marinematters

IMOS

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Integrated **Marine Observing** System

IMOS News

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Reef sharks and their changing environment

Despite a long history of research, our understanding of how changes in environmental conditions affect coral reef fish species is limited. As coral reef ecosystems come under increasing pressure from fisheries and climate change, understanding how species that rely on these habitats respond to changes within their environment is increasingly important.

For reef sharks in particular, there are predictions that they are at risk from changes in environmental conditions related to climate change.

While reef sharks have been the focus of research throughout their range for several decades, little data is available regarding long-term space use, seasonal trends in movement, or environmental drivers for habitat use, despite a range of studies on the presence and movement of various reef shark species.

The Australian Institute of Marine Science has been monitoring the presence and movement of 28 grey reef sharks for more than two years in the southern Great Barrier Reef to look for new evidence that environmental drivers affect reef shark movements.

In their study, sharks around Heron Island and Sykes Reefs were caught, measured, tagged and fitted with an acoustic transmitter, each with a unique identification code and depth sensor.

Acoustic receivers monitored the sharks, downloading data twice per year.

The study showed that there was no particular relationship between shark movement and environmental conditions in this area, although researchers are working on investigating this further as they have recorded significant inter-reef movement in other areas.

This indicates that movement between or away from reef platforms was more likely to be related to biological factors such as prey density, competition, reproduction or dispersal, rather than environmental or seasonal changes.

According to project leader Michelle Heupel from the Australian Institute of Marine Science, integrating data from multiple IMOS facilities was the cornerstone of the research and demonstrates the power of combined data resources.

“We integrated data from the IMOS national mooring network, the animal tagging and monitoring facility and the wireless sensor network along with data obtained through the IMOS Marine Information data portal to do the analysis.”

“Data like this is critical in understanding how environmental factors affect reef residents,” she explains, “so that we can ensure effective management into the future.”

The project is funded by an Australian Research Council Future Fellowship, part of the IMOS Animal Tagging and Monitoring Facility, and is led by the Australian Institute of Marine Science at the Queensland IMOS Node.

The acoustic array at Heron Island and Sykes Reefs in the Capricorn-Bunker Group of the GBR. Points indicate acoustic receiver locations. Image courtesy Google Earth.

director's corner

Welcome to the final edition of Marine Matters for 2013. It's been a great year for IMOS national collaboration, as we've seen an increasing level of benefits flowing from sustained investment in systematic observation of Australia's vast and valuable marine territory.

Three themes emerge from the stories featured in this edition.

IMOS is now a major player on the international stage. Our engagement with the established leaders in global ocean observing has grown considerably as the program has consolidated and matured. We are seen by the US and Europe as a fully-fledged partner in the global ocean observing enterprise, and we are seeing significant emerging economies such as Brazil reaching out to tap our expertise. The rest of the world is saying that Australia has 'got it right' with IMOS. We need to keep it going.

Co-evolution of marine observing and coastal and ocean modelling within Australia is another pleasing development. When IMOS Node science plans were internationally peer reviewed in 2009 and 2010, the clearest and most consistent feedback received was the need to place more focus on the interaction between IMOS and the relevant modelling frameworks. We have put a number of strategies in place to address this in recent years, and significant progress in now being made in areas such as ocean forecasting and regional ocean modelling.

The capacity of IMOS to enable integrated, biophysical research is also well and truly on show in this edition of Marine Matters. A number of stories have this theme, ranging from reef sharks on the Great Barrier Reef to seals in the Southern Ocean.

In closing, I'd like to wish you all a very Merry Christmas and a Happy New Year. IMOS is nothing without the collective effort of the people involved in the program, and I hope you can all take the time for some well-earned rest and relaxation over the festive season.

Tim Moltmann

Covering achievements by IMOS in its sixth year, the Annual Highlights 2012-2013 shows clear and compelling evidence of the benefits of sustained investment in IMOS.

IMOS
BULLETIN

The IMOS Bulletin contains information on new deployments, new data streams available on the IMOS Ocean Portal and recent and upcoming events. For the power users of IMOS data, issued monthly. To subscribe, email: jess.tyler@utas.edu.au

imos.org.au/bulletin.html

IMOS awarded a further $25.6 million in funding

The University of Tasmania has been awarded a further $25.6 million under the Commonwealth Government's latest research infrastructure funding schemes, to extend operation of Australia's Integrated Marine Observing System (IMOS) out to June 2015.

UTAS is the lead institution for IMOS, a national collaboration that deploys ocean-observing equipment throughout Australia's vast ocean territory. All of its data is available for research and teaching in the marine, climate and Antarctic sciences.

IMOS Director Mr Tim Moltmann welcomed the funding decision: "This is another vote of confidence for IMOS as an essential element of the national research infrastructure.

"During 2013 there was $240 million made available under collaborative research infrastructure schemes, and 20 projects have been funded. IMOS was awarded the highest amount, about 11 per cent of the funding available, so it's clearly seen as a high priority," he said.

The funding will be used to maintain the IMOS program, which integrates observations from the open ocean into the coast, and across the physical, chemical and biological sciences.

"As an island nation, Australia's future depends on having appropriate levels of information about what's actually happening in the oceans around us, including how change and natural variability is affecting our climate and weather, and our marine ecosystems and industries," Mr Moltmann said.

"We are very pleased that this further $25.6 million will allow us to continue to play a key role in ocean research over the next two years," Mr Moltmann said.

Physical oceanographic influences on Queensland reef fish and scallops

New research is examining the effects of physical oceanographic conditions on the catch rates and abundance of some of Queensland's most valuable commercial and recreational fish stocks.

An 18-month long project, a joint initiative of the Queensland Department of Agriculture, Fisheries and Forestry (DAFF), the University of Queensland's Centre for Applications in Natural Resource Mathematics, and the Bureau of Meteorology, will examine relationships between recruitment strength in reef fish and scallop stocks on the Queensland coast, along with physical oceanographic factors including sea surface temperature, current strength and direction, satellite-based chlorophyll measurements, sea surface height, and radii and wind speeds of tropical cyclones. The study will also investigate temporal and spatial patterns in fish and scallop larval dispersal.

Dr Tony Courtney, DAFF Principal Fisheries Biologist, says the study will also examine environmental variables that may make fish easier or more difficult to catch (referred to as 'catchability') but do not affect their overall abundance.

"This work is important for assessing the status of the stocks and we hope it will also improve our ability to predict how good or bad upcoming fishing seasons are likely to be," he explains.

The project will use outputs between 1993-2011from the CSIRO BLUELink ReANalysis 3.5 model to quantify prevailing conditions such as temperature, salinity, currents, and sea level height. Data from the Queensland IMOS Node will be key to assess the performance of BRAN in the southern Great Barrier Reef region.

The influence of physical oceanographic conditions on catch rates will be investigated using the Queensland commercial fishing logbook database, which provides daily catch information since 1988. Other animal population data that will be considered include underwater visual survey data and age-frequency and length-frequency data collected by the Australian Institute of Marine Science, the Great Barrier Reef Marine Part Authority, James Cook University, DAFF and others.

The research is funded by the Fisheries Research and Development Corporation and the Great Barrier Reef Marine Part Authority.

ANIMAL TAGS ON TARGET

Despite the global importance of the Southern Ocean, little is known about its physical structure, especially south of 60°, where conventional sampling using ships and Argo floats is sparse, at best. Attaching high-resolution oceanographic sensors to animals, particularly seals, is proving to be an efficient solution.

Animal tracking data is providing valuable insights by collecting data over many years over predictable migratory routes in vast swathes of the Southern Ocean. Individual animal-borne conductivity-temperature-depth sensors (CTD) record physical properties of the ocean, from which we can quantify those attributes in areas of ecological importance to particular animals.

IMOS is supporting tracking of several species in the Southern Ocean using CTD tags.

Seals in particular are proving especially productive - with units on 123 separate seals between 2010-2013 and at five sites, IMOS has compiled a calibrated collection of seal-derived hydrographic data consisting of more than 165,000 profiles.

This data collection is providing a comprehensive description of the ocean habitats used by seals, as well as invaluable insights into the general physical structure of the Southern Ocean.

Importantly, the data is showing a strong match with satellite observations, demonstrating that data from instrumented animals can significantly improve representations of annual sea-ice dynamics efficiently, reducing a critical observational gap.

Including this seal-derived data in ocean models has also substantially modified estimates of surface mixed-layer properties and circulation patterns within and south of the Antarctic Circumpolar Current. Thanks to seals, scientists discovered of a fourth outflow of the Antarctic Bottom Water, a critical component of the Earth's climate engine. Were it not for data delivered by seals foraging at depths far below traditional measuring technology, this current may have remained undiscovered for some time.

So as well as gathering valuable data from animals, a fundamental goal in animal ecology is to quantify how environmental factors influence an individual animal's movement, as this is key to understanding responsiveness of populations to future environmental change (see box).

However, interpreting the many individual data streams is complex, and researchers have created a new animal movement model that takes into account both the environment and the behaviour of the animal.

For example, using the model studies revealed that there was a specific change in diving times in response to colder waters, with seals spending less time at the bottom and descending rapidly. In another study, seals showed their seasonal foraging habits were in response to favourable feeding conditions brought about by a particular ocean circulation feature, which brought nutrients to the surface.

As data accuracy and spatial coverage increase, the seals' contribution to monitoring polar climate variability will continue to grow and these sorts of interpretations will have wider uses in analyzing the movements of other species in response to their environment.

Footnote: Article prepared from:

Roquet, F. et al (in press) Estimates of the Southern Ocean General Circulation Improved by Animal-Borne Instruments. Geophysical Research Letters.

Bestley, S., et al. (2013). 'Integrative modelling of animal movement: incorporating in situ habitat and behavioural information for a migratory marine predator.' Proceedings of the Royal Society B: Biological Sciences 280(1750).

Ohshima, K. I., et al. (2013). 'Antarctic Bottom Water production by intense sea-ice formation in the Cape Darnley polynya.' Nature Geosci 6(3): 235-240.

Williams, G. D., et al. (2011). 'Upper ocean stratification and sea ice growth rates during the summer-fall transition, as revealed by Elephant seal foraging in the Adelie Depression, East Antarctica.' Ocean Science 7(2): 185-202.

plankton TOOLBOX UPDATE

Wayne Rochester & Anthony Richardson

We have continued to develop our capability for analysing IMOS plankton data through number of projects that involve integrating plankton data with oceanographic data including sea surface temperature, sea level anomaly, satellite chlorophyll measurements, bathymetry and NRS CTD and WQM temperature measurements.

We are working on the Australian Zooplankton Taxonomic Guide and Atlas with CSIRO, and UTAS as well as further strategic research with CSIRO on sustained ecological observing, including supporting student projects based on IMOS plankton data.

Our work on a plankton ecosystem assessment report, *Plankton 2013* and a second global ecological status report with Global Alliance of CPR Surveys with the Australian Antarctic Division and CSIRO is also adding to our capacity.

First data on the swim-through feeding habits of Australian sea lions

Armed with new technology combining telemetric, oceanographic and biogeochemical techniques, previously unavailable high-resolution oceanographic datasets have been achieved for adult male Australian sea lions for the first time.

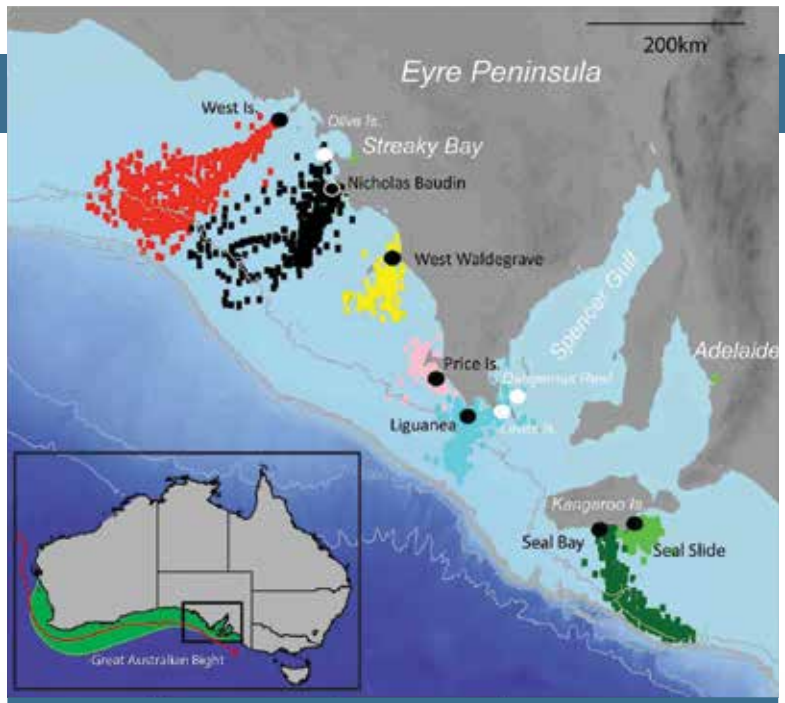
The southern coastline of Australia is home to around 80% of the world's population of the endangered native Australian sea lion – the most rare seal in the world.

Seals in general use a range of foraging strategies in their challenge to find food; some hunt in upper waters, others in deep waters and others rely on changes in ocean circulation to bring them food and nutrients at particular times of the year.

Gathering data from these wild, elusive animals during their foraging trips out to sea is an expensive exercise, so data has been limited to observations of less than half the 16 total seal species.

Technology has proven to be the main barrier, with the battery life of telemetry devices cutting short important insights into longer-term behaviour patterns. And no data exists at all on the adult male Australian sea lion for its at-sea movements.

A comprehensive world-first study by the South Australian Research & Development Institute and Macquarie University has revealed that individual seals have both long-term favourite areas to live, and their own favourite food stops at predicable times throughout the seasons, when ocean cycles changes the amount of food available in specific areas.



Location of study sites relative to Australian sea lion species distribution. [Inset] the Australian sea lion is distributed from Kangaroo Island in South Australia to the Abrohlos Islands in Western Australia (light green).

As well as gathering important information on local oceanographic processes, combining data from a range of technology platforms, has shown that Australian sea lions prefer familiar food, only changing the type of food they eat when supplies of their favourites are low, rather than changing where they hunt in order to follow the tastiest meals.

Given their restricted range and localised feeding, especially in the face of predicted changes in ocean conditions, this low-diversity eating might have important implications for the conservation of these animals.

In the interim, through the IMOS Seals as Oceanographers program, they continue to provide important information about the nature and magnitude of these changes.

Source: Lowther AD, Harcourt RG, Page B, Goldsworthy SD (2013) Steady as He Goes: At-Sea Movement of Adult Male Australian Sea Lions in a Dynamic Marine Environment. PLoS ONE 8(9): e74348. doi:10.1371/journal.pone.0074348

Plankton 2013 provided a timely and important quality assurance process for the IMOS plankton database and data. Preparing the report required all major data types in the complex database to be queried in a variety of ways, giving us a useful road-test for data analysis. Summary maps and graphs and data checking steps in the analyses gave the database a good sweep for errors, and we were pleased to discover that the database passed the test easily and that very few errors were detected during the analysis. This work has allowed us to improve the method for standardising zooplankton abundances in the AODN data stream.

We have had a number of opportunities to facilitate applying IMOS data when working on other CSIRO projects: With Keith Hayes in the CSIRO sustained ecological observing project, we compared AusCPR plankton observations with phytoplankton indicators derived from satellite measurements of ocean chlorophyll. This analysis was a first step in the development of indicators of ecosystem state from sustained observations from platforms such as IMOS. Results from this work, combined with other statistics, allowed us to simply and quickly parameterise phytoplankton distributions in the CSIRO Northern Atlantis model led by Trevor Hutton.

The US Integrated Ocean Observing System (IOOS) and Australia's Integrated Marine Observing System (IMOS):

What can we learn from our experiences?

Zdenka Willis, Director of the US-IOOS Program Office and IMOS Director Tim Moltmann, outlined their respective national observing programs at recent seminars in Sydney and Hobart. The seminars highlighted different objectives and business models based on each nation's perspectives, but it was the similarities that really shone through.

Ocean observing is an international endeavour that is being implemented at global, regional and national scales. A relatively small number of countries have invested in creating integrated ocean observing systems to support their own national goals, and to position themselves to be active participants in global and regional programs.

IOOS and IMOS have been collaborating since their inception and this collaboration has now grown to encompass joint participation in global programs on high frequency radar, ocean gliders, animal tracking and data management. IOOS is currently leading the council of Global Ocean Observing System (GOOS) Regional Alliances, and IMOS is an increasingly active member of that council.

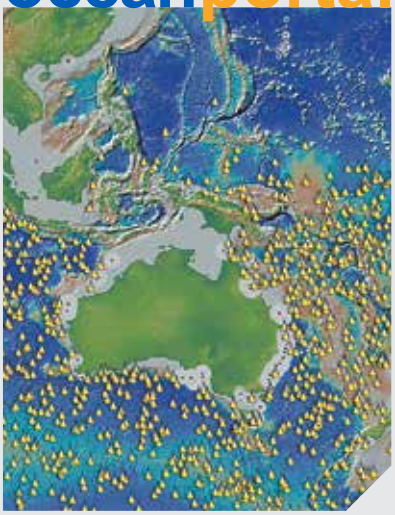
The US and Australian systems have some fundamental differences that are informative to discuss and explore.

"In terms of long-term funding," said Moltmann, "IOOS has a stronger operational perspective, with statutory backing through the Integrated Coastal Ocean Observation System Act of 2009."

"On the other hand, as a national collaborative research infrastructure, IMOS is perhaps more deeply engaged across the marine and climate science community."

"Despite these differences, our assessment is that we are the only national programs tackling integrated ocean monitoring at such a large scale."

"So our collaboration is just going to get stronger as a result of Zdenka's visit. It's one ocean, and we're in it together."



The primary access point for search, discovery, access and download of data collected by the Integrated Marine Observing System. Data is accessible either through the map interface with user-defined data layers, or by keyword searching the metadata catalogue.

AODN
Australian Ocean Data Network

imos.aodn.org.au/imos

Brazil's ocean observers tap into Australian expertise

IMOS has been targeted by Brazil to provide advice on building their national-scale ocean observing system.

The Brazilian government is implementing SiMCosta, a coastal monitoring system that is part of a wider, robust and integrated observing system of the Brazilian oceanic and coastal waters.

It is aimed at generating long-term time series atmospheric, hydrological and oceanic data and much like Australia's IMOS, SiMCosta will generate a reliable database of information about the oceans and coastal zone which can be used as indicators of relevant changes in the marine and coastal environment in the future.

As an invited keynote speaker at the international meeting hosted by the SiMCosta project in Brazil, IMOS Director Tim Moltmann spoke on oceanic and coastal observing systems, focusing on Australia's experience in creating a fully integrated national system for observing at ocean basin and regional scales, covering physical, chemical and biological variables.

Dr Carlos Garcia, Director of the Institute of Oceanography of the Federal University of Rio Grande and responsible for the SiMCosta project, was in Australia earlier in 2013 on a fact-finding mission.

"I am very impressed with the IMOS," he said during his visit.

"It is a very comprehensive array of observing equipment to monitor the ocean and coastal marine environments around Australia, and it is very important to have the IMOS Director come to Brazil to share his experience with us."

Other international keynote speakers included:

- Professor Colin Woodroffe (University of Wollongong, Australia)
- Professor Thomas Malone (University of Maryland, USA)
- Dr Libby Jewett (NOAA, USA)

Ocean forecasting for the future

Australia's expertise in ocean forecasting was on show in Baltimore in the USA in November at an international meeting of experts led by Australia and France.

The meeting was an important mid-term review of GODAE OceanView – the second phase of the Global Ocean Data Assimilation Experiment (GODAE), which began in 1997 to create an ocean forecasting capability through international cooperation and coordination. Outcomes of this latest review will have a significant influence on the future of the world's ocean analysis and forecasting capability.

The GODAE OceanView international science team was co-chaired by CSIRO's Dr Andreas Schiller and included members from twelve different nations. The Australian contingent included scientists from CSIRO and the Bureau of Meteorology, as well as IMOS Director Tim Moltmann.

"Having a national ocean forecasting capability based on an integrated observing system is incredibly important for Australia as a marine nation," said Moltmann at the meeting.

"Ocean forecasts, like the weather forecasts we're all familiar with, provide critical information on future ocean conditions from 24 hours to seven days in advance."

"Forecasts rely on computer models, models need data, and data comes from actually observing the ocean," he said.

"We think we've done a pretty good job it putting these pieces together in Australia in recent years, and this international symposium gives us a great opportunity to benchmark our national capability on the world stage, and to provide our stakeholders with solid evidence that investments being made back home are on the money."

He pointed to the success of BLUELink, Australia's first operational ocean forecasting system created through a three-way partnership between the Royal Australian Navy, CSIRO and the Bureau of Meteorology.

"The Navy has long understood the importance of having best available oceanographic information, and the operational ocean forecasting system is providing this critical data," said the Navy's Commander Robyn Phillips, a member of the IMOS Advisory Board.

"Output is now included in onboard decision systems and provides the Navy with an operational capability that is far superior to that available in the past."

The IMOS contribution to Ocean Forecasting

Australia's ocean forecasting system assimilates real-time data from satellites measuring sea surface height and sea surface temperature, and from in-situ measurements.

IMOS plays an important role in providing high quality in water observations to calibrate and validate the products from international satellite missions. In some cases, calibration sites maintained by IMOS are the only ones in the Southern Hemisphere.

In-situ observations come from Argo profiling floats, autonomous robots that measure temperature and salinity from 2,000 m depth to the surface every 10 days. The IMOS Argo Facility provides Australia's contribution this global array.

Other real-time observations provided by IMOS are being considered for inclusion in the ocean forecasting system, including data from ocean radars, ocean gliders, and marine mammals equipped with satellite tags.

Ocean forecasts provide continuous information on the future condition of the sea as far ahead as possible. 'Nowcasts' provide the most usefully accurate description of the present state of the sea. IMOS OceanCurrent maps all of the real-time observations on a daily basis to give scientists and other users the most up to date information available on what's actually happening in Australia's vast marine estate.

IMOS Postgraduate **Student Profile**

Students working with IMOS for their postgraduate research

Project: *Effects of climate change on phytoplankton communities along Australia's east coast*

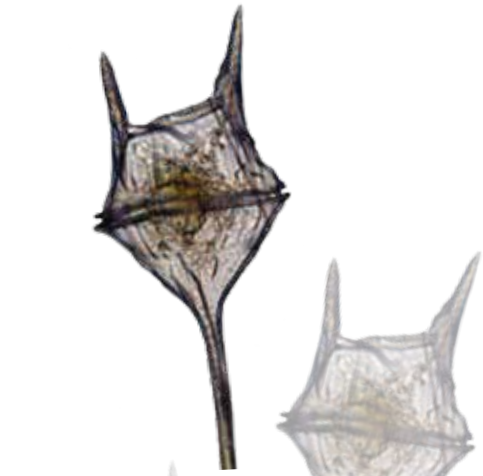
Alex Coughlan

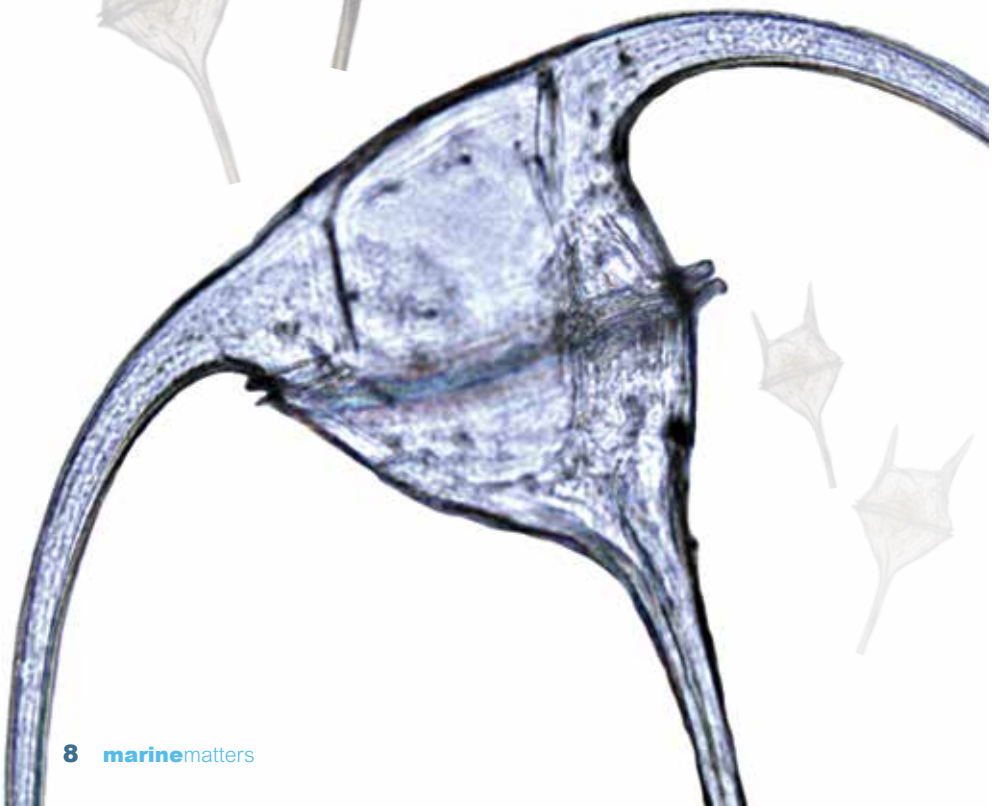
Phytoplankton form the base of the marine food web and play a fundamental role in biogeochemical processes globally. The phytoplankton community is responding to a changing climate by altering their bloom timing and duration as well as shifting their distributions. Studies in the Northern Hemisphere have identified such changes, however paucity of data in the Southern Hemisphere has hampered similar investigations.

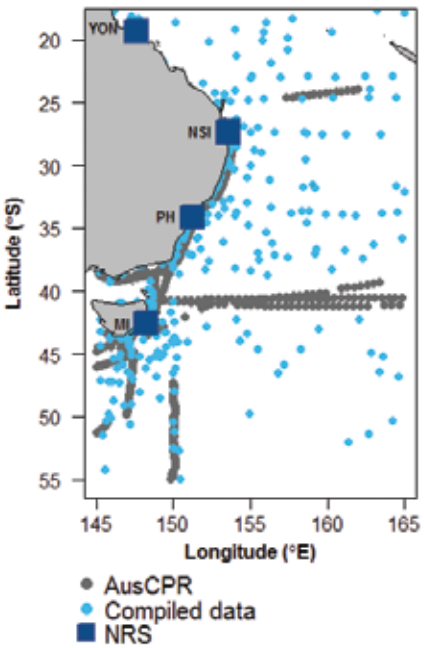
In 2013 Alex Coughlan conducted the first large-scale investigation of the effect of climate change on phytoplankton communities along Australia's east coast. Alex investigated long-term changes in species distribution, bloom timing and duration and species composition along the east coast and at the Port Hacking National Reference Station (NRS).

A large phytoplankton species occurrence database was constructed as part of Alex's honours. The database consisted of 21,000 observations manually entered from historical published and unpublished literature, large databases and data from the Australian Continuous Plankton Recorder and NRSs including data ranging from northern Queensland and down into the Southern Ocean since the 1940s.

The results show that Australian phytoplankton communities are responding to a changing climate, with species observed in the study shifting their distributions polewards along the east coast. Phytoplankton blooms are also occurring earlier and for longer and there are also changes in the abundance of species. This study has provided us with the first insight into the impact climate change has had on Australian phytoplankton communities.







news from the nodes

South Australia benefits from ocean observations

A new computer model developed by the South Australian Research & Development Institute (SARDI) is enhancing marine management in Spencer Gulf.

Spencer Gulf provides a wealth of commercial, economic and environmental benefits for South Australia, and the new regional ocean model will inform decision-making to capitalise on these opportunities.

The model simulates ocean circulation and flow of nutrients through the marine food web, enabling scientists to run different scenarios and test likely results.

At its heart is state-of-the-art data collected through the South Australian IMOS Node.

"This is an excellent example of how systematic and sustained ocean observing, guided by societal needs, can help to deliver real impact," says IMOS Director Tim Moltmann.

"Through Australian Government support IMOS, SARDI and Flinders University have been collecting new observations and data in this region since 2007. Without this observation-based evidence in place, the new model simply wouldn't be as accurate and reliable, or useful to decision makers."

SARDI oceanographer Dr Charles James processing wave data as part of the Spencer Gulf project. Credit: Nat Rogers

Southern IMOS work highlighted at SARDI Open Day

The South Australian public had an exciting insight into the value of IMOS following the SARDI Aquatic Sciences Open Day held on 17 November.

More than 4000 people attended the Open Day, themed 'Healthy Waters Healthy Fish', and according to SARDI Oceanography researcher, Paul Malthouse, many were drawn to the Southern Australian IMOS Node display.

"There was a lot of interest in what all the equipment does and how it fits together in the program," he said.

"One of the major insights for most people was to see the area we are working in, what equipment is being used and how that information is being integrated into practical uses," he said.

"We talked with people about how IMOS data from moorings and biological surveys are being used to help build and validate 3D hydrodynamic computer models, and how information contributes to fisheries and aquaculture management.

"Many people were also surprised to find that IMOS data is available to the public for free and said that they would take a look at the Australian Ocean Data Network and IMOS sites," said Paul.

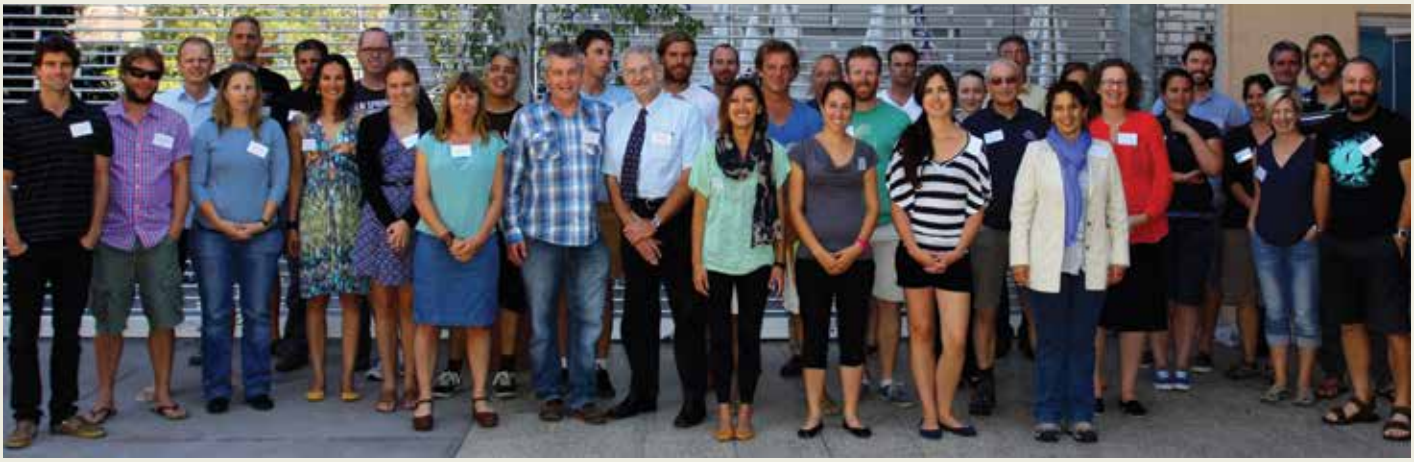
"A few local fishermen were also interested in the OceanCurrent maps available on the IMOS web site, which we directed them to, and again they were amazed that these products are freely available."

Dr John Luick, who is also on the Southern Australian IMOS Node team at SARDI, added that a kids quiz created lots of interest from children who wanted to know answers to questions such as whether a bottle of seawater weighed more than a bottle of fresh water, where waves at the beach came from and what information about the ocean could be picked up by satellites.

Associate Professor John Middleton explains the 3D hydrodynamic modeling capability developed through the Southern Australian IMOS Node, at the SARDI Aquatic Sciences Open Day.

FACILITY 8: Australian Acoustic Tagging and Monitoring System

What is the point of a national acoustic workshop?



I have been fortunate enough to attend all 4 of the IMOS acoustic telemetry workshops as part of the IMOS animal tagging and monitoring system over the past six years. It is one of those events that is somewhat unique in its approach, it features a variety of community talks, is small enough that you can get into the nuts and bolts of acoustic theory and technology, and goes for just long enough that you have a chance to talk and get to know everyone at the event. I am pleased to say that over the course of these workshops the interest and participation has dramatically increased and the quality overall of the presentations has reached the point that this is one of the most desirable workshops of it's kind anywhere in the world.

This year's event was no exception, attracting people from not only the Australian research community but the international platform as well. Over 50 delegates from around the country descended on the University of Queensland, Brisbane and Moreton Bay research station to attend the workshop over the three days.

The executive director of the Ocean Tracking Network (OTN), Fred Whorisky delivered a powerful talk on the creation of a Global Observing System and the role of the Ocean Tracking Network. Fred discussed the growth of acoustic telemetry to monitor marine life around the globe and how the OTN is leading the way to develop a global network as part of the UN's Global Ocean Observing System.

Professor Rob Harcourt from Macquarie University illustrated that by sharing information through IMOS we are able to see the "Big Picture" and highlighted how a study on the tracking of southern elephant seals as part of AATAMS has identified a new source of Antarctic bottom water. In addition a new study in press, IMOS made a sustainable contribution to a new state estimate model of the Southern Ocean.

Russ Babcock from CSIRO showed how the recent collaboration of seven institutions across 10 campuses has developed an acoustic network of more than 160 receivers covering over 600km in the Moreton Bay area of Southern Queensland. Both IMOS and TERN networks have been integrated to fundamentally transform the picture available to the research community in this area. Together with the different streams of IMOS data available this will provide excellent opportunities to relate animal behaviour to environmental variables and long-term trends.

Roger Proctor from the electronic marine information infrastructure (eMII) another of the IMOS facilities introduced the acoustic users to the IMOS ocean portal and delivered a practical lesson on how to discover the various streams of IMOS data freely available to the research community.

New CEO Mark Jollymore from Vemco together with Tim Stone gave a series of technical talks on Vemco equipment. As well as announcing Vemco will now have an Australian office, welcome news to most of us in Australia.

As the workshop came to a close I am reminded of how far the community has come since the first workshop in 2009. The first workshop saw about 20 people join us to discuss topics on acoustic telemetry mostly around presence and absence studies and how we could become a part of a national tracking network.

This year's workshop showed we are truly in the age of large data and "new frontiers" was a well-chosen name for the event. The high quality of all the talks presented shows the integration of not only this "large data" but physical data supported by IMOS through a series of national databases freely available to all.

Most importantly the true value of these events is getting members of the community together in one place and watching new friendships evolve and new collaboration being planned for a future that has never looked better.

Andrew Boomer

FACILITY 4: Australian National Facility for Ocean Gliders

Ocean gliders workshop

The Ocean Gliders Facility operates and maintains a fleet of ocean gliders as part of the IMOS research infrastructure. Core data parameters are collected as the gliders seesaw through the water column. Near-real-time data streams are available from each deployment then data is stored with appropriate QC flags as NetCDF format in accordance with the IMOS data file conventions.

An interactive workshop by the West Australian IMOS Node helped participants to locate data from glider deployments or missions around the West Australian coast, access and learn to handle NetCDF files of glider data with confidence and visualise parameters in the water column with a user-friendly interface.

A focus was on discovering data that can be integrated into studies of boundary currents, shelf processes, ecological communities, water types and masses, and oceanographic habitats and the workshops also lay the foundation for interpreting animal movements and integrating remote sensing of the ocean.

FACILITY 6: Australian National Moorings Network

National mooring network QC summit

The third annual IMOS National Mooring Network Facility quality control summit was held 10-12 December at CSIRO in Hobart, Tasmania.

This year the program focused on workshops, including an ADCP workshops run by Craig Steinberg, a CTD profiling workshop with Val Latham, a BGC sample Oracle database workshops for both users and samplers with Claire Davies and a Matlab toolbox workshop with Guillaume Galibert.

In parallel with the QC Summit the Bio-optics Working Group was also in Hobart to develop the National Mooring Network Facility's mission for satellite calibration and validation of ocean colour products.

Throttling of both the Leeuwin and East Australian Currents

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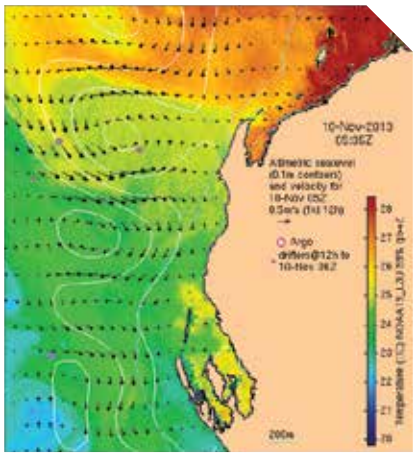
By chance, the southward flows of both the Leeuwin Current (LC) and the East Australian Current (EAC) are presently being strongly impeded by eddies near the continental slope. On the west coast, the opposing force is from an anticyclonic (anti-clockwise rotating, warm-core, high sea level) eddy that is diverting the LC offshore, while on the east coast it is a cyclonic (clockwise, cold-core, low sea level) eddy that is achieving a similar effect.

In both cases, some of the flow continues southward after completing a detour around the eddy but it is clear that there are impacts downstream (including the end of the warm spell off NSW discussed last month) when these diversions occur, as well as local impacts inshore of the eddies where there is suddenly much less tropical water. Both eddies have been sampled near their centres by Argo profilers. The 70m downward displacement (compared with climatology) in the Ningaloo eddy is in good agreement with our satellite-based projection, as is the 100m upward displacement in the Brisbane eddy.



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21-28 November 2013

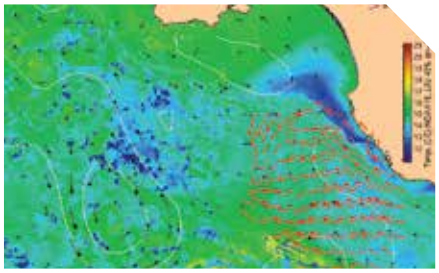
Bonnie Coast upwelling: a strong, early start of the 2013-14 season

The first upwelling of the 2013-14 season occurred from 11-17 November due to strong south east winds for several days. This was a strong event, especially for so early in the season, with the NOAA satellites seeing upwelled water at 12-13° C, the HF radar seeing surface flows of 0.3m/s to the north west and tide gauges seeing coastal sea level depressed by 0.2m.

This occurrence of an early, strong upwelling in November is in contrast to the lack of strong upwelling until March during the previous summer. The event is quite well simulated by Bluelink which shows excellent agreement with the HF radar data, and an upwelled plume of 15° C water.

26 Nov: The first pygmy blue whale sightings for this upwelling season were reported south east of Portland a week or two ago. Continued strong upwelling may draw larger aggregations of blue whales in coming months. Last year's season was certainly characterised by fewer blue whale sightings and weak upwelling.

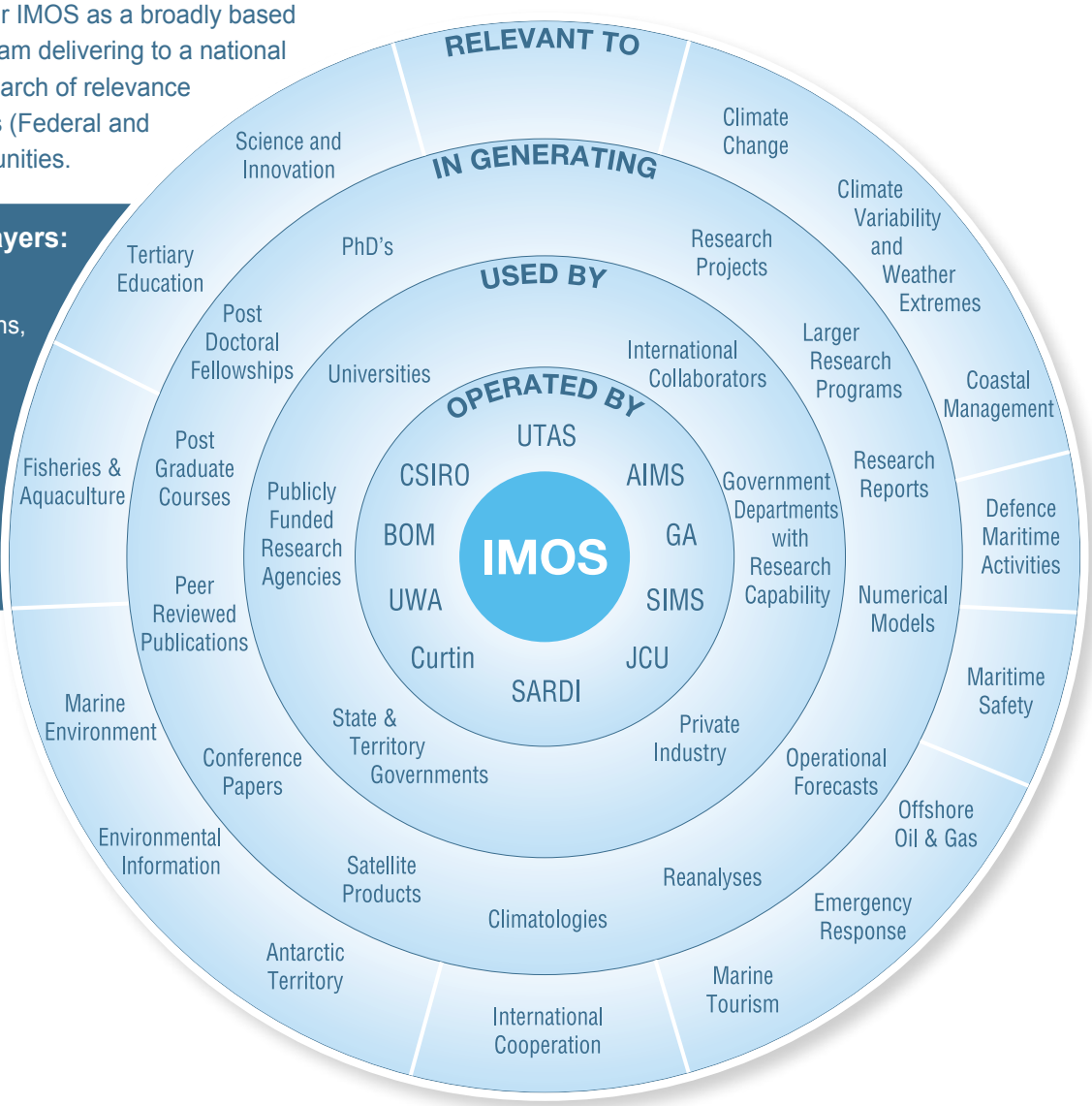
25 November: The latest few images (up to 19Z 24 Nov) vindicated the forecast, showing a plume of water at the surface that was even colder than the previous week (although the seasonally-changing colourbar does exaggerate this a little). Some frontal features appeared to have shifted up to 8km over 3h, or 0.75m/s, suggesting the flow was more energetic than forecast. The imagery also suggested that cold water was surfacing north of Kangaroo Island, and west of the Eyre Peninsula, where the HF radar has recorded flows of about 0.4m/s to the NW.



IMOS has developed a 'circle diagram' to capture the complexity of engagement for IMOS as a broadly based research infrastructure program delivering to a national community, undertaking research of relevance across government portfolios (Federal and State), industries and communities.

The diagram has five layers:

1. IMOS at the core,
2. the ten operating institutions,
3. the broader research community,
4. various pathways for uptake and use of IMOS data and products, and
5. portfolios of relevance and impact.



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National Collaborative Research Infrastructure Strategy

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