Department for Environment and Heritage

Eyre Peninsula Natural Resources Management Region

Estuaries Information Package

Government of South Australia

Australian Government

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Overview

The Eyre Peninsula Natural Resources Management region (EP NRM region) is one of eight NRM regions within the State (see Figure 1). The region covers over 80,000 km^2 including large expanses of coast and marine waters. Sixteen estuaries have been identified within the region. These provide substantial environmental, economic and social values to the community.

Environment

- The estuaries identified in the National Land and Water Resources Audit (NLWRA) were classified as tide dominated, with the exception of the Tod River which is river dominated.
- The Tod River estuary is the only estuary to receive permanent flow throughout the year.
- Smoky Bay and Tourville Bay are two of three estuaries that have been identified as near pristine in South Australia in the NLWRA.

Conservation and protection

- The State and nationally vulnerable bead samphire *Halosarcia flabelliformis (Environment Protection and Biodiversity Conservation (EPBC) Act 1999, National Parks and Wildlife (NPW) Act 1972)* is present around Venus Bay, Acraman Creek and Arno Bay.
- The rare cushion samphire *Centrolepis cephaloformis (NPW Act 1972)* is present around Acraman Creek, Tumby Bay, Smoky Bay and Venus Bay.
- There are many important shorebird sites associated with estuaries.
- The region's estuaries are nursery areas for numerous commercially and recreationally important fish, prawn and crab species.
- Five estuaries are within conservation parks, conservation reserves or national parks.
- Seven estuaries are included in the Directory of Important Wetlands in Australia (DIWA).
- Eleven sites listed on the Register of the National Estate are associated with estuaries.

Cultural and socio-economic values

- The region contains indigenous and European culturally significant sites associated with estuaries.
- Several estuaries provide economic benefit to the community through agriculture, commercial fishing, tourism, aquaculture and recreational activities.

Issues and initiatives

- Land clearance, agricultural and urban run-off, extensive groundwater extraction, and increasing industrial and urban development are all placing pressure on estuarine condition.
- Several initiatives are underway that aim to increase our understanding about local estuarine environments and help manage and protect the region's estuaries.

Figure 1. The EP NRM region and identified estuaries in South Australia

1. Introduction

The South Australian Department for Environment and Heritage (DEH), with support from the Australian Government's Natural Heritage Trust, has developed this estuaries information package (EIP) for Eyre Peninsula (EP) to support natural resources management (NRM) bodies, State and local government and other agencies in undertaking planning and management in estuarine areas.

There are four other EIPs in the series for South Australia: Northern and Yorke (NY), Adelaide and Mount Lofty Ranges (AMLR), Kangaroo Island (KI) and South East (SE) NRM region EIPs.

Each EIP consists of information collated from various sources relevant to the estuaries within that region. As a result, some key information gaps and potential directions have been included as a guide for management options for South Australia's estuaries.

As part of the *State NRM Plan 2006*, one of the resource condition targets for water is that by 2015, no further net loss of wetlands or estuaries, extent or condition, has occurred compared to 2006.

2. What is an estuary?

Estuaries and the land surrounding them are places of transition - where water from the land meets and mixes with the sea. They may be large or small systems, influenced by tidal exchange, stormwater discharge or groundwater intrusion.

Fluctuating salinity levels occur in estuaries. A variety of flora and fauna species have been able to adapt to the conditions and live within estuaries.

Estuaries are generally highly productive systems that are essential for the health and well being of the marine environment. The health of the estuary is very dependent on the catchment-coast-ocean connection. Land management practices and land uses occurring upstream and on the adjacent lands have the potential to affect water quality, animal life and habitats within the estuary.

The *Natural Resources Management Act 2004* defines an estuary as:

'A partially enclosed coastal body of water that is either permanently, periodically, intermittently or occasionally open to the sea within which there is a measurable variation in salinity due to the mixture of seawater with water derived from on or under the land'.

The Act also notes that an estuary may include any ecosystem processes or biodiversity associated with an estuary and estuarine habitats adjacent to an estuary.

3. Estuaries of the EP NRM region

3.1 Estuary classification

Within the EP NRM region, 16 estuaries (see Figure 2) have been identified by an across-agency Estuaries Working Group. The estuaries in this region are primarily tide-dominated systems or coastal embayments, with the exception of the Tod River that is river dominated.

Information on estuary classification, maximum length and perimeter for eight of the 16 estuaries is contained in Table 1; only those estuaries that have been mapped as part of the NLWRA (2001) have been included. Table 2 provides information on the catchment size for each estuary where available.

3.2 Regional NRM Groups

The EP NRM region is divided into four areas[1] for management purposes: Western Eyre, Central Eyre, Eastern Eyre and Southern Eyre NRM Group areas. Within each of these group areas there are estuaries with differing features, functions and pressures that need to be managed.

It is a role of the NRM Groups, in consultation with other organisations, to oversee and implement a range of management actions to protect those estuaries within each of their group boundaries.

3.3 Coastal councils

There are nine coastal councils within the EP NRM region, with varying numbers of estuaries located in each (see Figure 3). Although land-based influences can occur upstream in non-coastal areas (and there is a duty of care for upstream councils), it is the coastal councils that have direct responsibility for managing estuaries within their boundaries.

The District Council of Tumby Bay contains four estuaries, followed by the District Councils of Lower Eyre Peninsula and Ceduna, each having three estuaries. The District Councils of Streaky Bay and Franklin Harbor each have two estuaries within their boundaries, whilst the District Councils of Elliston and Cleve have one estuary each. The Corporation of the City of Whyalla and the City of Port Lincoln are the only two councils within the region to have no estuaries located within their boundaries.

[1] NRM Group areas have been established by the NRM Board as part of the initial concept statement for the region. These areas may be subject to change (see EPNRB 2006).

Figure 2. Estuaries of the EP NRM region

Table 1. EP NRM region estuary classification and size

Estuary	Classification	Sub classification	Approximate size of estuary (maximum length, perimeter and water area) L= length (km) P = perimeter (km) A = area (km²)
Franklin Harbor	Tide dominated	Coastal embayment, coastal creek or channel	L = 15.6 P = 55.4 A = 57.1
Tod River	River dominated	Tide-dominated delta	N/A
Coffin Bay	Tide dominated	Coastal embayment, coastal creek or channel	L = 23.5 P = 131.7 A = 117.6
Venus Bay	Tide dominated	Coastal embayment, coastal creek or channel	L = 17.3 P = 67.1 A = 70.6
Baird Bay	Tide dominated	Coastal embayment, coastal creek or channel	L = 21.3 P = 59 A =43.7
Blanche Port	Tide dominated	Coastal embayment, coastal creek or channel	L = 7.5 P = 29.9 A = 28.4
Smoky Bay	Tide dominated	Coastal embayment, coastal creek or channel	L = 3.9 P = 41.4 A = 14.2
Tourville Bay	Tide dominated	Coastal embayment, coastal creek or channel	L = 10.9 P = 80.3 A = 52.6

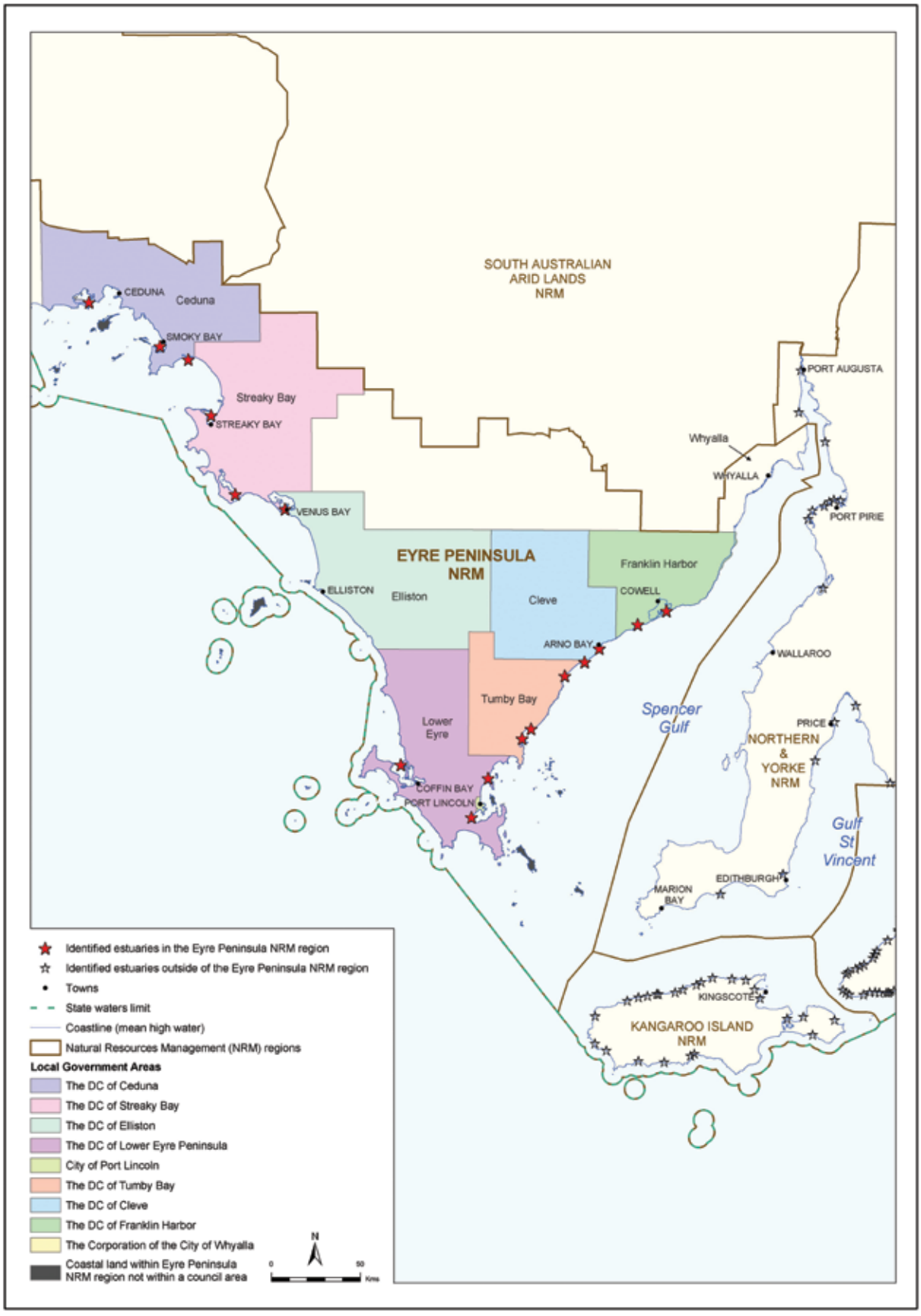
Note: only those estuaries mapped as part of the NLRWA (2001) are included in Table 1; N/A - not available.

Table 2. Estuaries and their associated catchment size

Estuary	Catchment size (km²)
Franklin Harbor	2,187
Yabmana Creek	176
Arno Bay	281
Driver River	1,135
Dutton River	503
Salt Creek (Eyre)	629
Tumby Bay	193
Tod River	387
Duck Ponds Creek	178
Coffin Bay	1,197
Venus Bay	N/A
Baird Bay	N/A
Blanche Port	N/A
Acraman Creek	N/A
Smoky Bay	N/A
Tourville Bay	N/A

Source: surface-water catchments - DWLBC. Note: N/A – not available (predominantly marine with some groundwater influence).
Although every effort has been made to ensure the accuracy of the statistical information provided from the spatial data, errors in the spatial data are possible.

Figure 3. Estuaries located within coastal council areas



4. Surface water, groundwater and marine areas

4.1 Environmental flows

Since surface water is scarce in the region, most of the creeks have limited or ephemeral river flow and minimal connection to the ocean (EPNRMG 2002). The Tod River estuary is the only surface water system with a permanent connection between the mouth and the ocean.

4.2 Groundwater influence

Within the EP NRM region there is an increasing reliance upon groundwater supplies for human use. Groundwater features in the EP NRM region are shown in Figure 4. Groundwater is considered to contribute to maintaining flow levels and pools within some of the creeks in the region, particularly in those areas where there is no apparent surface water drainage system (EPCWMB 2005). Groundwater is discharged through many of the coastal embayments to the marine environment (eg at Tumby Bay and Franklin Harbor) (EA 2001).

4.3 Marine bioregions and biounits

A marine bioregion is an area within the marine environment that has distinctive biodiversity and can consist of several smaller biounits. Each biounit is defined primarily on the basis of coastal physiography, topography and major marine physical habitat or seascape features of habitat distributions at a scale of 100 km^2.
For further information see http://www.environment.sa.gov.au/coasts/marineparks/background/marine_bioregions.html.

The EP NRM region has four marine bioregions: Murat, Eyre, Spencer Gulf and Northern Spencer Gulf (see Figure 5). The biounits in the Eyre bioregion that include estuaries (in the EP NRM region) are Jussieu, Douglas and Yanerbie. The Streaky biounit is located within the Murat bioregion and the Franklin and Dutton biounits are located in the Spencer Gulf bioregion. While there are other biounits located with the EP NRM region, they do not contain any estuaries.

Figure 4. Groundwater watertable depth and groundwater basins

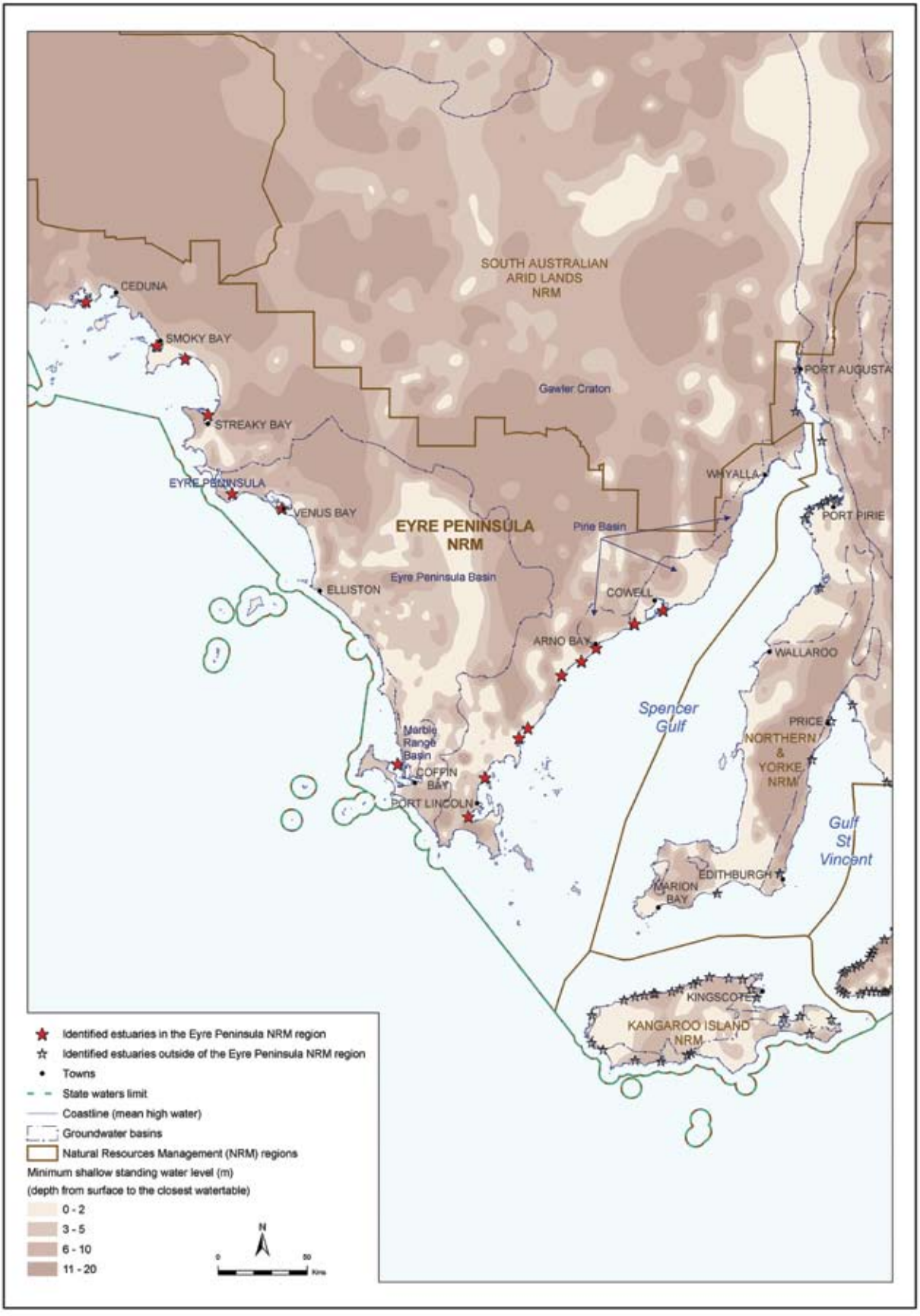


Figure 5. Marine bioregions and biounits

5. Habitats of the EP NRM region's estuaries

5.1 Floodplains

Floodplains can provide valuable habitat and act as refuges for migratory birds and other animals during the dry season (Turner et al. 2004). Plant species most commonly found in the floodplain include *Melaleuca* species, sedges and grasses.

5.2 Saltmarshes

Expanses of samphire[2] are present in several estuaries in the region including Franklin Harbor, Acraman Creek, Coffin Bay and Smoky Bay (see Figure 6 and Table 3). Up to 8,711 ha have been mapped region wide (DEH 2002).

Clearance of saltmarsh (samphire) without consent can be an offence under the *Native Vegetation Act 1991*. Note there are exemptions.

The Acraman Creek Conservation Park includes one of the best examples of diverse samphire vegetation in the region (DEH 2002). Of note within this estuary is the State and nationally vulnerable bead samphire *Halosarcia flabelliformis (EPBC Act 1999, NPW Act 1972)*. The bead samphire has also been observed around Venus Bay and Arno Bay (see http://www.flora.sa.gov.au/).

The rare species of cushion samphire *Centrolepis cephaloformis (NPW Act 1972)* has been identified around Acraman Creek, Tumby Bay, Streaky Bay and Venus Bay (http://www.flora.sa.gov.au).

Saltmarshes are under threat from inappropriate use of off-road vehicles, which has resulted in networks of informal tracks, as well as from illegal dumping of rubbish. Projected sea level rise through climate change will likely result in habitat retreat and have secondary impacts on fish and many other species dependent on saltmarsh habitat for survival.

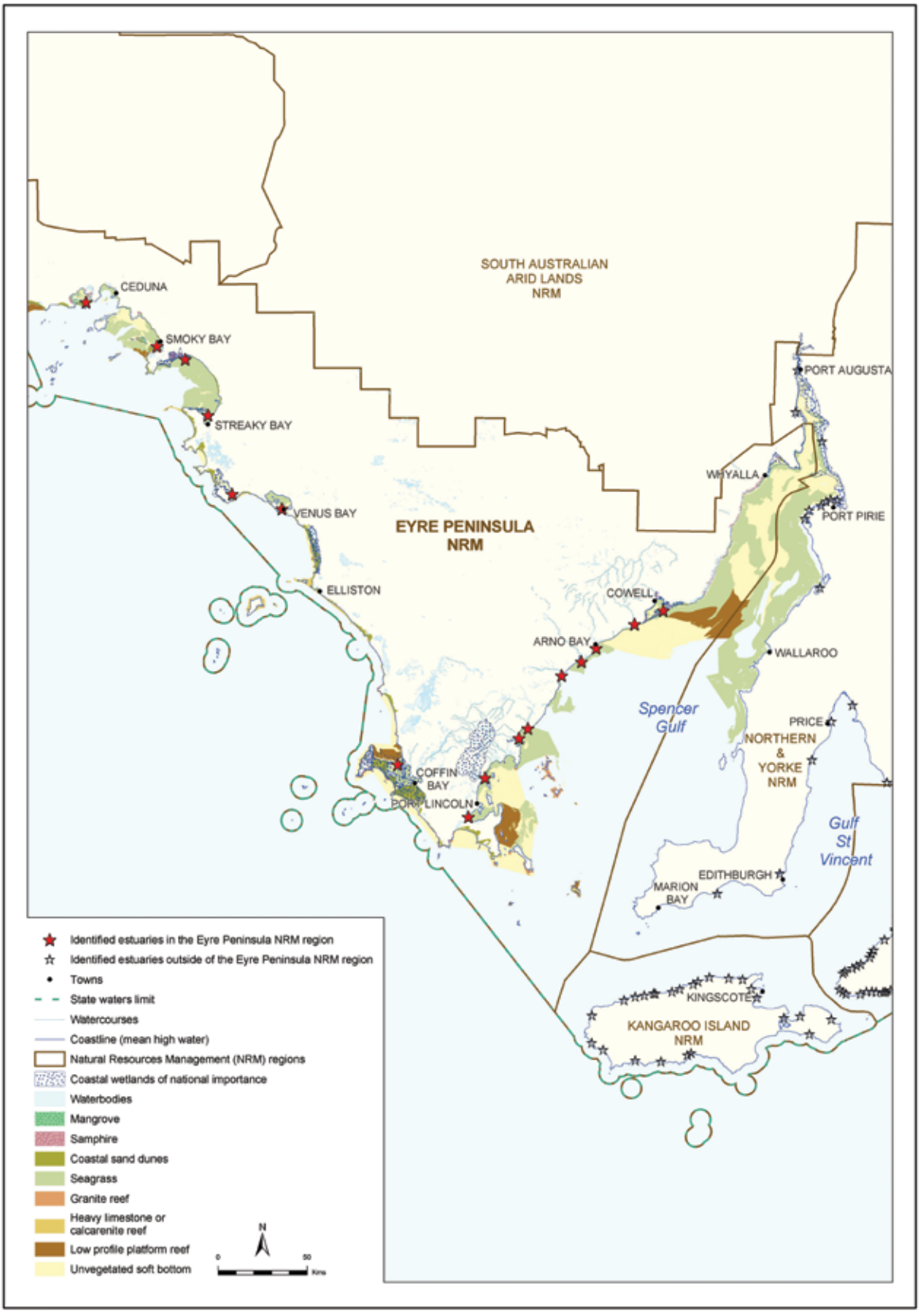
Table 3. Saltmarsh, mudflat, mangrove and seagrass habitats within estuaries

Estuary	Saltmarsh area (km²)	Saltmarsh species (EA 2001)	Mudflat area (km²)	Mangrove area (km²)	Seagrass area (km²)	Seagrass species (Baker 2004)
Franklin Harbor	7.1	• *Halosarcia* spp. • *Sarcocornia* spp. • *Sueda* spp. • *Maireana* spp. • *Atriplex* spp.	2.4	8.1	No information available	Species include: • *Zostera tasmanica* • *Posidonia australis*
Tod River	0.1		0.06	None present		
Coffin Bay	3.5		2.5	.04	86	
Venus Bay	1.8		3.5	0.95	90	
Baird Bay	1.0		3.4	1.2	6.5	
Blanche Port	1.3		12.7	2.5	30.8	
Smoky Bay	5.2		15.5	11.3	No information available	

Note: only those estuaries that were mapped as part of the NLWRA (2001) have been included in Table 3.

[2] Samphires are saltmarsh plants dominated by the family *Chenopodiaceae*.

Figure 6. Habitats within and surrounding estuaries



5.3 Intertidal mudflats

Mudflats are home to a range of invertebrate species such as polychaete worms, amphipods, molluscs and crustaceans. The tidal cycle also increases the use of the mudflats by other animals (eg crabs) and provides feeding sites for migratory shorebirds.

Mudflats in several of the estuaries within the region have been mapped as part of the NLWRA (2001) (see Table 3).

5.4 Mangrove communities

Only one species of mangrove *Avicennia marina* is represented in South Australia (Graham et al. 2001). More than 3,300 ha of mangroves are located in the region, with 23% (766 ha) of those protected in parks and reserves such as the Franklin Harbor and Venus Bay Conservation Parks (DEH 2002). The largest area of mangroves on the West Coast is located around Tourville Bay (including Davenport Creek) and is believed to be an area of high conservation value (Ellis et al. 1983).

Mangroves in the region are under threat from increasing development, pollution and increasing sediment deposition (DEH 2002).

5.5 Seagrass communities

Dense seagrass beds are located within Smoky Bay, Blanche Port, Baird Bay, Venus Bay and Tumby Bay, and proximal to Acraman Creek, Duck Ponds Creek, Tod River, Dutton River and Driver River estuaries.

These areas are important nursery habitats for many commercially and recreationally important fishery species such as the King George whiting *Sillaginodes punctata*, Western Australian salmon *Arripis truttacea*, western king prawn *Penaeus Latisulcatus* and blue swimmer crab *Portunus pelagicus*.

Seagrasses, like mangroves, are under threat from elevated nutrient levels, as well as increased levels of sediment entering the gulf from effluents, stormwater and other industry discharges (Bryars 2003).

6. Internationally and nationally protected bird species

The estuaries of the EP NRM region are rich in bird life (see Appendix 1). Waktins (1993) identified Baird Bay, Streaky Bay and Tourville Bay as internationally and nationally important sites for shorebirds (*EPBC Act 1999* and international treaties). Baird Bay has one species of international and national importance (grey plover *Pluvialis squatarola*) (*EPBC Act 1999* and international treaties). Tourville Bay is identified as an internationally important site for three species (ie sooty oystercatcher *Haematopus fuliginosus*, grey plover *Pluvialis squatarola* and pied oystercatcher *Haematopus longirostris*) (*EPBC Act 1999* and international treaties) and four species of national importance (as above and the common greenshank *Tringa nebularia) (EPBC Act* 1999 and international treaties*)*. Spencer Gulf has also been reported as a site of importance for 10 international and 12 national species (further ground counts are required to identify discrete ecological and management units).

Wilson (2000) identified Tourville Bay, Acraman Creek, Baird Bay, Coffin Bay and Franklin Harbor as important sites for wader birds. Significant seabird sites[3] are also found at Tourville Bay, Baird Bay, Venus Bay, Coffin Bay, Duck Ponds Creek and Franklin Harbor estuaries.

7. Fish and other fauna of the EP NRM region's estuaries

Estuaries of the EP NRM region provide valuable nursery and breeding areas for many of the State's commercially and recreationally important fish and invertebrate species (see Appendix 2). For example, Baird Bay, Venus Bay and Franklin Harbor are important nursery areas for the King George whiting *Sillaginodes punctata*, and Tourville Bay, Smoky Bay, Acraman Creek and Streaky Bay (Blanche Port) are nursery areas for the Western Australian salmon *Arripis truttacea*, tommy ruff *Arripis geogiana*, southern sea garfish *Hyporhamphus melanochir*, yellow-eyed mullet *Aldrichetta forsteri* and flathead (eg *Platycephalus* spp.).

Smoky Bay, Acraman Creek, Baird Bay, and Franklin Harbor are known nursery areas for the western king prawn *Penaeus Latisulcatus*. Nursery areas for the sand crab *Ovalipes australiensis* are located around Venus Bay and Baird Bay, whereas a nursery area for the gummy shark *Mustelus antarcticus* is also located around Venus Bay.

8. Protection arrangements for the EP NRM region's estuaries

8.1 Parks and reserves

Several of the estuaries in the region are managed within conservation parks, recreation parks and conservation reserves (Figure 7). Management plans have been prepared to conserve, protect, rehabilitate and restore the indigenous flora and fauna within these parks and reserves (see Table 4). In addition, DEH has developed a *Biodiversity Plan for the Eyre Peninsula* (DEH 2002).

Ellis et al. (1983) recommend the waters of Tourville Bay and adjacent tidal creeks be declared an aquatic reserve, although proclamation is yet to occur. No other estuaries in the Eyre Peninsula are included within aquatic reserves.

[3] Data is from Biological Survey and Monitoring, DEH, Status of seabirds, based on the reporting by Copley, 1996 .

Figure 7. Conservation areas and aquatic reserves including estuaries

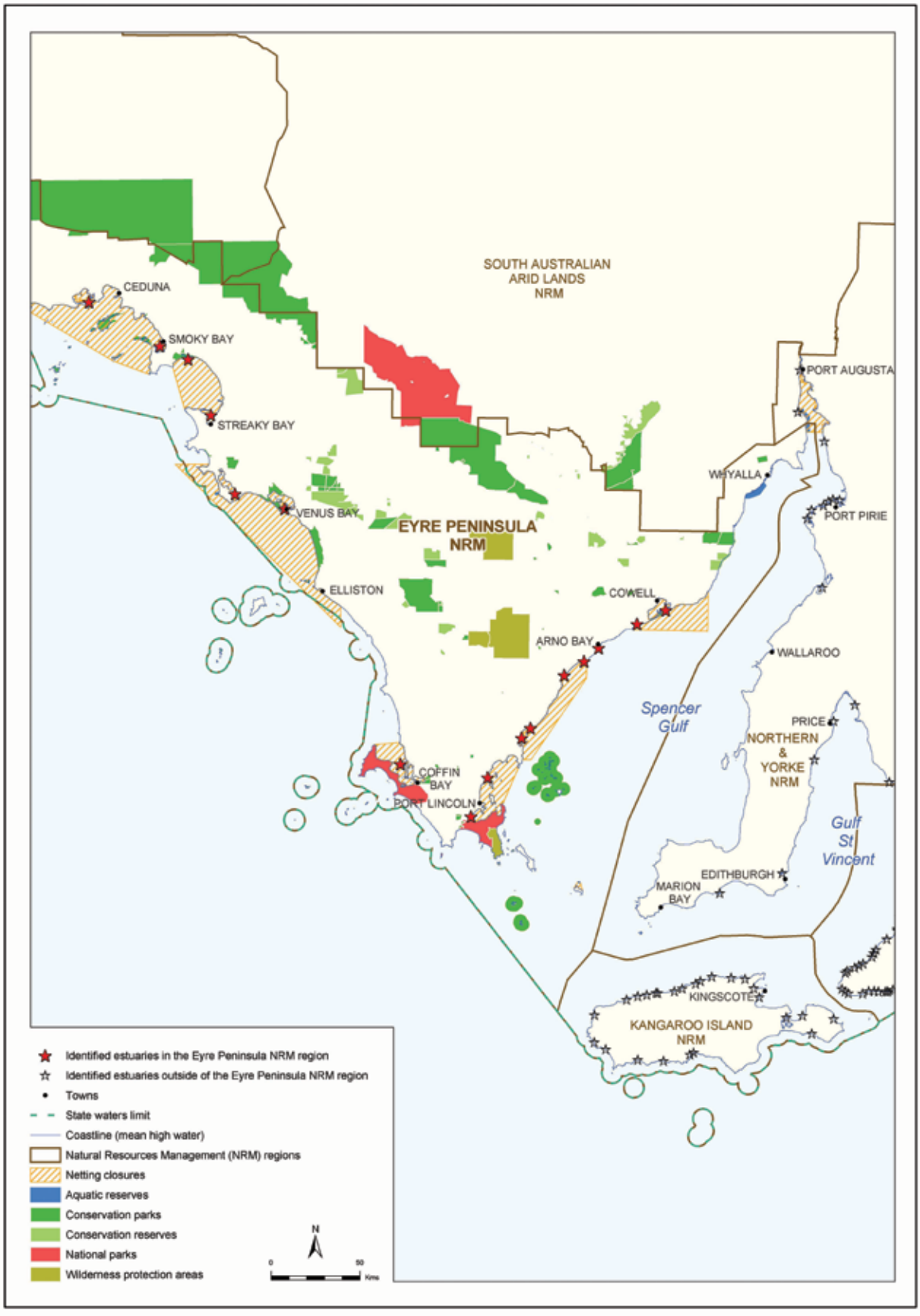


Table 4. Protection arrangements and management plans

Estuary[4]	National park/conservation park/ recreation park/conservation reserve	Management plan
All		*Regional Natural Resources Management Plan 2004-2007* (EPNRM 2004)
Tourville Bay		*Davenport Creek Management Plan* (Davenport Creek Management Committee 2003) *Davenport Creek Preliminary Management Report* (Ellis et al. 1983)
Tod River		*A River Management Plan for the Tod Catchment* (Rixon et al. 2002)
Venus Bay	Venus Bay Conservation Park, Venus Bay Conservation Reserve	*Venus Bay Conservation Park Management Plan* (DEH 2006b)
Coffin Bay	Coffin Bay National Park Mount Dutton Conservation Park Kellidie Bay Conservation Park	*Parks of the Coffin Bay Area Management Plan* (DEH 2004a)
Baird Bay		*Island Parks of Western Eyre Peninsula* (DEH 2005)
Tumby Bay	Tumby Island Conservation Park	
Acraman Creek	Acraman Creek Conservation Park	
Franklin Harbor	Franklin Harbor Conservation Park	

Note: DEH manages national parks, conservation parks, recreation parks and conservation reserves under the *NPW Act 1972*.

8.2 Directory of Important Wetlands

Seven estuaries within the EP NRM region have been included in the Directory of Important Wetlands in Australia (DIWA) (see Table 5 and Figure 6). The criteria for inclusion into the Directory are shown in Appendix 3.

Table 5. Estuaries included in the Directory of Important Wetlands in Australia

Estuary	DIWA name	Criteria for inclusion
Tourville Bay	Davenport Creek wetland (SA009)	1, 3, 5, 6
Acraman Creek	Streaky Bay wetland (SA016)	3, 5
Baird Bay	Baird Bay wetland system (SA004)	3
Coffin Bay	Coffin Bay wetland system (SA008)	3, 5, 6
Tod River	Tod River wetland system (SA017)	1, 2, 3
Tumby Bay	Tumby Bay (SA018)	1, 3
Franklin Harbor	Franklin Harbor (SA010)	1, 3, 6

[4] Some estuaries may not necessarily fall within NPWSA Reserve boundaries as actual estuary boundaries have not yet been defined.



8.3 Register of the National Estate

Many sites associated with estuaries across the EP NRM region are included on the Register of the National Estate (http://www.ahc.gov.au/register/) (see Table 6).

Table 6. Sites including or associated with estuaries in the Register of the National Estate

Site[5]	Estuary	Significance
Baird Bay Islands Conservation Park (natural)	Baird Bay	This site is a breeding location for several seabird species including the uncommon osprey *Pandion* sp. and the sooty oystercatcher *Haematopus fuliginosus*.
Venus Bay Conservation Park (natural)	Venus Bay	This site is an important breeding location for several seabird species including the caspian tern *Hydropogne caspia (EPBC Act 1999)*, reef heron *Ardea sacra* (*EPBC Act 1999, NPW Act 1972*) and the sooty oystercatcher *Haematopus fuliginosus*.
Kellidie Bay Conservation Park (natural)	Coffin Bay	This location preserves a rare area of drooping sheoak *Allocasuarina verticillata*, black tea-tree *Melaleuca lanceolata* and the saw sedge *Gahnia* sp. It is also an important site for the white-bellied sea eagle *Haliaeetus leucogaster* (*EPBC Act 1999, NPW Act 1972*) and the osprey *Pandion haliaetus*.
Mount Dutton Bay Conservation Park (natural)	Coffin Bay	It is an important breeding location for seabirds.
Coffin Bay and surrounds (natural)	Coffin Bay	The location supports a diversity of flora and fauna species.
Mount Dutton Bay jetty and woolshed (natural)	Coffin Bay	The location is an important visual and historic landmark set within a rural landscape.
Poonindie mission (indigenous)	Tod River	Poonindie is a socially and economically viable community created for Aborigines around the time of European settlement.
St Matthews Anglican church (historic)	Tod River	St Matthews provides an example of a rural church from the 1850s.
Tumby Island Conservation Park (natural)	Tumby Bay	Tumby Island is a small island providing feeding and roosting habitat for seabirds.
Franklin Harbor Conservation Park (natural)	Franklin Harbor	The park preserves an area of mangrove and saltmarsh flats, supporting important seabird populations (eg for species protected under the *EPBC Act 1999* and international treaties).
Cowell fish trap No 1 (indigenous)	Franklin Harbor	No information is currently available.

Source: Australian Heritage Directory. See http://www.heritage.gov.au/datalists.html.

[5] Sites may not necessarily fall within actual estuary boundaries as the boundaries have not been defined.

9. Cultural assets

The EP NRM region is rich in Aboriginal heritage (see Figure 8). The region is home to numerous indigenous communities including the Wirangu, Bungala, Kokotha, Mirning Pit and Anangu people (Mazur et al. 2004). Culturally significant sites recorded on the heritage register include the Poonindie mission, Coffin Bay Peninsula and the Cowell fish trap No. 1 (for further information see http://www.deh.gov.au/cgi-bin/ahdb/search.pl). Some non-registered sites are also recorded with the Department of Premier and Cabinet, Aboriginal Affairs and Reconciliation Division.

All Aboriginal sites, objects and remains of significance in South Australia are protected under the *Aboriginal Heritage Act 1988*.

The *Aboriginal Heritage Act 1988* provides protection for Aboriginal sites, objects, anthropology, history and tradition.

NOTE: Pursuant to section 23 of the *Aboriginal Heritage Act 1988 (SA)*, a person must not, without the authority of the Minister [for Aboriginal Affairs and Reconciliation] -

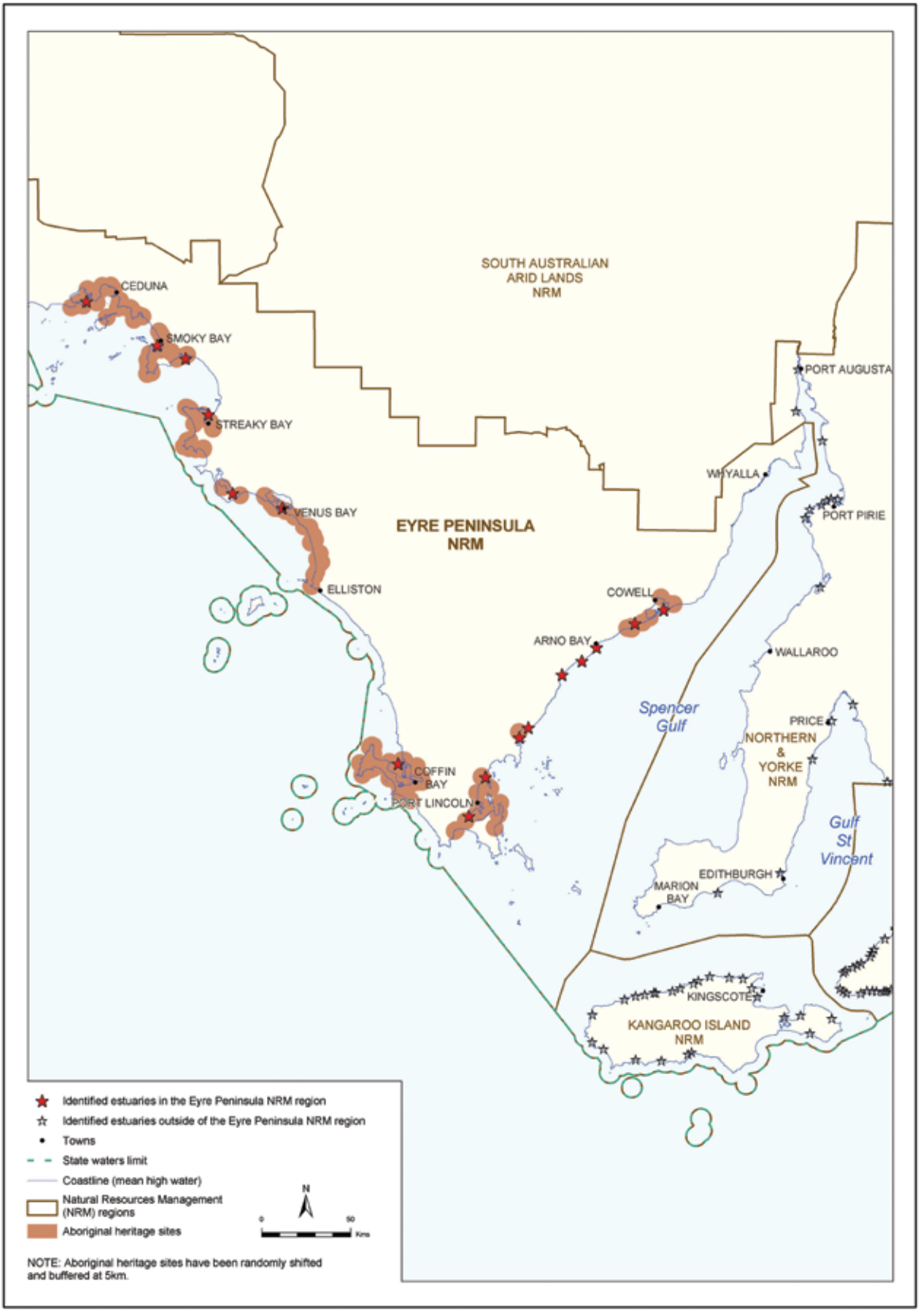
(a) damage, disturb or interfere with any Aboriginal site; or
(b) damage any Aboriginal object; or
(c) where any Aboriginal object or remains are found -
    (i) disturb or interfere with the object or remains; or
    (ii) remove the object or remains.

European heritage sites are also found on the State Heritage Register (http://www.heritage.gov.au/ahpi/index.html), which lists places of heritage significance to the State. Sites associated with estuaries include:

- Point Collinson whaling station at Smoky Bay
- the former Coffin Bay whaling site
- Memory Cove tablet site and Memory Cove wilderness protection area
- Elliston jetty
- Mount Dutton Bay jetty and woolshed.

Further information on places of heritage significance to the State can be found at http://www.environment.sa.gov.au/heritage/.

Figure 8. Aboriginal heritage sites associated with estuaries



10. Economic and social regional importance

Much of the economic development within the region is strongly linked to the local environment including estuarine areas. Economic drivers for the region include:

• Agriculture, eg cropping and grazing

The EP NRM region is one of South Australia's most productive areas, with 45% of the State's wheat crop and 20% of the State's barley crop exceeding a total value of $450 million annually (ERDB 2003).

• Commercial fishing, eg marine-scale fishery

Sixty nine percent of the State's seafood harvest is produced in the region, with 80% of the product exported from the region (ERDB 2003).

• Tourism

Tourism within the region is the third largest industry (after agriculture and commercial fishing), with an annual value of $168 million (SATC 2006). The region attracts 327,000 visitors annually (13,000 international) and accounts for nearly 1.6 million visitor nights (in 2005) (SATC 2006). It also has a higher proportion of visitors that stay 4 to 7 nights than any other SA region (SATC 2006).

Major attractions for visitors include the coast and the flora and fauna of the region (SATC 2006). It has the second highest participation rate for fishing by regional visitors compared to other tourism regions within the State (SATC 2006).

More than 2,000 people are employed in the tourism industry (15% of the total regional employment) (ERDB 2003).

• Aquaculture

This industry has experienced the largest regional economic growth rate over the past 10 years (averaging 14% per year) (DTEI 2006) and has been identified as a key driver for the region's future economy (ERDB 2003).

The aquaculture industry employs more than 2,000 people, with Port Lincoln having the highest number of people employed directly (318). The tuna sector accounts for nearly 70% of people working in the aquaculture industry and it is the single most valuable sector in South Australia's aquaculture industry (followed by the pacific oyster *Crassostrea gigas*) (ERDB 2003, Mazur et al. 2004). There are significant flow-on effects generated from the industry through the handling and marketing of fish products and the purchase of materials, service and labour (Mazur et al. 2004).

• Recreational activities, eg boating, fishing and camping

Increasing importance is being placed on healthy lifestyles (SATC 2002a). Some of the most popular visitor activities include fishing, going to the beach and visiting national parks (SATC 2006). The tourism and retail industries each receive flow-on effects from these activities.

Social values associated with all the above activities are varied. In a community attitudes survey completed in 2001 for the development of the South Australian Tourism Plan, the community indicated that tourism is more important to community prosperity and quality of life than agriculture, manufacturing, mining, wine or information technology (SATC 2002a, SATC 2002b). Recreational activities such as boating and fishing are believed to enhance interpersonal skills, make people more adaptable to change and enhance community stewardship (Planning SA 2004).

Industries such as commercial fishing also have multiplier effects for other industries, especially for increasing employment opportunities.

11. Activities and pressures associated with estuaries of the region

Eight estuaries within the EP NRM region were included in the NLWRA (2001) (see Table 7). These estuaries were identified to be in varying condition from near pristine to extensively modified[6], and under moderate to very high pressure. Smoky Bay and Tourville Bay are two of three estuaries in South Australia that were identified as near pristine in 2001 (NLWRA 2001).

Table 7. Condition and pressure classification of estuaries identified in the National Land and Water Resources Audit

Estuary	Condition	Pressure
Tourville Bay	Near pristine	N/A
Smoky Bay	Near pristine	N/A
Blanche Port	Modified	High to very high pressure
Baird Bay	Modified	Moderate to high pressure
Venus Bay	Largely unmodified	Moderate to high pressure
Coffin Bay	Modified	High to very high pressure
Tod River	Extensively modified	High to very high pressure
Franklin Harbor	Extensively modified	High to very high pressure

Note: N/A – not available.

Various modifications to these estuaries have occurred over time to support human settlement, economic development and to provide recreational opportunities for the community. Each of these is linked to a range of activities occurring in and on the land surrounding estuaries including:

- cropping and grazing
- oyster and scallop aquaculture
- recreational practises, eg fishing, boating, camping
- tourism, eg walking in conservation parks
- groundwater extraction for water supply and irrigation
- industry usage including commercial fishing
- mineral exploration.

(See Figures 9 and 10).

Some of the infrastructure and issues related to these activities are given in Table 8. Of particular note in the region is recreational, industrial and urban use, as well as the potential for impacts arising from climate change.

[6] Near pristine estuaries are generally recognised as being in excellent condition, with management activities focused particularly on the protection of natural values. In contrast, extensively modified estuaries are generally recognised as having multiple problems due to a complexity of impacts from within the catchment, waterway and estuary (NLWRA 2001).

Figure 9. Activities occurring in and around estuaries

Figure 10. Petroleum, mining and geothermal exploration licences and applications

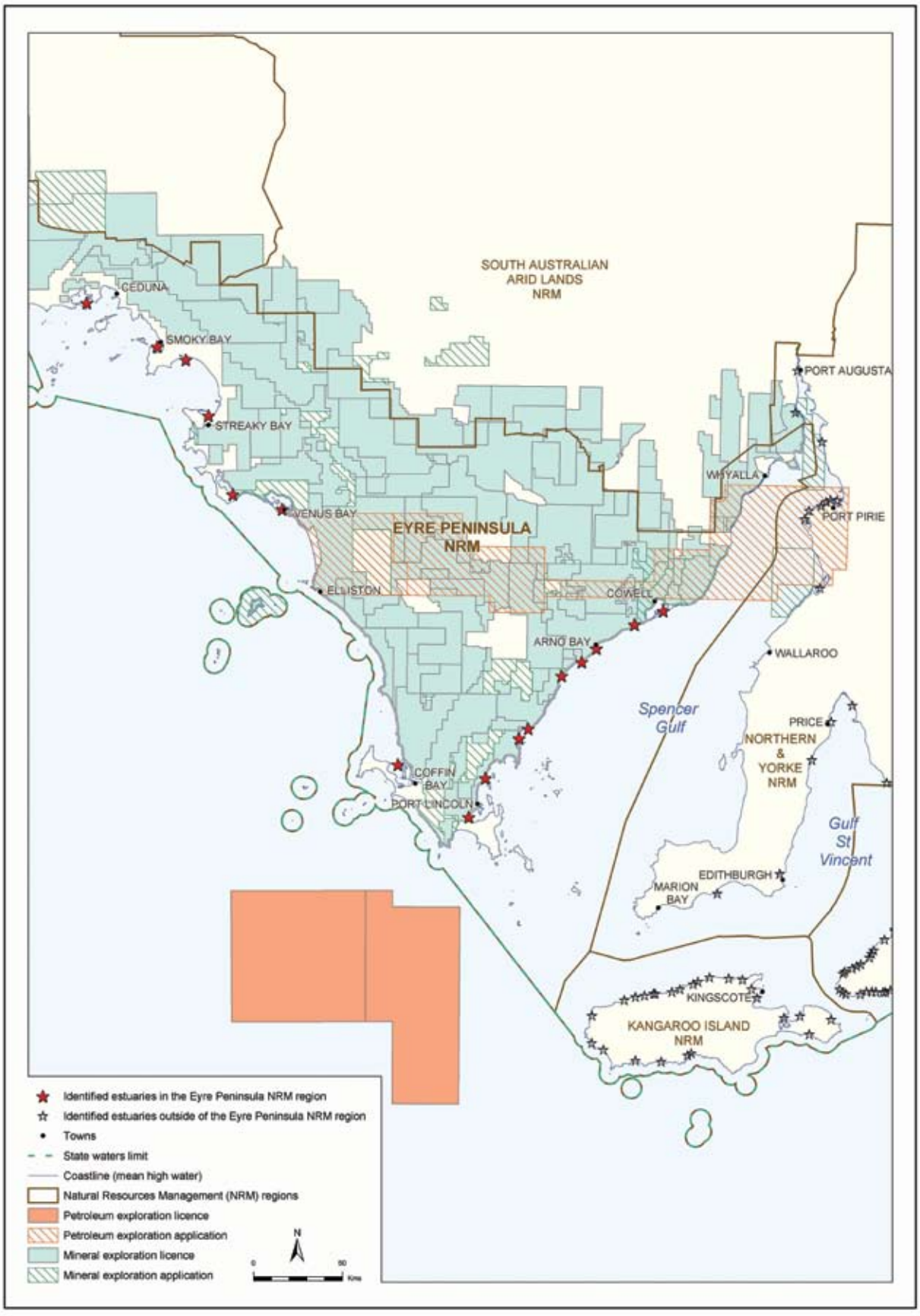


Table 8. Some of the infrastructure, activities and issues within estuaries

	Feature	Location
Infrastructure	Boat ramps	• 1 at Nadia Landing (Tourville Bay) (4WD only) • 1 at Smoky Bay • 1 at Moore's Landing and Streaky Bay (Blanche Port) • 1 at Venus Bay • 1 at Farm Beach (Coffin Bay) (4WD only) • 4 located around Port Lincoln Harbor • 1 at Tumby Bay • 1 at Arno Bay • 2 at Cowell (Franklin Harbor) • 1 at Lucky Bay (Franklin Harbor)
	Marina/moorings	• Smoky Bay • Moorings around Streaky Bay (Blanche Port) • Port Lincoln
	Wastewater treatment plant (WWTP)	• Port Lincoln – WWTP. This plant historically released 2.4 ML/day of wastewater to Proper Bay but was upgraded to decrease discharge to the marine environment (SA Water 2003).
Activities	Aquaculture	Oyster aquaculture sites are located around: • Blanche Port • Denial Bay • Dutton Bay • Franklin Harbor • Smoky Bay • Coffin Bay • Tod River. Scallop aquaculture sites located around: • Blanche Port. Tuna Farming sites: • Port Lincoln/Duck Ponds Creek.
	Mining exploration licences[7]	Licences located at: • Tumby Bay • Salt Creek (Eyre) • Arno Bay • Dutton River • Yabmana Creek • Franklin Harbor.
	Dredging	• Franklin Harbor (historical) • Lincoln Cove marina (historical) • Tumby Bay marina (potential site for dredging) • Arno Bay (possible historical dredging locations) • Coffin Bay (possible historical dredging locations)

table continued

[7] Both the *Petroleum Act 2000* and the *Petroleum (Submerged Lands) Act 1982* have similar requirements in that environmental values and appropriate protection measures must be identified prior to activities occurring in affected area, eg coastal waters. The *Petroleum Act 2000* also requires existing management plans to be considered and incorporated into the objectives of the proposed activity prior to the mineral or petroleum industry receiving access. The *Mining Act 1971* further requires activities not to contravene the *Fisheries Management Act 2007*, which has provisions for aquatic reserves. Specific conditions can be placed on mining exploration licences on a case by case basis to ensure environmental values are protected.

Table 8. Some of the infrastructure, activities and issues within estuaries continued

	Feature	Location
Issues	Coastal acid sulfate soils[8] (CASS)	• Franklin Harbor – moderate risk potential acid sulfate soils (PASS) in intertidal samphire and seagrass, high risk PASS in mangrove areas. • Arno Bay – moderate risk PASS in supratidal and intertidal samphire, high risk PASS in mangroves. • Coffin Bay – moderate risk PASS in intertidal samphire. • Venus Bay – moderate risk PASS in intertidal samphire, moderate risk disturbed PASS in the stranded tidal flat. • Tumby Bay – moderate risk PASS in supratidal and intertidal samphire, high risk PASS in intertidal mangroves. • Baird Bay – moderate risk PASS in supratidal and intertidal samphire. • Acraman Creek – disturbed PASS in stranded tidal flat samphire. • Smoky Bay – PASS in intertidal subsoil, thick PASS in mangroves. • Tourville Bay – moderate risk PASS in subsoil, high risk and thick PASS in mangroves, PASS in underlying tidal streams, disturbed PASS in stranded tidal flat.
	Climate change	Possible sea level rise, increase in water temperature and CO_2 absorption, and likelihood of more frequent storm events. The one of the impacts of climate change will be habitat retreat particularly for mangroves and saltmarshes.
	Netting closures	• Denial and Smoky Bay (Tourville Bay and Smoky Bay estuaries) • Streaky Bay – Blanche Port (Acraman Creek and Blanche Port estuaries) • Baird Bay • Venus Bay (waters <5 m) • Coffin Bay • Port Lincoln (Duck Ponds Creek and Tod River estuaries) • Tumby Bay to Dutton Bay (waters <5 m) (Tumby Bay, Salt Creek (Eyre), Dutton River and Driver River estuaries) • Arno Bay • Spencer Gulf – Gibbon Point (Yabmana Creek estuary) • Cowell: Franklin Harbor Spencer Gulf – Gibbon Point (Franklin Harbor estuary)

Sources: topography - boat ramps – DEH, Coast Protection Branch
Aquaculture licences and lease boundaries – PIRSA
Acid sulfate soils – Coast maps, Government of SA
Moorings – DEH
Netting closures - PIRSA
Dredging – DTEI

Note: errors in the spatial data are possible although every effort has been made to ensure the accuracy of the statistical information provided.

[8] Coastal acid sulfate soils are soils that generate sulfuric acid when exposed to oxygen.

12. Case study

As with many of the region's estuaries, the Tod River estuary is valued environmentally, economically and socially. It is under threat from a range of influences and requires further planning, management and action to ensure its health is sustained. Further information on this estuary is shown in the following case study.

Case study: Tod River estuary

The Tod River is the only permanent surface stream on the Lower Eyre Peninsula. Upstream from the estuary there is a reservoir used for reticulated water supplies (the river supplies 80% of reticulated water to the region).

The estuary is included in the Directory of Important Wetlands in Australia. It provides an important refuge for waterbirds and other aquatic fauna during drought periods. It is also a significant site for shorebirds (Watkins 1993), with nineteen waterbird species recorded (eg the Cape Barren goose *Cereopsis novaehollandiae* and musk duck *Biziura lobata,* which are both protected under the *EPBC Act 1999* and the *NPW Act 1972*).

The area is also an important location for the King George whiting *Sillaginodes punctata* and numerous other fish species.

The major threats facing the Tod River estuary include:

- extensive land clearance and livestock grazing adjacent to and upstream from the estuary – these have led to erosion and an increase in sediments and nutrients entering the system (resulting in silting at the mouth)
- significant increases in salinity levels (13 mg/L per annum increase since 1930)
- reduction in water flows entering the estuary due to storage within the Tod Reservoir
- reduction in native vegetation through land management practices (Rixon et al. 2002).

13. Current management initiatives

Table 9 indicates those projects currently underway in the EP NRM region's estuaries. Many agencies, local government and community groups are responsible for the management and protection of these estuaries. Across the region there is scope for other research, monitoring, education, awareness-raising and on-ground activities.

Table 9. Current management initiatives

Initiative	Agency/group involved	Estuaries included in the project	Contact details
Investigating the use of biological indicators of estuarine condition in South Australia	EPA	Selected estuaries	Senior Aquatic Biologist Environment Protection Authority Ph.(08) 8204 2044
Domestic ballast water management arrangements as part of the *National Ballast Water Framework and the National System for the Prevention and Management of Marine Pest Incursions*	PIRSA	Estuaries that have ports and marinas	PIRSA Fisheries Marine Bio-security Program Ph.(08) 8226 2874
Development of Coastal Marina Strategy and Guidelines	Chaired by Planning SA (DPC, DEH, DTEI, DWLBC, EPA, OLG, PIRSA, SATC)	SA coast	PIRSA Planning SA (Strategic and Social Planning) http://www.planning.sa.gov.au Ph.(08) 8303 0760
Boardwalk and walking trail through samphire and mangroves	Arno Bay Estuary Group and Arno Bay Progress Association	Arno Bay	Arno Bay Estuary Group Ph.(08) 8628 0124
Arno Bay Management Plan	Arno Bay Waters Development/ Arno Bay Progress Association	Arno Bay	Arno Bay Progress Association C/ President Ph.(08) 8628 0108.
Bead samphire *Halosarcia flabelliformis* monitoring program (proposed project)	DEH	Eyre Peninsula	Threatened Flora Project Officer C/ DEH Ph.(08) 8688 3180
Coordinated approach to coastal wetlands (proposed project for 2007-2010)	EP NRM Board	Upper Spencer Gulf coastal wetlands	EP NRM Board
Saltmarsh and mangrove monitoring	DEH/Coast Protection Board	Selected areas within the EP NRM region	Coast Protection Branch Ph.(08) 8124 4700

14. Potential directions

There are several information gaps that could be addressed to improve the management of estuaries in the EP NRM region.

Information gaps and potential directions for management include:

- develop a regional inventory of estuaries
- refine regional targets for healthy ecosystems and describe ecosystem services
- identify groundwater influences and use within estuaries (including whether salinity levels are rising and impacting estuarine condition, flora and fauna)
- develop and implement an estuarine monitoring program for priority estuaries (including biogeochemical, water quality and water quantity, habitat assessment and species diversity, presence and abundance) to monitor trends in condition of estuaries
- determine the impacts of stormwater and urban encroachment on estuaries and amend council development plans accordingly
- investigate and address other potential sources of pollution to the estuarine environment
- develop targeted education programs and activities to engage landholders, tourists, industry and other estuary users, and the broader community to build capacity for the management of estuaries
- identify potential climate change impacts for estuaries and their adjacent habitats.

References and relevant reading

Aslin, H and Bryon, I, 2003, *Community Perceptions of Fishing: Implications for Industry Image, Marketing and Sustainability*, Fisheries Research and Development Corporation.

Baker, J L, 2004, *Towards a System of Ecologically Representative Marine Protected Areas in South Australian Marine Bioregions* – Technical Report, prepared for Coast and Marine Conservation Branch, Department for Environment and Heritage, South Australia.

Bryars, S, 2003, *An Inventory of Important Coastal Fisheries Habitats in South Australia,* Fisheries Habitat Program, Primary Industries and Resources South Australia.

Davenport Creek Management Committee, 2003, *Davenport Creek Management Plan,* District Council of Ceduna.

DEH, *Status of Seabirds*, data from Biological Survey Database and Biodiversity Survey and Monitoring, Department for Environment and Heritage, based on the report by Copley, PB, 1996, *The Status of Seabirds in South Australia*.

DEH, 2002, *Biodiversity Plan for the Eyre Peninsula*, Department for Environment and Heritage, South Australia.

DEH, 2004a, *Parks of the Coffin Bay Area Management Plan, Adelaide, South Australia,* Department for Environment and Heritage.

DEH, 2004b, *Living Coast Strategy for South Australia*, prepared by Natural and Cultural Heritage, Department for Environment and Heritage for the Government of South Australia.

DEH, 2005, *Island Parks of Western Eyre Peninsula Management Plan* – draft, Department for Environment and Heritage, Adelaide, South Australia.

DEH, 2006a, *Biological Database of South Australia*, Department for Environment and Heritage, Adelaide, South Australia.

DEH, 2006b, *Venus Bay Conservation Park Management Plan* – draft, Department for Environment and Heritage, Adelaide, South Australia.

DEH and DWLBC, 2003, *Wetlands Strategy for South Australia,* Department for Environment and Heritage and Department of Water, Land, Biodiversity and Conservation, Adelaide.

DTEI, 2006, *Eyre Peninsula,* Department for Transport, Energy and Infrastructure 2006. http://www.infrastructure.sa.gov.au/documents/2_EYRE PENINSULA_6-13.pdf.

DWLBC, 2006, Surface-Water Catchments, Department of Water, Land and Biodiversity Conservation.

EA, 2001, *A Directory of Important Wetlands in Australia*, Third Edition, Environment Australia, Canberra. www.environment.gov.au/water/wetlands.

Ellis, D, Fotheringham, D, Fitzpatrick, P, 1983, *Davenport Creek Preliminary Management Report,* prepared by the Coastal Management Branch and the Aboriginal Heritage Section.

EPA, 2003, *Environment Protection (Water Quality) Policy and Explanatory Report*, Environment Protection Authority.

EPCWMB, 2005, *Eyre Peninsula Catchment Water Management Plan,* Eyre Peninsula Catchment Water Management Board.

EP Local Government Association Coastal Councils Working Group, 2006, *Eyre Peninsula Coastal Development Strategy*.

EPNRB, 2006, *Towards a Regional Natural Resources Management Plan for Eyre Peninsula: A Concept Statement for Consultation – August 2006,* Eyre Peninsula Natural Resources Management Board.

EPNRM, 2004, *Regional Natural Resources Management Plan: 2004-2007,* Eyre Peninsula Natural Resources Management.

EPNRMG, 2002, *A Background to Integrated Natural Resources Management for Eyre Peninsula*, Eyre Peninsula Natural Resources Management Group, Wudinna.

ERDB, 2003, *Eyre Peninsula: Regional Profile,* Eyre Regional Development Board. http://www.erdb.org.au/.

Graham, A, Oppermann, A, Inns, R W, 2001, *Biodiversity Plan for Northern Agricultural Districts*, Department for Environment and Heritage, South Australia.

Government of South Australia, 2006, *State Natural Resources Management Plan 2006*, Department for Water, Land and Biodiversity Conservation.

Jones, K, 2005, personal records, South Australian Research and Development Institute, Aquatic Sciences.

Mazur, N, Aslin, H, Curtis, A, Byron, I, Magpantay, C, 2004, *Community Perceptions of Aquaculture: Report on the Eyre Peninsula,* Social Sciences Program, Bureau of Rural Sciences.

NLWRA, 2001, National Land and Water Resources Audit, http://www.nlwra.gov.au, data formerly held in the Ozestuaries database.

Planning SA, 2004, *Upper Spencer Gulf Region Recreation, Sport and Open Space Study*, prepared by Stratcorp Consulting Pty Ltd.

Rixon, S, Kotz, S, Thomas, D, 2002, *A River Management Plan for the Tod Catchment*. Healthy Rivers Unit, Evaluation Branch, Environment Protection Agency, Department for Environment and Heritage.

SATC, 2002a, *South Australian Tourism Plan 2003-2008, Inspiring Partnerships for Sustainable Tourism,* South Australian Tourism Commission.

SATC, 2002b, *Sustainable Tourism Development in Regional South Australia*, discussion paper, South Australian Tourism Commission.

SATC, 2006, *Eyre Peninsula*: *regional tourism profile 2005*, South Australian Tourism Commission. http://www.infrastructure.sa.gov.au/documents/2_EYRE PENINSULA_6-13.pdf.

SA Water, 2003, *Eyre Peninsula Water Supply Master Plan*, Parsons Brinckerhoff Australia Pty Ltd.

Turner, L, Tracey, D, Tilden, J, Dennison, W.C, 2004, *Where the River Meets the Sea: Exploring Australia's Estuaries*, Cooperative Research Centre for Coastal Zone, Estuary and Waterway Management (Coastal CRC).

Watkins, D, 1993, *A National Plan for Shorebird Conservation in Australia*. Australasian Wader Study Group of the Royal Australasian Ornithologists Union.

Wilson, J, 2000, *South Australian Wader Surveys: January and February 2000,* Australasian Wader Studies Group and the South Australian Ornithologists Association.

Referenced and recommended websites

Australian Heritage Directory
http://www.heritage.gov.au/datalists.html (viewed March 27th 2007)

Department for Environment and Heritage
http://www.environment.sa.gov.au (viewed March 27th 2007)

Estuaries Management and Planning (SA)
http://www.environment.sa.gov.au/coasts/estuaries.html (viewed March 27th 2007)

National Land and Water Resources Audit
http://www.nlwra.gov.au/ (viewed March 28th 2007)

Register of the National Estate
http://www.ahc.gov.au/register/ (viewed March 28th 2007)

State Heritage Register
http://www.heritage.gov.au/ahpi/index.html) (viewed March 28th 2007)

The Protecting Waterways Manual
http://www.transport.sa.gov.au/publications/protecting_the_waterways.asp (viewed March 28th 2007)

Water Proofing Adelaide
http://www.waterproofingadelaide.sa.gov.au/main/ (viewed March 28th 2007)

Relevant legislation

Aboriginal Heritage Act 1988
http://www.austlii.edu.au/au/legis/sa/consol_act/aha1988164/index.html (viewed March 28th 2007)

Adelaide Dolphin Sanctuary Act 2005
http://www.legislation.sa.gov.au/browseActs.aspx (viewed March 28th 2007)

Coast Protection Act 1972
http://www.legislation.sa.gov.au/browseActs.aspx (viewed March 28th 2007)

Crown Lands Act 1929
http://www.legislation.sa.gov.au/browseActs.aspx (viewed March 28th 2007)

Development Act 1993
http://www.legislation.sa.gov.au/browseActs.aspx (viewed March 28th 2007)

Environment Protection Act 1993
http://www.legislation.sa.gov.au/browseActs.aspx (viewed March 28th 2007)

Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth)
http://www.environment.gov.au/epbc/index.html (viewed March 28th 2007)

Fisheries Management Act 2007
http://www.legislation.sa.gov.au/browseActs.aspx (viewed March 28th 2007)

Heritage Places Act 1993
http://www.legislation.sa.gov.au/browseActs.aspx (viewed June 15th 2007)

Mining Act 1971
http://www.legislation.sa.gov.au/browseActs.aspx (viewed March 28th 2007)

National Parks and Wildlife Act 1972
http://www.legislation.sa.gov.au/browseActs.aspx (viewed March 28th 2007)

Native Vegetation Act 1991
http://www.legislation.sa.gov.au/browseActs.aspx (viewed March 28th 2007)

Natural Resources Management Act 2004
http://www.legislation.sa.gov.au/browseActs.aspx (viewed March 28th 2007)

Petroleum Act 2000
http://www.legislation.sa.gov.au/browseActs.aspx (viewed March 28th 2007)

Petroleum (Submerged Lands) Act 1982
http://www.legislation.sa.gov.au/browseActs.aspx (viewed March 28th 2007)

Abbreviations

CASS	Coastal acid sulfate soils
DEH	Department for Environment and Heritage
DIWA	Directory of Important Wetlands in Australia
DPC	Department of Premier and Cabinet
DTEI	Department of Transport, Energy and Infrastructure
DWLBC	Department of Water, Land and Biodiversity Conservation
EA	Environment Australia
EPA	Environment Protection Authority
EPCWMB	Eyre Peninsula Catchment Water Management Board
EPNR Board	Eyre Peninsula Natural Resources Board
EP NRM	Eyre Peninsula Natural Resources Management
EPNRMG	Eyre Peninsula Natural Resources Management Group
ERBD	Eyre Regional Development Board
ha	hectare
ML	megalitre
NLWRA	National Land and Water Resources Audit
NRM	Natural Resources Management
OLG	Office of Local Government
PASS	Potential acid sulfate soils
PIRSA	Primary Industries and Resources, South Australia
SATC	South Australian Tourism Commission
WWTP	Wastewater treatment plant

Appendices

Appendix 1. A sample of bird species associated with the EP NRM region's estuaries

	Franklin Harbor	Tumby Bay	Tod River	Coffin Bay	Venus Bay	Baird Bay	Acraman Creek	SmoKy Bay	Tourville Bay
Australian pelican		•	•		•	•	•		
banded lapwing								•	•
banded stilt					•	•			
bar-tailed godwit	•			•	•	•			•
black-faced cormorant	•								
black-tailed godwit	•			•		•			
Cape Barren goose			•	•					
caspian tern	•			•	•				
common greenshank	•			•	•	•	•	•	•
common sandpiper				•					
crested tern				•	•	•			
curlew sandpiper	•				•	•		•	•
double banded plover						•			
eastern curlew		•		•	•	•			•
eastern reef egret				•	•				
fairy tern		•		•	•	•			
great cormorant					•				•
great knot					•	•			•
greater sand plover						•			•
grey plover	•	•		•	•	•	•	•	•
grey-tailed tattler				•					
grey teal			•						
hoary-headed grebe			•			•			
hooded plover	•			•	•				•
lesser sand plover				•		•			•
little black cormorant					•				
little penguin				•					

table continued

Appendix 1. A sample of bird species associated with the EP NRM region's estuaries continued

	Franklin Harbor	Tumby Bay	Tod River	Coffin Bay	Venus Bay	Baird Bay	Acraman Creek	SmoKy Bay	Tourville Bay
little pied cormorant					•				
masked lapwing	•					•		•	•
musk dusk	•			•	•				
osprey				•	•	•			
pacific black duck			•						
pacific golden plover		•				•	•	•	•
pacific gull				•	•	•	•		
pied cormorant	•		•		•	•	•		•
pied oystercatcher	•			•	•	•	•	•	•
red-capped plover	•			•	•	•		•	•
red knot						•	•		•
red-necked stint	•				•	•	•	•	•
rock parrot					•		•		
ruddy turnstone		•		•		•	•	•	•
sanderling				•		•			•
sharp-tailed sandpiper	•	•		•	•	•	•	•	•
silver gull				•	•	•			
sooty oystercatcher				•	•	•		•	•
whimbrel									
white-bellied sea eagle	•			•	•	•			
white egret									
white-faced heron		•	•		•				

Sources: Baker (2004), DEH 2006b, DEH (2002), EA (2001), Watkins (1993), Wilson (2000).
Note: not all estuaries have been included in this table and the list is by no means extensive.

Appendix 2. A sample of fish species recorded in EP NRM region's estuaries

	Franklin Harbor	Yabmana Creek	Arno Bay	Dutton River	Salt Creek/ Tumby Bay	Coffin Bay	Tod River	Venus Bay	Baird Bay	Blanche Port	Acraman Creek	Tourvillle Bay
Commercial fish species												
black bream					•		•					
flathead	•	•		•	•	•	•	•	•		•	•
flounder	•	•		•		•	•	•	•		•	•
King George whiting	•	•		•		•	•	•	•	•	•	•
red mullet	•	•		•		•		•	•			
river garfish												
school whiting		•		•		•		•	•			
snapper	•	•		•		•						
snook		•		•		•		•	•			•
southern sea garfish	•	•		•		•	•	•	•	•	•	•
tommy ruff	•	•		•		•	•	•	•	•	•	•
trevally		•		•		•		•	•		•	
Western Australian salmon*	•	•	•	•	•	•	•	•	•	•	•	•
yellow-eyed mullet	•	•	•	•	•	•	•	•	•	•	•	•
yellowfin whiting	•		•				•		•			
yellowtail kingfish		•										
Other fish species												
crested weedfish									•			
leather jackets*	•	•		•		•		•	•		•	
small-mouthed hardyheard	•								•		•	
snake blenny									•			
southern long-finned goby*	•											

Sources: Baker (2004), Bryars (2003), EA (2001), Jones, (pers. records).
(Note: the data included in this table is limited, not all estuaries in the region have been included and fish lists are not extensive.

* indicates species that are marine stragglers or temporary visitors, which may have only been chance strays into the estuary.

Appendix 3. Criteria for determining important wetlands in Australia

A wetland may be considered nationally important if it meets at least one of the following criteria (EA 2001):

1. It is a good example of a wetland type occurring within a bio-geographic region in Australia.
2. It is a wetland which plays an important ecological or hydrological role in the natural functioning of a major wetland system/complex.
3. It is a wetland which is important as the habitat for animal taxa at a vulnerable stage in their life cycles, or provides a refuge when adverse conditions such as drought prevail.
4. The wetland supports 1% or more of the national populations of any native plant or animal taxa.
5. The wetland supports native plant or animal taxa or communities which are considered endangered or vulnerable at the national level.
6. The wetland is of outstanding historical or cultural significance.

Maps produced by
Coast and Marine Conservation Branch
Department for Environment and Heritage
GPO Box 1047
Adelaide SA 5001

Map Sources
Topographic data, NPWSA reserves, point source pollution, boat ramps, ports and harbours, coastal shack sites, CASS data, saltmarsh and mangrove mapping, coastal sand dune mapping, recreational fishing sites, LGAs - DEH
Estuaries - NLWRA and DEH
Marine bioregions, marine biounits - DEH and SARDI, PIRSA
Coastal wetlands data from 'A Directory of Important Wetlands in Australia, 3rd ed., 2001'
Benthic habitat mapping - CSIRO, DEH and SARDI, PIRSA
Aquatic reserves, netting closures, aquaculture licenses, mining data - PIRSA
Water catchment boundaries, NRM boundaries, groundwater basins, shallow standing water level data - DWLBC
Land use zoning - Planning SA, PIRSA
Aboriginal heritage sites - AARD, DPC
Maritime boundaries - Geoscience Australia

Department for Environment and Heritage (2007)
Eyre Peninsula Natural Resources Management Region
Estuaries Information Package, Department for Environment and Heritage,
Adelaide, SA.

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