

NCRIS IMOS Proposal Template

Investment Proposal Title/Description	Southern Australian IMOS: a coastal node and backbone for Southern Australia
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Commencement Date	July 2007
Termination Date	Ongoing
Principal Contact and Address for Correspondence	Dr John F Middleton, SARDI Aquatic Sciences, PO Box 120 Henley Beach, S.A., 5044 Middleton.John@saugov.sa.gov.au
Identification Specifications	In the first 5 years SAIMOS will provide data that will be used to determine the nature and dynamics of two key, and unique ecosystems (Kangaroo Is-Eyre Peninsula and then the Bonney Coast) and the relation of ocean circulation, chemistry and sediments to lower trophic dynamics (phytoplankton/zooplankton), larval transport and higher marine species foraging. In addition, SAIMOS will provide direct input to other nodes through observations of key ocean current systems that connect the regions of W.A., the Southern Ocean and N.S.W. through processes that occur on weekly to El Nino time scales.

A Project Details – Proposal Participants

Contributor	Discipline	Affiliation
A/Professor Jim Denier	Fluid Dynamics	University of Adelaide
Dr Jochen Kaempf	Physical Oceanography	Flinders University
Prof. Matt Tomczak	Physical Oceanography	Flinders University
Dr John Middleton	Physical Oceanography	SARDI Aquatic Sciences
Dr Stuart Anderson	HF RADAR	DSTO
Dr Bill Mitchell	Physical Oceanography	National Tidal Office (BoM)
A/Professor John Bye	Physical Oceanography	University of Melbourne
Dr Gennady Platov	Physical Oceanography	Novosibersk, Russia
Dr Caecilia Ewenz	Meteorology	Flinders University
Doug Fotheringham	Coastal Geomorphologist	DEH S.A.
Dr Murray Townsend	Coastal Engineer	DEH S.A.
Prof. Jorg Hacker	Meteorologist	A.R.A. Flinders University
A/Prof. Mary Batteen	Physical Oceanography	Monterey Post-Grad School, U.S.
Dr Dave Cockshell	Petroleum Geophysicist	PIRSA
Dr Yvonne Bone	Marine Geology	University of Adelaide
Dr Moninya Roughan	Physical Oceanography	UNSW
A/Prof Tobi Payenberg	Marine Geology	University of Adelaide
Dr Peter Boulton	Marine Geology	PIRSA
Dr Miguel Gil Coto	Physical Oceanography	Flinders University
Professor Allan Clarke	Physical Oceanography	Florida State
Dr David Griffin	Physical Oceanography	CSIRO
Dr Karen Wild-Allen	Physical Oceanography	CSIRO
Dr Andrew Watson	Meteorology	S.A. BoM
Dr Mark Hemer	Physical Oceanography	CSIRO
Dr John Hughes	Geophysics	Santos
Dr. Rob McCauley	Acoustics	Curtin University
Dr Mark Baird	Biological Oceanography	UNSW
Dr Sam McClatchie	Biological Oceanography	SARDI Aquatic Sciences
Prof. Peter Fairweather	Marine biology	Flinders university
A/Prof. Jim Mitchell	Biological oceanography	Flinders university
Dr Tim Ward	Marine biology	SARDI Aquatic Sciences
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Dr Toby Bolton	Marine biology	Flinders university

Contributor	Discipline	Affiliation
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Karl Sammut	Acoustic and Glider technician	Flinders university
Dr Sue Murray-Jones	Marine Biologist	DEH S.A.
Dr Bryan McDonald	Senior Marine Scientist	DEH S.A.
Dr. Sasi Nayar	Phytoplankton Biologist	SARDI
Prof Gerry Quinn	Marine ecology	Deakin University
A/Prof Sean D. Connell	Marine ecology	University of Adelaide
Dr Bronwyn Gillanders	Marine biology	University of Adelaide
Dr Peter Gill	Australocetus Research	Deakin University
Mr Andrew Levings	Australocetus Research	Deakin University
Dr Brad Page	Marine Biologist	SARDI
Dr Simon Goldsworthy	Marine Biologist	SARDI
Dr. Adrian Linnane	Fishery Biologist	SARDI
Dr. Richard McGarvey	Fishery Population Modeller	SARDI
Dr Jason Tanner	Marine ecology	SARDI
Dr Milena Fernandes	Marine Chemist	SARDI
Dr Barry Bruce	Marine Biologist	CSIRO
R Steven Clarke	Marine Biologist	SARDI

B Proposal Details – Brief Statement of Work

1 Scope of the Proposal : The ocean currents along Australia's southern shelves are connected to those of the Southern Ocean and the shelves of western and eastern Australia, (Figure 1 below). Within this larger context, the Kangaroo Island-Eyre Peninsula (KI-EP) region and Bonney Coast (BC) host two of Australia's iconic and distinct marine ecosystems. In this proposal, we seek \$5.8 M over the first 5 years to begin building marine observing infrastructure for the W.A., S.A., and Victorian shelves. This information and research outcomes will focus on the larger scale oceanic currents and also on the physical and biological properties of these ecosystems in a sequential manner. The KI-EP region will be the focus of infrastructure deployment over 2007-2009 followed by the BC region. Importantly, through the connectivity of the current systems noted above, and by maintaining National Backbone moorings of the mid-Bight and Kangaroo Is, SAIMOS will also contribute to the Bluewater IMOS (at larger and climate scales) and to the regional nodes and backbone including those off Western, (WAIMOS) and Eastern Australia. In addition, the infrastructure requested will complement the ongoing research appointments made by Marine Innovation, South Australia (MISA).

2. Fields of Application – which scientific research fields will benefit from this investment and how?

Through analysis, modelling and assimilation, the data obtained from the infrastructure requested will provide information for research outcomes in the fields of physical and chemical oceanography, sedimentology, meteorology, altimetry, spatial systems, marine biology, aquaculture and biological oceanography. The latter will include lower trophic level research as well as research relevant to commercially exploited species such as prawns and lobsters and higher marine vertebrates.

3. Roles, functions, responsibilities of each Proposal Party

Each proposal party will be defined at this initial stage by those groups taking responsibility for research outcomes in the areas of physical processes, biological processes, benthos (sediments, geology), acoustics and higher predator tracking. The details of infrastructure deployments and timing by these groups will be determined later, and perhaps under the guidance of a local coordinating body appointed by IMOS, MISA and other relevant partners.

C Investment Details – Proposal Plan Outline

Background

Along Australia's vast southern shelf, eastward propagating storms drive intense Coastal Trapped Waves (CTWs; ocean weather) that are further intensified by waves generated off W.A., (Figure 1). These waves in turn effect the circulation within Bass Strait and the NSW shelf. At longer time scales, the Flinders (shelf slope) Current is in part driven by variations in the equatorward transport of the Southern Ocean and uniquely, forms a small sister of the world's major western boundary currents (eg., the East Australian Current). Seasonal shelf currents, upwelling and the Flinders Current are also subject to significant El Nino influences via West Australian shelf-slope currents. The Flinders Current is also influenced by the Tasman Outflow, a remnant of the East Australian Current. The life cycle of many marine species (eg., West Australian salmon and juvenile southern bluefin tuna) are known to depend on these currents. Within this larger context, the Kangaroo Island-Eyre Peninsula region and Bonney Coast host two of Australia's iconic and distinct marine upwelling systems. These ecosystems underpin a rich and diverse biodiversity, marine parks and ecotourism and a \$370M/yr fishery that must be managed in the context of increasing gas and oil developments. Our knowledge of the ocean currents is based on very few observations while their relation to and nature of the ecosystems is unknown.

Approach and Major Research Questions

Our approach reflects the concept that variability in physical and chemical forcing associated with regional processes of cross-shelf exchange (including upwelling) has ramifications throughout the food web, that extend from phytoplankton and zooplankton and all the way to the foraging patterns of higher marine predators (sea lions, whales, sharks). The overriding questions to be addressed using observational infrastructure here focus on the link between the physical and chemical marine environment and the biological production of the region. The primary questions include:

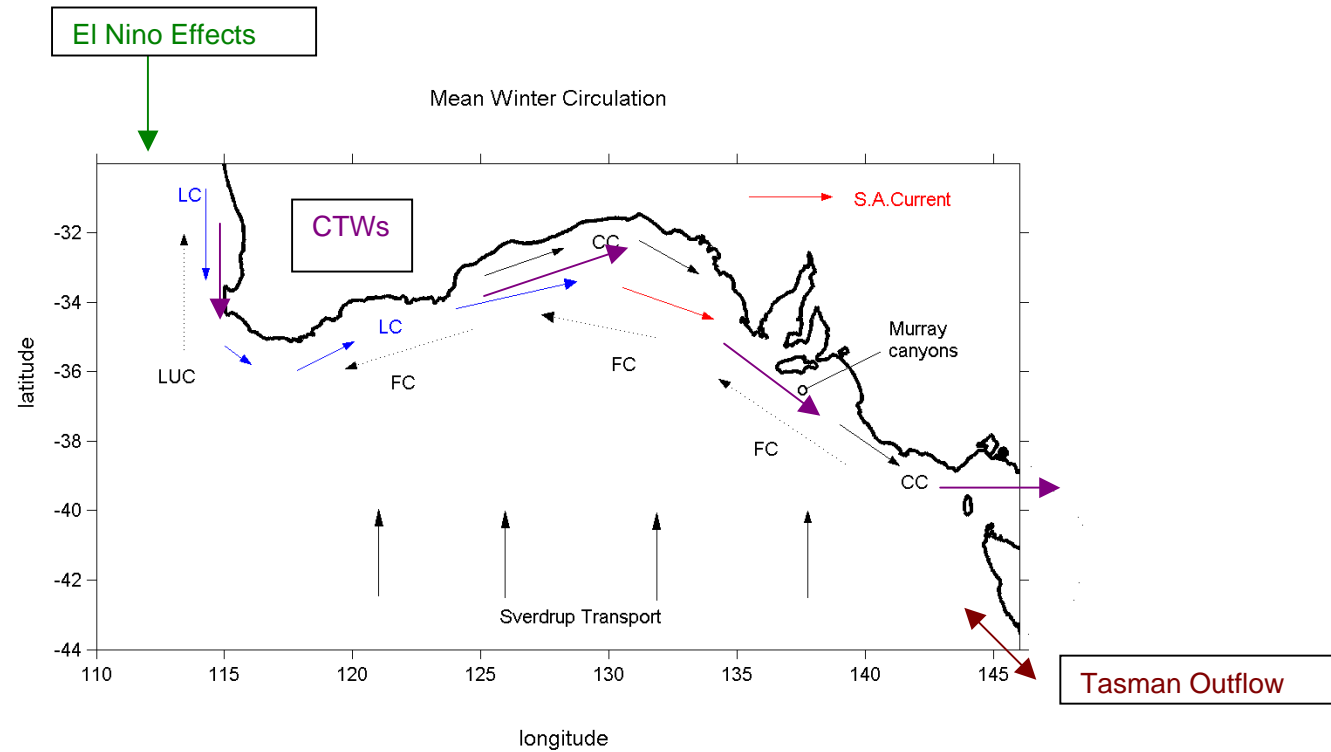


Figure 1. Schematic illustrating the winter current systems of the southern region and inter-connectivity. The Leeuwin Current (LC) is modulated by El Niño events, and penetrates into the Bight where it has a strong influence on shelf currents during winter. The Flinders Current (FC) forms a deep slope undercurrent of the LC off W.A. The FC is also influenced in magnitude by the equatorward currents (Sverdrup transport) in the Southern Ocean and by the Tasman Outflow in the east. The CTWs (mauve) generated off W.A. also reinforce locally driven waves within the Bight, which in turn drive CTWs through Bass Strait and onto the shelves of Tasmania and NSW.

- What is the detailed connection between shelf currents and the Flinders Current to non-regional influences (eg Southern Ocean, W.A.)?
- What is the nature of oceanic currents and processes (eg. wave drift, mixing, eddies) that drive both winter and summer cross and alongshelf exchange including the summertime upwelling systems and flushing of the gulfs?
- How does the ocean circulation, wave drift, eddies and environmental variability affect the distribution of sediments, nutrients, the production of lower trophic levels (phytoplankton and zooplankton), the dispersal of larvae that underpin productive fisheries in the region and the effects of environment on aquaculture?

A feature of the region is the abundance of higher marine predators including sharks, seals and whales. The foraging patterns of these higher predators are likely linked to the spatial and temporal patterns of the lower trophic levels and the paths of cross-shelf exchange and upwelling. These species can be instrumented and remotely tracked and the data collected will therefore be used to augment the SAIMOS. Thus, a third question is:

- How is the distribution of higher predators affected by the physical patterns, and the variability of lower trophic levels.

Specific Questions and Processes:

1. *Primary physical processes* range in time scales from days to years (including El Nino) and questions include:

- what is the nature of summertime upwelling of nutrients and biota off the Bonney Coast (BC) and Kangaroo Is-Eyre Peninsula (KIEP) regions including the role of the shelf slope Flinders Current, canyons, coastal trapped waves and winds?
- what is the nature and role of surface waves, ocean currents and mesoscale eddies in the transport of nutrients and marine biota both along and across the shelf during winter and summer?
- what is the importance of El Nino to shelf currents, upwelling and the Flinders Current?
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Additional physical processes and topics include:

- modification of the sea breeze and ocean circulation due to upwelling events
- the extent of Gulf –Shelf exchange of water, nutrients and sediments during both summer and winter
- role of internal tides on mixing on the shelf slope
- what is the shape and nature of the sea floor in the context of frictional effects on ocean currents and how do these currents in turn effect the sea floor and erosion of canyons through sediment transport?

2. *Primary biological and chemical processes* and questions include:

- what are the magnitude, timing and temporal scales of variability in phytoplankton and zooplankton that constitute the lower trophic levels?
- how is this variability forced by physical/ chemical processes?
- what are the spatial and temporal dependencies of primary and secondary production in relation to key nutrients and physical processes?
- how does the variability in physical and biological processes influence the population and foraging ecology of high predators?

Additional biological processes and topics include:

- how is the distribution and foraging of higher predators related to the variability at lower levels in the food web?
- what is the nature of the shelf and gulf ecological systems of the lobster, abalone and prawns and how do they relate to the physical environment?
- how do physical transport processes and water column biogeochemical processes influence aquaculture?
- what is the nature of the benthos (biological) and what is its relation to sediments and ocean currents and waves.

Existing Infrastructure

A plot of the location of some existing *in-situ* marine observing infrastructure is shown in Figure 2 below. SAIMOS will build on this infrastructure which we itemise as:

SARDI sardine repeat surveys: Ancillary data will be provided to the observing system through the annual sardine ichthyoplankton survey, the extent which is indicated by the blue cross-shelf lines. These data and the CTD and fluorescence obtained will provide additional data during February-March. The repeat surveys will permit (partial) servicing of two of the backbone lines of ADCP and moorings as noted below.

XBT surveys: The red lines of XBT surveys on ships of opportunity are illustrated by the red lines in Figure 2. The timing of these will be coordinated with the Navy and BoM.

Automatic Weather Stations: These are indicated by the n in Figure 2. There are an additional 27 AWS's along the coast for this region. These will be supplemented by offshore AWS on the outermost moorings (see below).

Airborne Research Australia: This facility is based in Adelaide and using aircraft, is able to provide high level meteorological data as well as oceanographic data using the L-Band receiver for measuring sea-surface Salinity, the IR-imager for SST images and scanning laser altimeter for wave spectra.

Sea Level: The Australian Baseline stations and Port Adelaide are indicated.

Telemetry: Ocean based meteorological systems, CTD and fluorescence monitoring off Port Lincoln are being expanded to include ocean currents (ADCP) and waves.

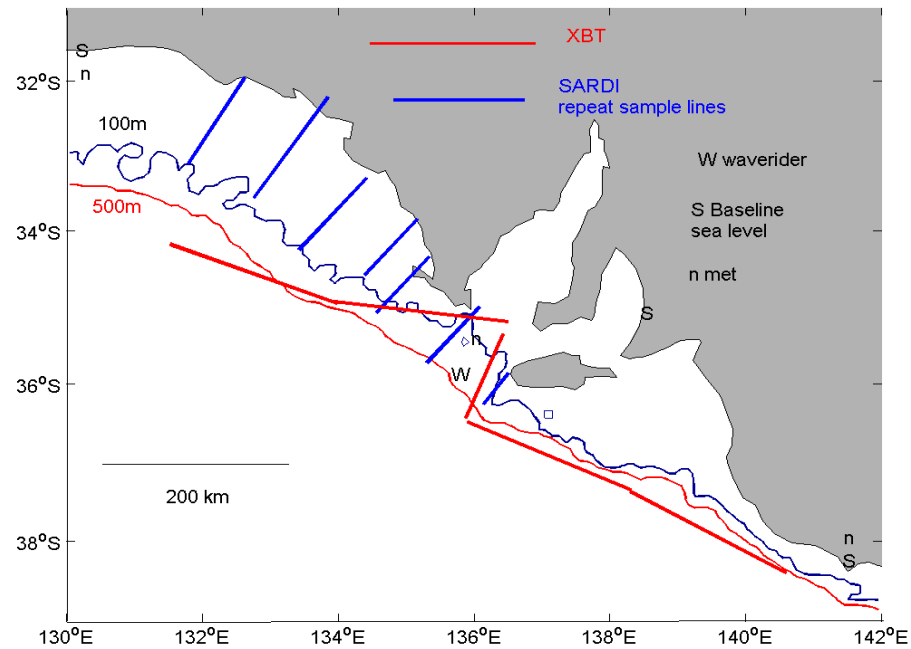


Figure 2 Existing *in-situ* marine observing systems for the region. The blue lines represent a subset of the sardine egg survey (and CTD, fluorescence) undertaken by SARDI each February and since 1998. The red lines represent XBT lines of opportunity. The n represent 3 of the 27 marine AWS's maintained by the BoM. The W is a BoM waverider buoy and the S, Baseline sealevel stations maintained by the NTO (BoM).

In addition to the above, the SARDI has the following research infrastructure: MRV Ngerin (7.2m beam, 197 tonne); 2 ADCPs, Ocean Data Buoy (ADCP,CTD and AWS); Sea Bird CTD; split beam echo-sounder, seal capture and anesthetic equipment. Flinders has 3 Aanderaa RCM-9 Current Meters, a real-time Aanderaa Coastal Monitoring Buoy (with meteorology and ocean sensors), 2 ADCPs, a small Research Launch R/L Hero, and one in Port Lincoln and a well-equipped mechanical workshop. The University of Adelaide facilities include a FIA Latchet nutrient analyser (auto analyser) Nortek Acoustic Velocimeter (wave ht, wave period, flow), Hyperspectrometer (UVA, UVB, UVC) & light meter arrays, PAM Fluorometer and Research vessels: 6.5, 6.1 and 5.8 metres. SARDI Aquatic Sciences and the Schools of Biological Science at Flinders and the University of Adelaide have multi-million dollar facilities for the analysis of biological data. However, it should be noted that much of this infrastructure is used for other on-going research activities and therefore might not always be available to SAIMOS.

Infrastructure Perspective

We envision the observing system to be based around arrays of moorings carrying instrument packages at selected depths to measure both physical variables (temperature, salinity, currents) and biological variables (fluorescence, oxygen, and possibly, in situ nutrient sensors). Each mooring would be associated with a bottom-mounted ADCP to measure a profile of current velocities and acoustic backscatter from zooplankton. Hydrophones and acoustic loggers to measure sea “noise” and track marine predators will also be included in association with the national acoustic facilities group. Where possible, the shelf-break moorings would have telemetry to transfer data to shore for real-time analysis and display. This key feature will alert researchers of key episodic events (eg upwelling) so that event focused vessel and glider measurements may be taken. In addition, the telemetry of AWS data from the shelf break sites will provide real time atmospheric data for research and improvement of weather predictions. Where possible, moorings will be collocated with existing infrastructure (such as wave-rider buoys) so as to reduce national costs for maintenance.

We anticipate sampling the mesoscale spatial field around the mooring array using Slocum gliders carrying both physical (temperature, salinity) and biological (fluorescence) sensors. The gliders will have satellite telemetry capability to permit real-time display of sections to reveal small-scale structure in physical and phytoplankton structure.

Small satellite-linked microprocessors (CTDs) deployed on moving animals (mainly fur seals, sharks and sea lions) will provide the observing system with ancillary physical data that will be ground-truthed against other data. This data will complement the spatial and temporal scales of the combined glider/ mooring system and provide broad spatial and temporal coverage of physical changes across shelf and slope waters in the region.

A key element of the observing system will be calibration visits to the mooring array using a vessel. This will permit calibration samples to be taken for chlorophyll, oxygen, salinity, and nutrients as well the collection of irradiance profiles to help with remote sensing algorithm calibration. Zooplankton tows to calibrate the ADCP backscatter will also be vessel-based. In addition, multi-beam measurements of bottom topography will be obtained along with samples of benthos and sediments.

Recognising that limited funds are available, the KI-EP region will form the focus of infrastructure deployment over 2007-2009. Following this, much of the infrastructure will be re-located to the BC region. A National Backbone mooring array will be continuously maintained off Kangaroo Is to obtain long-time series of ocean currents that may be related to large-scale ocean current variability.

Requested National Backbone Infrastructure

Altimeter and SST and ocean colour satellite data are needed for the region. These must be ground truthed to enable extrapolation of the data to other sites within the region of study.

Two long-term mooring arrays are needed to provide a large-scale context for the behaviour and nature of the shelf currents (CTWs and “mean”) as well as the slope Flinders Current. These might consist of bottom mounted ADCPs with CTD, bottom pressure, and fluorescence sensors across shelf and off the mid-GAB (see red and black lines in Figure 3). As planned by the National Backbone, an additional mooring array could be deployed off Maria Is (south-eastern Tasmania) and would complement the existing long-term mooring. These would be paid for by the National Backbone. The mid-GAB section will line up with the routine SARDI sardine survey line and be maintained by SAIMOS. In accordance with the above, this would permit calibration samples to be taken for chlorophyll, oxygen, salinity, as well collection of irradiance profiles to help with remote sensing algorithm calibration. Zooplankton tows to calibrate the ADCP backscatter and essential nutrient samples at a range of depths would be vessel-based.

An additional National Backbone array will be maintained off the Kangaroo Is region (red/black lines Figure 3). This site represents a choke point for shelf and slope currents, is relatively close to shore and facilities and collocated with a SARDI repeat survey section. This will be maintained by SAIMOS.

Requested Regional Infrastructure

In addition to the above, we request the following infrastructure to cover the Kangaroo Is-Eyre Peninsula (KI-EP) and Bonney Coast (BC) sub-regions in a sequential campaign.

HF RADAR (long range). The HF RADAR will provide ocean surface currents that will be integrated into hydrodynamic models for the region as well as providing information for surface larval dispersal and retention. The headland locations are indicated by the x in Figure 3 for both regions and the approximate coverage by the circles. Expert assistance in deployment and maintenance will be provided by Mal Heron’s AHFRN.

Moorings and bottom mounted ADCPs. A total of 9 moorings is planned for each sub-region and along the thick dark lines in Figure 3. The deepest moorings will monitor the Flinders Current and provide information on deep canyon and shelf break exchange including both physical and biological processes (eg upwelling). For the mooring near the shelf break an ocean Data Buoy (including AWS, wave height, ocean currents, CTD etc) will also be included with live telemetry to shore (via VHF or Argos) so as to monitor important transient events such as upwelling and dense water outflow from Spencer Gulf, geological slumps in the shelf slope. Hydrophones and acoustic loggers may be included on the shelf break moorings to record unusual predator activity. For the KI-EP region, the shelf moorings will be deployed along the 100 m isobath so as to follow the expected path of upwelled nutrient water and resultant lower trophic activity. These arrays (and those off the BC), will also permit dense water outflows to be monitored.

Automated Sediment Traps: One of these may be deployed on the National Backbone moorings and likely near the shelf break. These can help to investigate primary and secondary productivity providing information on the time scales necessary for nutrients and trace elements to be assimilated or reach the seafloor.

The maintenance of moorings is a key issue and will depend on mooring life. This could be done by replacement so as to keep continuous records for the National Backbone components. Alternatively, it may be possible to service the moorings on ship using a stock of replacement parts and batteries. Moorings could also be retrieved, serviced at base and then re-deployed. A 3-monthly cycle of replacement/service is assumed. The moorings will be

deployed with assistance from a National Mooring Group that will assist in the deployment of all IMOS moorings. This will be done to ensure correct operating and maximise the probability of retrieval.

Repeat Vessel Sampling: These ship-based samples will follow the mooring lines for i) servicing, ii) calibration of ADCP backscatter/zooplankton and chlorophyll iii) sampling of nutrients, marine biota, bottom sediments and benthos iv) multi-beam swaths of bottom topography.

Slocum Gliders: These permit CTD, fluorescence and turbidity to be measure at arbitrary sites and to depths of 200 m. Two of these will be obtained for each sub-region and may be used for intense and larger scale sampling that can be determined using the live telemetry mooring data. An illustrative path is indicated in Figure 3.

Sea Bat Multibeam Echosounder: This hull-mounted device will enable high resolution mapping of sea floor topography that will be related to benthos and sediment types.

Technicians: Salaries are requested to fund two full-time technicians who will maintain and service all equipment and also assist in the delivery of the data to the National Backbone in an appropriate format and timely manner.

Higher Predator Measurements and Monitoring: Biological, autonomous sampling systems, such as fur seals, sea lions and sharks, have the potential to provide oceanographic sampling data that is on par, in terms of quality, with other sampling systems, over broad geographical areas. Satellite tracked predators can provide information on temperature and other variables in real time and as a function of the animals preferred paths of foraging. These data may well provide information on links between lower trophic variability and underlying processes, but will need calibration and interpretation.

Airborne Research: 50 hours of Airborne Research Australia will be used to fly instruments through the upwelling zones so as to examine the impact of cold upwelled water on the sea breeze and *vici-versa*. Information on mammal populations can also be obtained.

Additional Equipment may include: turbulence shear probes and nutrient analysers.

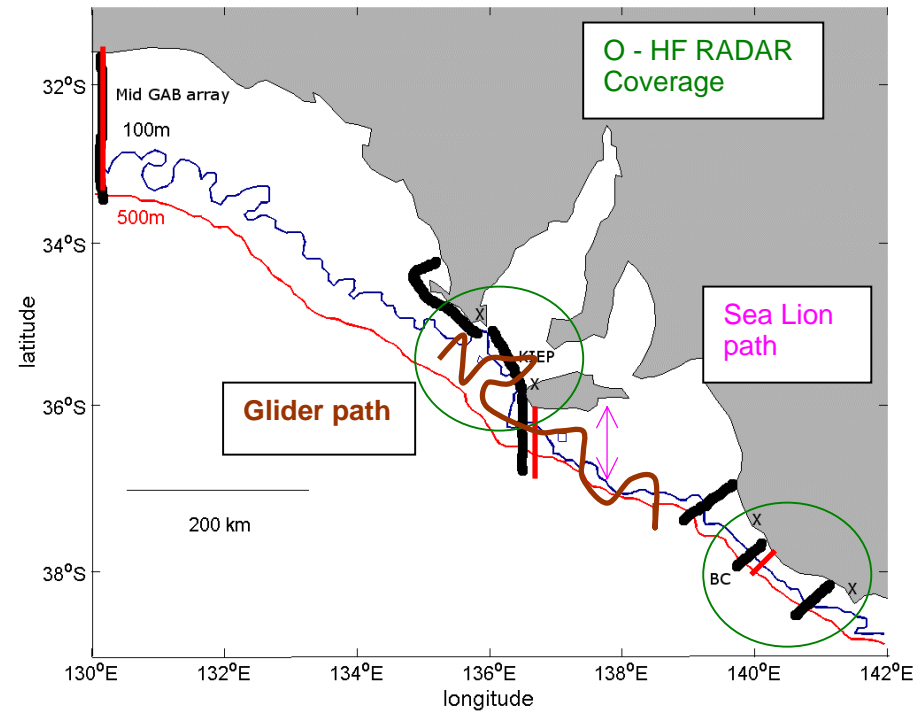


Figure 3: The Kangaroo Is-Eyre Peninsula (KIEP) and Bonney Coast (BC) regions for SAIMOS are indicated. The mid-GAB array line could coincide with a SARDI repeat survey line and will be a National backbone line (serviced by SAIMOS). The thick dark lines represent sites of the mooring lines and repeat ship-based sample survey lines. An additional National Backbone line off Kangaroo Is will also be continuously maintained. The X indicate possible locations for HF RADAR. The green circles represent the extent of HF RADAR current coverage. Possible glider paths are in brown while a typical predator path is in pink.

Activity No	Activity	Proposal Party	Duration (months)	Start	Finish
	Kangaroo Is – Eyre Peninsula sub-region and mid-GAB			2007	
1.	HF RADAR Installation in late 2007.	Physical	On going	mid-2007	
2.	Mooring deployments (KI-EP) on Surveyor or equivalent; ship-based surveys; sea-floor mapping	Physical/Biological /Benthos/Acoustic	On going	late 2007	
3.	First Glider deployment	Physical	On going	mid-2008	
4.	Mooring replacement & retrieval (KI-EP) on Surveyor or equivalent; ship-based surveys	Physical/Biological / Benthos/Acoustic	Every 3 months	March 2008	
5.	Higher predator sensors deployed	Predator	ongoing	2007	
6.	Bonney Coast sub-region, KI-EP and mid-Gab Backbones			2009	
7.	HF RADAR Installation in late 2009 off BC.	Physical	On going	mid-2009	
8.	Mooring deployments (KI-EP) on Surveyor or equivalent; ship-based surveys; sea-floor mapping off BC.	Physical/Biological / Benthos/Acoustic	On going	late 2009	
9.	Second Glider deployment off BC	Physical	On going	mid-2009	
10.	Mooring replacement & retrieval (KI-EP) on Surveyor or equivalent; ship-based surveys of BC, KI-EP and mid GAB	Physical/Biological / Benthos/Acoustic	Every 3 months	March 2009	

- **Significant timing/location issues:** Ship time will be crucial.

D Proposal Details- Significance and Benefit

- **Significance for R&D community:** The ocean currents along Australia's southern shelf are determined and connected to those of W.A., Tasmania , Victoria and N.S.W. (Figure 1). In addition, the currents and physical processes are determined by forcing from the Southern Ocean, the Leeuwin Current, Tasman Outflow and by El Nino events and climate change. The life cycle of many marine species off southern Australia are known to be affected on these currents. Within this larger context, the Kangaroo Island-Eyre Peninsula region and Bonney Coast host two of Australia's iconic and distinct marine ecosystems . These ecosystems underpin a rich and diverse biota, marine parks and ecotourism and a \$370M/yr fishery that must be managed in the context of increasing gas and oil development. Data collected for this vast region and from the two key ecosystem sub-regions in SAIMOS to date, has necessarily been piecemeal and uncoordinated due to the lack of funds and an overriding research plan. The structured focus provided by SAIMOS will provide data sets and multidisciplinary research that will elucidate the nature and dynamics of the ecosystems and relation to the physical environment. In addition, an understanding of these ecosystems will also permit systematic and further research into higher trophic levels as well as the "coastal" ecosystems of Spencer Gulf, Gulf St Vincent, and the Coorong and Encounter Bay. The servicing of the new infrastructure will provide new platforms and opportunities for additional marine research.
- **Significance relative to regional and/or national priorities:** At the regional; level, the S.A. Government has demonstrated its commitment to marine research through the establishment of the \$5M Marine Innovation, South Australia (MISA). The proposed research appointments to be made in 2006 and beyond in marine science are both timely and highly complementary to the request for SAIMOS infrastructure. At the national level, SAIMOS directly addresses the research priority area "An Environmentally Sustainable Australia" through the sub-priorities Sustainable use of Australia's Biodiversity and Response to Climate Change and Variability.
- **Significance within international ocean observing programs:** Regional SAIMOS will form part of a national and international backbone of marine observing systems and uniquely, looks out to, and is affected by, global and climate related processes that influence the Southern Ocean.
- **Significance for training and education:** SAIMOS will provide research students and the next generation of Australian scientists with world-class data sets and instrumentation that will enable them to respond to the increasing challenges of marine resource management and climate change.
- **Key outputs (product lines) and benefits:** The streams of data delivered in a timely and appropriately formatted manner to IMOS will be a principal product. Benefits include (a) the determination of the nature and dynamics of the ocean current systems along Australia's southern shelves will provide a sound physical basis for issues of management and exploitation of the marine

environment, and b) the determination (and ultimately predictability) of the ecological systems of the KI-EP and BC regions and represent the first step in understanding and managing the wild fishery and aquaculture industries of Australia's southern shelves.

E Proposal Details- Access and Governance Regimes

- **How will access be provided?** Access of data will be through the National Backbone Data portal.
- **How will data and products be managed?** Two full time technicians will be employed to manage the data and service and deploy/retrieve the instruments. The technicians will also assist that research workers in meeting IMOS standards and also assist in the delivery of data to the National Backbone in a timely manner.
- **What are the dependencies on external/other facilities (national/international)?** SAIMOS will require data from WAIMOS for use in determining the nature and variability of shelf and slope currents. In addition, SAIMOS will require high-resolution marine products (atmospheric, waves, sea level) from BoM for the southern shelves and oceans and in real time.
- **Collaborative structures for allocation of priorities:** Marine Innovation South Australia (MISA) is a consortium of the Universities of Adelaide and Flinders, the S.A. Museum and SARDI. MISA together with the Governance Board of IMOS and other relevant partners, will appoint an overseeing committee that will allocate local priorities for infrastructure deployment, timing of research activities and replacement of equipment.

Proposal Details- Costs and Contributions

- **Indicative capital and operating costs:** In the Appendix, a list of infrastructure items and costs is given. A "wish list" is given there of all instrumentation required to maintain full observing systems off the BC and KI-EP regions. The budget there is costed at about \$12M including a 30% cost of maintenance and infrastructure replacement. A more modest list of items is given in the Table below that comes to under \$5M (without replacement costs). Costs have been contained to under \$5M by redeploying most instrumentation from one region to the other after a period of 2-3 years. However, the National Backbone of 3 moorings off the Kangaroo Is region would be maintained at an additional cost of \$583,000. The total budget is then \$4531,000 with an additional maintenance and replacement cost (at 30%) of \$1,243,000. The total is \$5,774,000. The budget breakdown is given below. Note, the multi-beam echosounder is not included in the total. As a tool of national use, it might better be funded through the national backbone (if one already does not exist).

Item	Description	Cost (\$)
HF RADAR	CODAR HF RADAR	526,000
Moorings	8 moorings with bottom ADCP, 4 vertical stations to measure CTD, O2, fluorescence, turbidity, 8 acoustic loggers for predators, 1 sea noise logger, 1 sediment trap	1312,000
1 Data Buoy		120,000
Gliders	2 gliders	310,000
Predators (satellite tracking)	20 units including deployment and retrieval	220,000
Predators (acoustic tagging)	20 times \$7K	140,000
Technicians	2 technicians for 5 years	800,000
Ship time	4 cruises for 10 days each year for 5 yrs	520,000
Total for 5 years		3,948,000

- **Asset replacement cycle:** In the above, we assume a 20% loss of infrastructure over the 5 year period and 10% costs for maintenance.
- **Existence of related facilities including barriers to access and state of technological obsolescence.** Access to a suitable ship is the main impediment to SAIMOS.
- **Readiness of technology:** All infrastructure is well tested. Skills for deployment exist in Australia.
- **Ongoing support:** Provided by the infrastructure of participating institutions and new MISA positions.
- **Dependencies on**
 - i. **Other elements of the IMOS: SAIMOS** will need support for the National Backbone mooring arrays off the mid-GAB and Tasmania. IN addition, SAIMOS will need data from WAIMOS, although this is not crucial. SAIMOS will need technical support in mooring construction, deployments, and retrievals, HF RADAR set-up and glider technology.
 - ii. **Components/systems beyond IMOS:** Satellite data
- **NCRIS investment and Co-investment by parties** The repeat month long sardine surveys undertaken by SARDI represent a \$78,000 contribution in ship time to SAIMOS. In addition, MISA has committed \$1M for salaries of marine research workers.
- **Hosting arrangements** including proposed owner of assets: to be determined.

F Proposal Details - Performance Management

- **Indicative performance targets:** t.b.a
- **Indicative Service Level:** t.b.a
- **Measurement and Reporting Mechanisms:** t.b.a

G Proposal Details - Specific Requirements

For example

1. **Training and Skill Levels to be developed:** SAIMOS will need technical support in mooring construction, deployments, and retrievals, HF RADAR set –up and glider technology.
2. **Readiness and feasibility:** Ship availability is a key issue. Readiness will be determined by expert technical support for deployments of HFRADAR, moorings and gliders.
3. **IPR :** All data to be public domain
4. **Branding Requirements:** N.A.
5. **Privacy Requirements** N.A.

H Proposal Details - Risk Management Plan

RISK ANALYSIS SUMMARY

Note: the following table is merely an indication of some of the issues that may need to be addressed during the course of this Project. The ratings are also indicative. The risks and their respective ratings will need to be considered and verified with the relevant Project Parties.

	Description of the Risk	Rating of Likelihood <i>(highly/likely /unlikely)</i>	Rating of Adverse impact <i>Minor/Significant/ catastrophic)</i>	Gross Rating of the Risk <i>(High/Significant/ Moderate/Low</i>	Proposed treatment of Risk
1.	HF RADAR –damage/ theft	unlikely	Significant	Moderate	Secure fencing, housing and alarms will be adopted and units deployed at Lighthouse sites where power is available.
2.	Loss of moorings by storms/trawling	likely	Significant	Significant	Expert deployment and retrievals; use of Argos satellite tracking; use of surface reflectors; notice to mariners and to all fishers – meetings with fishers to point out this is their IMOS
3.	Loss/damage to gliders	unlikely	Significant	Significant	notice to all fishers – meetings with fishers to point out this is their IMOS
4.	Loss of predator sensors	unlikely	significant	low	Appropriate animal selection, recover them < 1 yr after deployment

Appendix:**Table 1:** Costings per item of Infrastructure

Item	Description	Cost \$K
HF RADAR	CODAR -2 sets of long and short transmit & receive antenna and PC for processing (inc shipping)	486
HF RADAR	Site preparation, Housing, fencing and air conditioning, phone line	40
HF RADAR (total/region)		526
Moorings - ADCP	2 RD LongRanger (to 1500m) and 6 Workhorse Sentinel (to 200 m) with CTD, bottom mounts, acoustic releases, buoys and deck unit	604
Moorings -additional sensors	O2, Fluorometer and turbidity	15
Moorings -additional sensors	NXIC CTD 7000	10 US
Moorings – location equipment	Novatech strobe, transmitter and direction finder for retrieval and Argos tracking	8 (US)
Moorings - reflectors	Wire and surface reflectors	10
Data Buoy	Aanderaa Data Buoy DB4280 gives met, wave height, ocean currents and T,S Ph,O2 via VHF or Argos	120
Automated Sediment Traps	\$55k/unit and \$8K for deck unit	58
Predator sensors	\$11K/sensor including deployment, retrieval and satellite	11/sensor
Acoustic tracking loggers for predators	Vemco VR3 modem \$7K/logger	7
Slocum Gliders	CTD, fluorescence and turbidity (inc shipping)	140
Slocum Gliders	Batterys and satellite time	3/yr
Multibeam echosounder	Reson Sea Bat 8160 Multibeam echosounder for sea floor topography (hull mounted – costs not included) and motion sensor and software	550
Ship time (Ngerin)	\$2,600/day	
Sea Noise loggers		35
Airborne Research	Ten 5hr flights	95
Technician salary		80/yr

Table 2: The SAIMOS wish list! As requested, we present our wish list that comes to a total of about \$12M. A more modest request is presented below in Table 3.

Item	Description	Cost (\$)
HF RADAR	CODAR HF RADAR	526,000
Moorings	9 moorings with bottom ADCP, 5 vertical stations to measure CTD, O ₂ , fluorescence, turbidity, 9 acoustic loggers for predators, 1 sea noise logger, 3 sediment traps	2112,000
1 Data Buoy		120,000
Gliders	2 gliders	310,000
Predators (satellite tracking)	40 units including deployment and retrieval	550,000
Predators (acoustic tagging)	20 times \$7K	140,000
Technicians	2 technicians for 5 years	800,000
Airborne Research	50 hrs	95,000
Ship time	4 cruises for 10 days each year for 5 yrs	520,000
Total for 5 years		5183,000

The multi-beam echosounder is not included in the total. As a tool of national use, it might better be funded through the national backbone (if one already does not exist). In addition, assuming 30% costs for maintenance and instrument loss over a 5 year period implies an additional cost of \$1461K so that the total is around \$6,644,000 for one sub-region (KI-EP or BC). The second subregion if undertaken simultaneously and with an additional (identical) infrastructure, will cost an additional \$6,644,000 less the salaries (\$800,000) = \$5844,000. A grand total of \$12,488,000.