



President's Message

How quickly this year is going, now we are into the second half. It has been an eventful 6 months along the coast.

The big news story from the Media's point of view has been the fish deaths. A lot of opinion and answers demanded from all sources. In the end (although it will be ongoing) it was necessary to wait and see the various reports and then they were not able to offer anything conclusive. This edition of the Blue Swimmer offers the best available knowledge from the various tests and autopsies carried out.

The Marine Parks were at last declared, there was a strong reaction from the recreational fishers with the announcement of the initial sanctuary zones scenario three years ago, but through extensive consultation and negotiation along with inputs from groups like ours the final scenario is a much fairer one. The results of the effects of the marine parks will be a long time coming and will depend on how effectively they are monitored.

The Metropolitan Coast Park is slowly eventuating with the communities divided on the need. The coastal councils appear to be operating in isolation of one another on this issue and apply community consultation to suit their own agendas.

The common factor in the health of the gulf is water quality with the numerous threats including stormwater, industrial and waste water discharges remaining largely unchecked. On a personal level we need to maintain constant awareness of what is going down our drains. Everyday urban activities like planting, watering, fertilising lawns and gardens, or washing cars in the street contribute to the harmful effects. The

Friends of Gulf St Vincent remain committed to seeking solutions that will improve the environment, we encourage the community's input to identify and avert impacts of poorly controlled development. We will continue the management of water quality monitoring through the Secchi Project and now have made application for an extension for a further two years.

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Autumn fish deaths in SA

Some of us have been monitoring the reports of fish and dolphin deaths and subsequent investigations with great concern. It was most distressing to see such a quantity of fish washed up along the length of the metropolitan coast, and at other localities in the State.

The first articles about the fish deaths appeared in the media at the beginning of May, and were reported at Port Neill on Eyre Peninsula, where caravan park visitors found large numbers of

small leatherjackets washed up. A range of fish species were found locally, including ringed toadfish, leatherjackets, ornate cowfish and others.

Well it has been an interesting six months in South Australian waters, but not in any good way. In this edition of the Blue Swimmer we will be looking at some of the issues that have arisen and, perhaps, why.

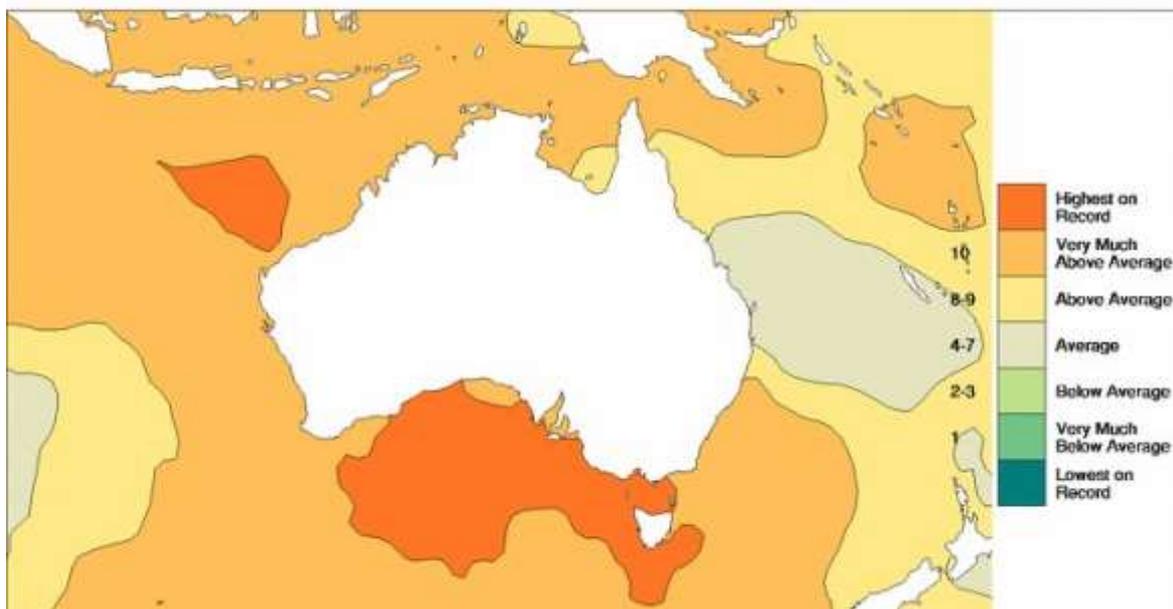
Lack of care, insufficient knowledge, climate change, pollution, overfishing - these are all our doing - and the world's oceans are interconnected - there is really no way to isolate ourselves. If there's one thing we have heard time and time again in Community Fora, it's that ecosystems and the environment are complex.

Australia promotes itself as a clean green island in so many ways - but this seems to be a pretty facile generalisation when you consider some of the abuses being inflicted on both land and sea. Here's just one example. At a recent Marine Discovery Centre Dune Care Forum one of the speakers presented staggering data on the quantity of ghost nets - discarded or lost fishing nets that are drifting off our northern coasts, and still entangling fish and other marine life. Fisheries operators who don't demonstrate responsible practices in this don't deserve much sympathy!



Coinciding with the fish kills, there have been around 30 dolphin deaths, mostly concentrated in the Gulf St Vincent bioregion. It is thought that these are caused by a virus. See our article on this on page 6.

SST NCEP-REYNOLDS deciles (1900-pres.) 2deg X 2deg grid. 20130101 to 20130430
Distribution Based on Gridded Data

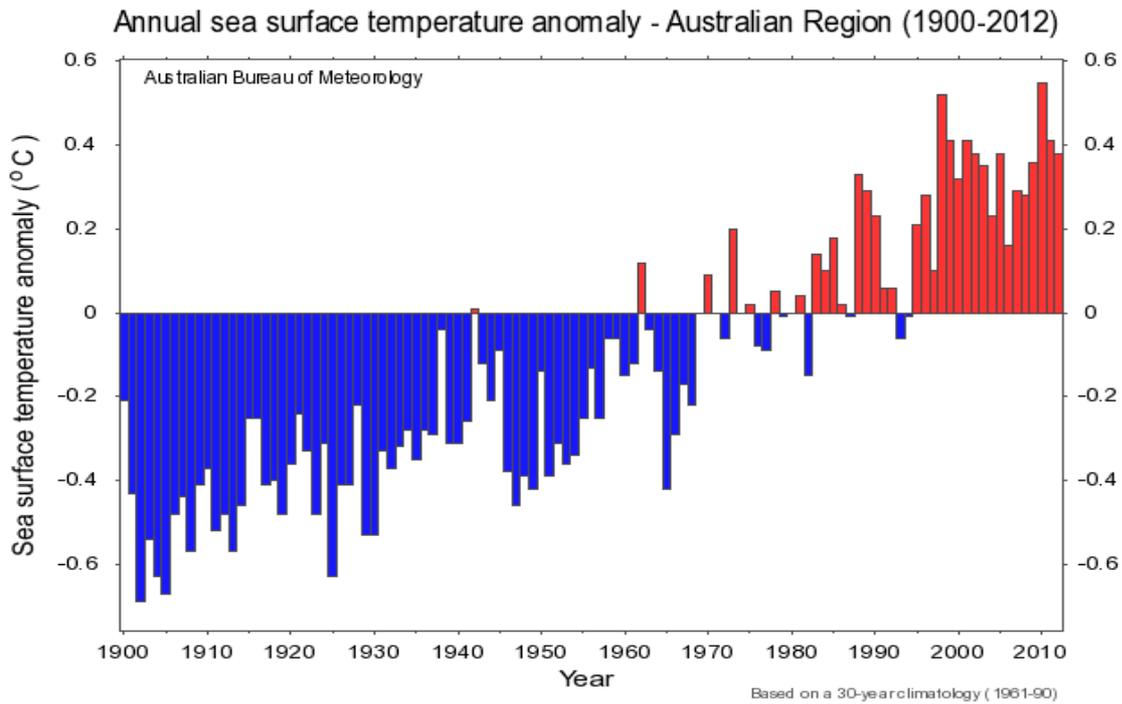


Sea surface temperatures in our region between 1 Jan 2013 and 30 April 2013



PIRSA issued a series of bulletins, which has helped to offer some explanation for the series of events which lead up to the deaths. SARDI Aquatic Sciences, the South Australian Museum and other agencies have been investigating the deaths throughout autumn. PIRSA has attributed the deaths to algal blooms, probably exacerbated by warmer than usual sea surface water temperatures. Satellite data and

should be investigated outside of South Australia. If none occurred in other areas where similar high temperatures occurred, then the influence of nutrients in the blooms could be considered a key factor, and investigations need to be undertaken to determine whether nutrients from seasonal upwelling (natural events) or from human-induced coastal sources are most implicated.



Data on sea surface temperatures (SST) from the Bureau of Meteorology, show alarming sustained increases off our coast.

sampling have confirmed that there were algal blooms during this period. One type of alga which has been detected is a *Chaetoceros* species, a diatom which can stick in fish gills and cause death.

Sea Surface Temperatures

The maps below are from the Bureau of Meteorology, one showing a summary of the sea surface temperature anomalies in southern Australia over summer 2013, and the other showing an alarming trend in annual sea surface temperature anomaly over the past 112 years in Australian waters. In some parts of southern Australia, summer water temperatures have been the highest on record. Note the "hot water" close to shore on Eyre Peninsula, where the fish mortalities were first detected. Given the geographic distribution of the "highest on record" summer to autumn temperatures in southern Australia, the geographic extent of the fish kills

What are possible contributing factors?

The SA government has attributed the blooms to natural oceanographic upwelling of nutrients, and warmer than usual ocean temperatures. There is evidence that natural coastal upwelling of nutrients occurs south of Eyre Peninsula and west of Kangaroo Island region during summer and autumn (Seuront et al. 2009). During this period, the area normally has low surface water temperatures and elevated concentrations of nutrients (which may therefore promote high levels of microalgae, which can form blooms).

During the past summer, however, the sea surface temperature in the Eyre Peninsula region (and other parts of SA) was the highest on record and this is also likely to have contributed to the blooms. Algal blooms can be stimulated by a combination of factors, particularly temperature, nutrients, mixing of the water body from storms, and light levels. In addition to seasonal upwelling from the south, a significant source of nutrients in

the eastern Eyre Peninsula / south-western Spencer Gulf region (where the autumn fish kills were first detected), is waste from finfish cages.

The data on nutrient loads from finfish aquaculture in SA are not publicly available, and the Friends call on the Government to disclose these figures.

Additionally, it is recommended that investigation be made into the role of wind (e.g. in-blowing nutrient-rich dusts off farmlands in Eyre and Yorke Peninsulas) and storm water outfalls (again, washing nutrient rich sediments into the nearshore areas) and other conditions prior to the event. Discharge from new coastal housing developments might also contribute, but this has been little investigated in rural areas of SA. Members of the Friends of Gulf St Vincent have been provided informal reports from divers who have observed evidence of nutrient enrichment in near-shore areas off Yorke Peninsula, in the form of *Hincksia* blooms, and also noticed heavy sedimentation on some reefs.

Although *Chaetoceros* can grow in many different conditions (including cool waters), the vegetative cells can bloom given sufficient light intensity, temperature and nutrients. There are 200 species in the genus *Chaetoceros*, and some of these can kill at low cell densities (e.g. ~ 100 cells per litre), due to the spines made of silica which are intensely irritating to tissue. Chains of cells apparently become lodged between secondary lamellae in the fish gills and cause blood hypoxia as a result of mucus production. These diatoms may be restricted to near-surface waters or mixed throughout the water column depending on local hydrographic conditions. In both North America (e.g. Boesch et al. 1997), and the UK, *Chaetoceros* has been responsible for fish kills, including mass mortality of farmed fish in sea pens.

A variety of phytoplankton species has been observed at monitoring stations along southern Eyre Peninsula (south of Spencer Gulf) and western Kangaroo Island during summer. For example, sampling during 2009 showed that dinoflagellates and diatoms respectively accounted for 70 to 80% and from 20 to 30% of phytoplankton cell abundances. Dinoflagellates were dominated principally by the genera *Gymnodinium* sp., *Cochlodinium* sp., *Gyrodinium* sp. and *Gonyaulax* sp. Diatoms were mainly dominated by *Thalassiosira* sp., and *Chaetoceros* sp. *Navicula* sp. and *Pseudonitzschia* sp. were also regularly observed. According to Seuront et al. (2010), the spatial distribution of the genera *Gymnodinium* sp. and *Thalassiosira* sp. seem to be mainly driven by temperature and salinity.

Research results should soon be available from government, including results of phytoplankton sampling following the fish kill event. Evidence so far is indicating that higher than average summer

sea surface temperatures, coupled with nutrient enrichment (whether from single or multiple sources), has stimulated algal blooms (including *Chaetoceros*), and it is the slower swimming fish which appear to have been most affected. Slow swimmers and territorial fish are less able to avoid the bloom.

Other causes?

In the recent media since the autumn fish kill event in SA, the Adelaide Desalination Plant has been singled out as a culprit. To date, there is no evidence that this could be the case, considering the combination of temperature and nutrient influences over the period, coupled with the fact that the blooms were first detected on Eyre Peninsula, and spread (likely via wind and current conditions) to Gulf St Vincent, and further east. The fish kills have been quite widespread, extending well beyond any influence of the desal plant. Whilst the desalination plant is an easy target, and unpopular with many in the community, flogging this horse distracts us from understanding the bigger picture, and asking relevant questions.

References

Boesch, D.F., Anderson, D.A., Horner, R.A., Shumway, S.E., Tester, P.A. and Whitledge, T.E. (1997) *Harmful Algal Blooms in Coastal Waters: Options for Prevention, Control and Mitigation*. NOAA Coastal Ocean Program, Decision Analysis Series No. 10, Special Joint Report with the National Fish and Wildlife Foundation, February 1997.

Seuront, L., Leterme, S.C., Middleton, J., Byrnes, S., James, C., Luick, J., Nedoncelle, K., Paterson, J., Teixeira, C. and van Dongen-Vogels, V. (2010) Biophysical couplings in South Australian shelf waters under conditions of summer upwelling and winter downwelling: results from the Southern Australia Integrated Marine Observing System (SAIMOS). In: Hall, J., Harrison, D.E. and Stammer, D. (Eds) *Proceedings of the "OceanObs'09: Sustained Ocean Observations and Information for Society" Conference, Venice, Italy, 21-25 September 2009*, ESA Publication WPP-306, 2010.



a certain level the populations can collapse very suddenly. The problem is that threshold is pretty much unknown. This should be yet another caution to all of us not to take the abundance we grew up with for granted!

Blue swimmer crabs

An item in the Sunday Mail on May 5th reported on record low stocks of blue swimmers in the Gulf. Some of you may have seen that this was a blog topic on the FoGSV website, following a query from a reader who goes on annual holidays to Yorke Peninsula. He was surprised that they didn't catch any crabs this summer, and asked what might have been the explanation.

We sent the query to a SARDI scientist hoping that he would be able to shed some light on the crab situation. His reply is as follows

"SA biologists have reported that abundances of blue swimmer crabs (prawns also) have declined very markedly this year. Commercial crab fishers (and prawners) stopped fishing late last year.

Two causes are thought to be operating:

1. There could be a lower recruitment (breeding) of crabs than is usual

2. Another contributing factor is that snapper numbers have greatly increased. They are significant predators of crabs and prawns and undoubtedly have contributed strongly to the steep decline in crab (and prawn) numbers.

Marine food webs are most interesting, and the above illustrates the 'cascade' effect when a higher level of the food web causes dramatic changes at lower levels. Hence, the underlying aim of fishery management must always be 'ecosystem management' in which a balanced ecosystem is maintained."

It is estimated that up to 50% of blue swimmers caught in the gulf each year can be taken by amateurs (you and me crabbing) so we DO contribute to the decline in numbers. It is interesting that even though the commercial operators have stopped, there has been no call to the wider community to play its part.

It was also interesting that there was no obvious reference on the PIRSA Fisheries website to the closure of the crab fishery. PIRSA might consider making such information more obvious, so that concerned citizens can play their part.

Last October we heard from Sean Connell, who described a fisheries threshold phenomenon, which suggests that if a species is fished beyond



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Dolphin deaths in Gulf St Vincent during March–May 2013

Catherine Kemper, Ikuko Tomo and Sue Gibbs (South Australian Museum) in association with Biosecurity SA (PIRSA); Gribbles Pathology, Department for Environment, Water and Natural Resources; University of Adelaide (School of Veterinary Science); Australian Marine Wildlife Research and Rescue Organisation

From early March to early May 2013 an unusually high number of dead dolphins was reported in Gulf St Vincent Bioregion, South Australia. The number of dead dolphins reported was 30 (not all were confirmed) and, of these, 21 were collected for post-mortem examination by the SA Museum or University of Adelaide. The maximum number reported for the same time period in the last 15 years is 8 (mean of 3.7). Carcasses were found throughout the region but concentrated along the coast of Adelaide, probably because they would have been more easily discovered and reported where many people visit the coast. At least six dolphins were found floating dead and none was live-stranded. Most were in a fresh condition, enabling full post-mortem examination. Of the 24 dolphins that could be identified to species, 2 were Short-beaked Common Dolphins and 22 were Indo-Pacific Bottlenose Dolphins, the same species as occurs in the Port River. In addition to routine gross pathology and histological examinations, samples were analysed for presence of *Morbillivirus* (genetically and with immunohistochemistry techniques), bacterial and fungal culture and biotoxins.

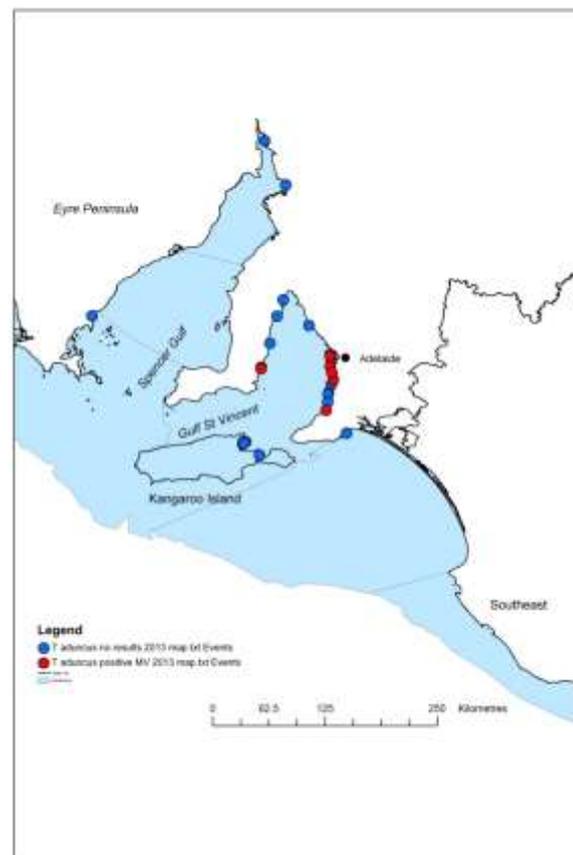
Body lengths ranged from 93 to 207 cm and weights from 7.5 to 80.4 kg. Relative ages of the dolphins were: 7 newborns (less than 2 months old), 6 calves (not newborn, and probably still suckling), 11 juveniles (body length > 140 cm and not sexually mature), 1 subadult (sexually but not physically mature). Two newborn dolphins appeared to have been stillborn.

Stomachs were examined to identify diet items. Eight had no food items, six had milk or a milk-like substance and four had small numbers of squid and octopus beaks and/or fish remains. Gender was determined for 22 dolphins (ratio 1:1).

Post-mortem examinations showed that some pathological conditions were present in most dolphins that died during the event. These included severe haemorrhaging around the throat and lower jaw, a congested brain, emaciated condition of the body, lung infections and swollen spleen and lymph nodes.

Tests of samples from six Indo-Pacific Bottlenose Dolphins confirmed the presence of dolphin *Morbillivirus*, not previously identified in South Australia. The results for the remaining dolphins sampled will be known in late July or early August. To date, the tissues of no Short-beaked Common Dolphins have been tested so we don't know for certain that this species escaped the disease.

Several environmental perturbations occurred at about the same time as the unusual mortality event. The gulfs region experienced higher than normal water temperatures and chlorophyll. Results are not finalised and some samples have not been tested so the investigation will continue for some months. Although the mortalities occurred mostly in Gulf St Vincent, the carcasses of dolphins outside the region are also being studied to find out if the virus was widespread.



Locations of Indo-Pacific Bottlenose Dolphins during the unusual mortality event of 2013. Blue dot = results pending for Morbillivirus, red dot = positive for dolphin Morbillivirus. Copyright: C. Kemper/SA Museum.

The SA mortality event is unprecedented on a national scale. Apart from mass strandings of single species at the same time, there has not been so many dolphins die in a two-month period in any Australian state or territory. *Morbillivirus* has been recorded in Western Australia, Queensland and New South Wales but in only a small number of dolphins. In other parts of the world the virus is associated with mass die-offs of seals and dolphins since the 1980s.



Note the extensive bruising on the throat of this young Indo-Pacific Bottlenose Dolphin. Photo: C. Kemper/SA Museum.

The South Australian investigation has been successful because of the involvement of many agencies (both government and non-government) and the community. The team has had extra government funding to deal with the unpredictable nature of the dolphin mortality event. The South Australian Museum has played an important role in the investigation because of the expertise of its researchers and its vast collections of archived specimens and data spanning the past 25 years.

Editor's note. I put a few extra questions to Dr Kemper about the dolphin situation

Q. Is there anything you can say about the injuries and whether such bruising has been seen elsewhere with morbillivirus?

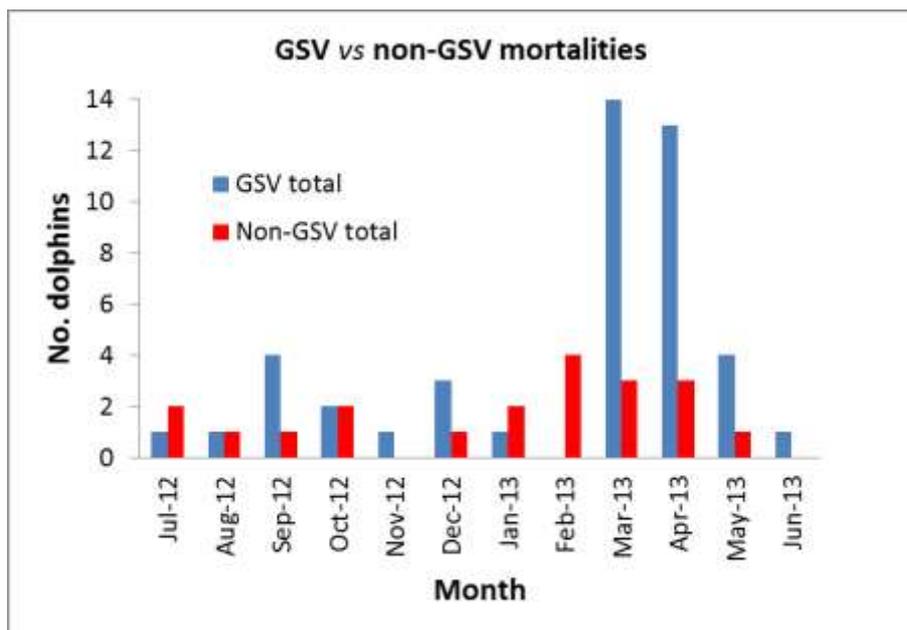
A. Severe bruising around the head has been recorded during at least one other event.

Q. How might the morbillivirus affect an animal's health such that it could be prone to getting such bruising?

It is too early to say this. We may find out more when we read all the literature. One possibility is convulsion but it would be hard to prove.

Q. Morbillivirus has been reported in many parts of the world, but the only evidence you get is from dead animals, and sick ones haven't been observed – so can we only guess at how their declining health ends up as widespread bruising and internal damage?

A. We believe that something compromises the body condition, leading to immune system suppression, which makes the animal more vulnerable to the virus. Once contracted, the morbillivirus weakens the body so that other diseases, especially those associated with the lung (pneumonia with fungi, bacteria, parasites), can take hold. One of the theories is that pollution is in some way compromising the animals but more investigation of this aspect is required.



Records of dead common and bottlenose dolphins from Gulf St Vincent during July 2012 to June 2013. Copyright: C. Kemper/SA Museum.



What is TREND?

Article contributed by *Stephan Caddy-Retalic (Uni of Adelaide)* and *Jason Tanner (SARDI)*

TREND – Trends in ENvironmental monitoring and Decision making – is a multi-million dollar project financed mainly by the [state government of South Australia](#) and the [Terrestrial Ecosystem Research Network](#).

TREND provides a system of data collection across native ecosystems, primary production regions and marine environments. By assessing the impacts of various potential climatic and environmental shifts, TREND will provide an early warning system for changes in South Australia’s diverse environments and a lasting legacy of long-term monitoring, informed policy and proactive response to environmental change.

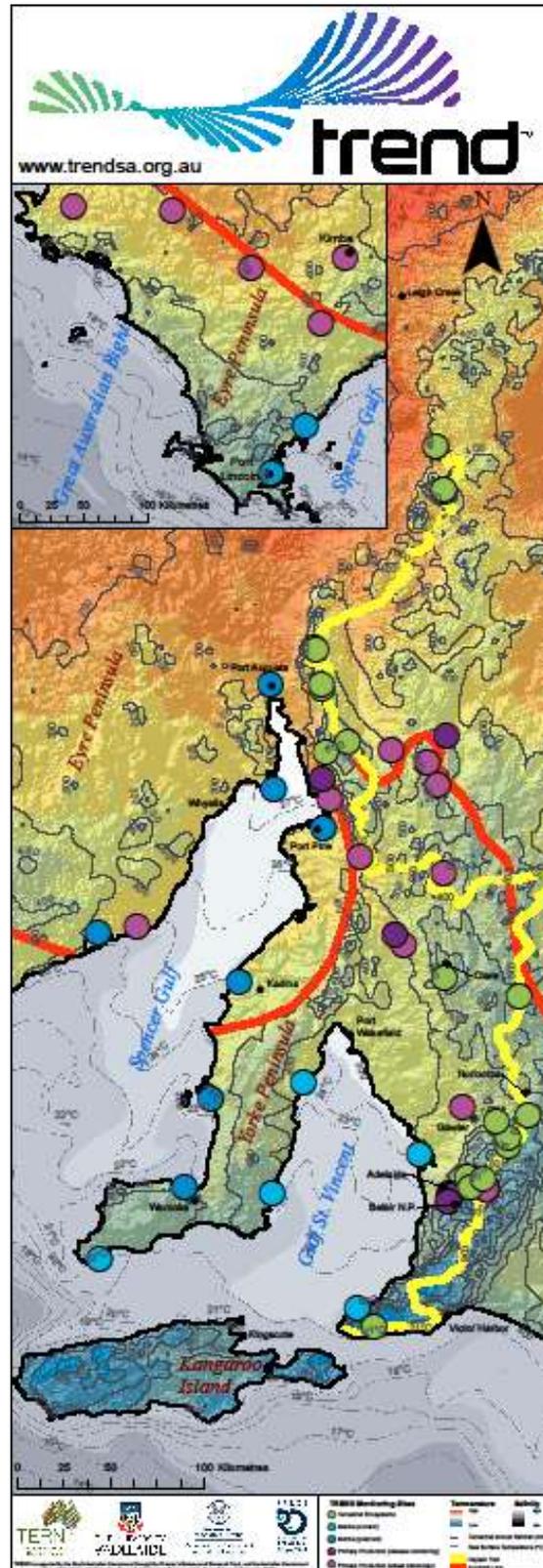
The TREND program focuses on transects of bushland, farmland and marine environments in South Australia, which follow specific environmental gradients. These overlapping transects range from the relatively high rainfall region of the southern Mt Lofty Ranges to the hotter and drier northern Flinders Ranges, some sites across the Eyre Peninsula, and marine sites within the Spencer Gulf and the Gulf of St Vincent. Within the transects, species are being monitored in terms of their distribution, structure, life-cycle, overall health, appearance and genetic variation.”

Marine transects overview

South Australian seas contain some of the world’s most geographically concentrated natural temperature and salinity gradients. By examining changes across these gradients, researchers from the Marine Ecosystems Research Group are predicting how potential environmental changes could alter the distribution and abundance of marine invertebrates, a key component of marine ecosystems. The Group aims to project the geographical distribution of marine invertebrate species under realistic future climate predictions, by constructing spatial models using data from settlement plates and clearance experiments, and climate model forecasts.

Location

South Australia’s Spencer Gulf and Gulf St Vincent are dominated by evaporation, creating north-south temperature gradients of up to 15°C and highly variable salinities. These gradients are ideal for conducting experiments examining potential impacts of climate change on marine ecosystems. Experimental sites are currently located along the east and west coastline of Gulf



St Vincent, at Stenhouse Bay, Klein Point, Ardrossan, Outer Harbour and Rapid Bay. The Gulfs’ ecosystems are also an ideal test region for marine community climate change predictions that will be applicable to most of the world’s mid-temperate marine ecosystems.

Monitoring

Marine invertebrate assemblages on jetty pylons have been surveyed at each site, and a clearance experiment established to monitor recruitment of new individuals and how the assemblage develops over time. These plots have been photographically monitored every three months for the duration of the study. In addition, settlement plates have been deployed at the northern and southern-most sites to establish assemblages which were then translocated to the other sites. This will allow the study of how these assemblages change when exposed to different conditions.

Outcomes

The Marine Ecosystems Research Group aims to project the geographical distribution of marine invertebrate taxa under realistic climate change scenarios, by constructing spatial models using data from settlement plates and clearance experiments, and climate model forecasts.

Progress so far

Experimental clearances, and settlement and translocation panels, have been established at various sites along Gulf St Vincent to examine the effects of rising temperature and salinity on the invertebrate fauna permanently attached to jetty pylons. These plots and panels were surveyed quarterly for up to 2 years prior to completion of the field component of the study.

Jetty pylons are a wonderful experimental set-up because they provide multiple vertical structures on which we can examine how invertebrates colonise under different temperature and salinity regimes, and how well local invertebrate communities are adapted to local conditions using translocation experiments.

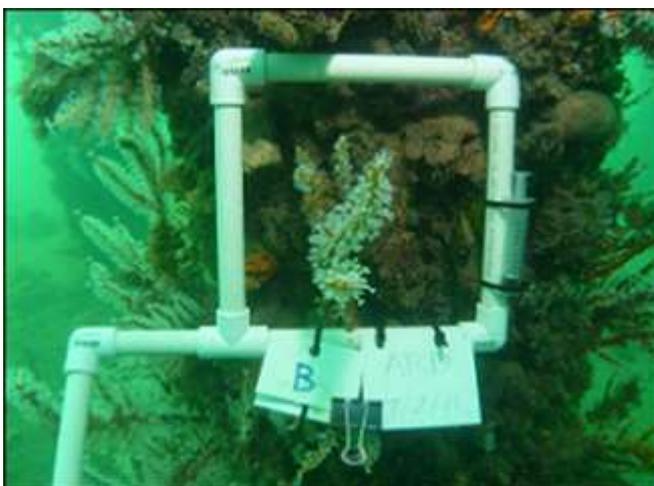
The reason that South Australian gulfs are so ideal for this sort of study is the extraordinary environmental gradients that develop there each summer, such that we can use a 'space-for-time' approach to predict the effects of climate change (i.e., assuming sites in the south will eventually come to resemble sites in the north as things warm up). These gulfs are *inverse* estuaries – because they have a temperature and salinity gradient opposite to typical estuaries (with freshwater inflow). The temperature and salt budgets within the gulfs are instead dominated by evaporation, such that temperatures can vary by as much as 15 deg C along their north-south gradients in late summer and early winter, and salinities range from > 48 practical salinity units (psu) near the head to ~35-38 psu near the mouth (about a distance of 300 km in Spencer Gulf and 140 km in Gulf St Vincent).

Basically, TREND is a landscape-scale experiment of almost untold control over a concentrated environmental gradient that exists in few other places on the planet. And the prospects ARE pretty exciting.

Now that we have completed the field component of the study, we have commenced analysis of the extensive series of photographic images that we have obtained. These allow us to determine the cover of different organisms in each plot, and show how assemblages change both over time and along the gradient. Initial analyses of the data have focussed on testing rapid analysis methods for photographic images that don't require the painstaking task of manual identification and enumeration, but we are now ready to also analyse changes in assemblage composition.

It's a big ask, but a lot of fun (and work) setting up. We have high hopes for our ability to develop some pretty cool predictive models for what the gulfs might look like in terms of basic community shifts over the next 50 to 100 years.

Oh, and let's not forget the terrestrial side of things – I'm sure we'll have some equally cool results from those transects soon too. Stay tuned, and follow progress on the [TREND website](#).



One of the jetty sites for marine invertebrate monitoring



Contributions to the Blue Swimmer newsletter are welcome. Please send articles to: angela.gackle@bigpond.com or leave a message on our website blog!

SNIPPETS

New Website for Friends of Gulf St Vincent

Have you had a chance to look at the new Friends of Gulf St Vincent website yet? The address is friendsofgulfstvincent.org.au and we had made available on it a wide range of resources including past issues of the Blue Swimmer and submissions on a variety of topics.

We welcome contributions from members and others who have something to say about the Gulf!

WESTERN ADELAIDE COASTAL RESIDENTS' ASSOCIATION INC.

Curry Night

Join us for a night of food and fun!

VENUE: Reedbeds Community Centre
Corner Fitch and Halscy Roads, Fulham
(Car parking available inside Centre)

DATE: Saturday 27th July 2013

TIME: Doors open 6.00pm. Dinner served 6.30pm

COST: \$25 for non-members, \$20 for members and concession, \$10 for children under 12

INCLUDES: A choice of 3 curries – chicken, beef and vegetarian, accompanied by dahl, rice and condiments, plus dessert, tea and coffee

BYO: Drinks and glassware

RSVP: By July 24th 2013

BOOKINGS: Email: agoldsmith@internode.on.net
Phone: 8356 1436
Online: www.wacra.org.au
Please advise if you require a registration card when you RSVP

As the perfect accompaniment to the night, there'll be a presentation at 8.00pm by **DAVID INVERARITY** on 'Why Geography Matters Today'. Many decisions facing us today require geographical literacy at a time when geography in education is at a low ebb. Decisions at local and national levels about environment, the shape of settlement, the destiny of cities, food production and population policy are all issues for our modern life and democracy. As a lifelong geography student David looks at the geographical history of the Western suburbs to the Adelaide Hills - via Ceduna - and how it enhances our understanding of major issues today.

EVERYONE'S WELCOME