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MARINE BIODIVERSITY AND RESOURCES

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IN THIS ISSUE

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

Convenor's Spot

Welcome to the autumn 2012 issue of the MAB.

As we say farewell to autumn, we at the Marine Adaptation Network are beginning to get excited about the upcoming NCCARF conference – Climate Adaptation in Action. During the conference there will be five special marine sessions. Among these, Marcus Haward, Keith Sainsbury, Paul Marshall and I will convene two special marine sessions on Wednesday 27 and Thursday 28 June 2012, sponsored by the Great Barrier Reef Marine Park Authority, to discuss and address issues related to managing marine ecosystems and resources in a warming world. An expert panel session will also be held ahead of time (morning of 27 June) to prompt discussion and thoughts regarding this important area. There will be an Australian Institute of Marine Science sponsored session on Wednesday 27 June, convened by Ken Anthony, entitled "Strategies for supporting reef ecosystem resilience," and a Fisheries Research and Development Corporation sponsored session on Thursday 28 June, convened by Colin Creighton, entitled "Enhancing resilience at the marine-land interface."

Another very important activity that the Network has been involved in recently is the review and update of the National Climate Change Adaptation Research Plan (NARP) for Marine Biodiversity and Resources. Key documents including a critical literature review, the updated NARP – reviewed by invited marine stakeholders, and the updated NARP Implementation Plan, were submitted to the NCCARF Board for their consideration at the beginning of May.

In this issue, we announce the honours and masters research support grant recipients for 2012 (see page 8). We are also pleased to announce that two research synthesis workshops have been funded, and will be held later this year. These are projects entitled "Multi-objective Estuary and Wetland Repair" chaired by Colin Creighton, Anissa Lawrence and team, while the other entitled "Rapid assessment tools for evaluating impacts and implementing adaptation options for shifting marine resources in Australia" will be led by A/Prof Stewart Frusher.

The theme of this issue is adaptive fisheries management. We hope you enjoy it!

Neil Holbrook.

Effects of Climate Change on Coral Trout (*Plectropomus leopardus*), the Most Important Marine Fisheries Species in Tropical Australia

Morgan Pratchett, ARC Centre of Excellence for Coral Reef Studies, James Cook University, Adaptation Research Grant Project Principle Investigator; Adam Reynolds, Queensland Government Department of Employment and Economic Development and Innovation Northern Fisheries Centre. Project title: Effects of climate change on reproduction, larval development, and population growth of coral trout (Plectropomus spp.). Project number: 2010/554 FRDC-DCCEE.

Effects of climate change on marine fishes are likely to vary greatly among individuals, populations and species, depending on the location, their biology and ecology. Importantly, some fishes may actually benefit from projected changes in environmental conditions and we cannot assume that specific responses established for a limited number of individuals will apply equally to all other fishes. Current understanding of the potential effects of climate change on coral reef fishes is limited to small-bodied and strongly habitat-associated species, such as anemone fishes[1], and we have no idea how important fisheries species may respond. As such, projected effects of climate change on tropical coastal fisheries[2] may be significantly underestimated.

At present, there are two separate (but inter-related) questions that must be addressed to establish the vulnerability of reef-based fisheries to sustained and ongoing climate change:

i) what is the sensitivity (biological and behavioural responses) of major fisheries species to projected changes in environmental conditions?; and

ii) what is the adaptive capacity of the fisheries sector, and what adaptation strategies will further increase adaptive capacity, assuming that climate change does threaten stocks of key fisheries species?

Coral trout (specifically, *Plectropomus leopardus*) are among Australia's most important fisheries species, accounting for 41% of wild-caught fishes in Queensland waters. Exports of coral trout to SE Asia are worth as much as $67.3 million per annum, and coral trout are the economic mainstay of current reef-based fisheries. Research on the sensitivity of coral trout to increasing temperatures and ocean acidification is critical in understanding the vulnerability of reef fishes and fisheries to climate change, as well as establishing the aquaculture potential for this species. If climate change undermines the long-term sustainability of wild harvests of coral trout, then aquaculture may prove critical in meeting increasing national and international demands for this species. In this instance, data on key sensitivities of coral trout to changing environmental conditions (especially during early life-history stages) will be fundamental in assessing logistical and infrastructure needs (e.g. sea cages versus closed-system land-based aquaculture) for successful aquaculture production of this important and valuable food fish.

There are three critical stages in the life-history of coral trout (and reef fishes, generally) where climate change is likely to have the greatest impacts. Firstly, changing environmental conditions may affect fertilisation success and hatching, owing to extreme temperature sensitivities of eggs for a range of different fishes[3]. Secondly, climate-related changes in temperature and seawater chemistry are likely to have a significant impact on larval stages for coral trout (Figure 1), due to changes in metabolic demands and sensory perception[1], at a time when food is potentially limiting and survival depends on successfully navigating open water environments. Thirdly, climate-induced coral loss and degradation of coral reef habitats may have impacts across many different reef fishes[4]. It is currently unknown whether coral trout depend upon live corals (for shelter or effective foraging) once they have recruited to reef habitats, but if so, sustained and ongoing declines in coral cover could have significant ramifications. Research into each of these three areas is ongoing and will greatly improve understanding of the likely effects of climate change on reef fishes and fisheries.

Research into the biological sensitivity of coral trout to climate change was initiated with funding from the Australian Government Department of Climate Change and Energy Efficiency (DCCEE) and the Fisheries Research and Development Corporation (FRDC) through a National Climate Change Adaptation Research Grant Project. The Coral Trout Project, at James Cook University, has also received significant research funding from the ARC Centre of Excellence for Coral Reef Studies, and a Queensland Smart Futures Fellowship awarded to Morgan Pratchett.

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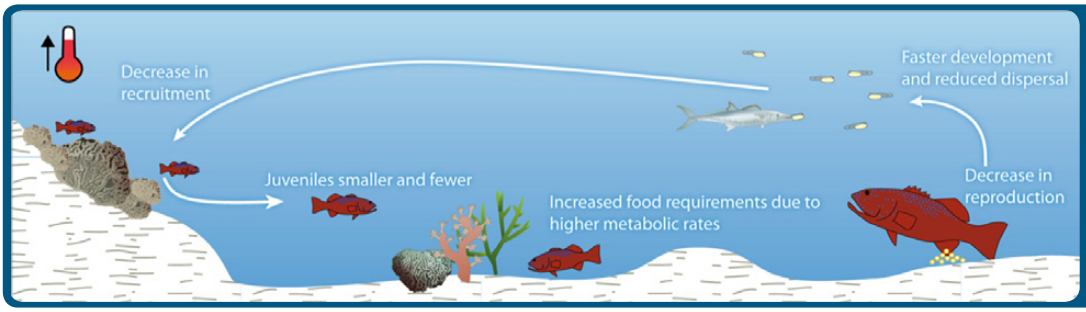

Left: Figure 1

Reef Guardian Fishers: Recognising environmental stewardship

Nathan Walker, Manager, Reef Guardian Fishers, Great Barrier Reef Marine Park Authority.

The *Reef Guardians* program fosters the uptake of practices that will improve the environmental sustainability of the Great Barrier Reef Marine Park by improving its resilience. The development of a *Reef Guardian Fishers* program follows the successful implementation of *Reef Guardian* programs in both schools and councils throughout the GBR catchment. The *Reef Guardian Fishers* concept uses a comprehensive approach and recognises the value of the economic, social and environmental sustainability of fishing businesses. Participants in this pilot program consider a range of environmental and management activities, all of which aim to build more resilient fishing businesses, and improve the health of the GBR. A key component is sharing knowledge and information with others in their industry.

The viability of commercial fishing industries depends on the health and resilience of the marine ecosystems in which they operate. In the context of the Great Barrier Reef (GBR), this means maintaining and improving the health of the Reef is vital to the fishing industry that depends on it for their livelihoods. In the face of impacts from a changing climate, including those due to increases in extreme weather events, the resilience of the GBR and the fishing businesses that rely on it will be critical.

The *Reef Guardian Fishers* pilot program showcases fishers who are fishing sustainably and working to maintain the health and resilience of the GBR, while building a viable future for their business and their fishery. Participants in the program are already implementing practices that go above and beyond what's required by State and Federal laws.

The *Reef Guardian Fishers* program encourages and recognises the work of fishers in four key areas:

Use of best practice on the Reef

The use of best practice while fishing on the GBR is both an adaptation to climate change and a resilience-building measure. Reducing human impacts on fish populations and coral reefs allows the latter more scope to adapt to climate change impacts because they are less stressed. For example, reefs that are not damaged by anchors and divers fins are more resilient to climate change impacts, such as bleaching caused by high water temperatures.

Gareth, Andrew, family and crew on board the Ankh Cross. Photo courtesy of the GBRMPA.

Reef Guardian Fishers in the *Reef Line* fishery pilot program have worked with the Great Barrier Reef Marine Park Authority (GBRMPA) to develop a comprehensive set of practices that deliver on the desired environmental, social and economic outcomes identified for this fishery. These practices minimise their impact on fish populations and coral reefs, and strengthen their business performance through more efficient vessel operations.

These practices include: inductions to crew on all rules and procedures, robust fuel transfer procedures, the safe release of undersize or unwanted fish, procedures to minimise handling of fish, anchoring procedures to minimise damage to coral, strategic planning of vessel maintenance, and engaging with the community about their fishery and the *Reef Guardians* program.

Improved data on fishing activities

Improved data collection can help a fishery adapt to climate change impacts by decreasing the costs associated with fishing and by improving management of the fishery. The GBRMPA and *Reef Guardian Fishers* in the *Reef Line* fishery have been trialling electronic data collection devices to explore the feasibility of collecting more detailed information about fishing activities. These data are recorded electronically so that they can be potentially accessed more quickly, subject to suitable confidentiality protection, and allow for more responsive, timely and accurate analyses of the status of the fishery, in response to extreme weather events. There are also opportunities for the fine-scale electronic data for individual fishing operations to assist individual fishers in optimising the management and efficiency of their fishing operations.

The initial trial was very successful, and with support from fishers, the GBRMPA is investigating the development of a custom-designed data collection system. Such a system could improve safety for dorymen, reduce paperwork required by reporting fishing data directly to Fisheries Queensland, and provide an invaluable dataset to help manage a fishery that has shown vulnerability to intense tropical cyclones.

Improved responses to extreme weather events

Reducing stress on fish and coral reefs helps to maintain their resilience in the face of climate-induced change. The *Coral Stress Response Plan* is an adaptation that the Marine Aquarium Fish and Coral Collection fishery has made to protect its resource in the face of climate change. The GBRMPA recognised the *Reef Guardian Fishers* pilot participant-program and *Pro-Vision Reef*, the peak body in the Marine Aquarium Fish and Coral Collection fishery, for establishing their Stewardship Action Plan. This Stewardship Action Plan includes the *Coral Stress Response Plan* that allows fishers to voluntarily limit the collection of fish and coral from coral reefs that have shown symptoms of stress and damage. The GBRMPA is working with the Queensland Seafood Industry Association and other fisheries to consider what adaptation strategies might be required in the event of further impacts of a changing climate.

Improved information on Reef health

Monitoring programs are a way of dealing with ongoing change and they are at the heart of adaptive management. *Reef Guardian Fishers* are also keen to be involved in trials of the integrated *Eye on the Reef* environmental monitoring program. The project is designed to enable fishers, and others in the community, to report information on protected and iconic species and coral reef health to the GBRMPA.

The GBRMPA uses the information captured by the *Eye on the Reef* program to improve our understanding of ecosystem resilience, risks to that resilience, and to develop actions to support Reef resilience to a changing climate.

For further information regarding this article please contact: nathan.walker@gbrmpa.gov.au or visit <http://www.gbrmpa.gov.au/our-partners/reef-guardians/reef-guardian-fishers>

reef guardian fisher

Australian Government
Great Barrier Reef Marine Park Authority

Creating Future Opportunities for Marine Fisheries and Aquaculture Across the Value Chain

Dr Alistair Hobday, CSIRO, Marine Atmospheric Research Climate Adaptation Flagship – Adaptation Research Grant Project Principle Investigator. Project: Growth opportunities & critical elements in the value chain for wild fisheries & aquaculture in a changing climate. Project number: 2011/233 FRDC-DCCEE.

Fisheries and aquaculture businesses in Australia are well placed for the future. Environmental stewardship is on the rise, over-capacity in wild fisheries has largely been removed and markets are growing for wild and cultured products. Challenges remain, however, such as access to suitable workforce, fuel prices, international competition and imports, social perceptions regarding sustainability, and the additional uncertainty created by climate change. Recent studies have suggested that productivity of Australia's regional seas will rise due to climate change this century[1], and as a result, increases in the potential yield of well-managed fisheries and their economic benefits should be possible[2]. There are also cases where climate will have negative effects on fished species this century, particularly at the southern edge of the continent[3]. To date, research has focused on determining the impacts of climate for fisheries and aquaculture, and to a more limited extent, the adaptation options that might exist for the species and fisheries.

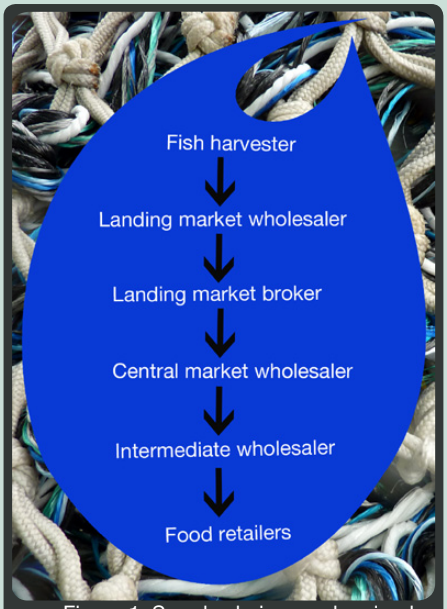

Figure 1. Supply chains can be simple, or more realistic (Figure 2) to reflect a specific fishery, such as the Torres Strait rock lobster fishery. Photo: Fishing net blue & white, Oxfordian Kissuth, Creative Commons.

However, catching fish is only the first step in getting seafood to consumers. Seafood can pass from processors, transporters, distributors, exporters, wholesalers and retailers before reaching the consumer. Just as fishers may have to adapt to minimise costs and maximise opportunities due to climate change, other sectors of this pathway – known as the supply (or value) chain - may also need to adapt. A simple supply chain is a schematic representation of the flow of product from boat to throat (Figure 1 & 2).

Supply chain analysis is a formal method that can be used for developing adaptation options, for climate (or any other stressor). This method typically identifies cost drivers and points in the chain of supply where value is added. By representing the processes involved in producing goods by means of a supply chain, an overview of the relative importance of each of the links can be gained. Furthermore, supply chain analysis underpins input output analysis which can determine the economic consequences of changes in one industry on others, consumers, governments and the economy as a whole.

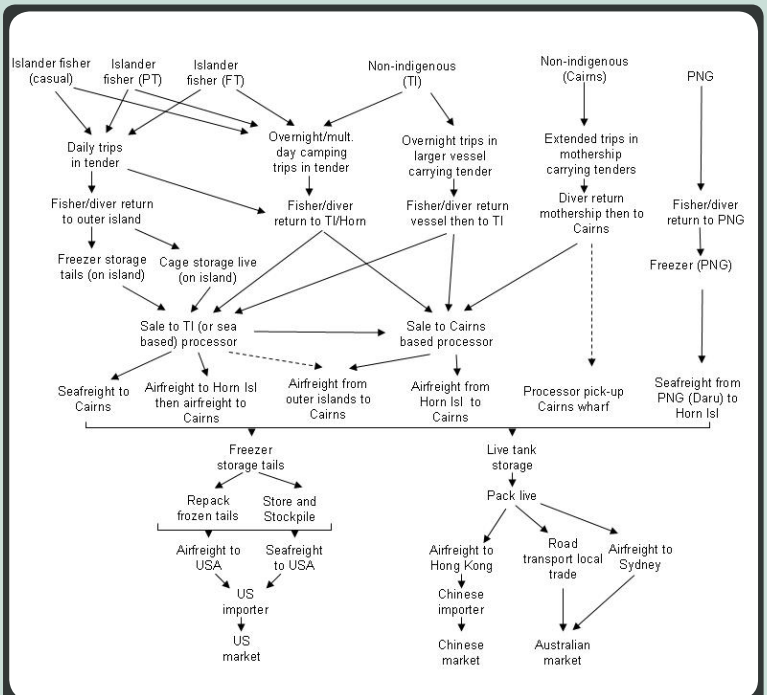

Figure 2.

A new project, funded under the DCCEE-FRDC-NCCARF Marine National Adaptation Research Plan, is seeking to explore some of the opportunities for growth in Australian fisheries and aquaculture along the value chain. This two year project, led by CSIRO's Climate Adaptation Flagship in partnership with University of Tasmania's Institute for Marine and Antarctic studies, will first document supply chains for selected fisheries, including the Tasmanian rock lobster, Torres Strait rock lobster, and NSW oyster culture. Life cycle analysis (LCA), a technique often used to assess environmental impacts associated with all the stages of a product's passage along the supply chain (i.e., from raw material extraction through materials processing, manufacture, distribution, use, repair and maintenance, and disposal or recycling), will be completed for a subset of these case studies. In the context of fisheries, LCA will be used to compile an inventory of relevant energy and material inputs and environmental releases along the supply chain. Of particular interest given the carbon pollution reduction scheme, will be the "carbon footprint" of each stage along the supply chain. The connected sectors in the supply chain can then work to reduce that footprint, such that the consumer can choose products with least impact on the climate.

The supply chain analysis can also suggest opportunities for product expansion into new markets. To support these decisions, the project team will conduct market integration and demand analysis for case studies. Market integration analysis, for example, is used to investigate the relationship between prices of similar products in the market. Questions answered by market integration analysis include: Is there a product leading prices of other products in a market? What products compete in the same market?

Armed with this knowledge, the project team will then develop future models of the value chains to identify opportunities and barriers with regard to environmental change, biology, social and economic factors. An important element will be developing strategies to overcome the barriers and take advantage of the opportunities - this process will involve stakeholders across the supply chain.

Understanding how stakeholders would view strategies is a critical element to the project. The social dimensions of natural resource management issues are integral to understanding both the causes and possible resolutions of issues. Understanding how people are interacting with the environment (and how they value it) is an essential step to identifying the best possible ways to develop management scenarios and improve the sustainable use of resources. Social science research can clarify how different people and groups perceive, behave and interact in particular situations and how they are likely to respond to changes. We will use social perception techniques to understand the values and attitudes of the stakeholders for each fishery case study. These techniques will also aid understanding and ownership of the project through transparency and collaboration.

Our project is guided by senior fishery policy and management staff from each Australian state. Involving these people in the project should facilitate sets of adaptation strategies for the fishery case studies endorsed by policy and industry representatives, and a pathway for uptake identified. We expect this project to develop realistic adaptation management and policy options to enhance cost-effectiveness along the supply chain. We expect to generate targeted recommendations in relation to efficiencies and reduction of the carbon footprint. Adaptation by the fisheries and aquaculture sector to climate change will be enhanced by increased awareness of their markets and supply challenges, and maximise the growth opportunities for this important Australian industry.

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Student Research Support Grant 2011: The vulnerability of mangrove and saltmarsh to sea-level rise at Minnamurra NSW

Thomas Oliver, Honours Thesis, Faculty of Earth and Environmental Science, University of Wollongong: project supported by a Marine Adaptation Network Research Support Grant.

Mangrove and saltmarsh are an integral part of estuarine systems and broader coastal ecosystems. They provide habitat for many juvenile fish, water birds and invertebrates such as prawns, crabs and oysters. Hence they are vital to maintaining sustainable long-term commercial and recreational fishing industries. Wetland communities also sequester carbon and therefore have the potential to reduce carbon emissions if their current distribution is preserved[1]. Acting as a natural barrier against severe storm surges and tsunamis, they are also important for attenuating wave energy and protecting the hinterland against severe storms and wave events - as seen in the 2004 Indian Ocean Tsunami[2].

Saltmarsh plain with colonising mangroves at Minnamurra, NSW. Photo courtesy of Kerrylee Rogers, 2011.

Mangrove and saltmarsh ecosystems appear particularly vulnerable to the impacts of climate change, and their effective management will require forecasts of how these wetland habitats are likely to respond to sea-level rise through the 21st century. This project adopted an integrated assessment of the vulnerability of mangrove and saltmarsh ecosystems in the Minnamurra River estuary in NSW involving:

- monitoring of changes in the elevation of the marsh surface with respect to sea level;
- mapping of historical changes in mangrove and saltmarsh distribution from aerial photography; and
- modelling of probable future changes under sea-level rise scenarios.

Analysis of wetland elevation data revealed that current rates of surface elevation increase are significantly below current local and national sea level trends, as well as IPCC sea-level rise projections. Examination of mapped changes in wetland distribution showed that over the study period, mangrove has transgressed landwards into saltmarsh. It is proposed that sea-level rise, outpacing wetland surface elevation change, is at least partly responsible for this pattern. Model results show significant loss of saltmarsh in the next 40 years under the highest sea-level rise scenario.

This study concluded that mangrove and saltmarsh at Minnamurra NSW are highly vulnerable to the threat of future sea-level rise and reinforces the need for greater measures to be taken to ensure that coastal wetlands in NSW are preserved into the future. Such measures include allowing these communities to self-adjust, by migration and accretion, to external changes such as sea-level rise. The results also demonstrated the considerable opportunities to refine the data input and model outputs as part of adaptive management, as more sophisticated technologies and data become available. This study advocates the need for the integration of these three approaches: monitoring, mapping and modelling, as a basis for future management and adaptation.

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International Perspective: Adaptive Fisheries Management with Respect to Climate Change in the UK

Miranda C. Jones, University of East Anglia, Norwich UK, and Centre for Environment, Food and Aquaculture Services (Cefas), Norwich UK; and Gurpreet Padda, University of East Anglia, Norwich UK, and Department of Environment, Food and Rural Affairs (Defra), London UK.

Commercial fishing is an important socio-economic activity in coastal regions of the United Kingdom and Ireland. While, in 2009, landings into the UK and Ireland only contributed around 1% of global catch, this comprised 30% of landed value (www.seaaroundus.org). The UK fishing sector directly employs approximately 12,200 people, with some coastal communities having over 20% job dependency in this sector. In 1930, the UK total landing peaked at 1.1 million tonnes, but by 2009 landings had decreased to 580 tonnes. This fall occurred despite a fishery expansion and increase in fishing power by an order of magnitude[1] and coincided with changes in fishery landing structures and a move in markets towards low trophic level, low price species[2].

Scarborough Fishing Boats, UK. Photo: Dom H., Creative Commons.

Observed and predicted ocean-atmospheric changes may affect future fish and shellfish production, bringing increasing challenges to maintaining sustainable, long-term fisheries management. Warming has, for example, been seen to influence the distribution of species in UK and Irish waters[3,4] and may lead to changes in productivity and catch potential[5] such as opening up new fishing opportunities in new or expanding fisheries for sea bass, red mullet, John Dory, anchovy and squid in the UK[2].

As fish and seafood are traded globally, the anticipated changes in fisheries production will also impact trade patterns, prices, markets and access agreements. Greenland fisheries are amongst the few expected to benefit from climate change[6], and the access agreements and imports, particularly to the UK and Ireland, are likely to become increasingly important to markets and consumers. A Fisheries Partnership Agreement has, for example, recently been concluded between the EU community and Greenland for the period 2007-12, allowing vessels from Germany, Denmark, UK, Spain and Portugal to fish in Greenland waters, an agreement that represents an investment of 15.8 million Euros.

In order for the UK to adapt to climate change, the Marine Climate Change Impacts Partnership (MCCIP), formed in 2005, aimed at providing credible and salient expert advice to NGOs, industry partners, and policy and decision makers. With over 100 experts from 40 leading UK research institutes, MCCIP acts as the primary focus for the supply of evidence and advice to partners, enabling them to individually and collectively plan for the challenges and opportunities presented by the impacts of climate change in the marine environment.

The MCCIP produces an annual report card[7] which assesses the current scientific understanding on impacts of climate change across different components of the physical marine and human ecosystem. The annual report card has evolved significantly since it began incorporating new information on air-sea exchanges of CO_2, deep sea habitats, water birds, human health and scientific confidence assessments. The latest suite of climate change projections (i.e. sea level rise, temperature and salinity, etc.) has offered the fishing industry useful scientific information, allowing it to adapt to future climate change induced uncertainties. For example, the latest annual report card reported that "the UK is expected to benefit from slightly (i.e. + 1–2% compared to present) higher fishery yields by 2050." However, the Irish Sea, English Channel and Celtic Seas may see either a significant decrease or disappearance of some roundfish species (cod, whiting or haddock) by 2100, while cod in the North Sea are expected to decline. Furthermore, "climate change has been reducing the maximum sustainable yield … of cod in the North Sea by around 32,000t per decade... Calculations suggest … that consequences will be significant for fishery-dependent communities in the north of Scotland and south-west England. Ocean acidification may pose a significant threat to the UK shellfish industry, but more research is required"[8].

Despite some suggestions that the UK's economy is not very vulnerable to climate change impacts[9], inevitable effects on marine fish and invertebrates will lead to both winners and losers. Adaptation will involve changing patterns of production and consumption at local levels, while responding to preference patterns in the EU and USA[10]. As the price of fishmeal has grown because of its use in aquaculture[11], fish farms will have to decrease their production costs; and fishing fleets will need to increase efficiency and reduce environmental impacts in response to fuel price volatility and targeted taxation aimed at lowering carbon emissions. It may, however, frequently be the case that 'adaptive capacity' is limited, and fishers sometimes leave the sector rather than adapt[12]. Furthermore, although the seafood industry and markets' adaptive capacity is thought to be high, there is concern that those communities with the highest economic and job dependency will also be those to feel climate change impacts most acutely, as they may already suffer relatively high levels of deprivation and geographic isolation and are likely to experience greater changes in flooding, temperature and precipitation than inland communities. These are the communities that might face challenges in successfully adapting and consequently have been suggested as a key priority in climate change policy adaptation[13].

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Industry Prepares Itself to Meet the Challenges of Change Posed by Climate Change

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

After the highly successful conference of 2010, the Queensland Seafood Industry Association (QSIA) was proud to host a second national climate change symposium entitled, 'Working in a Carbon Economy: Adapting to New Market Conditions,' held in Brisbane on 1-2 March 2012.

The symposium brought together some of Australia's leading scientists, commercial fishers, aquaculture farmers, industry body representatives, fisheries and conservation management representatives. The aim of the symposium was to further consider the impacts of climate change on the seafood industry, the potential impacts on industry with the impending introduction of a price on carbon, and consider possible adaptation strategies in response to these impacts.

Video interviews were conducted with symposium attendees, including Colin Creighton (Fisheries Research Development Corporation, FRDC), Michael Keogh (Australian Farm Institute, AFI), Dr Sean Pascoe (CSIRO) and Dr Rachel Pears (GBRMPA).

Michael Keogh noted a series of implications for the wild harvest and aquaculture sectors, whilst Dr Trevor Anderson provided a brief outline of aquaculture and carbon production thinking, and covered issues relating to energy consumption and the carbon footprint of aquaculture. Colin Creighton spoke about how the role of the oceans and wetland ecosystems in carbon capture and storage have been largely overlooked; he noted that between 50% and 71% of the carbon that is stored in ocean sediments occurs in wetlands and estuaries, which amount to just 0.5% of the ocean area in Australia.

Symposium attendees identified a series of action items for consideration including:

1. An ongoing education program, for industry to improve knowledge of climate change and carbon tax impacts;

2. The development of a national policy and a meeting of key stakeholders for responding to major climatic events for the wild harvest and aquaculture sectors; and

3. The building of resilience, at the business level, to better deal with impacts of climate change or legislative change (e.g. price on carbon).

Videos of speakers' presentations and the taped interviews are available for public viewing at <www.climatechangefishing.com.au>.

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L-R: Michael Keogh; Tom Clark; group session; Colin Creighton; Ryan Donnelly. Photos courtesy of Scott Bowerman.

Climate Adaptation in Action 2012

Sharing knowledge to adapt

26-28 June 2012, Sebel Hotel Albert Park, Melbourne
<http://www.nccarf.edu.au/conference2012>

Australia's National Climate Change Adaptation Research Facility is very soon hosting the 2012 National Climate Change Adaptation Conference. The three-day conference (26-28 June) will focus on the information needed to ensure Australia is adapting well to climate change. Researchers, practitioners and decision makers will congregate to share knowledge and research approaches that inform policy and practice in planning for climate change in Australia.

During the conference there will be five special marine sessions. Among these, A/Prof. Marcus Haward, Prof. Keith Sainsbury, Dr Paul Marshall and A/Prof Neil Holbrook will convene two special marine sessions on Wednesday 27th and Thursday 28th June 2012 to discuss and address issues related to managing marine ecosystems and resources in a warming world. An expert panel session will be held ahead of time to prompt discussion and thoughts regarding this important area.

Honours and Masters Research Support Grants 2012

The Marine Adaptation Network awarded four research support grants to honours and masters students studying during 2012. The grant scheme provides funding for honours and masters students to cover research costs of selected eligible projects focused on climate change adaptation in Marine Biodiversity and Resources. The aim is to provide data that will inform recommendations for policy or management relevant to the area of climate change adaptation for marine biodiversity and resources. 2012 recipients are:

Stefan Andrews *(The University of Western Australia)* "Temperature of tolerances and assisted rehabilitation of temperate seaweed populations."

Michael Dan *(University of the Sunshine Coast & University of San Francisco in Quito)* "The impact of climate change on Galapagos Sea Lions."

Shannon Klein *(Griffith University)* "Will ocean warming and acidification allow box jellyfish to survive in more southern waters?"

Elliot Scanes *(University of Western Sydney)* "Are ocean scallop and abalone mollusc species less resilient to ocean acidification?"

NCCARF
National Climate Change Adaptation Research Facility
Adaptation Research Network
MARINE BIODIVERSITY AND RESOURCES

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This issue of the Marine Adaptation Bulletin has been compiled by Laura Purcell.

Future MABs:

Winter 2012: ***Adaptive Aquaculture***
Spring 2012: ***Adaptive Communities***

If you would like to contribute an article to the Marine Adaptation Bulletin please write to arnmbr@arnmbr.org or call 03 6226 2134.

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