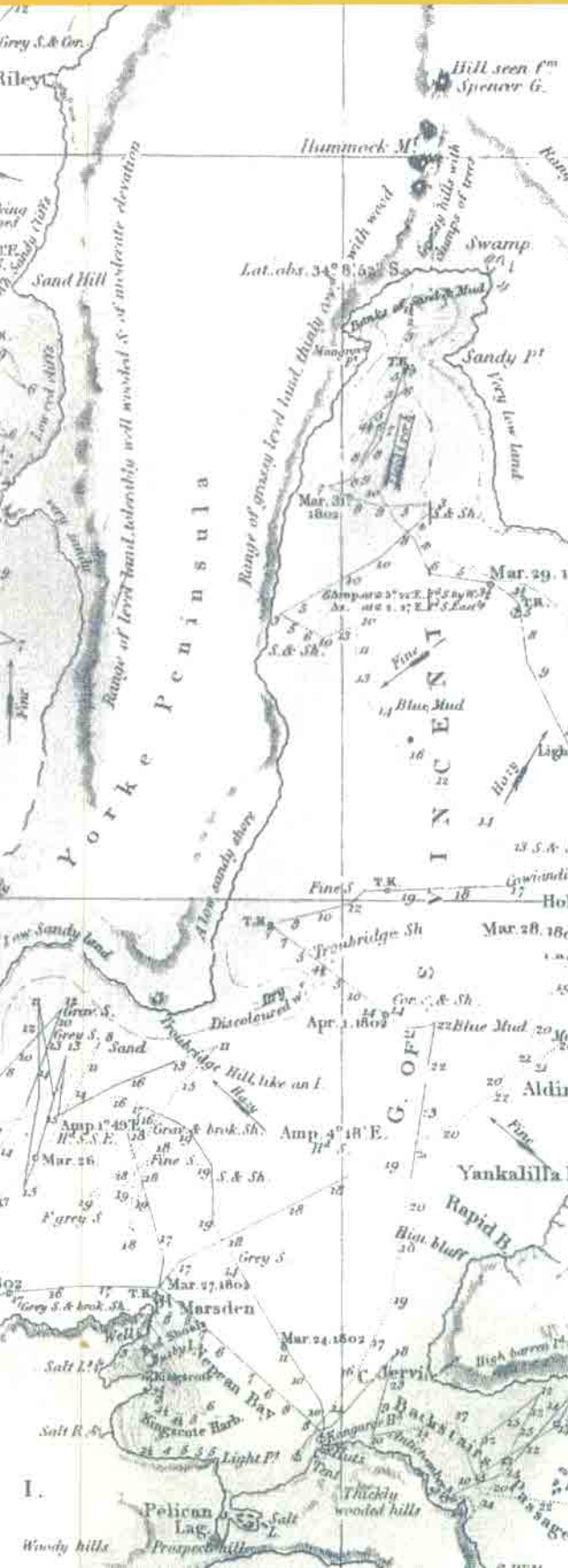
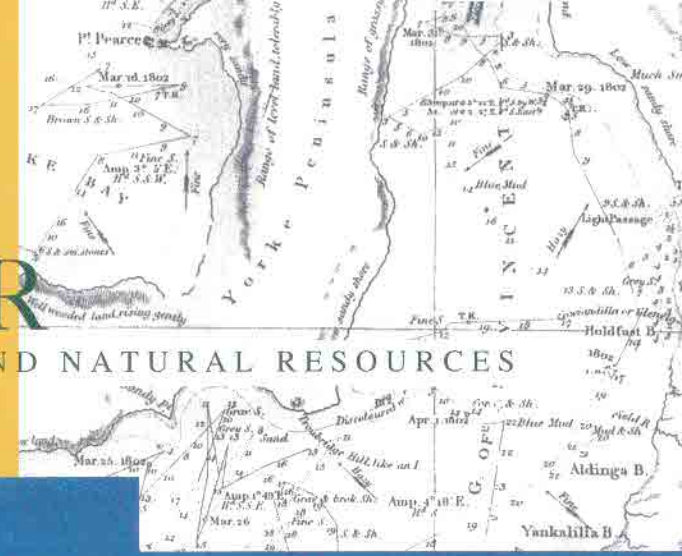


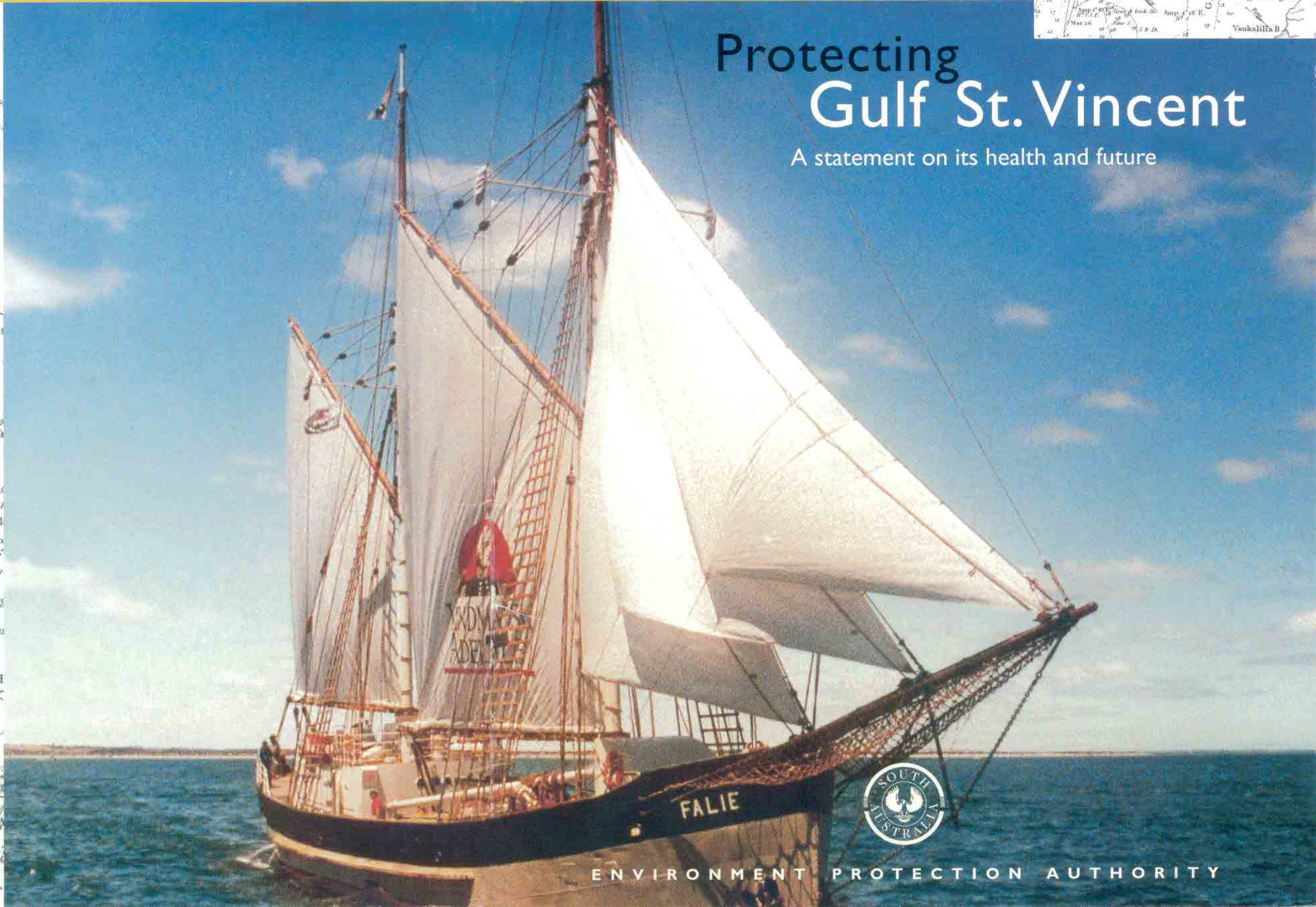


DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES



Protecting Gulf St. Vincent

A statement on its health and future



ENVIRONMENT PROTECTION AUTHORITY

Protecting Gulf St. Vincent
A statement on its health and future
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FOREWORD

South Australia's commitment to protecting Gulf St. Vincent

The Importance of Gulf St. Vincent

The South Australian Government is committed to achieving a sustainable future for this State, and a healthy Gulf St. Vincent is critical to this endeavour. The Government is therefore intent on working with the community and all spheres of government to ensure that the Gulf can be used and enjoyed both now and in the future.

The Gulf is a magnificent asset to the State. It supports an abundant aquatic ecosystem, provides an important sea link to other cities, produces fish and seafood recognised throughout the world, has wonderful beaches and coastal scenery, and supports a wide range of water based recreational activities.

However, the effects of urbanisation are becoming increasingly apparent along the metropolitan coastline. Although effects are localised, the loss of seagrass, increased sand movement, algal blooms, degradation in water quality, litter on beaches, loss of mangroves, and sediment on reef systems are all indicative of problems that need to be addressed now before it is too late.

One only has to reflect a moment on what Adelaide in particular, and South Australia as a whole, would be like without Gulf St. Vincent to realise the importance of the Gulf to our wellbeing. Suppose that we were unable to swim in the Gulf, walk along our magnificent beaches, catch fish, enjoy the wonderful coastline and participate in all the water sports we now take for granted. What if we had to travel hundreds of kilometres to enjoy these uses? How would this affect our quality of life?

This document describes the Gulf as it was when Colonel Light selected a site for Adelaide, what it is like now, and what it could be in the future. It is intended to be both informative and thought provoking. While the document identifies important issues for the management of the Gulf, we are also seeking your ideas and input so that together, we can put in place measures to ensure that the Gulf can continue to be used and enjoyed by everyone. This feedback will also assist the broader task of developing a Marine and Estuarine Strategy for South Australia.

I commend the Department of the Environment and Natural Resources and the Environment Protection Authority for their efforts in initiating this project and focusing attention on this very important area of our State.



JOHN OLSEN FNIA MP
Premier of South Australia



DAVID WOTTON MP
Minister for the Environment and Natural Resources

September 1997

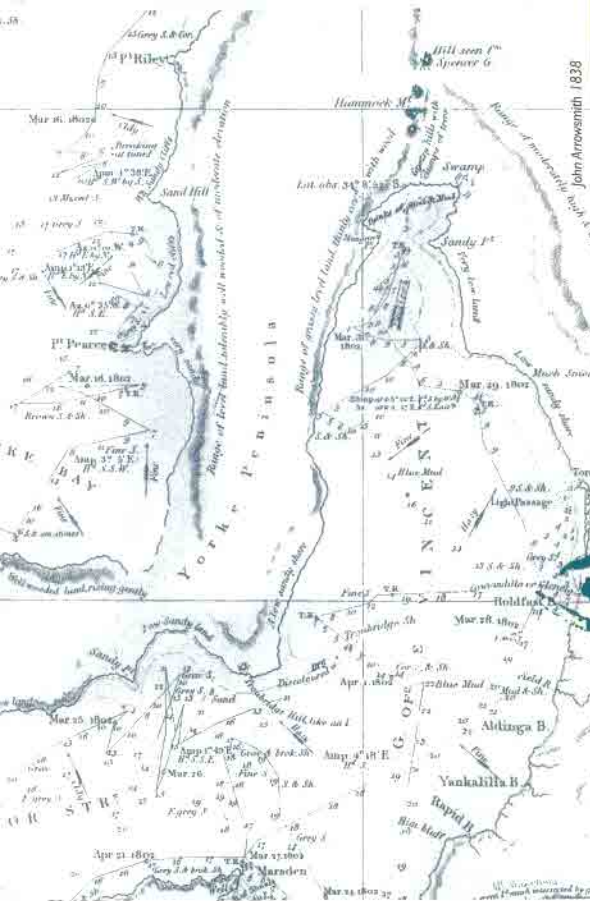
Please send written submissions on this document to:
Protecting Gulf St. Vincent
Office of Environment Protection
GPO Box 2607, Adelaide 5001
by February 1998



John Olsen FNIA MP
Premier of South Australia



David Wotton MP
*Minister for the Environment
and Natural Resources*



What is Gulf St. Vincent to you?

- a great swimming beach
- a place to catch fish
- blue water and a breeze
- a complex marine community
- a salt resource for industry
- a corridor for container ships
- a natural sink for stormwater
- a world class sailing venue
- a great view from the window
- a special place

What else?



Old Brighton Jetty



SA Tourism



SA Tourism

Cliffs at Second Valley

Will the Gulf meet our expectations

- for fishing
- bathing water quality
- clean sandy beaches

this summer?



SA Tourism

Children at Glenelg

What about the future?

In 50 years time, will our children still expect to:

- swim in clear, clean water and play on the beach?
- fish from a boat, a jetty or the beach, and catch fish and crabs that are safe to eat?
- walk barefooted along the sand and in the shallows without injury from broken bottles and other beach litter?
- watch dolphins playing near the coast?
- discover a new world of plants and animals in a rock pool?
- explore reef systems and mangrove forests?
- look out over blue water and see fishing boats, cargo ships and yachts passing by?

Will the quality of Gulf waters still be good enough to support all of the things we now take for granted?





The hatch boat, carried on the brig Rapid

Which Gulf?

The gulf the French explorer Baudin called **Gulf Josephine** is the smaller of our two marine inlets and carries the sea more than 100 km inland to Port Wakefield. Matthew Flinders later named it **Gulf St. Vincent** in honour of Admiral Lord St. Vincent. Flinders explored the Gulf in 1802, preparing its first detailed hydrographic charts. Most of these soundings are still used on our navigational charts today. Flinders



William Light

The hatch boat in Port Adelaide Creek, September 30th, 1836

recognised a line joining Troubridge Point on Yorke Peninsula and Cape Jervis on Fleurieu Peninsula as the entrance to the Gulf.

Colonel William Light explored the east coast between Cape Jervis and Port Wakefield in 1836, looking for a site for the city of Adelaide. Port Lincoln and Nepean Bay on Kangaroo Island had been rejected because of the lack of water and poor soil.

(Light's Brief Journal, Wakefield Press, 1984)

What was the Gulf like then?

Aboriginal people of the Narrunga tribe set fish traps and gathered shell fish along the western coast of the Gulf. Traces of their camps have been found near Ardrossan and Black Point. The Kurna people lived on the eastern side, and smoke from their fires was seen by ships arriving in the Gulf in the 1830s.

First priority for the new colonists was safe passage to a sheltered harbour, so records of their observations refer to the physical features, such as weather, shelter, good 'holding', shoals and rocks.

Colonel Light's diaries record the weather conditions every day, safe anchorages, and the search for rivers (freshwater) and good soil. He also mentions the thriving seal and whale industries at the southern end of the Gulf.

His observations within the upper Gulf note the wide shallows and dense mangroves on the eastern side which made it difficult to find the mouth of any river or tidal creek, especially the Port River. **Looking for the mouth of the river (Torrens), Light found that it 'exhausts itself in the lagoons', without reaching the sea.**

The safety of the anchorage at Holdfast Bay, where the first settlers landed, and its superiority to anything in Encounter Bay or Spencer Gulf was due to good holding on the sandy bottom and the absence of rocky outcrops. Most ships wrecked along



South Coast Air Centre (Brian Rowlands)

Southern coast of Gulf St. Vincent

the eastern coasts of Gulf St. Vincent 100 years ago were blown ashore or onto rocks when their anchors dragged in a gale.

The early settlers probably knew the Gulf better than we do now because it was the fastest trade route between the coastal settlements and Port Adelaide.

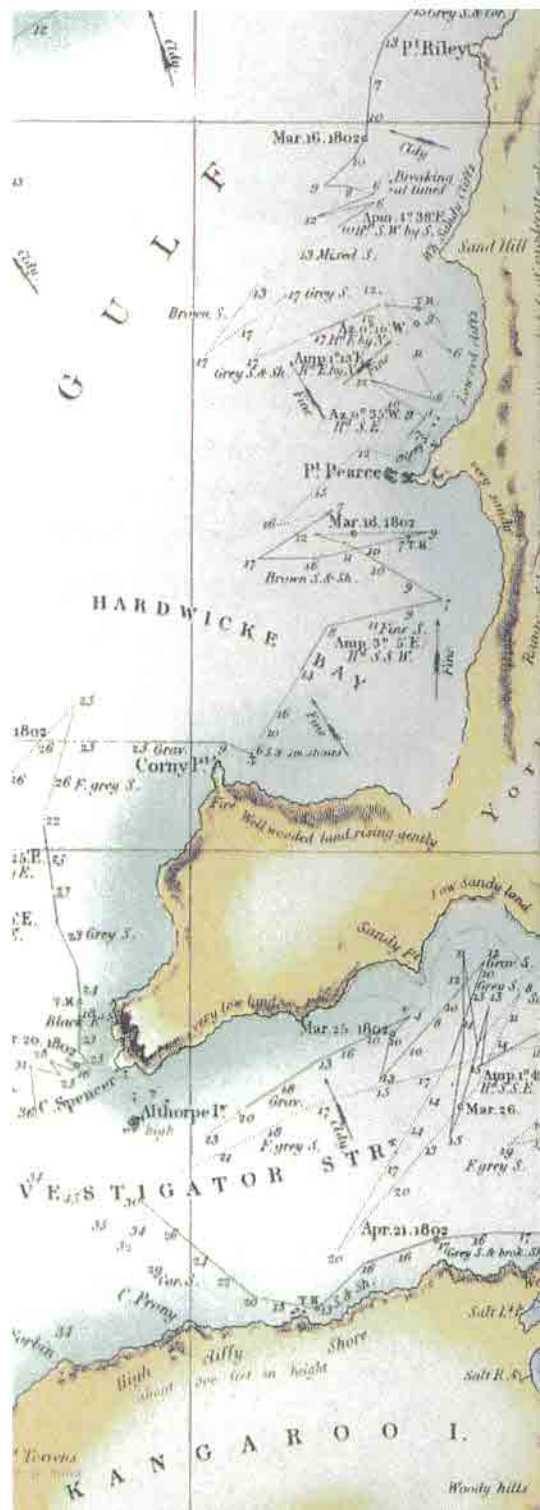
From the 1840s the new steamships competed with sailing ketches for the coastal trade in mallee roots, salt, gypsum, lime, shellgrit, wheat and wool, but the ketches had the advantage in shallow water.

Port Wakefield was opened in 1850 to ship copper from the mines at Burra and to import coal.

In 1855, flat bottomed barges were used to bring stone from Port Vincent to build Glanville Hall at Semaphore.

Captain Butler flew across the Gulf in 1919, from Adelaide to Minlaton, carrying the first airmail.

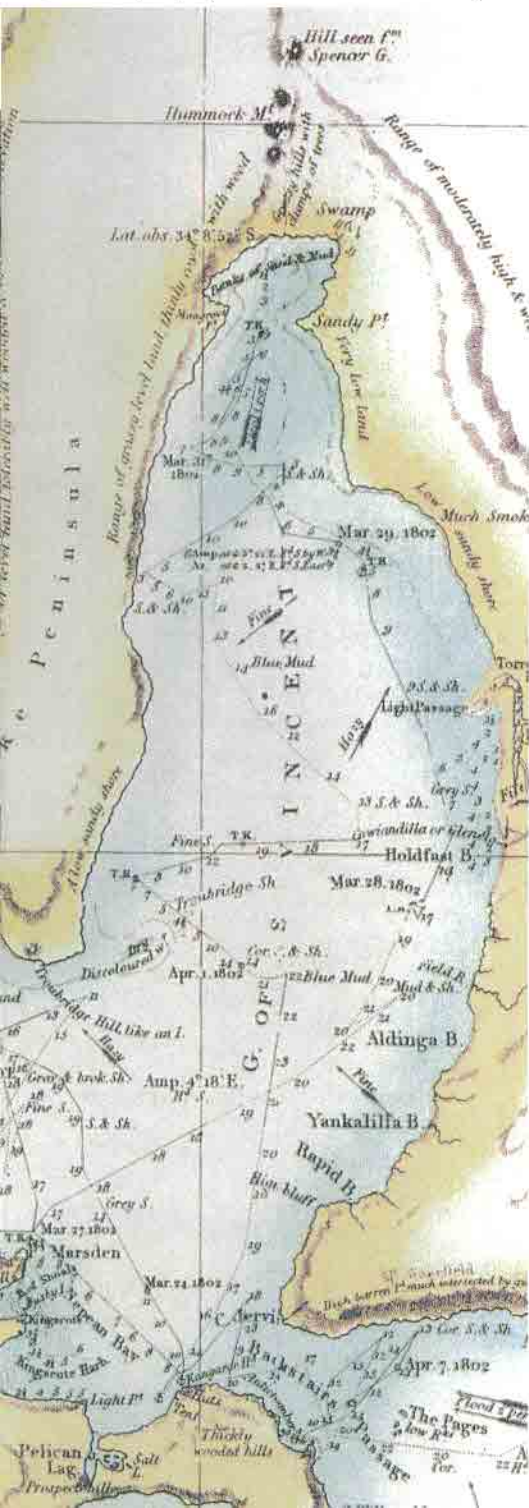
In the 1930s passengers embarked at Port Adelaide for the 'Gulf Trip', a fun cruise to Spencer Gulf which lasted for six days. Regular cargo and passenger services across Gulf St. Vincent, and to Kangaroo Island, ran on the SS Warrawee, Karatta, Kopoola, Juno, and MV Kooraka.





Salt warehouses at Edithburgh, now demolished

Below: Maritime portion of South Australia - from surveys of Captain Flinders and Colonel Light



Now ... has it changed?

After 160 years of urban settlement:

- More than 1 million people live around the coast of Gulf St. Vincent.
- Sand dunes, marshes, mangroves and tidal creeks have given way to wharves and other development at Port Adelaide, but tidal marshes further north, like the delta of the Light River, are still almost as William Light first saw them.
- Urban development along the coast has replaced many original Aboriginal sites but the legendary journey of Tjilbruke from the Tjilbruke Springs to Cape Jervis is commemorated by a rock sculpture overlooking the sea at Kingston Park.
- Jetties project from the sandy shoreline, providing access to the sea for 'land lubbers' and fishers as well as habitat for a colourful array of marine algae and invertebrates. The original jetty at Glenelg, more than 350 m long, was built in 1859.
- Brightly coloured sails fly over the blue water on Saturday afternoon but in some places the seabed is littered with plastic bags, bottles and cans.
- The River Torrens now discharges through a channel directly to the sea, and the waves along the beach are sometimes turbid and brown with the stormwater silts once trapped in the reed beds at Grange.
- More than 4000 ha of seagrass has disappeared completely from the 'blue line' along the metropolitan coast and there has been extensive loss of the more sensitive *Amphibolis* species from areas where it once co-existed with other seagrasses.
- Exotic marine organisms, arriving in ships' ballast water, are competing with the native species in ports and harbours.
- Sheltered anchorages are still important and more are being created for recreational boats. Designs for harbour walls are now 'wave tested' in model tank systems to ensure shelter from storms.
- There is no weekly steamer to Port Vincent but the *Falie* makes day trips along the coast from Port Adelaide, and the sail training ship *One and All*, built in Adelaide in 1988, is often seen in the Gulf. The first Adelaide built submarine appeared in the Gulf in 1995.

But not enough people see the best view of Adelaide – from the middle of Gulf St. Vincent.

Dolphins in Gulf St. Vincent



Who uses the Gulf now? and what for?

Commercial shipping:

- Last year, 170 container ships moved up the Gulf to the container terminal at Outer Harbor.
- 16 'multistorey' livestock carriers loaded sheep and 80 vehicle carriers loaded cars at Outer Harbor.
- On the other side of the Gulf, 51 bulk carriers called at Ardrossan and 35 at Port Giles. Most grain ships discharge ballast water before loading cargo.

Recreational boating:

How many small boats are out on the Gulf on a sunny weekend?

- More than 45,000 recreational boats are registered in South Australia, and about 70% of these would use Gulf St. Vincent. Small sailing boats without motors are not included in this number.

Recreational fishing:

A new 'boat ramp' survey carried out by SARDI interviewed 1777 fishers in one year, and found that:

- The annual recreational fishing effort for Gulf St. Vincent was 425,525 boat hours! Equivalent to about 100 boats fishing every daylight hour for the year (1995).
- 297,868 boat hours were spent along the metropolitan coast:
 - 64% fished for whiting
 - 41% fished for garfish
 - 36% fished for squid
- The total reported catch for the year was:
 - 78 tonnes whiting — value nearly \$2 million
 - 32 tonnes garfish — value \$650,000
 - 34 tonnes squid — value \$300,000
- The commercial catch of whiting was 92 tonnes for the same period, worth more than \$2 million.

Commercial fishing:

- Currently there are 10 prawn licences and 2 blue crab licences for Gulf St. Vincent.
- 141 licensed marine scale fishers live around the coast of the Gulf, although they may fish in all State waters.
- The reported prawn catch for Gulf St. Vincent in the 1994–95 year, limited to 23 days fishing, was 147 tonnes, worth about \$3 million.

Education:

- The number of students and teachers using our beaches and coastal waters for day visits or long term research is not known, but last year more than 25,000 people used the St. Kilda boardwalk for guided tours of the coastal mangrove system, and about 13,000 of these were in school and university groups.

Salt production:

- Water from Gulf St. Vincent is used to produce 750,000 tonnes of salt per year at Dry Creek salt fields, and up to 200,000 tonnes at Price on the western side of the Gulf.

Wastewater disposal:

- About 180,000 ML of stormwater runoff reaches the Gulf each year, equivalent to Adelaide's annual use of reticulated water.
- This stormwater also transports more than 6000 tonnes of silt from the catchment into the Gulf each year.
- Our four sewage treatment plants also dispose of a total of about 80,000 ML of treated effluent to the Gulf, containing, on average, 2,760 t nitrogen and 573 t phosphorus.

These are some of the ways we use the Gulf.

Remember, the Gulf is also a habitat, a source of food and shelter for all marine life beneath the surface.

THE SHIPPING NEWS — 1995–96

- 794 vessels called at the Port of Adelaide carrying 2,258,770 tonnes of imports, and 2,625,513 tonnes of exports.
- The *Accolade* carried 1,406,494 tonnes of limestone across the Gulf from Port Klein to Port Adelaide.
- 38 overseas ships called at Port Giles, near Edithburgh to load 424,521 tonnes grain. 49,717 tonnes were loaded onto 3 interstate ships.
- 122 oil tankers called at Port Stanvac, moving 3,725,531 tonnes oil and petroleum products.

INVOICE

For materials delivered to: Gulf St. Vincent
 From: Adelaide Plains and Hills
 Supplied by: Metropolitan land users
 Period: An average year of runoff

180,000 ML fresh water @ 80c/kL	\$ 144,000,000.00
1200 tonnes nitrogen @ \$295/t	\$ 354,000.00
250 tonnes phosphorus @ \$258/t	\$ 64,500.00
6200 tonnes topsoil @ \$25/t	\$ 155,000.00
TOTAL COST	\$ 144,573,500.00





Container wharf at Outer Harbor



Houses built on sand dunes at Tennyson

Coastal Management Section - DEWR



Scallops and sponges near Port Stanvac

Brian Rowlands

Can these values be protected?

If we agree on how we want to use the Gulf, we can define the water quality we need to protect these uses. There are National Water Quality Guidelines to protect most environmental values. The most strict criteria apply to:

- **Protection of aquatic ecosystems** — protecting the habitat for fish and all other marine life in the Gulf.
- **Primary contact recreation** — such as swimming, where there is direct body contact with the water.
- **Aquaculture** — high standards of water quality are necessary to provide oysters, mussels and fish fit for human consumption.

If the Gulf meets water quality guidelines for these three uses, the water should meet our expectations for all other uses. (But not drinking!)

But seawater along Adelaide's coast does not always meet these criteria.

What is of greatest value to users of the Gulf?

- Sandy beaches
- Clean water
- Dunes
- Tidal flats and wading birds
- Reef systems
- Seagrass meadows
- Tidal creeks and mangrove forests
- Public access to the shoreline
- Jetties
- Shipping lanes
- The fishing resources
- The view

What else?

Does Gulf St. Vincent have a dollar value?

- Home buyers pay an additional \$50,000 – 100,000 for a seafront house with a view of the Gulf.
- The market value of the fish and prawns caught in the Gulf is more than \$5 million per year.
- A shipping corridor could be valued in terms of import and export cargoes.
- A recent study of the value of world ecosystems has estimated that seagrass meadows are worth \$US 19,000 per hectare per year. Tidal marshes and mangroves are valued at \$US 10,000 per hectare per year.

Natural integrity means the degree to which a natural system retains its condition and natural rate of change in terms of size, biological diversity, geodiversity and habitat (Australian Natural Heritage Charter, 1996).

How much do we know about the Gulf?

How does the Gulf behave?

The physical oceanography of the Gulf includes:

- bathymetry (depth contours)
- tidal rhythms (predictions of tide levels and times)
- changes in sea level
- water temperatures and salinity profile variations at depth
- patterns of water circulation (numeric models)
- current speed and direction
- weather patterns and winds.

Our knowledge of the physical characteristics of Gulf waters owes much to the painstaking and meticulous work of the early naval surveyors, beginning with Flinders in 1802. More recent research by the Flinders Institute of Atmospheric and

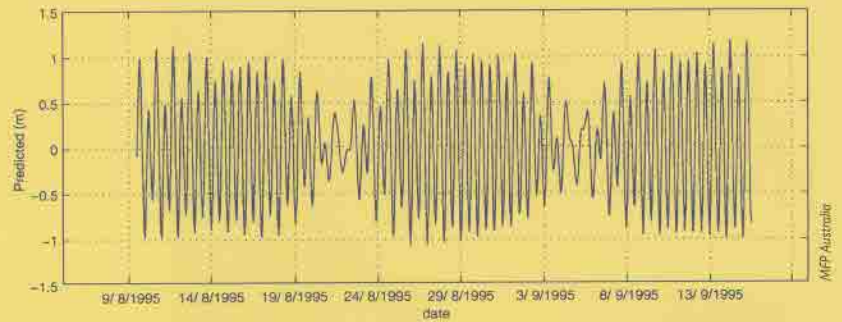
Marine Sciences, the National Tidal Facility, The University of Adelaide's Departments of Applied Mathematics, and Civil and Environmental Engineering as well as Government departments and individual studies have added details of **tidal and wind-driven water circulation, water chemistry, turbidity, prevailing winds, geology, stratigraphy, sediments, and the direction of sand movement** along the coast. Keen sailors have even provided **guides to sheltered anchorages!**

The work on **sand movements** along the metropolitan coast is fundamental to the management of beach sand resources.

Studies have also included modelling of **water circulation, salinity and temperature** in the Port River Estuary and Barker Inlet, and modelling the dispersion of stormwater plumes on the metropolitan coast.

Tidal movement in Gulf St. Vincent almost ceases during 'dodge' tides, which can occur twice in a month. Land based discharges have less dilution and dispersion at these times.

The Gulf also acts as an **'inverse estuary'**, becoming more saline at the top, or northern, end. In summer, the exchange of water between Gulf St. Vincent and the open sea is reduced by the formation of salinity and sea surface temperature gradients



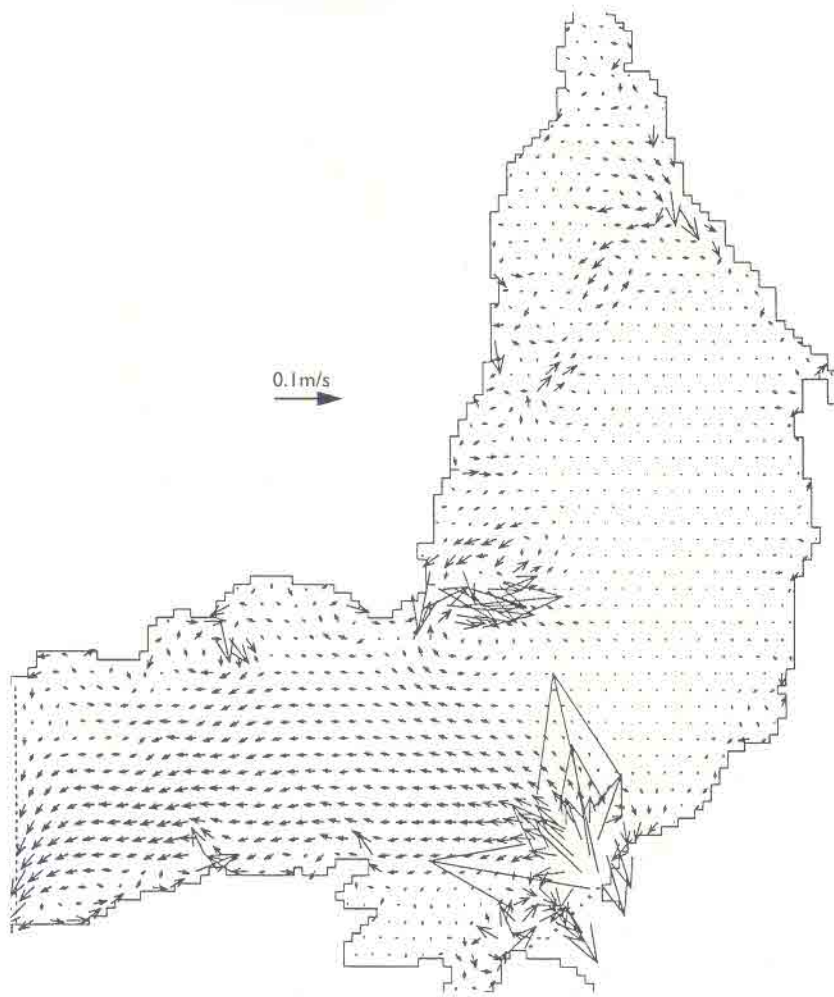
A tidal record for the Fairway beacon



Henley Jetty during a storm, 1995

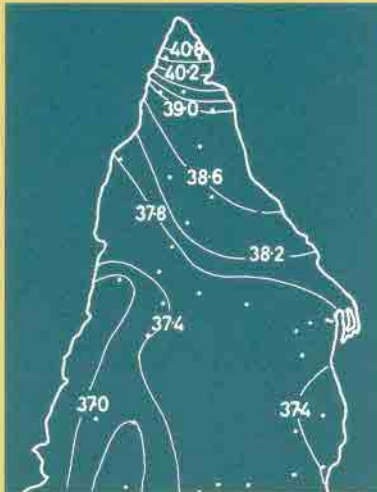
across the mouth of the Gulf.

Some of this information will contribute to the **aquaculture management plans** now being prepared for Gulf St. Vincent, and to the assessment of proposals for stormwater discharges and harbour developments along the metropolitan coast.



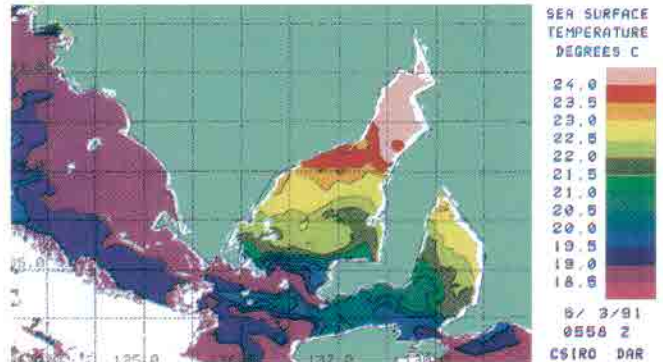
Department of Applied Mathematics, The University of Adelaide, 1996

Averaged net water movements over one month in Gulf St. Vincent



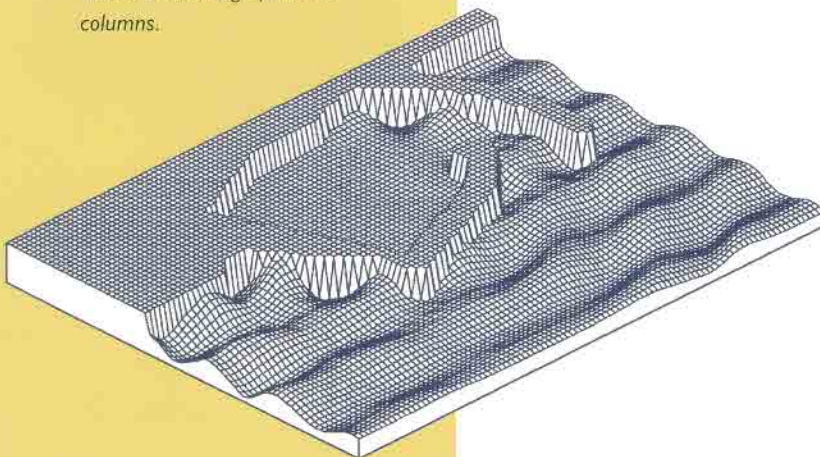
J. Bye, 1976

Distribution of salinity (ppt) in Gulf St. Vincent March 1975. Values are average for water columns.



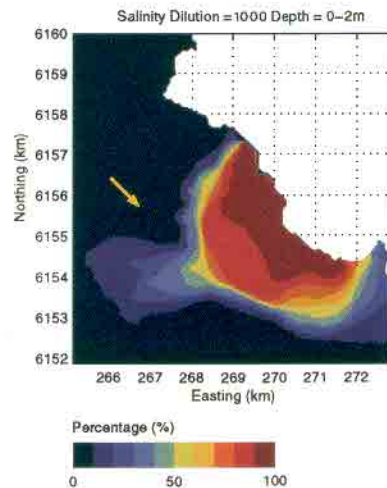
CSIRO Division of Atmospheric Research

Sea surface temperature contours for the gulfs, March 1991



Wave modelling for Worrina Cove

Department of Civil and Environmental Engineering, The University of Adelaide, 1996.



MPP Australia 1996

Salinity dilution contours at the Bolivar STW outfall, wind north-easterly

How much do we know about the biological communities (marine life) in the Gulf?

The botanist Ferdinand Mueller began to investigate Gulf St. Vincent on the day he arrived, collecting two species of *Sargassum* from 'the ocean gulf' before his ship berthed at the port of Adelaide on 15 December 1847. Next day he returned to Port Adelaide to collect algae from the nearby beaches. Eleven species dated 16 December 1847 are among his collections held at the National Herbarium of Victoria.

Fish from Gulf St. Vincent were collected for the first curator of the South Australian Museum in 1860, and 5 new genera and 15 new species were described by Castelnau in 1872 and 1873. By 1973, 216 species had been recorded from the Gulf.

Some of the very different habitats found in the Gulf are:

- intertidal mudflats and mangroves
- rocky reef platforms with many plants and animals attached
- seagrass meadows in shallow water
- deep water communities of sponges, sea squirts, scallops, bryozoan corals and brachiopods
- *Pinna* (razorfish) communities, with rich epifauna
- tyre reefs and old shipwrecks.

Many researchers have studied the diversity of plant and animal communities and their interdependence (ecology) in Gulf St. Vincent, and it is now known that the **seagrass meadows** are of **fundamental importance** to the whole Gulf ecosystem.

We also know that *Amphibolis* (wire weed) is the most sensitive of our subtidal seagrasses, and disappears before *Posidonia* (tape weed) is affected. **Nutrient rich waters have been implicated in seagrass loss**, and turbidity may also be a factor.

If the seagrass goes:

- The sand, held in place by the seagrass roots, is free to move away.
- We lose the small crustaceans, fish, worms, and shellfish which shelter and feed among the leaf blades.
- The whiting and other fish which feed on the shrimps and worms will disappear.

Aerial photography suggests that thousands of hectares of seagrass have disappeared from the metropolitan coast and that the loss is continuing.

And we know that:

- a large area of seagrass has disappeared around each sewage outfall
- some seagrasses do not regrow once they have been lost.

Recent research has identified areas where declining water quality threatens the survival of the remaining seagrass meadows.

We do not know how much waste the Gulf can accept without irreparable damage.



A healthy seagrass bed with *Amphibolis* and *Posidonia*



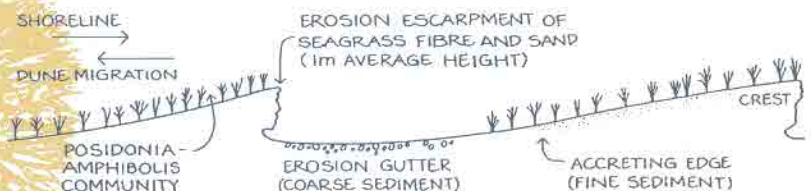
Heavy growth of epiphytes on *Amphibolis*

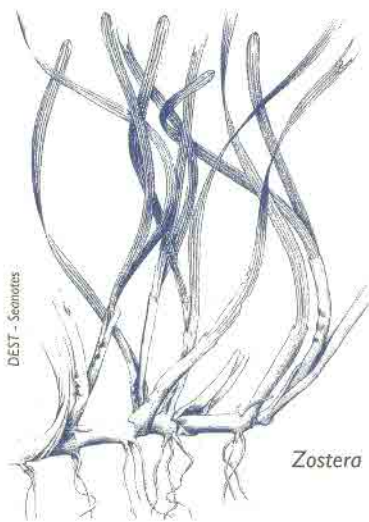


A badly affected bed of *Posidonia* (*Halophila* in foreground)

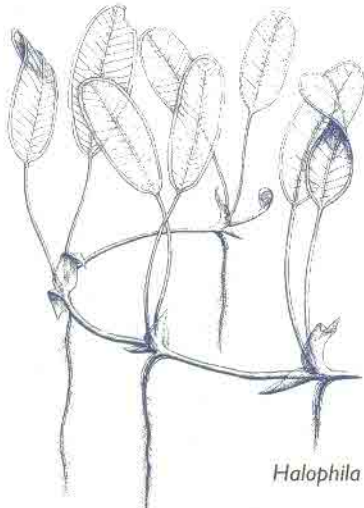


Total loss of seagrasses





Zostera

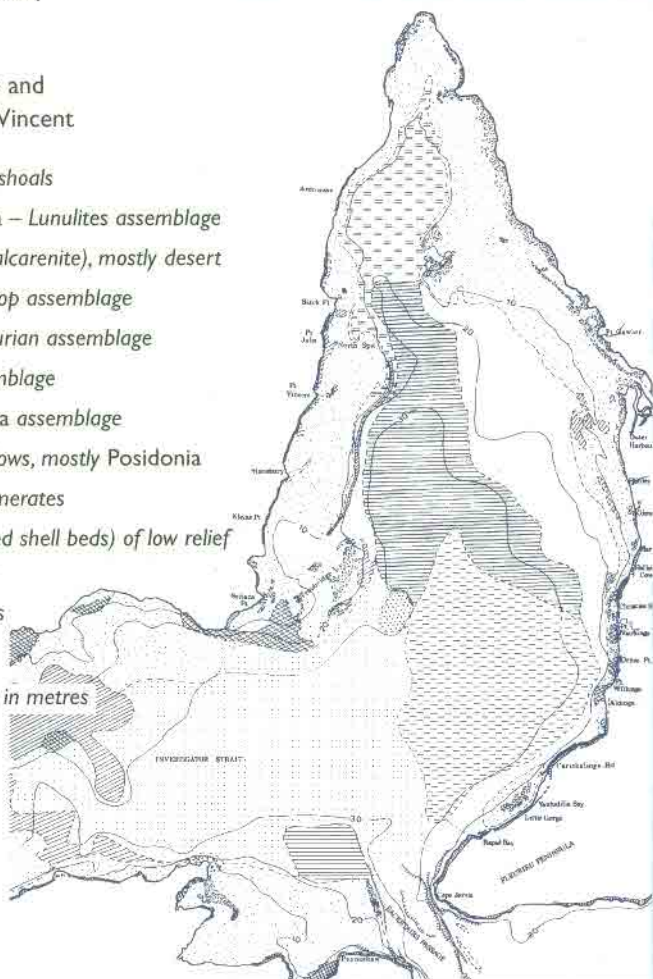


Halophila

Other seagrasses in the Gulf

Benthic communities and substrate of Gulf St. Vincent

- Bare sand and shoals
 - Heterozostera – Lunulites assemblage
 - Algal debris (Calcarenite), mostly desert
 - Ascidian – scallop assemblage
 - Pinna – holothurian assemblage
 - Bryozoan assemblage
 - Malleus – Pinna assemblage
 - Seagrass meadows, mostly Posidonia
 - Boulder conglomerates
 - Reef (kunkarised shell beds) of low relief
 - Aeolianite reef
 - Erosion benches
 - Scarps
- Depth of water in metres



Shepherd and Sprigg, 1976.

The ecology of the margins of the gulf between high and low water level, and the influence of tides on the vertical extent or zonation of intertidal organisms, was described by Womersley and Edmonds in 1958. This paper related the communities of plants and animals to sandy and muddy beaches in the northern part of the gulf and rocky shorelines in the south. These habitats were further classified into high energy, moderate and low wave energy coasts.

In 1964 biologists and geologists began a survey of the sediments and marine communities on the sea floor of Gulf St. Vincent which involved more than 560 diving stations over a period of 5 years. This information was compiled as a map of the substrate and benthic communities of Gulf St. Vincent and Investigator Strait, and is documented in the *Natural History of the Adelaide Region* published by the Royal Society in 1976. This detailed investigation forms the basis of more recent biogeographic

surveys by SARDI, which are essential to the preparation of aquaculture management plans for Gulf St. Vincent.

More information about the natural systems in Gulf St. Vincent can be found in:

Southern Fisheries, published by PISA Fisheries four times a year.

Natural History of the Adelaide Region, Chapters 12, 13, 14, published by the Royal Society of SA, 1976.

Computer Aided Learning Program for South Australian Coastal Marine Ecosystems, developed by Flinders University for the EPA, 1996.

Tide Tables for South Australian Ports, printed by Ports Corp.

Marine Invertebrates of Southern Australia, Parts I and II, edited by Shepherd and Thomas, published by the Government Printer, 1989.

The Marine Benthic Flora of Southern Australia, Parts I, II, and III, by HBS Womersley, published by the SA Handbooks Committee and Australian Biological Resources Study, 1984–1994.

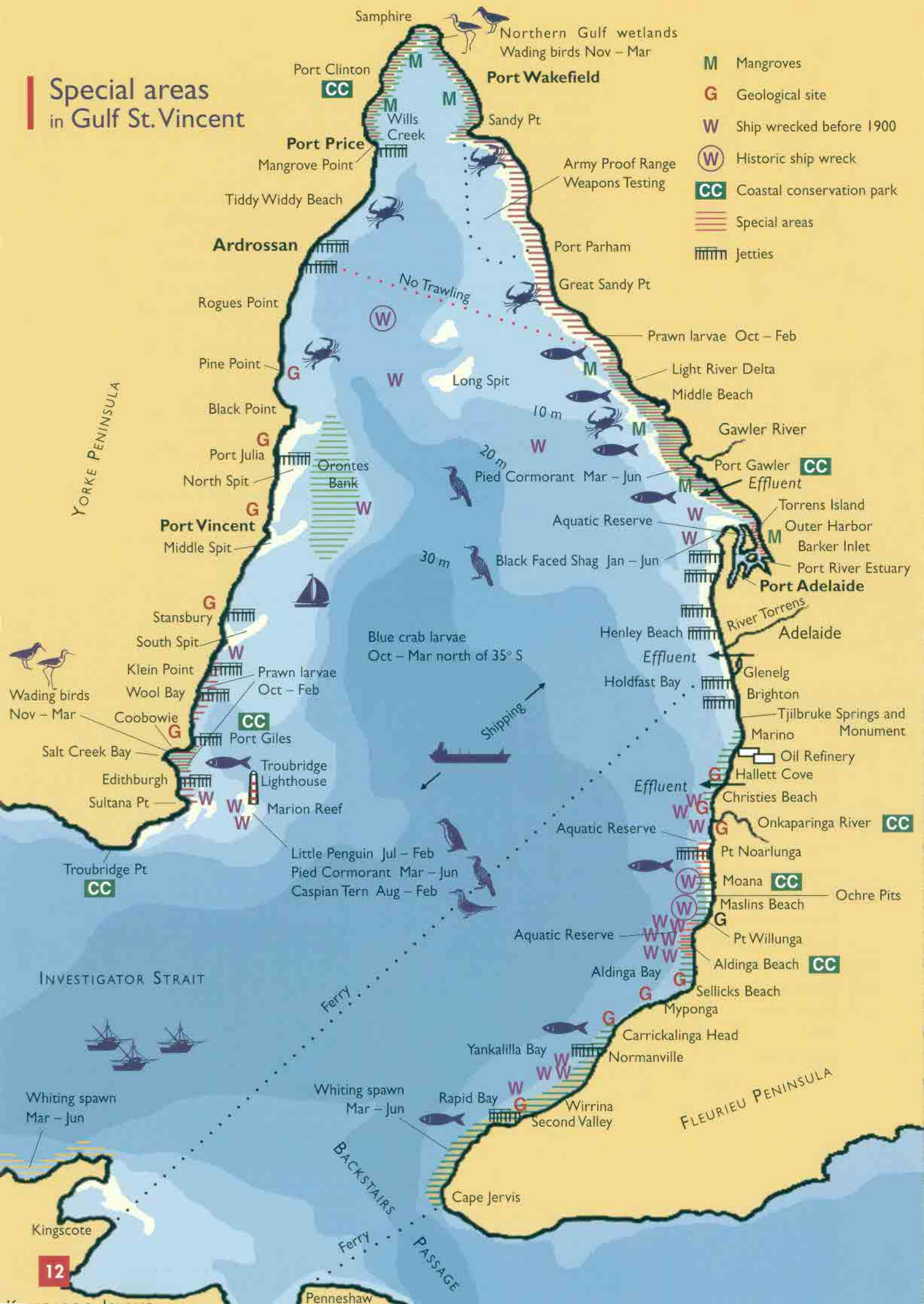
Mangroves in South Australia by K Edyvane, published by SARDI, 1995.

Marine Biogeography and Conservation Values of the Gulf St. Vincent, by K Edyvane, for SACPB, 1976.



'Old wives' schooling over seagrass beds

Special areas in Gulf St. Vincent



- M** Mangroves
- G** Geological site
- W** Ship wrecked before 1900
- (W)** Historic ship wreck
- CC** Coastal conservation park
- |||||** Special areas
- |||||** Jetties

Samphire
Northern Gulf wetlands
Wading birds Nov – Mar

Port Clinton **CC**

Port Wakefield

Port Price
Mangrove Point

Sandy Pt
Army Proof Range
Weapons Testing

Ardrossan

Port Parham

Rogues Point

Great Sandy Pt

Pine Point

Long Spit

Prawn larvae Oct – Feb

Light River Delta

Black Point

Middle Beach

Port Julia

Orontes Bank

10 m

Gawler River

North Spit

20 m

Pied Cormorant Mar – Jun

Port Gawler **CC**

Port Vincent

Aquatic Reserve

Torrens Island

Middle Spit

30 m

Black Faced Shag Jan – Jun

Outer Harbor

Stansbury

Henley Beach

Port River Estuary

South Spit

Effluent

Adelaide

Klein Point

Prawn larvae Oct – Feb

Holdfast Bay

Glenelg

Wool Bay

Wading birds Nov – Mar

Coobowie

CC

Port Giles

Brighton

Tjilbruke Springs and Monument

Salt Creek Bay

Troubridge Lighthouse

Effluent

Hallett Cove

Edithburgh

Marion Reef

Aquatic Reserve

Christies Beach

Sultana Pt

Little Penguin Jul – Feb

Pied Cormorant Mar – Jun

Caspian Tern Aug – Feb

Pt Noarlunga

Onkaparinga River **CC**

Troubridge Pt **CC**

Moana **CC**

Ochre Pits

INVESTIGATOR STRAIT

Aquatic Reserve

Pt Willunga

Aldinga Bay

Aldinga Beach **CC**

Whiting spawn Mar – Jun

Sellicks Beach

Myponga

Kingscote

Yankalilla Bay

Carrickalinga Head

12

Whiting spawn Mar – Jun

Rapid Bay

Normanville

BACKSTAIRS

Wirrina Second Valley

FLEURIEU PENINSULA

PASSAGE

Cape Jervis

Penneshaw

Is the Gulf healthy now?

Recent studies have shown that some parts of the Gulf are badly degraded, with very little of the natural habitat remaining. The most degraded areas are probably along the Adelaide coastline.

But other areas appear almost untouched, providing glimpses of the marine habitat Matthew Flinders and Colonel Light must have observed.

Troubridge Shoal, at the south-west entrance to the Gulf, has a historic lighthouse and is a haven for seabirds, its sandy shoreline only changed by the wind and waves.

The Orontes Bank is a long sand bar with outcropping limestone reefs running north and south on the western side of the Gulf, shaped by the tidal currents and colonised by thriving seagrass beds. 25 sea miles from Outer Harbor, it is almost unknown except to navigators and fishermen.

The extensive **delta of the River Light**, deposited in a wetter climate thousands of years ago, is still an inaccessible wilderness of mud and mangroves, vital to the maintenance of juvenile fish, crabs and prawns (The area of the delta may be increasing because of clearing and erosion on the landward side).

Salt Creek Bay north of Edithburgh with extensive seagrass meadows, is an important fisheries nursery area.

Some of the special areas of Gulf St. Vincent are shown on the map.

Will they be protected in the future?

Degradation means any decline in the quality of natural resources or the viability of ecosystems caused directly or indirectly by human activities
(*Australian Natural Heritage Charter, 1996*).

What are the key indicators of the health of the Gulf?

Do

- clear water
 - thriving seagrass meadows
 - good fishing
 - the presence of dolphins
- indicate a healthy Gulf?**

Do

- algal blooms
- dead mangroves
- fish kills

mean the Gulf is not healthy?

Do we know if the Gulf can continue to accept the load of water, silt, nutrients, metals and hydrocarbons we put into it every year?

What are the major threats to the health of the Gulf?

Gulf St. Vincent is more vulnerable to change than Spencer Gulf, simply because many more people use a gulf which is less than $\frac{1}{3}$ the size! Gulf St. Vincent has approximately 350 km of coastline, while Spencer Gulf has more than 800 km. If the people living around Gulf St. Vincent were spread evenly along its coastline, there would be 1,700 people/km. Around Spencer Gulf, there would only be about 100 people/km.

The seagrass, reef and intertidal communities along Adelaide's coastline were probably established in clear waters which received very little runoff from the land. The River Torrens deposited its freshwater and silt loads in the reed beds of the Cowandilla plains, seldom reaching the sea. Now we have concrete 'fast tracks' which carry these waters directly to the sea, causing a band of brown silty, turbid water to extend for several kilometres along the city beaches in winter. Our wastewaters also carry thousands of tonnes of nutrients to the sea at Christies Beach, Glenelg and Bolivar, and to the Port River.

Greg Adams, courtesy of The Adelaide Advertiser



Cleaning up oil on Port Noarlunga Beach, September 1996

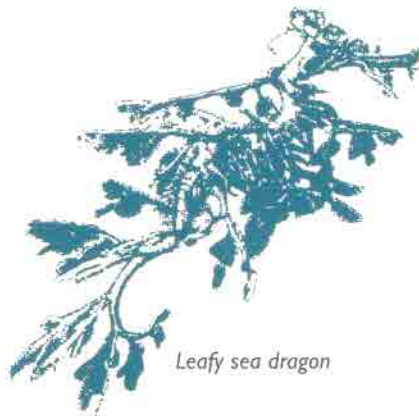
The load of nutrients causes excess algal growth, and blankets seagrass, young mangroves and tidal flats with a mat of organic debris, shutting out the light plants need for growth and depriving juvenile fish and mangroves of vital oxygen. Seagrass leaf blades may break off under the dragging weight of epiphyte growth.

Other threats to the health of the Gulf are:

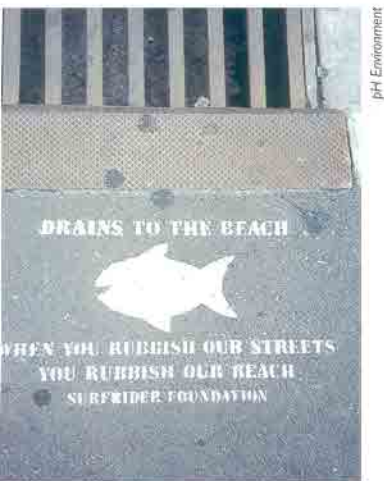
- **Toxicants**, such as the antifoulant paint tributyl tin, which damages shellfish and has been found in sediments in the Port River Estuary
- **Wave erosion**, increasing areas of seagrass blowouts
- **Oil spills**, coating mangroves, birds, and beaches
- **Over-fishing**, decimating the populations of fish, crabs, prawns, scallops and intertidal shellfish
- **Seawalls**, built to protect houses and roads, have caused beaches to disappear
- **Plastic rubbish**, entangling seabirds, seals and dolphins
- **Exotic species**, such as *Sabella*, toxic dinoflagellates and pathogenic microorganisms, spread from port to port in ballast water, smothering native marine life and making coastal waters unsafe for aquaculture and fishing.



Birds on Troubridge Island



Leafy sea dragon



pH Environment

Surfrider sign on a stormwater drain in Adelaide city



Marin Jacka

The QE II at Outer Harbor

What is being done now, to protect Gulf St. Vincent?

The State Government has invested heavily in the future of the Gulf to protect the habitat which supports marine life, and to control both point source and diffuse discharges to the Gulf.

- **Aquatic Reserves** were established in 1971 at Aldinga Reef, Port Noarlunga Reef, Barker Inlet and St. Kilda–Chapmans creek to protect marine habitats and species (**PISA Fisheries**). Troubridge Island and Clinton Conservation Park are also Marine Protected Areas (MPAs) in Gulf St. Vincent (**NPWSA**). **Should there be more reserves?**
- **Catchment Management Boards** have been set up under the Catchment Management Act to manage terrestrial runoff and the load of litter, silt and pollutants which reaches the Gulf after heavy rains. This investment will establish management plans for each catchment, as well as trash racks, wetlands, silt traps and other infrastructure to remove pollutants from stormwater before it enters gulf waters.
- **Industrial discharges** to the Gulf are subject to a licence which requires operators to monitor the quality of the discharge and its impact on the marine environment. Industry must prepare **Environmental Improvement Programmes** now to meet water quality criteria by the year 2001 (**EPA**).
- **SA Water** has agreed with the EPA on **Environment Improvement Programmes** for the four metropolitan wastewater treatment plants. Environmental upgrades will reduce nutrients entering the Gulf by 80%. Estimated to cost about \$180 million, these programmes will also divert at least 60% of the entire effluent flow to agriculture on the northern Adelaide Plains (**SA Water, EPA, MFP, Virginia Irrigation Association**).
- **Polluted sediments** have been dredged from the Patawalonga and are no longer discharged as a black plume to the Gulf (**MFP & DHUD**).
- **The SA Government's** most recent initiative is the development of a **marine and estuarine strategy** for all waters under State jurisdiction. The strategy aims to achieve sustainable use and improved management of our marine estate, which includes **Gulf St. Vincent (P & C)**.

Maintenance means the continuous protective care of the *biological diversity* and *geodiversity* of a place and is to be distinguished from repair. Repair involves *restoration* and *reinstatement* (Australian Natural Heritage Charter, 1996).



Other actions by State

Government agencies include:

- **The Beach Replenishment Programme** by the Coast Protection Board, which restores sand to eroded beaches along the metropolitan coast (**Coastal Management Branch, DENR**).
- A review of the management of Adelaide's beaches between Kingston Park and Outer Harbor (**DENR**).
- Research and management programmes to support the Gulf St. Vincent prawn fishery (**PISA Fisheries, SAFIC**).
- An Ambient Water Quality Monitoring Programme to characterize the pollution status of gulf waters (**EPA**).
- **A Fishwatch programme** providing information and education for recreational fishers, as well as encouraging the community to accept responsibility for our fishing 'commons' (**PISA Fisheries**).

Important studies are also under way to increase our understanding of:

- changes in seagrass area over the last 30 years (**EPA**)
- water and sediment quality in the Port River Estuary (**EPA**)
- epiphyte growth rates in metropolitan waters (**EPA**)
- a methodology to assess the condition of reef systems (**EPA**)
- juvenile fish populations in Barker Inlet (**SARDI**)
- mangrove forests and the effect of waste water discharges on their health (**SARDI**)
- marine plant and animal communities in Gulf St. Vincent (**SARDI**)
- the saltmarsh vegetation around the margins of the Gulf (**DENR Coastal Management**)
- colonisation by the exotic worm, *Sabella* (**EPA**)
- water circulation in the Port River Estuary (**MFP**)

- stormwater and wastewater dispersion along the metropolitan coast (**DHUD**)
- the movement of oil spills in the southern Gulf (**DoT**)
- bioaccumulation of metals in marine mammals of Barker Inlet and Port Pirie (**SA Museum**)
- taxonomy of marine invertebrates, fish, mammals and birds (**by the SA Museum**)

Other information vital to the management of the Gulf is being collected by our universities and includes research on:

- the effects of dredging sand (Department of Botany, The University of Adelaide)
- the behaviour of dolphins (University of SA)
- tidal and wind driven circulation models, also applied to oil spills and dispersal of prawn larvae (Department of Applied Mathematics, The University of Adelaide)
- temperature and salinity gradients in Gulf waters (Flinders Institute of Atmospheric and Marine Sciences)
- the introduction of exotic organisms in ballast water (School of Biological Sciences, Flinders University)
- the design of harbours and marinas to withstand wave action (Civil and Environmental Engineering, The University of Adelaide)
- developing an electronic atlas of marine life in Gulf St. Vincent (School of Biological Sciences, Flinders University).

And what is being done by the community to protect Gulf St. Vincent?

Just a few examples:

- **A Marine and Coastal Community Network**, part of **Ocean Rescue 2000**, is coordinating the work of many groups who care for their local sand dunes, foreshores, cliffs, mangrove and estuarine environments.

- The **'Fishcare' volunteer programme** involves recreational fishers in protection of our fisheries resource for future generations.
- **Recreational diving clubs** clean up litter from the seabed as part of the Cleanup Australia Programme and also assist in a photopoint survey of the Aldinga Reef system.
- **ReefWatch** is a long term reef monitoring programme established in association with universities and the EPA.
- **Dragon Search** is a community based scientific survey of leafy sea dragons and other fish species.
- **The Australian Dolphin Research Foundation** supports studies on the natural history of the Port River dolphins.
- **Seaweed**, initiated by the Marine Education Society of Australia, promotes care for the coast among school children.
- **The Coastal Action Programme** to promote the ecologically sustainable use of South Australia's coastal zone is an initiative of Commonwealth, State and local governments. **Coast care projects** aiming to help understand and protect our coasts are funded by this programme.

Government agencies, community groups and universities are all working to protect Gulf St. Vincent now – but will our efforts be enough?

Dept Civil and Environmental Engineering



Wave modelling tank used to test marina design

Sabella

Some of the studies have identified serious threats to the health of the Gulf.

Parts of a marine ecosystem which developed in clear waters with very little runoff from the land, are now struggling to survive in a turbid nutrient-rich sink. In the most affected areas, mangroves are dying, seagrasses have disappeared and the sand they once stabilised is on the move.

To protect the Gulf we need to:

- prepare a comprehensive management plan for the Gulf
- define water quality objectives needed to maintain the Gulf ecosystem and our recreational uses
- minimise the discharge of nutrient rich effluent
- improve the quality of stormwater discharges
- protect the biodiversity and habitat of marine organisms
- develop sustainable aquaculture management plans
- manage the release of ballast water from ships to stop the spread of exotic organisms
- control the use of toxic antifouling paints to protect shellfish and other sensitive marine species
- reduce or eliminate industrial discharges.

And we also need to know more about:

- the Gulf ecosystem and how it works
- the transport and fate of pollutants
- the movement of sand along the coast
- the condition of our reef systems



Conversation with a cormorant, Outer Harbor

- and how they are changing
- maintaining healthy seagrass communities
- the level of sustainable nutrient discharges to the Gulf
- factors needed to maintain healthy mangrove forests
- protecting ecologically sensitive regions
- the spread of exotic organisms.

What else?

The South Australian Government is committed to the development of a marine and estuarine strategy for all South Australian waters including Gulf St. Vincent.

Issues to be addressed in the strategy will include:

- proper management of wild fishing stocks
- sustainable aquaculture
- protection of biodiversity and habitat
- an agreed system for zoning coastal lands
- discharges from catchments into the marine environment.



The Australian Natural Heritage Charter (IUCN), adopted in December 1996, is directed to the conservation of our natural heritage, including marine areas. Important principles which relate to Gulf St. Vincent are:

The principle of existence value — living organisms, earth processes and ecosystems may have value beyond the social, economic or cultural values held by humans.

The precautionary principle — where there are threats or potential threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.

Intergenerational equity — the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations.



Martin Jacka

Our Gulf in the 21st century — what is it to be?

We will need Gulf St.Vincent as:

- a transport corridor for our export trade
- a natural sink for some of our runoff

and we want to keep

- a **healthy marine ecosystem**, where the unique marine communities of South Australia are protected
- a viable commercial and recreational fishing resource
- a place for recreation, relaxation and seaside activities such as walking, swimming, sailing, windsurfing and family picnics
- a focus for tourism, with beautiful recreation beaches, unique diving sites and historic ship wrecks all within 20 minutes of the city centre.



SA Tourism

Cliffs at Maslins Beach

But the health of Gulf St.Vincent in the 21st century will depend on how we care for the Gulf **now**.

We hold the Gulf in trust for future generations. To ensure it survives another 150 years of urban settlement:

- **we must have** a comprehensive understanding of the Gulf ecosystem and how it works
- **we must make** responsible and coordinated management decisions based on this knowledge
- **we will need** the cooperation and commitment of all who use its waters, beaches, wetlands, cliffs and shallows to protecting Gulf St.Vincent.



More information about Gulf St. Vincent

**Australian Association for
Environment Education**
PO Box 65, Norton Summit 5136
Tel [08] 8390 1347

**Australian Dolphin Research
Foundation**
Tel [08] 8243 0362

Conservation Council of SA
120 Wakefield St, Adelaide 5000
Tel [08] 8223 5155

Coastal Action Programme
[Coastcare]
GPO Box 2693, Adelaide 5001
Tel [08] 8224 2046

DENR
Department of Environment and
Natural Resources
Office of Environment Protection
Level 7, 77 Grenfell St
Adelaide 5000
Tel [08] 8204 2000

Environment & Natural Resource
Information Centre
Ground Floor, 77 Grenfell St
GPO Box 1047, Adelaide 5001
Tel [08] 8204 1913

Coastal Management Branch
GPO Box 1047, Adelaide 5001
Tel [08] 8204 8840

State Heritage
[including shipwrecks]
GPO Box 1047, Adelaide 5001
Tel [08] 8204 9311 or 8204 9299

NPWSA
Education Officer, GPO Box 1047
Adelaide 5001
Tel [08] 8204 9182

Environment Australia
Community Information Unit
Canberra [Ocean Rescue 2000, Coastal
Action Programme & Sea Notes]
Free call 1800 803 772

**Dept of Transport
Marine Facilities**
33-37 Warwick St, Walkerville 5081
Tel [08] 8343 2222

EPA
The Environment Protection Authority
GPO Box 2607, Adelaide 5001
Tel [08] 8204 2000

KESAB
[Underwater and beach litter]
395 Glen Osmond Rd
Glen Osmond 5064
Tel [08] 8338 1855

Local Government Association
Environment Resource Officer
GPO Box 2693, Adelaide 5001
Tel [08] 8224 2043

MCCN (SA)
[Community involvement in marine
conservation]
PO Box 120, Henley Beach 5022
Tel [08] 8200 2455

**Marine Education Society of
Australasia, SA**
PO Box 367, Torrensville 5031
Tel [08] 8280 8172

Marine Life Society of SA
PO Box 369, Brighton 5048
Tel [08] 8270 4463

PISA Fisheries
16th Floor, 25 Grenfell St
Adelaide 5000
Tel [08] 8226 2311

Ports Corp South Australia
293 St. Vincent St
Port Adelaide 5015
Tel [08] 8447 0611

SAFIC
PO Box 3058, Port Adelaide 5015
Tel [08] 8303 3786

SARDI
South Australian Aquatic
Science Centre
2 Hamra Ave, West Beach 5024
Tel [08] 8200 2400

**South Australian Maritime
Museum**
127 Lipson St, Port Adelaide 5015
Tel [08] 8240 0200

South Australian Museum
North Terrace, Adelaide 5000
Tel [08] 8207 7500

St. Kilda Mangrove Trail
St. Kilda 5110
Tel [08] 8280 8172

State Information Centre
Ground floor, 77 Grenfell St,
Adelaide 5000
Tel [08] 8204 1900

Abbreviations

ANZECC	Australian and New Zealand Environment and Conservation Council	MEPFund	Marine Environment Protection Fund
AQUIS	Australian Quarantine and Inspection Service	MFP	MFP Development Corporation
DENR	Dept of Environment and Natural Resources	MPA	Marine Protected Area
DHUD	Dept of Housing and Urban Development	NPWSA	National Parks and Wildlife South Australia
DoT	Dept of Transport	P & C	Department of Premier and Cabinet
EIP	Environmental Improvement Programme	PISA	Primary Industries South Australia
EPA	Environment Protection Authority	ppt	parts per thousand
KESAB	Keep South Australia Beautiful	SAFIC	South Australian Fishing Industries Council
MCCN(SA)	Marine and Coastal Community Network (SA)	SARDI	South Australian Research and Development Institute
		SA Museum	South Australian Museum



**Gulf St. Vincent
by road**