



NCCARF

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Climate Change Adaptation
Research Facility

Adaptation Research Network
MARINE BIODIVERSITY AND RESOURCES

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Convenor's Spot



Welcome to the winter issue of MAB for 2011. The thematic focus is on policy and management. This issue commences

with a discussion by Peat Leith (UTAS) around the need for not only inter-disciplinary research, but collaboration across science, policy and practice to identify key questions, risks, opportunities and impacts in order to strengthen the attributes of communities, industries and social networks and make them more adaptive and resilient.

Chloe Schauble (GBRMPA) discusses the *Bringing Adaptation to Life* workshop held in Cairns in April 2011 which was designed to identify principles for converting adaptation knowledge to adaptation outcomes in marine systems. Eric Perez (QSIA) reports on the success of a climate change and fisheries partnership that has progressed into many inter-related climate change projects and brought together fishers, management/conservation agencies and researchers.

Alistair Hobday (CSIRO) introduces their funded adaptation research grant project entitled Human adaptation options to increase resilience of conservation-dependent

seabirds and marine mammals impacted by climate change. Amongst its objectives is to better detect the effects of climate change and assess management responses by connecting researchers, managers and policy makers, to focus on climate-ready monitoring and adaptation options for conservation-dependent seabirds and marine mammals. Erinn Kelly (University of Adelaide), one of the marine network's research support grant recipients, reports on the effectiveness of conservation programs with a critical analysis of South Australian Marine Protected Areas, where the success of these frameworks often hinge on a balanced approach to ecological, social and economic criteria.

MAB's international perspective article for this quarter is by Chris Bergh (USA) who shares with us the objectives of the *Climate Change Action Plan for the Florida Reef System 2010-2015* to be implemented at the local level by reef managers and reef users for the improvement, health and sustainability of the Florida Reef system. Finally, Dallas D'Silva (Fisheries Victoria) discusses management priorities for the development of adaptation strategies to maintain black bream numbers in the Gippsland Lakes.

Neil Holbrook

At a glance

The Adaptation Research Network for Marine Biodiversity and Resources will foster an inclusive, collaborative and interdisciplinary research environment that generates outputs relevant for policy-makers and managers to develop appropriate climate change adaptation responses.

INVESTMENT

Australian Government Department of Climate Change & Energy Efficiency (DCCEE) through the National Climate Change Adaptation Research Facility (NCCARF) hosted by Griffith University

FRAMEWORK

Five interconnecting themes (integration, biodiversity & resources, communities, markets, policy)

HOST INSTITUTION

University of Tasmania

CONVENOR

Associate Professor Neil Holbrook

TIMEFRAME

2009-2012

Adaptation and the Interface of Science, Policy and Practice

Dr. Peat Leith, Research Fellow, School of Geography & Environmental Studies, University of Tasmania; Policy Theme, Marine Adaptation Network.

Late last year, the Adaptation Research Network for Marine Biodiversity & Resources (ARN-MBR) conducted a series of phone interviews followed by roundtable discussions with key marine stakeholders across all Australian states and the Northern Territory. The purpose of these roundtable dialogues was to ascertain the central priorities for climate change adaptation among the people who manage our nation's marine biodiversity and resources. A swag of local and regional priorities were identified; but one message came across consistently from all sectors, and across the states: we need better communication, engagement, consultation and collaboration if we are to adapt.

This response from industry and community sector representatives and public sector managers echoes a finding of research from across the world: successful adaptation will often require working strategically, in partnerships, to integrate uncertain scientific information with contested societal goals, values and aspirations^{1,2}. The question I want to raise here is how we might foster such partnerships between science, policy and practice? At least part of the answer lies in the incentives that encourage scientists, policy-makers and the public to engage with each other in addressing the challenges that climate change poses.

The effects of climate change will not only be defined by changes in the biophysical environment. The context in which adaptation occurs is broad indeed. Fluctuations in currencies and commodity prices, the effectiveness and flexibility of policy instruments, financial and social resilience of individuals and communities are just a few of the issues which make adaptation a very messy process. Social, political, economic, cultural, psychological and environmental factors are entangled.

The old dictum that 'for every complex problem there is a simple solution, but it's always wrong' means that messy problems will require a combination of approaches to address them effectively. This is why the ARN-MBR was developed within an inter-disciplinary framework. Yet, through our work on climate change adaptation we have learnt that inter-disciplinary research is not enough. Adaptation requires collaboration across science, policy and practice to identify the questions

that are truly worth asking, and the subset of these can yield useful and useable answers³. It is also beneficial to adaptation if we are able to consider climate change in terms of risk, opportunities and impacts, and at the same time strengthen the traits of communities, industries and social networks that make them more adaptive and resilient. Unfortunately, there are currently few incentives for such collaborative work.

Research organisations often claim that stakeholder engagement and collaboration are central concerns, yet the incentives and other institutions which drive research rarely reflect this position. Of course, collaboration does happen, but it is often because individuals understand that it is essential to achieve outcomes rather than because the research governance or science policy encourage it.

'Trans-disciplinary collaboration for climate adaptation across science, government and industry will remain marginal and piecemeal unless there are incentives that make it an imperative.'

In the previous Marine Adaptation Bulletin (Autumn 2011 issue), Melissa Nursey-Bray argued that social learning is central to adaptation⁴. Our own national roundtable discussions appear to add weight to this conclusion, as does much of the social science literature on adaptation. Yet, the key question is not what do we need but how do we get it? Unless we can establish incentives for trans-disciplinary collaboration for adaptation via the institutions that underpin science, government and industry, such work will remain marginal and piecemeal.

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Seabird and Mammal Researchers Tackling Climate Change

Dr Alistair Hobday, Stream Leader - Climate Adaptation Flagship, Marine and Atmospheric Research, CSIRO; Biodiversity & Resources, Theme Leader, Marine Adaptation Network.

Climate change is already impacting the oceans and marine life around Australia. In recent years, shifts in species distribution have been documented at a range of lower trophic levels in Australia, including phytoplankton, zooplankton, intertidal and subtidal invertebrates such as snails and sea urchins, and more than 40 species of coastal fish. However, responses to climate variability and change for Australia's iconic higher trophic level marine taxa are poorly understood, including for many conservation-dependent seabirds and marine mammals.

These species are protected throughout Australia and in some cases populations are recovering from previous human exploitation. Resolution of climate change impacts versus other non-climate threats is needed for these species in order to implement appropriate and timely adaptive management responses. Unfortunately, for most species, there are few records demonstrating responses to environmental variability. However, some examples have recently emerged. The inter-annual variation in the number of Australian fur seal pups born in central Bass Strait is one such example, and was found to be negatively correlated with the sea surface temperature in western Bass Strait recorded from up to 10 months previously¹. Similarly, timing and success of breeding in Little Penguins *Eudyptula Minor* is also correlated with ocean temperatures in Bass Strait many months in advance of the breeding season². The processes driving these relationships are largely unknown, which is seen by managers as a major impediment to ongoing conservation management and planning in the face of climate variability and change. In addition, monitoring approaches for some of these species may also need to be reassessed and modified in order to better detect the impacts of climate change, and assess the management responses.

In response to this need, an Adaptation Research Grant project was funded by the Department of Climate Change and Energy Efficiency (DCCEE), the Fisheries Research and Development Corporation (FRDC) and CSIRO's Climate Adaptation Flagship, entitled *Human adaptation options to increase resilience of conservation-dependent seabirds and marine mammals impacted by climate change*³, and follows the release of the National Climate Change Adaptation Research Plan (NARP) for Marine Biodiversity and Resources. The overall objectives of this project are to:



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1. connect researchers, managers and policy makers, to focus on climate-ready monitoring and adaptation options for conservation-dependent seabirds and marine mammals;
2. link ongoing monitoring programs around Australia for seabirds and marine mammals with relevant wildlife and conservation management agencies;
3. extract climate signals for selected time series data around Australia using cutting-edge statistical approaches;
4. develop protocols for monitoring impacts of environmental variation on indicator species and develop an indicator suite of spatial and temporal metrics for climate change impacts;
5. combine the indicator metrics to develop multi-species productivity indicators for Australian regions; and
6. provide practical adaptation guidelines for science and management, including on-ground monitoring protocols.

The first workshop for this project was held at the Australian Bureau of Meteorology (BOM), in Melbourne on 28-29 March 2011, and brought together 21 researchers from around Australia, with an additional group who were unable to attend also contributing material to the workshop.

This workshop focused on the first three project objectives. Researchers presented summaries of existing work around Australia, in particular describing any known environmental relationships and biological trends in their focal species. The main focus of the workshop was to demonstrate methods for analysis of environment-biology relationships, and participants worked through a draft analysis of their time series with several environmental variables. Future change in these critical environmental variables may impact the viability of some populations; necessitating the planning of adaptation measures. Summary metrics for each time series were also investigated, including the coefficient of variation (CV) for the different parameters measured. Preliminary comparison of these CV's indicated some agreement between the types of data series (metrics) presented at this workshop and previously reported studies⁴. In particular, the lower CV's tended to be for measures of mass, then breeding chronology, breeding success, population size and diet. We will examine if time series based on metrics with lower CV show a response to

recent climate change. Calculation of CVs for additional datasets held by participants will help to clarify these relationships and may assist in targeting metrics for monitoring climate change impacts. Selection of useful monitoring metrics can be guided by their sensitivity to the environment and the temporal auto-correlation.

It is anticipated that as a result of this workshop, and subsequent interaction with the project team for statistical support and environmental data access, that participants will publish a number of individual models of environmental-biology relationships. This will underpin an understanding of vulnerability for a range of species to climate change. The development of regional multi-species indices of environmental change was discussed, and will be a focus in the second year of the project. Efficient ongoing monitoring is also required to allow adaptation responses to be validated, and suitable approaches will emerge following preliminary analyses over the next year. An important focus over the coming months is consideration of adaptation options as a response to deleterious climate impacts. Overall, results from this project will support adaptation efforts by managers charged with managing these iconic animals.

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The Politics of Marine Protected Areas (MPA) in South Australia: a critical analysis of the establishment of marine protected areas

Erinn Kelly, Honours Thesis, Environmental Policy & Management, University of Adelaide; project financially supported by Marine Adaptation Network

The Government of South Australia has developed policies to guide the establishment of the South Australian Representative System of Marine Protected Areas (SARSMMPA). The success of the program in providing comprehensive, adequate and representative protection for marine biodiversity is underpinned by these policies in approaching key aspects of the establishment process.

Within my dissertation, a document analysis methodology was used to examine and critically analyse South Australia's policy framework for the establishment of SARSMMPA. I discussed international and national standards, South Australia's history of Marine Park Areas (MPAs) establishment policies and programs, and key criteria for MPA establishment to determine the adequacy of the program in conserving marine biodiversity. This analysis resulted in the following findings:

One of the most significant gaps exposed within the National Representative System of Marine Protected Areas NRSMPA and SARSMMPA programs was the absence of plans for monitoring and evaluating the establishment process after it having been implemented.

This form of evaluation is vital to ensure that issues with the establishment process are highlighted and addressed. Feedback and evaluation on the MPA establishment processes can be valuable in mitigating future problems, which was particularly the case with the Encounter Marine Park pilot. A lack of evaluation mechanisms for the other 18 MPAs may hinder the effectiveness of future programs and also neglect key aspects which require improvement.

Many of the commitments made to the finalisation of the program had not been met.

Of particular concern was the commitment to finalisation of the program by 2010. Currently the finalisation of the program in its entirety is not expected until 2012.

Although the multiple-use approach for zoning and management within areas is beneficial in maintaining a balanced approach to marine conservation, the amount of areas dedicated to each of the multiple-use zoning types was not discussed within any of the documents.

Recommendations were made towards implementing a framework for ensuring a consistent proportion of marine life is allocated under strict 'no-take' zones and that open access areas should be kept to a minimum to achieve conservation goals and also to maintain a consistency throughout the process.

It was found that the importance placed on ecological criteria, particularly in the case of the Australian and New Zealand Environment Conservation Council (ANZECC) document, had substantially overshadowed socio-economic considerations.

Although improvements have been made towards greater emphasis placed on ecological criteria for selection of areas designated protection, I had found that the success of many conservation programs often hinges on a balanced approach to ecological, social and economic criteria. Living Coast Strategy of 2004 had to some extent achieved this balance.

International Perspective: Climate Change Action Plan for the Florida (U.S.A.) Reef System

Chris Bergh is Director of Coastal and Marine Resilience for The Nature Conservancy's Florida Chapter and past chairman of the Florida Reef Resilience Program Steering Committee

Extending along the south eastern shore of the state, Florida's coral reefs are vital habitat for marine life. Diving, fishing, and other reef-related activities that depend upon that marine life generate approximately 71,000 jobs and \$6.3 billion in economic activity annually in the Florida Keys, Miami, and neighbouring communities. As such, Florida supports one of the United States of America's, if not the planet's, most significant coral reef resources.

Global climate change impacts, particularly ocean warming and acidification—operating alone or in tandem with localised overfishing, land-based sources of pollution, and direct habitat degradation—are primary causes of declining reef condition in Florida. The *Climate Change Action Plan for the Florida Reef System 2010-2015* was developed by the reef managers, scientists and reef users involved in the *Florida Reef Resilience Program* as a guide for improving the health and sustainability of this national treasure.

The Plan's vision is to achieve three general outcomes:

1. increased resilience to global climate change impacts via active management of local reef impacts;
2. enhanced communications and awareness about climate change impacts on reefs and reef users; and
3. targeted research about these impacts.

Each outcome is supported by specific objectives and each objective is designed to be achieved through the completion of discrete actions—forty in all—which may be implemented at the local level by reef managers and reef users.

Representative examples of these actions include:

- development and implementation of a marine zoning plan for the entire Reef System that incorporates resilience-based concepts to provide maximum protection from non-climate stresses for all reef types and associated habitats;
- integration of climate change predictions and uncertainties into Florida's local government planning laws and procedures, particularly in coastal areas;

- decreasing the likelihood of negative fishing, diving, and other reef use impacts to key habitats and important functional groups of plants and animals (e.g. herbivores) by increasing law enforcement presence and regulatory compliance;
- developing climate change fact sheets tailored for reef users, elected officials, businesses and industries to increase understanding of and support for actions to increase resilience;
- forecasting the potential social and economic effects of climate change on reef-dependent industries and communities to measure their vulnerability and resilience;
- increasing awareness and appreciation of the Florida Reef System and encouragement of a sense of urgency for its sound management and protection;
- ensuring long term, question-driven monitoring of environmental variables linked to coral bleaching and other climate change impacts throughout the Florida Reef System; and
- identifying and mapping areas of high and low resilience to climate change in order to prioritise management efforts.

The Plan also recognises the need for regional, national and global action. These needs are described as “enabling conditions”, which are essential for protection of the Florida Reef System, but are beyond local control. Enabling conditions include, among others, an international greenhouse gas emissions reduction agreement, completion of Everglades Restoration, and the clean-up of the Mississippi River Basin and Gulf of Mexico.

The *Climate Change Action Plan for the Florida Reef System 2010-2015* is in the process of being implemented and it offers hope for Florida's reefs. By taking local action now, responsible federal, state and local governments and the people who depend upon Florida's reefs for their livelihoods, or recreational pursuits, can positively influence the future of this vital natural resource.

The Action Plan is available for download from the Florida Reef Resilience Program website: <<http://frrp.org>>

World Oceans Day begins the countdown to Rio+20

World Oceans Day was established in 1992, and is celebrated every year on 8 June. Approximately 400 events were held in 70 countries in celebration of World Oceans Day 2011. A total of 19 registered events were held throughout Australia, ranging from a beach clean-up (<http://worldoceansday.org/events/601/world-oceans-day-cooya-beach-clean-up/>), film nights (e.g. <http://worldoceansday.org/events/133/oceans-film-fundraiser/>) and art competitions (e.g. <http://worldoceansday.org/events/605/take-3-launches-marine-debris-art-competition/>). In celebration of World Oceans Day,

the Global Oceans Forum launched ‘Rio+20 Friends of the Ocean’ to support governments, organisations and individuals in achieving significant ocean outcomes at the UN Conference on Sustainable Development (Rio+20) to be held in Rio de Janeiro from 4-6 June, 2012. To participate as ‘Rio+20 Friends of the Ocean’ contact:

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<<http://www.globaloceans.org/content/rio20>>

Taking a Partnership Approach to Climate Change Policy

Eric Perez, Manager - Climate Change, Fisheries and Industry Development, Queensland Seafood Industry Association

There has been a near saturation in the print and television media about what are the primary drivers of climate change. Insert a robust political debate on how, as a nation, we should address the climate change issue and then superimpose global activity, or inactivity, and the climate change debate 'noise' overshadows the actual impact of climate change on people and businesses.

This is the broader context in which the Queensland Seafood Industry Association (QSIA) and the Great Barrier Reef Marine Park Authority (GBRMPA) formed a climate change and fisheries partnership in which to confront the climate change challenge and work with fisheries managers to ensure a sustainable future for the Great Barrier Reef.

Former QSIA President Neil Green saw the need for greater cooperation on climate change and fisheries policy which, in turn, led to the underpinning of the current climate change and fisheries partnership. This has been taken further with the current QSIA President, Dr Michael Gardner, and Chief Executive Officer, Mr Winston Harris, who strongly support an ongoing partnership with GBRMPA.

The partnership has led to the development of an emissions calculator to assist industry in measuring its carbon footprint; to develop vulnerability assessments, adaptation plans and conduct ecosystem resilience analyses; and to better understand the impacts of tropical cyclones (such as Tropical Cyclones Hamish and Yasi) from a biophysical perspective and how fishers responded to it in social and economic terms. What is clear is that the partnership has progressed into many inter-related climate change projects and brought together fishers, management/conservation agencies and researchers.

The QSIA has learnt a great deal from the partnership approach, including:

- electronic and print communications having a limited degree of success in the absence of the human element - rather, industry wants to see someone leading the discussion and seeking industry input (identifying industry champions);
- building relationships that provide valuable feedback; any barriers to information exchange need to be explored and alleviated;
- commercial fishers being more willing to listen to someone who knows what it means to be a fisher;
- getting industry to share their stories is a powerful way to deliver climate change messages; and
- talking to each other, in as many settings as possible – from

formal workshops/symposia to informally sharing a meal/drink – seek information from 'on the water', and understand where people are at.

Identifying Industry Champions

Tony and Karen Collard have been actively involved in delivering climate change messages to industry, most recently at an inaugural Australian seafood industry and climate change symposium held in Brisbane in March 2011. Karen has also had extensive involvement in developing a fishing industry emissions calculator and has been asked to continue a one-to-one roll out of the tool.



Tony & Karen Collard

If policy makers are looking for a 'proof of concept', that is, can a fisheries and climate partnership achieve impacts at an industry level, then Tony and Karen's ongoing support and involvement provide support for the 'yes' case:

- 1) Climate change impacts are still being developed, disputed and debated – threats seem to outweigh benefits – the only certainty is that changes to the way we do things is inevitable. Commercial fishers and indeed all of humanity need to prepare for future changes to our businesses, our eating habits, and our lifestyles.
- 2) Most Queensland commercial fishers are conservationists – they are concerned with the environment, the continued sustainability and access to fish stocks and reducing energy usage (carbon emissions).
- 3) Commercial fishers, researchers, fisheries managers and scientists need to develop respectful relationships, that value each other's knowledge and expertise, to ensure the future success of the Australian commercial fishing industry.

Australian Seafood Industry and Climate Change Symposium

In early March 2011, the QSIA proudly hosted Australia's first Australian Seafood Industry and Climate Change Symposium. Presentations were delivered from leading Australian climate change scientists, State government fisheries and conservation managers, and industry operators. The symposium was the first of its kind to integrate the learnings from the many important climate change stakeholders.

<http://www.climatechangefishing.com.au/australian-seafood-industry-and-climate-change-symposium-3-4-march-2011>

The policy development pathway continues and can only be strengthened through continuing dialogues between key fisheries stakeholders.

For further information please contact Eric on:

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Panel Session, left to right: Dr Renae Tobin, Assoc. Prof Neil Holbrook, Dr Andrew Tobin, Mr Simon Boag, Mr Colin Creighton, Mr Dallas D'Silva, Karen Collard, Mr Michael Garrahy and Dr Paul Marshall. Credit: Martin Bowerman.

Sharing Knowledge Around Climate Change Adaptation in the Marine Context

Dr Chloe Schauble, Great Barrier Reef Marine Park Authority

Under the Great Barrier Reef Climate Change Action Plan 2007-2012, the Great Barrier Reef Marine Park Authority (GBRMPA) works to support the resilience of the Great Barrier Reef, and the industries and communities that depend on it, through advancing adaptation thinking and practice. In this vein, the GBRMPA and the National Climate Change Adaptation Research Facility (NCCARF) partnered to organise a knowledge-sharing event: *Bringing adaptation to life*. Timed and collocated to coincide with the Greenhouse 2011 conference in Cairns, the workshop aimed to identify principles for converting adaptation knowledge to adaptation outcomes in marine systems.

'The entire focus of the workshop - lessons learned - is very different from other meetings I've attended. It's a great model to use, particularly for adaptation where we must all learn a lot very quickly.'

The last five years have seen an explosion in the number of research publications, government programs and local initiatives focused on climate change adaptation. Policy makers, funders, and stakeholders are expecting this emergent community of adaptation researchers and adaptation practitioners to deliver adaptation outcomes. Marine systems are highly vulnerable to climate change, and consequently marine managers, scientists and resource users are at the forefront of many of these adaptation efforts. The time was right to step back and ask questions like: How are we going? How successful have we been at transferring adaptation theory into practice? Are we delivering the desired adaptation outcomes, and what have we learned along the way?

The *Bringing adaptation to life* workshop focussed on the narrative around climate change adaptation and the thirty or so invited participants were encouraged to share lessons they have learned working in this space. As well as ongoing



Photo courtesy of Commonwealth of Australia (GBRMPA)

discussions throughout the day, there were keynote presentations by Prof. Tim Smith (University of the Sunshine Coast), Shaun Martin (WWF-US) and Eric Perez (Queensland Seafood Industry Association); and speed talks by Ryan Donnelly (Cairns Marine and ProVision Reef), Chris Briggs (Tourism & Recreation Group, GBRMPA), Doug Baird (Quicksilver Group), Greta Pecl (University Tasmania), Rob Kay (Coastal Zone Management), Netatua Pelesikoti (Secretariat of

the Regional Environment Programme) and Darren McEvoy (RMIT and Victorian Centre for Climate Change Adaptation Research).

The NCCARF Adaptation Research Network for Marine Biodiversity and Resources arranged a videographer for the day and facilitated the use of Turning Point technology to collect and share feedback from participants in real time during the workshop. Polling of participants during the workshop indicated that over 83% felt they had heard some things that had got them thinking and things that they intended to follow up on, while more than 90% heard things they'd draw on in future and things they'd like others to hear. A similarly high number felt their marine adaptation network had been enhanced by the workshop.



Photo courtesy of Commonwealth of Australia (GBRMPA)

One of the most valuable outcomes from the workshop was the community of practice connection emerging among those in attendance. One participant noted they valued the '... general discussion and connection with others working in the same field, and getting inspiration from a sense of being in a community of practice.' Others felt: 'It was great - lots of sharing, everyone wanted to be there and wasn't afraid to speak up...' and '...it was good to meet other practitioners from around the country and share experiences.' Two participants, from opposite ends of the country, were so inspired by what they experienced that a few weeks after the workshop they submitted pieces to the international climate change adaptation blog site climateprep.org in order to make their personal 'marine adaptation' insights and learnings available to even more people.

'... there seemed to be a good range of expertise and [include] both those who were very positive and those who provided a valuable role of questioning the proposed approach.'

The end result of the *Bringing adaptation to life* event was a list of 'ingredients' for successful adaptation in the marine sector. The organisers are currently busy distilling the insights from the workshop so they can be shared with the wider community in a variety of forms. Hopefully others interested in climate change adaptation within marine contexts will find value with them and use them to expand their own deliberations, understanding and activities.

Fisheries Adaptation to Climate Change – Black Bream in the Gippsland Lakes

Dallas D'Silva, Climate Change Policy Manager, Fisheries Victoria

The Gippsland Lakes represent a large and complex estuarine system that is influenced by a range of environmental and human impacts. This region supports important recreational and commercial fishery for black bream *Acanthopagrus butcheri*. Commercial black bream catches in the Gippsland Lakes have declined in recent years and the fishery, providing the Victorian public with access to black bream, is the last of its kind in Australia. The recreational fishery is also valuable from a tourism and socio-economic perspective in regional Victoria.

Fisheries Victoria researchers are currently investigating the habitat and environmental needs of black bream with the aim of reducing their vulnerability to climate change impacts. Under climate change projections, Victorian estuaries are likely to receive less rainfall and runoff overall and more extreme weather events. These conditions are likely to be less favourable for successful black bream spawning in future.

Spawning success and subsequent recruitment into the fishery is believed to be dependent on the formation of a salt wedge (i.e. the interface where freshwater and saltwater meet) within the estuary and timing of this with spawning during spring. Research has shown that the salt wedge moves up and down the river depending on the freshwater flows from the catchment. Lower inflows during spring leads to spawning up the rivers away from the best settlement habitat down in the lakes and is likely to result in fewer strong year classes entering the fishery. If left unmanaged, this is likely to result in a general decline in fisheries productivity. A management priority is for the development of adaptation strategies by water regulators that are based on environmental and habitat requirements for bream. The ultimate aim is for environmental flows that produce a salt wedge in or near the main lakes during spring months to maximise chances of bream reproductive success.

For further information please contact Dr Daniel Spooner, Group Leader - Chemistry & Benthic Ecology, Fisheries Victoria on (03) 5258 0311 or Mr Dallas D'Silva, Climate Change Policy Manager, Fisheries Victoria on (03) 9658 4363.



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THEMES

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MAB Editors: Neil Holbrook and Laura Purcell

Coming Up:

Spring 2011: *Markets - Economic Considerations & Costings*
Summer 2011/12: *Biodiversity - Conservation Management*

Marine Adaptation Network Partners:



The Adaptation Research Network for Marine Biodiversity & Resources is an initiative of the Australian Government Department of Climate Change & Energy Efficiency being conducted as part of the National Climate Change Adaptation Research Facility <http://www.nccarf.edu.au>