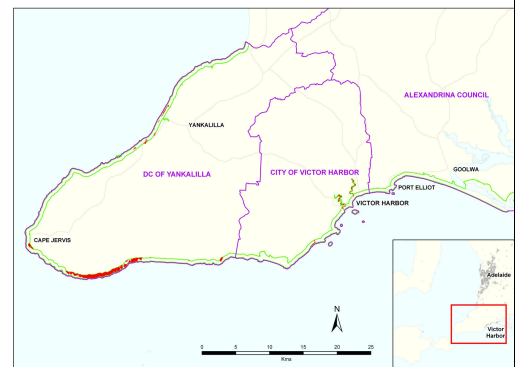
Painted Dragon (*Ctenophorus pictus*)

The Painted Dragon is a coastal dependent species which is restricted to coastal dune systems, with a preference towards large, relatively intact coastal shrublands. It commonly shelters in short burrows in sandy soils. It is a common species in the Southern Fleurieu coastal zone.



Mallee Snake-eye (*Morethia obscura*)

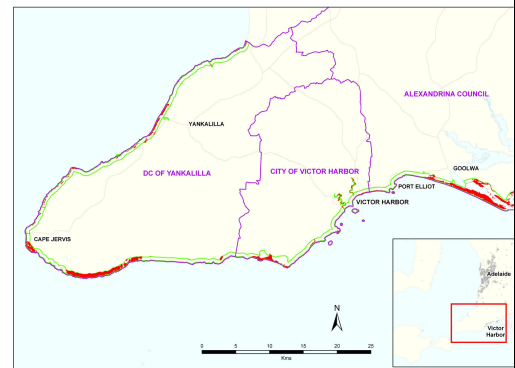
Limited information available. Species is partially dependent on the coast, distribution restricted to woodlands. Common in Southern Fleurieu.



3.3.6 Species with Restricted Distributions in the Southern Fleurieu Coastal Zone

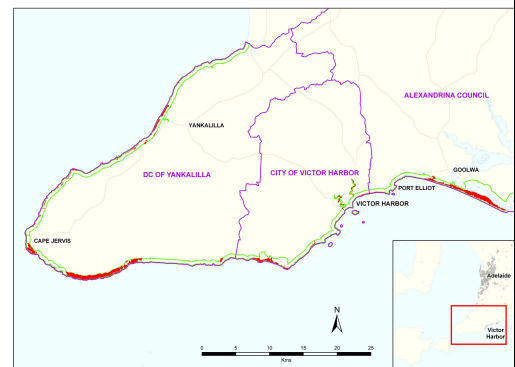
Adelaide Snake-lizard (*Delma mollerii*)

Commonly sighted legless lizard growing to 20 cm in length, featuring light brown colourings with a blackish-grey cap. Bears a resemblance to a juvenile eastern brown snake (*Pseudonaja textilis*). Not dependent on the coast, distribution restricted to woodlands, coastal shrublands, shrublands and grasslands. Common on the Southern Fleurieu.



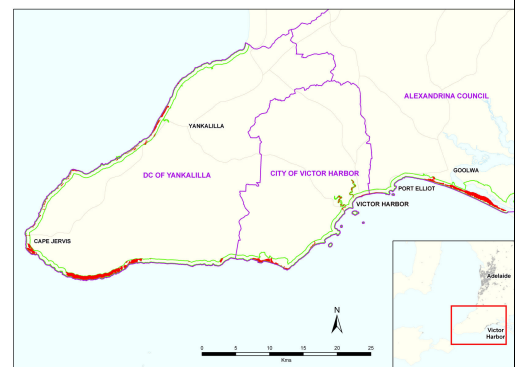
Southern Four-toed Slider (*Lerista dorsalis*)

A burrowing species which feeds on insects in loose sand or soil or beneath stones and logs. Restricted to woodlands and coastal shrublands, although not dependent on the coast. Uncommon in the Southern Fleurieu coastal zone.



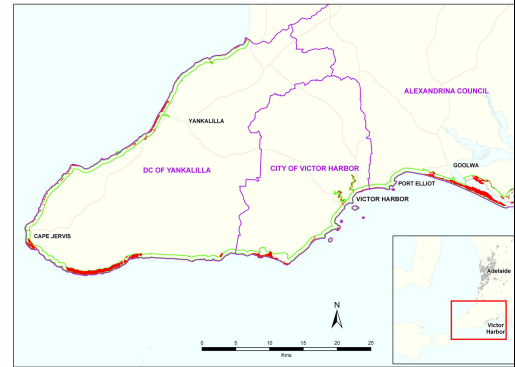
Dwarf Skink (*Menetia greyii*)

A diurnal species, commonly found in leaf litter or grasses. Restricted to woodlands and coastal shrublands, although not dependent on the coast. Common in the Southern Fleurieu coastal zone.



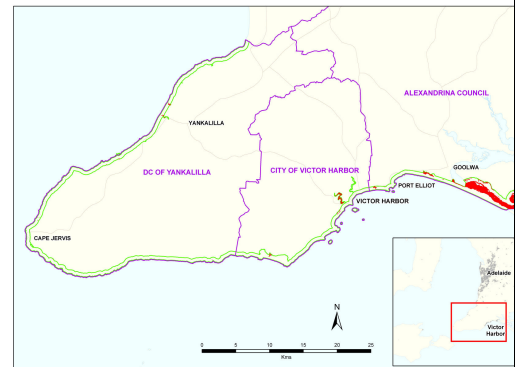
Southern Grass Skink (*Pseudemoia entrecasteauxii*)

Restricted to woodlands and shrublands, usually found on or around timber debris or foraging in leaf litter. Not dependent on the coast although common in the Southern Fleurieu coastal zone.



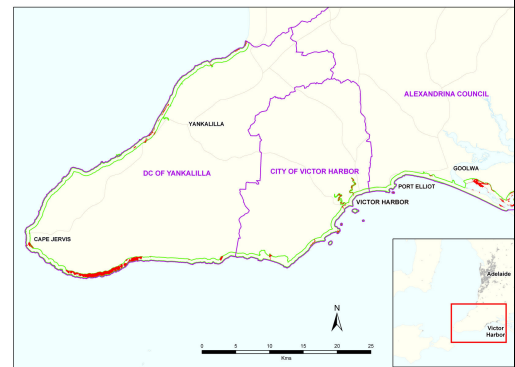
Eastern Tiger Snake (*Notechis scutatus*)

Venomous species that mainly feeds on frogs. Nocturnal in warmer conditions. Restricted to sedgelands and not dependent on the coast. Uncommon in the Southern Fleurieu coastal zone.



**Mallee Black-headed Snake
(*Suta spectabilis*)**

A nocturnal species often found sheltering under timber, rocks ground litter, or in abandoned insect and reptile burrows. Distribution restricted to woodlands and shrublands, not dependent on the coast. Uncommon in the Southern Fleurieu coastal zone.



3.4 Butterflies

Butterfly habitat has been included as a layer in the conservation analysis for this project. In 1997 a survey of the majority of the Southern Fleurieu coast was undertaken by Roger Grund. It identified areas of native vegetation remnants containing food plants favoured by butterfly larvae, together with comments on the health of those remnants (Grund, 1997).

Grund's survey was undertaken to identify remaining major vegetation remnants in region. Within the remnants identification of food plants for threatened butterfly species was undertaken as well as identification of species currently remaining. This work was based on the notion that butterfly populations are controlled by larval food plants.



Gahnia lanigera



Gahnia filum

(Photographs by Ron Sandercock)

Table 6. Southern Fleurieu: Butterfly Species and Larval Foodplants

[FAMILY] Species	Common Name	Vulnerability (Grund)	Larval Foodhost
[HESPERIIDAE] (Skippers)			[Skipper butterflies are entirely dependent on tussock grasses]
<i>Anisynta cynone cynone</i>	Cynone Skipper	Vulnerable	Native & introduced grasses, incl. e.g. <i>Brachypodium distachyon</i>
<i>Anisynta cynone gracilis</i>	Cynone Skipper	Rare	Native & introduced grasses, incl. e.g. <i>Brachypodium distachyon</i>
<i>Herimosa albovenata albovenata</i>	White-veined Skipper	Rare	<i>Stipa eremophila</i> ; <i>S. scabra falcata</i> ; <i>S. semibarbata</i>
<i>Hesperilla chrysotricha leucosia</i>	Chrysotricha Skipper	Vulnerable	<i>Gahnia duesta</i> ; <i>G. filum</i> ; <i>G. sieberiana</i> ; <i>G. trifida</i>
<i>Hesperilla donnysa diluta</i>	Donnysa Skipper	Rare	<i>Gahnia ancistrophylla</i> ; <i>G. duesta</i> ; <i>G. filum</i> ; <i>G. sieberiana</i> ; <i>G. trifida</i>
<i>Hesperilla idothea clara</i>	Flame Skipper	Rare	<i>Gahnia clarkei</i> ; <i>G. radula</i> ; <i>G. sieberiana</i> ; <i>G. trifida</i>
<i>Motasingha trimaculata trimaculata</i>	Trimaculata Skipper	Rare	<i>Lepidosperma carphoides</i> ; <i>L. viscidum</i>
<i>Antipodia atralba</i>	Black and White Skipper	Local	<i>Gahnia ancistrophylla</i> ; <i>G. duesta</i> ; <i>G. lanigera</i>
Sub-family [SATYRINAE] (Browns)			
<i>Geitoneura acantha ocrea</i>	Southern Ringed Xenica	Rare	<i>Microlaena stipoides</i> ; <i>Poa tenera</i> ; <i>Themeda triandra</i>
[LYCAENIDAE] (Coppers & blues)			
<i>Ogyris amaryllis meridionalis</i>	Amaryllis Azure	Local	<i>Amyema melaleucae</i> ; <i>A. miquelii</i> ; <i>A. pendulum pendulum</i> ; <i>A. presseii</i> . Larvae attended by small ants
<i>Ogyris genoveva genua</i>	Genoveva Azure		<i>A. miquelii</i> ; <i>A. pendulum pendulum</i> . Larvae attended by sugar ants
<i>Ogyris otanes</i>	Small brown Azure	Vulnerable	Larval stage spent in sugar ant nests
<i>Ogyris idmo halmaturia</i>	Large brown Azure	Endangered	<i>Choretrum glomeratum glomeratum</i> . Larvae attended by sugar ants
<i>Theclinesthes albocincta</i>	Grund's Blue	Local	<i>Adriana</i> spp. incl. <i>klotzshii</i>
<i>Jalmenus icilius</i>	Icilius Blue	Rare	<i>Acacia</i> spp. incl. <i>anceps</i> , <i>aneura aneura</i> , <i>pyncantha</i> , <i>retinodes</i> , <i>uncifolia</i> , <i>victoriae victoriae</i> . Larvae attended by small black ants

In the Southern Fleurieu, the area covered in the 1997 included wide coastal areas from Sellicks to Rapid Bay and from Newland Head to Murray Mouth. In 2006 Grund extended his work to include Deep Creek Conservation Park and areas of scrub near to Cape Jervis, thus allowing the completion of the database for this project.

Within this area significant privately held sites include Myponga and Yankalilla Rivers; two small cliff sites north of Carrickalinga; and some *Gahnia trifida* wetlands in the southern areas of the peninsula. These sites need heritage agreements. Other significant sites are in reserve status.

Table 7. Sites Identified by Grund (1997) (and updates, 2006) within the Southern Fleurieu Coastal Boundary

Location	Cell	Foodplants for thr. sp.	Observed Butterfly Sp	Likely thr.sp.	Land Status	Veg. Condition / Significant Butterfly species	Rehabilitation Suitability	Score
Newland Head	F15	✓	Thr. + C	✓	CP NPWS	Extensive varied habitat with valuable hostplant patches. Pressure of kangaroo grazing. Presence of <i>Hesperilla chrysotricha</i> , <i>A. atralba</i> , <i>Theclinesthes albocincta</i> .	Possible to rehabilitate fringe areas and reintroduce <i>Jalmenus icilius</i> , <i>Ogyris otanes</i> , <i>O. amaryllis</i> , <i>M. trimaculata</i> , <i>A. cynone cynone</i> , <i>G. acantha</i> , <i>O. genoveva</i>	9
Goolwa "CP"	F4	✓	Thr. + C	✓	NPWS (un dedic.)	Fair condition, but highly significant as major breeding habitat for <i>Anisynta cynone cynone</i> . Also present <i>Hesperilla donnysa diluta</i> , <i>Theclinesthes albocincta</i>	<i>H. chrysotricha</i> , <i>J. icilius</i> , <i>O. amaryllis</i>	9
Deep Creek CP						Extensive varied habitat with valuable hostplant patches. Presence of <i>H. chrysotricha</i> , <i>H. idothea</i> , <i>G. acantha</i> ,	Possible to rehabilitate and reintroduce <i>Ogyris otanes</i> , <i>Ogyris idmo</i> , <i>O. amaryllis</i> , <i>M. trimaculata</i> , <i>O. genoveva</i>	9

Sellicks Cliffs Coastal Reserve	F27	✓	C	✓	Coastal reserve	Degraded coastal heath	<i>A. cynone gracilis</i>	7
Carrickalinga Beach	F25	✓	C	-	Coastal reserve	Dunes in poor condition	<i>J. icilius, T. albocincta, A. cynone gracilis, O. amaryllis</i>	7
Normanville Dunes	F24, F23	✓✓	Thr. + C	✓	Coastal reserve	Dunes in good condition but degraded by <i>Acacia sophorae</i> . Presence of <i>J. icilius</i>	<i>T. albocincta, A. cynone gracilis, O. amaryllis, O. otares</i>	9
Second Valley, sea cliffs	F22	✓	C	✓	Coastal reserve	Coastal cliff heath, degraded by grazing pressure	<i>A. cynone gracilis, T. albocincta,</i>	7
Rapid Bay cliffs	F21	✓	C	✓	Coastal reserve	Cliffs provide habitat, cliff tops degraded by grazing pressure	<i>A. cynone gracilis, T. albocincta,</i>	7
Newland Head cliffs to Kings Head and the Bluff	F14, F13	✓	-	-	Coastal reserve	Coastal heath, sparse food plants; but many records of butterfly species in adjacent conservation park	<i>A. atralba M. trimaculata,</i>	7
Hindmarsh River Mouth, coastal reserve	F10	✓	C	(✓)	Coastal reserve	Significant site with rare foodplants	<i>T. albocincta, H. donnysa diluta</i>	7
Dunes: Surfers to Goolwa	F5, F6	✓	C	✓	Coastal reserve	Coastal dunes in mixed condition and under great pressure	<i>T. albocincta, A. cynone cynone, O. amaryllis</i>	5
Sir Richard Peninsula	F2	✓	C		SA Water reserve	Extensive barrier dune mass and fringing swamp, extensive areas of exotics	<i>T. albocincta, A. cynone cynone O amaryllis</i>	7
Hindmarsh Island, Murray Mouth Lookout Reserve	F1	✓	C	✓	Coastal reserve	Sand dune, with potential for supporting introduced foodplants	<i>A. cynone cynone</i>	5
Victor Harbor, Inman River Floodplain	F12	✓	C	✓	Council Reserve	Extensive well watered reserve, with considerable scope for introduced foodplants. Many old records of threatened species	<i>H. chrysotricha, T. albocincta, G. acantha, A. cynone cynone</i>	5
Goolwa Golf Course & Heritage Areas	F4	✓	Thr. + C	✓	Private, part Heritage listed	Significant woodland and heath site with <i>A. cynone cynone, T. albocincta, O. amaryllis, H. donnysa diluta</i>	<i>M. trimaculata</i>	9
Myponga River Gorge and Estuary	F27	✓	Thr. + C	(✓)	Private, SA Water	Estuarine system is rare, but considerably degraded by sedimentation and altered flow regime. <i>O. genoveva, O. amaryllis, G. acantha, H. chrysotricha</i>	<i>H. donnysa diluta, A. cynone gracilis, J. icilius</i>	9
Carrickalinga North, Whitelaw Road	F26	✓	Thr.	(✓)	Private & coastal reserve	<i>Gahnia lanigera</i> heath is one of two sites in region: presence of <i>Antipodia atralba</i>		9
Carrickalinga North Canyon	F26	✓	C	-	Private & coastal reserve	<i>Gahnia lanigera</i> heath and <i>E. diversifolia</i> heath	<i>T. albocincta</i>	9
Yankalilla, Bungala R & Hay Flat Road Creek	F24	✓	C	(✓)	Private & council reserve	Degraded wetland	<i>H. chrysotricha, G. acantha</i>	1
Yankalilla, Little Gorge	F23	✓	-	-	Private	Degraded through grazing		3
Yankalilla River (lower fraction only within boundary)	F23	✓	Thr. + C	(✓)	Private	Degraded wetland and valley woodland, but with numerous native veg remnants, not yet developed for housing. Presence of very large <i>O. olane</i> colony	Has considerable potential	8
Lady Bay Sea Cliffs	F23	✓	-	✓	Private	Coastal heath on very steep cliff slopes; vegetation on grazed tops virtually destroyed		3
Lady Bay					Private & coastal reserve	Coastal heath on degraded sand plain	<i>A. cynone gracilis, T. albocincta</i>	7
Wirrina Cove Resort & Anacotilla River	F22	✓	C	✓	Private & coastal reserve	Several and varied remnants; only cliff and coastal heath in good condition	<i>A. cynone gracilis, T. albocincta, O. amaryllis</i>	3

Cape Jervis, Lands End		✓	R		Private & coastal reserve	<i>Gahnia lanigera</i> heath, southernmost known in region; <i>A. atralba</i> present	<i>T. albocincta</i> , <i>M. trimaculata</i>	9
Second Valley, Parananaco o-ka River	F22	✓	C	✓	Private & Council reserve	Clearing and grazing have left the valley in poor condition	<i>H. chrysotricha</i>	1
Rapid Bay, Yattogolinga River	F21	✓	C	✓	Private & Council reserve	Clearing and grazing have left the valley in poor condition	<i>H. chrysotricha</i>	1
Victor Harbor, Lower Reaches of the Hindmarsh River	F11	✓	C	(✓)	Private	Degraded. Considerable re-vegetation needed to establish habitat	<i>H. chrysotricha</i> , <i>H. idothea</i> , <i>G. acantha</i>	1
Port Elliot, Watsons Gap swamp	F10	✓	Thr.	✓	Road reserve & private	A large remnant of <i>Gahnia filum</i> marshland on south side of road – a very significant feature	<i>A. cynone cynone</i> , <i>H. donnysa diluta</i>	8
Hindmarsh Island, Monument Road marshland	F1	✓	-	✓	Private	Saline chenopod grassland suitable for vulnerable skipper <i>Anisynta cynone cynone</i>	<i>A. cynone cynone</i> , <i>H. donnysa diluta</i>	8
Hindmarsh Island, Mundoo Channel & Boggy Creek	F1	✓	-	-	Private	Significant melaleuca stands and sedge swamp in good condition	<i>H. donnysa diluta</i>	5

Values for GIS analysis

9 – Unique, extensive remnant butterfly habitat containing breeding colonies of threatened butterflies. Highly significant, extensive butterfly habitat (rare foodplants or breeding habitat); containing rare or locally significant butterfly species.

8 – Highly significant, extensive butterfly habitat, suitable for additional revegetation with foodplants for threatened butterfly species and / or reintroduction of threatened butterfly species.

7 – Highly significant, extensive butterfly habitat, suffering degradation; suitable for additional revegetation with foodplants for rare or locally significant butterfly species and / or reintroduction of rare or locally significant butterfly species.

5 – Significant habitat in mixed to poor condition, but with considerable potential for threatened species.

3 – Habitat, with significant patches, with possible potential for threatened species.

1 – Habitat with potential for threatened species following considerable restoration.

Following discussion with Roger Grund, habitat was scored for its actual or potential value to butterfly larvae, together with the species status, as indicated above.

Heritage



Basham's Beach
Photographed by Alison Eaton



Morgan's Beach
Photographed by Ron Sandercock



Crushing & Dressing Works (c. 1863)
of the Talisker Silver / Lead Mine
Photographed by Ron Sandercock

3.5 Heritage

3.5.1 Aboriginal Heritage sites

Coastal lands of the Southern Fleurieu Peninsula have been the traditional country of the Ngarrindjeri and Ramindjeri people in the south, and the Kurna people on the Gulf coast. Ross, 1984, has produced a summary and discussion of Kurna Aboriginal sites in the Southern Mount Lofty Ranges for the Anthropological Society of South Australia. These show a preference for coastal sites over inland sites, because of the availability of food and water resources; coastal dune and river mouth sites being especially popular as campsites and meeting grounds. However, it should be remembered that the coastline has only been in its present position for the last 7000 years; when Aboriginal people arrived in the area, possibly 20,000 years ago, sea level was lower, and the coastline was located south of Kangaroo Island. Movement by land to KI and other islands would have been possible at that time. Records of coastal sites older than 7000 years have flooded by the rising sea level of the Post-Glacial Transgression.

Aboriginal heritage sites that have been registered on the State Heritage Register have been used in the conservation analysis. These sites are buffered on the digital maps to the cell level; thus if the cell contains a registered site, the whole cell would be given a high value for this digital layer. This process had two values for the analysis: firstly, Aboriginal sites contributed to the identification of places with a high conservation priority; secondly, the digital layer flags those areas where there is registered Aboriginal significance, for the users of this report. This is aimed to trigger a dialogue between users of the locality and the Aboriginal custodians of the site.

There are obvious shortcomings in this analysis. Some sites are notified, to the Department of Heritage, but not registered - these do not appear in the analysis. Other sites are of great significance to Aboriginal people, but are neither registered nor notified, and hence not counted in the analysis. The buffering introduces another problem: by buffering sites, they are to some extent protected, but within the analysis their value is diluted by extending over a large area. To take an extreme hypothetical case: if all significant sites were recorded and located on the digital map, it would be likely that there be one or more in every cell. In this scenario, through buffering to the cell level the entire coastal region would receive the same priority score, thus for this data set there would be no discrimination between one area and another, thereby defeating the object of the analysis. In reality, the process used here identifies about half the coastal cells as containing significant sites. Clearly, buffering reduces the discrimination of the analysis spatially, and the scoring method does not introduce any relative values for differing sites.

3.5.2 European Heritage sites

European heritage sites listed as 'natural heritage' on the State Heritage Register and on the Register of the National Estate are represented as a layer within the digital conservation analysis by presence or absence.

There are a number of European heritage registers currently in use in Australia: World Heritage, National Heritage, Commonwealth Heritage, Register of the National Estate, State Heritage and Local Heritage (these are discussed within Appendix 13). World, National and Commonwealth registers, however, have not recorded sites within the region, and sites on Local Heritage lists are shown on digital maps in the appendix (digital based Arc Reader map).

3.5.3 The Register of the National Estate

Criteria for entering a place on the Register of the National Estate (RNE) by the Australian Heritage Council are given in full in Appendix 13. These criteria relate to Australia's natural and cultural history and include flora, fauna, geomorphology and geology, as well as human use, occupation and aesthetics. Listing demonstrates the national significance of a place; this may influence management plans and development decisions. Under the EPBC Act the Commonwealth Minister for Environment and Heritage must take listing into account in any relevant decision.

The majority of the listings on the RNE are historic buildings within the coastal towns. These urban sites have not been used in this prioritisation, as they were unlikely to be part of the NRM region financial plan. However, 'natural areas' within the Southern Fleurieu coastal region are listed.

3.5.4 State Heritage Register

The State Heritage Register is a list of places of heritage value to the State. Places are entered in the Register by the State Heritage Authority, under the provisions of the *Heritage Act 1993*, and acting on advice from the

Heritage Branch. Criteria for entering on the state register are similar to the RNE, and these criteria are listed in full in Appendix 13.

3.6 Geological Monuments within, or partially within Fleurieu Coastal Boundary

The Southern Fleurieu coast is significant in the history of the study of geology in South Australia. At a number of key sites within the coastal cliffs and shore platforms of the rocky Fleurieu, key information is found relating to a number of geological themes. These include evidence of the geological conditions of the early Adelaide Geosyncline; evidence of the Delamerian Orogeny granitic rocks; and evidence of Permian glaciation. These sites have been visited and described by generations of geologists and are the subject of ongoing re-interpretation.

Apart from the limestone and dolomite quarry at Rapid Bay, there is little extractive industry within the Southern Fleurieu coastal boundary; removal of sand for glass making from the Normanville Dune ceased a generation ago. This does not mean that geological resources are not of value to the region: geology and related landform variation provides the basis of the scenic attraction of many parts of the coast. Also, the variable nature of the underlying rocks provides the basis of variation in soil quality within the coastal boundary. Thus the geology and geomorphology is of both scientific and economic value to the region and its natural resources management. For these reasons geological monuments have been used in the conservation analysis.

3.6.1 Geological Monuments

The concept of a geological monument “is a site showing features of outstanding geological or physiographic significance that is considered by the community of earth scientists to be worthy of conservation”, (McBriar & Giles, 1984, p.2). Monuments are examined in the field and assessed; the geology may be representative of wider features, or rare. If taken together, the geological monuments should represent the geological history of the state.

The list of Geological Monuments is reviewed and revised by the Geological Heritage Sub-committee of the SA Division of the Geological Society of Australia Incorporated. Information on geological monuments is stored at Primary Industries and Resources South Australia and at the South Australian Museum.

In brief, the sites listed in this report document the geological history of the region, as identified by the leading geologists of the state and supported by published documentation. As such they are of high conservation priority, and a score assigned to the appropriate coastal cell represents this. The presence or absence of a significant geological site within a coastal cell can be seen in the digital maps which form part of this report.

3.6.2 Conservation of Significant Geological Sites

While geological monuments are irreplaceable and need to be conserved, the means of conservation varies from site to site. Some need protection by reservation; others by fencing or access control; while more well-known sites may benefit from site interpretation. Almost all are threatened if development and earthmoving are proposed at the site and the list of monuments should be included as an attachment to the council development plans.

Selected details taken from listing of Geological Monuments by the Geological Society of Australia, SA Branch

1113 Geol Monument: CAPE JERVIS

Significance: Type section of the Cape Jervis Formation, unconformity with underlying Kanmantoo group. Also provides evidence for Permian glaciation (sediments, boulder erratics).

Preservation State: Trail bike activity has caused some damage; rubbish dump on top of the Permian beds is unsightly.

Comments: Rubbish dump closed approximately 1988. Part of monument area within National Estate area.

National Estate Y: State Heritage Y: Protection in Park N.

1119 Geol Monument: CARRICKALINGA HEAD

Significance: Type section of the Carrickalinga Formation. Outcrop of Normanville and Kanmantoo group contact.

Preservation State: Adequate.

Comments: Value of the research into stratigraphy of the lower Cambrian rocks. Popular tourist area and study area for students studying stratigraphy.

National Estate Y; State Heritage N; Protection in Park N.

1111 Geol Monument: CONGERATINGA RIVER, SOUTH COAST

Significance: Key area for elucidating the structural geology of the Fleurieu Peninsula, (basement - cover contact overturned, deformed conglomerates – pebbles, folding, overturned bedding, Permian glacial deposits, shearing, thrust fault, unconformity. **Preservation State:** Proterozoic rocks are safe from development; younger gravels within the creek bed have been covered and developed over.

Comments: Great for teaching purposes; structural tool.

National Estate N; State Heritage; N Protection in Park N.

1400 Geol Monument: DELAMERE - STOCKYARD CREEK (QUARRY A)

Significance: Hyolithids in the Sellick Hill Formation.

Preservation State: Adequate, so long as the area remains in its present rural state. Outcrop is safe.

Comments: Good for teaching principles of stratigraphy. The area still requires close study before the rock relationships are completely understood.

National Estate N; State Heritage N; Protection in Park N.

1401 Geol Monument: DELAMERE - STOCKYARD CREEK (QUARRY B)

Significance: uppermost Fork Tree Limestone.

Preservation State: Adequate, so long as the area remains in its present rural state. Outcrop is safe.

Comments: The area still requires close study before the rock relationships are completely understood.

National Estate N; State Heritage N; Protection in Park N.

1117 Geol Monument: DELAMERE - STOCKYARD CREEK (YOHOE CREEK)

Significance: Represents a complete sequence of metamorphosed equivalents of the Sellicks Hill section (Cambrian metasediments, cross bedding, folds, fossils, hyolithids, low grade regional metamorphism, Neoproterozoic rocks, Neoproterozoic/Cambrian contact).

Preservation State: Adequate, so long as the area remains in its present rural state. Outcrop is safe.

Comments: The area including road cuttings and creek bed are good for teaching principles of stratigraphy. The area still requires close study before the rock relationships are completely understood.

National Estate N; State Heritage N; Protection in Park N.

1331 Geol Monument: ENCOUNTER BAY REGION - GRANITE ISLAND

Significance: Outcrop of Delamerian Orogenic granite bodies (Encounter Bay granites and Victor Harbor granite. Dykes, xenoliths, unconformities).

Preservation State: Adequate, the relevant areas are located within recreation reserves. The outcrop is massive and resistant to erosion.

Comments: Easy access to Granite Island as it is a popular tourist attraction. Ideal location for teaching purposes.

National Estate Y; State Heritage Y; Protection in Park Y.

1115 Geol Monument: ENCOUNTER BAY REGION - NEWLAND HEAD TO ROSETTA HEAD/THE BLUFF

Significance: Key area in the state where the effects of metamorphism and tectonism can be clearly seen. Outcrop of Encounter Bay Granite and the nature of the contact with the metasediment is visible. Petrel Cove Formation type section. Amphibolite dykes, Cambrian metasediments, contact metamorphism, copper.

Preservation State: Adequate, the relevant outcrop is located on or near the coast which should prevent any major disruptions. Road widening along the road on Rosetta Head could destroy the outcrop though most of the relevant areas are located within recreation reserves. Western part is within Newland Head Conservation Park.

Comments: Ideal location for teaching purposes.

National Estate Y; State Heritage N; Protection in Park Y.

Note: only Rosetta Head and Wright Is. are listed on the Register of the National Estate.

1330 Geol Monument: ENCOUNTER BAY REGION - PORT ELLIOT

Significance: Outcrop of Delamerian Orogenic granite bodies (Encounter Bay granites - Port Elliot granite), between Commodore Headland and Knights Beach. Granites, dykes, xenoliths, unconformities seen.

Preservation State: Adequate. Pullen Island is a conservation park and the other parts of this region belong to a recreation park. The outcrop is massive and has not been drastically affected by coastal erosion.

Comments: Ideal location for teaching purposes. Permian glaciation event has shaped much of the topography and till deposits are found underlying the recent cover.

National Estate Y; State Heritage N; Protection in Park N.

1112 Geol Monument: FLEURIEU PENINSULA, SOUTH COAST

Significance: Excellent exposure of the metasediments of the Kanmantoo Group. Type section for the Kanmantoo group sediments.

Preservation State: Adequate. Parts of the designated area are currently located within conservation parks. The rest of the section is unlikely to be developed due to the remote location, steep coastline and limited access.

Comments: A continuous, lengthy, coastal section, extending from Deep Creek to Parsons Beach. The area is of great geological and geomorphological interest and is a coastline of great natural beauty; it is relatively untouched and should be preserved in this state. Access to the coast is limited (part of monument area within National Estate area).

National Estate: N State Heritage Y; Protection in Park N.

1512 Geol Monument: FLEURIEU PENINSULA, TALISKER MINE

Significance: Remnants of old stone mine buildings, including the stamp battery and powder house, in the vicinity of several shafts. Arsenopyrite, galena, en echelon quartz veins seen.

Preservation State: Good.

Comments: Within Talisker Conservation Park.

National Estate Y; State Heritage Y; Protection in Park.

1128 Geol Monument: HARRIS ROCK, LITTLE GORGE AREA

Significance: Glaciation evidence on crystalline gneiss of Palaeoproterozoic rocks: glacial erratics, glaciated outcrops, striations.

Preservation State: Good, pasture.

Comments: Most westerly known occurrence of glaciation.

National Estate N; State Heritage N; Protection in Park N.

1328 Geol Monument: INMAN VALLEY AREA (GREY SPUR)

Significance: Basement exposure, unconformable contact between Palaeoproterozoic and Neoproterozoic rocks.

Preservation State: Good condition. Most features are safe, though rural activity has accelerated erosion.

Comments: Ideal for teaching purposes. Part of monument area within National Estate area.

National Estate Y; State Heritage N; Protection in Park N.

1114 Geol Monument: INMAN VALLEY AREA (SELWYN ROCK)

Significance: Evidence of Permian glaciation in the Inman Valley area. Glacially modified valley forms; moraine, erratics, striations, grooved glacial pavements, pluck marks.

Preservation State: Good condition, located within a conservation park, though surrounding rural activity has accelerated gully erosion. Comparable records of the Permian glaciation are seen only in South Africa.

Comments: Ideal location for teaching. Inman valley area geological monuments have been subdivided into two separate entries.

National Estate Y; State Heritage Y; Protection in Park N.

1126 Geol Monument: INMAN VALLEY TOWNSHIP STRIATED BEDROCK

Significance: Extensive Permian glaciation on glacially smoothed Kanmantoo metasediments. Accessibility makes it very good for teaching.

Preservation State: Good, outcrops near bridge are well exposed.

Comments: A future bridge may threaten the outcrop.

National Estate N; State Heritage N; Protection in Park N.

1110 Geol Monument: LITTLE GORGE - SOUTH YANKALILLA BEACH

Significance: Contact of the Crystalline basement and Neoproterozoic rocks. Outcrop of basement rock.

Preservation State: Adequate. The best/interesting outcrops occur in locations where development would not likely take place.

Comments: Also section 80. The exposure and access to the basement makes an ideal location for teaching purposes.

National Estate N; State Heritage N; Protection in Park N.

1116 Geol Monument: MIDDLETON BEACH

Significance: Type section of the Middleton sandstone, with sedimentary structures, also overturned bedding and schistosity

Preservation State: Adequate, the coast is protected by the coastal protection board and in good condition.

Comments: Ideal location for teaching and research purposes, area should be preserved as is.

National Estate N; State Heritage N; Protection in Park N.

1329 Geol Monument: MIDDLETON QUARRY

Significance: Only area in the Kanmantoo group section where second-generation structures dominate; also large scale cross bedding.

Preservation State: Adequate. Threat of quarry being filled and further quarrying could destroy the magnificent fold structures. The quarry is located on private property.

Comments: Area has great value for research and teaching purposes; should be preserved as is.

National Estate N; State Heritage N; Protection in Park N.

1118 Geol Monument: MYPONGA BEACH

Significance: Excellent outcrop of Sellick Hill Limestone and Fork Tree Limestone. Best known locality for Hyolithes. Reference section for the Sellick Hill Limestone.

Preservation State: Adequate for the outcrop on the foreshore. On the state register and protected by Coastal Protection Board.

Comments: Easy access to locality, ideal location for teaching purposes. Part of monument area within National Estate area.

National Estate Y; State Heritage Y; Protection in Park N.

1109 Geol Monument: NORMANVILLE SAND DUNES

Significance: Relatively untouched sandhills, build up over the last 5000 years; last relics of dunes that were present along the coasts of the St Vincent Gulf. The dunes are of botanic and Archaeological significance.

Preservation State: Endangered. Dunes and vegetation are easily destroyed by almost all activity. Mining of quartz sands has affected the vegetation and dunes.

Comments: Part of monument area within National Estate area.

National Estate Y; State Heritage Y; Protection in Park N.

1120 Geol Monument: SECOND VALLEY HARBOUR

Significance: Excellent exposure of mesoscopic folds, foliation and linear features, which are not easily seen elsewhere in the Mt. Lofty Ranges.

Preservation State: Adequate at present. Access pathways should not be extended; any further construction is undesirable.

Comments: Ideal location for teaching purposes.

National Estate N; State Heritage Y; Protection in Park N.

Jetty

1327 Geol Monument: SELLICK BEACH

Significance: Willunga fault, expressed by upturned and overturned Tertiary units unconformably overlying steeply dipping brecciated Cambrian strata.

Preservation State: Adequate.

Comments: Not affected by suburban development.

National Estate N; State Heritage N; Protection in Park N.

1398 Geol Monument: SELLICK HILL (NEW ROAD)

Significance: The Cambrian and Neoproterozoic boundary. Type section for the 'lower Cambrian' units of the Fleurieu Peninsula. The closest locality to Adelaide at which Archaeocyatha occur, in early Cambrian limestones.

Preservation State: Adequate. Exposures occur in road cuttings and in the quarry. Weeds and grasses may cover the contact.

Comments: Archaeocyatha are index fossils for the Cambrian.

National Estate Y; State Heritage N; Protection in Park N.

1230 Geol Monument: STONE HILL

Significance: Exhumed Roche Moutonne.

Preservation State: Relatively unaltered since first discovered by a student of Professor Howchin. Described by Howchin in 1926.

Comments: Glaciation of late Palaeozoic time.

National Estate Y; State Heritage N; Protection in Park N.

1127 Geol Monument: STRANGWAYS HILL STRIATED BEDROCK

Significance: Kanmantoo metasediments show very clear indications of Permian glaciation, chatter marks, grooves and notches.

Preservation State: Outcrop good, other outcrops obscured.

Comments: Part of monument area within National Estate area.

National Estate Y; State Heritage N; Protection in Park N.

1129 Geol Monument: TERTIARY LIMESTONE IN UPPER HINDMARSH RIVER VALLEY

Significance: Fossiliferous limestone, the only outcrop in the Hindmarsh Valley.

Preservation State: Overgrown with vegetation partly obscuring the outcrop.

Comments: The first iron smelter in South Australia was located near here in the 1880s.

National Estate N; State Heritage N; Protection in Park N.

1232 Geol Monument: THE BASIN STRIATED BEDROCK

Significance: Striated Kanmantoo Group bedrock; striations up to 50mm deep.

Preservation State: Condition good, at present safe, as it is pasture.

National Estate N; State Heritage N; Protection in Park N.

1513 Geol Monument: TOOKAYERTA CREEK (DRUMLINOID LANDFORMS)

Significance: Late Palaeozoic glacial features on Cambrian rocks.

Preservation State: No external threats.

Comments: Ice movement shown by drumlinoid features in lithified sediments.

National Estate N; State Heritage N; Protection in Park N.

1233 Geol Monument: VICTOR HARBOR ANADARA SHELL BEDS

Significance: Pleistocene Anadara shells in lagoonal sediments six metres above present sea-level.

Preservation State: Condition good, hidden by vegetation that now protects the embankment from erosion and collecting.

Comments: The shells are found by Encounter Bay on the railway line, deposited about 6 m above present sea level along a shoreline; they are up to about 150 000 years Before Present in age, and provide evidence of a warmer climate.

National Estate N; State Heritage N; Protection in Park N.